ISSN P - 0973-5666
ISSN E - 0973-5674

Volume 5 | Number 2 | April - June 2011

Indian Journal of Physiotherapy and Occupational Therapy

An International Journal

website: www.ijpot.com

INDIAN JOURNAL OF PHYSIOTHERAPY AND OCCUPATIONAL THERAPY

Print-ISSN: 0973-5666 **Electronic - ISSN:** 0973-5674, **Frequency:** Quarterly (4 issues per volume).

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Website : www.ijpot.com

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Printed, published and owned by

Dr. Archna Sharma

Printed at

Process & Spot
C-112/3, Naraina Industrial Area, Phase-I
New Delhi-110 028

Published at

Aster-06/603, Supertech Emerald Court, Sector – 93 A,
Expressway, NOIDA 201 304, Uttar Pradesh

Indian Journal of
Physiotherapy and Occupational Therapy

www.ijpot.com

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Volume 5, Number 2 April-June 2011

Awareness of Diabetes Mellitus and Physical Activity Level among Malaysian Public

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Abstract

Background

Diabetes mellitus is on the rise in Malaysia and is becoming a public concern, hence the awareness of condition is critical to avoid the increasing prevalence of the condition.

Objective

This study determines the level of awareness on Diabetic Mellitus (DM) and the level of physical activity among Malaysian public in Cheras, Kuala Lumpur.

Method

There were 107 subjects aged 40 years and above participated. Subjects were required to fill in the demographic data, Diabetic Knowledge Questionnaire (DKQ) and International Physical Activity Questionnaire (IPAQ). Chi Square test was performed to identify associations between variables.

Result & Discussion

Mean aged of subjects was 53.2+ 8.82 years and were mainly women (54.2%). Only 16.8% of the subjects were aged 51 to 60 years (55.61+7.54) who had the highest level of awareness on DM ($p>0.05$). Subjects with highest educational level had the highest level of awareness on DM (66.7%), followed by those with secondary education (27.8%) and poor educational background (5.6%). No significant differences were found between gender, race, family history of DM and medical problem with the level of DM awareness ($p>0.05$). Subjects with the highest awareness level got their main source of information on DM awareness from electronic media (77.8%), printed media and health professional (66.7%). Majority of the subjects had the lowest level of physical activity, n=46 (43%) with mean aged 53.72+8.73 years. Most of the subjects with the highest level of DM awareness had only moderate physical activity level (26.3%). There was no significant difference between level of DM awareness with the physical activity level $p>0.05$.

Conclusion

The level of DM awareness was at the moderate level among the Malaysian public and was influenced by their level of education.

Keywords

Diabetic Mellitus, Level of awareness, Level of physical activity, Diabetic Knowledge Questionnaire (DKQ) and International Physical Activity Questionnaire (IIPAQ).

Introduction

Diabetes mellitus (DM) is a common and costly disease which is determined by high levels of blood glucose due to defect in insulin secretion. Insulin is one of the hormones which regulates carbohydrate metabolism by controlling blood glucose levels[1].

WHO (2000)[2] had indicated that from the diabetes database in 1999, about 4% adults are having diabetes in 1995 and this figure is expected to increase proportionately up to 5.4% in 2025. Singapore contributes the highest prevalence of DM patients about 9% in 1998.[3] According to the Ministry of Health Singapore (1998),[4] the National Health Survey Configuration stated that DM is the sixth caused of death and contributed to 2.2% of annual death. The average aged of patients diagnosed with DM are 47.3 years old for Chinese, 45.7 years old for Malay and 45.8 years old for Indian[3]. DM rank as the fifth highest disease that contributes to mortality regardless of race and ethnic groups[5].

This silent disease is very life threatening among the public due to lack of awareness and knowledge. 3 The common complications of DM are heart disease, stroke, high blood pressure, blindness, renal dysfunction, impaired sensation, amputation, periodontal disease and pregnancy complications[1].

According to Nishida et al. (2000),[6] energy consumption with physical activities is the main strategy in preventing increasing population on type 2 DM. Low level of physical activities include walking, cycling, swimming, tai-chi, yoga, gardening and high level physical activities are sports, hiking, athletic and gymnasium exercises have proven to reduce risk of DM[7]. In a study that was carried out among Canadians, the lack of leisure time, weather, increased distance of gymnasium location, fear of injury, hypoglycemia, fatigue, heart attack and heavy work schedules are the factors which limit one in doing physical activities[8].

Educational status is one of the factors that can enhance public awareness regarding DM. The more educated population has more exposure and better understanding in gaining knowledge on diabetic awareness. Studies have proven that public with tertiary

education level who are graduates from high schools or universities are 13.5 times more aware about DM disease compare to those with lower educational background[5]. It is the purpose of this study to determine whether the level of awareness on DM influences the level of physical activity among the Malaysian public at UKMMC Cheras, Kuala Lumpur.

Material and Method

Study Design

A Cross sectional study was done to identify the level of DM awareness among public at UKMMC Cheras, Kuala Lumpur from September 2007 to March 2008 using convenient sampling.

Subjects

One hundred and seven respondents aged between 40 and 70 years participated in this study. They were patients, carer or visitors to the UKMMC, Cheras in Kuala Lumpur. The inclusion criteria includes subject aged 40 and above, whether diabetes or not while exclusion criteria are subject having low mobility level such as bedridden, asthmatic during exercise and below 40 years of age.

Assessments on Outcome Measure

a. Diabetic Knowledge Questionnaire (DKQ)

This English version questionnaire has been developed by Villagomez in 1989 and consists of 25 items based on the National Standards for Diabetes Patient Education Programs9. Domains from the questionnaires include: General Knowledge, Risk Factor, Symptom and Complication, Treatment and Care and Monitoring. The scales of questionnaire are: 1 (correct answer) and 0 (incorrect answer or not given or unsure). Following the total scores are categorized as low awareness (0 – 8 scores), moderate awareness (9-16 scores) and high awareness (17-24 scores).

b. International Physical Activity Questionnaire (IPAQ)

This questionnaire was developed by International Consensus Group in 1997-1998 as an outcome measure for studies done by 14 research centers in 12 countries using standard method and protocol.10 The scores were categorised into 3 levels of physical activities. Low level (1st category) is described as subject who is inactive. Moderate level (2nd category) – is describe as if subject has done any of these criteria such as heavy activity at least for 20 minutes every day for 3 days or more, or moderate activity or walking for at least 30 minutes every day in 5 days or more, or any of combination activities such as walking, moderate or heavy activity using at least 600 metabolic equivalent (MET)-minute/week for 5 days or more. High level (3rd category) is describe as for subjects who has met these criteria of carrying heavy activity at least 3 days with 1500 MET –minute/week, combination of activities such as walking, moderate activity or heavy activity at least 3000 MET-minute/week for 7 days or more.

Research Procedure

The patients and clients who came to the Physiotherapy Department were informed to fill in the self address questionnaires (DKQ and IPAQ) by the receptionist. A box was placed at the counter following which the answered questionnaires were placed by volunteered participated subjects. The protocol of the study was approved by the ethical committee at PPUKM and informed consent obtained from all patients and clients involved.

Statistic Analysis

The SPSS version 12.0 software was used to analyse data. Statistical test, Chi Square was used to analyse the data with $p<0.05$ considered as significant association.

Results

One hundred and seven subjects at UKMMC, Cheras were enrolled in the study and answered both questionnaires. Majority of subjects were females (54.2%, n=58) compared to males (45.8%, n=49) with mean age of 53.2 + 8.82 years. Sixty five subjects (60.7%) were Malays, 24 were Chinese (22.4%), 17 were Indians (15.9%) and only 1 (0.9%) was others.

The level of awareness on DM was analysed using Chi-Square Test. The level of DM awareness score is seen in Table 1 that demonstrate 16.8% (n=18) subjects were aged between 51 to 60 years (55.61+7.54) with the highest level of awareness on DM. About 68.22% (n=74) subjects indicated moderate awareness were aged between 41 to 60 years (52.53+8.86) and 14.95% (n=16) had the lowest awareness on DM among aged between 41 to 50 years (53.44+9.99). There were no significant association between age group and level of DM awareness (p=0.23) as seen in Table 2.

Table 1: Score level of DM awareness on mean aged of the subjects

Score level of DM awareness	N	Mean + SD
0-8 (Lowest)	15	53.80+10.23
9-16 (Moderate)	74	52.47+8.82
17-24 (Highest)	18	55.61+7.54

From the DM awareness score in Table 2, both males and females had scored 50% (n=9) for the highest DM awareness level. About 60% (n=9) males compared to 40% (n=6) females had the lowest DM awareness level. There are no significant associations between gender, race and DM awareness level of score with $p > 0.05$. Regarding the educational level about 66.7% (n=12) subjects had the highest awareness score are from tertiary education (universities or colleges), 27.8% (n=5) from secondary schools and 5.6% (n=1) from primary schools and none educational background. Thus, the educational does influence the awareness of DM among public with $p<0.05$.

From the study patients with no family history of DM had high percentage of awareness level (55.6%, n=10)

Table 2: Distribution of DM awareness within demographic data baseline

DM Awarenes (Questionnaire Score)									
Criteria	**Lowest**		**Moderate**		**Highest**		**Total**		**p values**
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Age Group									
40 - 50	8	53.3	35	47.3	4	22.2	47	43.9	p = 0.063
> 50	7	46.7	39	52.7	14	77.8	60	56.1	
Gender									
Male	9	60.0	31	41.9	9	50.0	49	45.8	p = 0.632
Female	6	40.0	43	58.1	9	50.0	58	54.2	
Educational Level									
University/college	0	0.0	12	16.2	12	66.7	24	22.4	p=0.00*
Secondary School	4	26.7	41	55.4	5	27.8	50	46.7	
Primary School & None Educational Background	11	73.3	20	28.4	1	5.6	33	30.8	
Family History of DM									
Yes	6	40.0	33	44.6	8	44.4	47	43.9	p = 0.812
No	9	60.0	41	55.4	10	55.6	60	56.1	
Medical Problem									
Yes	11	73.3	32	43.2	8	44.4	51	47.7	p = 0.124
No	4	26.7	42	56.8	10	55.6	56	52.3	
Resources									
Electronic Media									
Yes	8	53.3	40	54.1	14	77.8	62	57.9	p = 0.134
No	7	46.7	34	45.9	4	22.2	45	42.1	
Printed Media									
Yes	8	53.3	36	48.6	12	66.7	56	52.3	p = 0.399
No	7	46.7	38	51.4	6	33.3	51	47.7	
Health Professional									
Yes	8	53.3	49	66.2	12	66.7	69	64.5	p = 0.454
No	7	46.7	25	33.8	6	33.3	38	35.5	

*Significant p values

compared to subjects with family history of DM (44.4%, n=8). Among subjects with medical problem they seem to demonstrate poor awareness of DM level (73.3%, n=11) compared to subjects with no medical problem (26.7%, n=4). There were no significant differences (p>0.05) found between family with history of medical and no medical problem in the level of DM awareness scores.

Resources of the information on DM awareness were analysed and reviewed. About 77.8% (n=14) subjects had highest awareness level from electronic media, followed by 66.7% (n= 12) from printed media and health professional resources. There were no significant differences (p>0.05) between resources with level of DM awareness score.

Table 3 showed that most of the subjects (43%, n=46) were at the lowest score of physical activity level with age 41-50 years old (53.72±8.73). In contrast only 21.5% (n=23) subjects indicated the highest score of physical activity level (51.61± 10.65) and 35.57% (n=38) subjects were at moderate level of physical activity (53.50±7.80). There was no significant differences found between age and physical activity level with p > 0.05 as seen in Table4.

Most of the females had highest physical activity level, (56.5%, n=13) compare to males (43.5%, n=10). Malay subjects had the highest physical activity level (65.2%, n=15) compare to Indians (21.7%, n=5) and Chinese (13.0%, n=3). Most of Malay subjects had a moderate physical activity level, while Chinese and Indian had the lowest level among themselves. There

Table 3: Score level of physical activity on mean aged of the subjects

Score Of Physical Activity Level	N	Mean + SD
Lowest	46	53.72+8.73
Moderate	38	53.50+7.80
Highest	23	51.61+10.65

Table 4: Distribution of physical activity level within demographic criteria

Level of physical activity									
Criteria	**Lowest**		**Moderate**		**Highest**		**Total**		**p Values**
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Age									
40 - 50	21	45.7	14	36.8	12	52.2	47	43.9	p = 0.782
>50	25	54.3	24	63.2	11	47.8	60	56.1	
Gender									
Male	21	45.7	18	47.4	10	43.5	49	45.8	p = 0.907
Female	25	54.3	20	52.6	13	56.5	58	54.2	
Race									
Malay	24	52.2	26	68.4	15	65.2	65	60.7	p = 0.352
Chinese	13	28.3	8	21.1	3	13.0	24	22.4	
Indian	8	17.4	4	10.5	5	21.7	17	15.9	
Other	1	2.2	0	0.0	0	0.0	1	0.9	
Educational Levels									
University/ College	11	23.9	9	23.7	4	17.4	24	22.4	p = 0.500
Secondary school	22	47.8	17	44.7	11	47.8	50	46.7	
Primary school & None educational background	13	28.3	12	31.6	8	34.8	33	30.8	
Family History of DM									
Yes	21	45.7	17	44.7	9	39.1	47	43.9	p = 0.635
No	25	54.3	21	55.3	14	60.9	60	56.1	
Medical Problem									
Yes	24	52.2	17	44.7	10	43.5	51	47.7	p = 0.449
No	22	47.8	21	55.3	13	56.5	56	52.3	
DM awareness level									
Lowest	8	17.4	6	15.8	1	4.3	15	14.0	p = 0.712
Moderate	31	67.4	22	57.9	21	91.3	74	69.2	
Highest	7	15.2	10	26.3	1	4.3	18	16.8	

were no significant differences found between gender and race with physical activity level (p>0.05).

Most of the subjects from higher educational background were from universities or colleges and secondary school that showed the lowest physical activity levels scoring between 23.9%, (n=11) and 47.8%, (n=22). About 56.5% (n=13) subjects with no medical problem had the highest level of physical activity while most of subjects 52.2% (n=24) with medical problem had the lowest physical activity.

There is no significant difference observed between level of DM awareness with the physical activity level, p >0.05. Whereas most of the subjects with the highest level of DM awareness had only moderate physical activity level 26.3% (n=10).

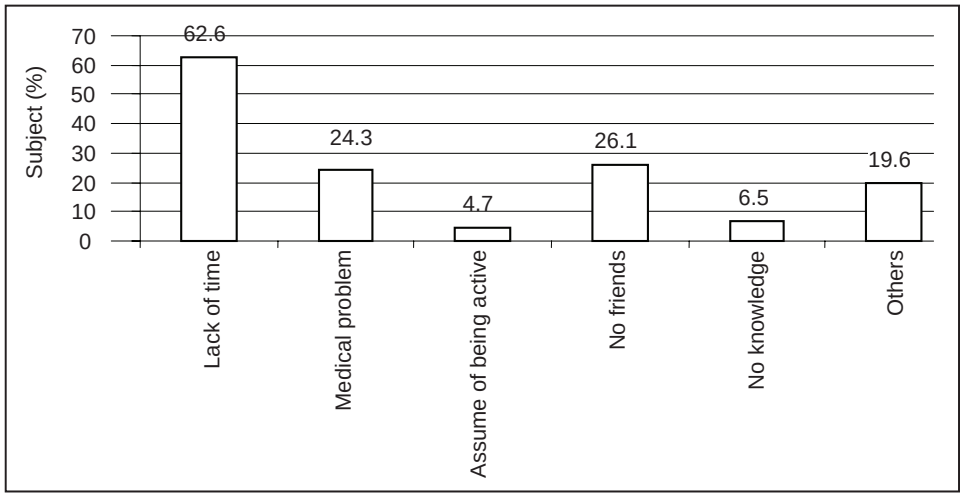
Figure 1 illustrates the barriers to physical activity. Majority of the subjects 62.6% (n=67) indicated that the lack of time was the main barrier doing physical activity. About 4.7% (n=5) assumed that they already active which contribute to the lowest percentage of barriers in physical activities. The barriers to physical activities that has been identified were medical problems, lack of physical activity knowledge, no friend to exercise with, assumption of already being active and others likes weather, feeling of tiredness not interested and wanting to spend more time with family members.

Discussion

In this study the level of DM awareness amongst public is moderate and mainly determined by the levels of education. Educational level has been demonstrated to influence the level of DM awareness among subjects. Poor educational background had the lowest level of DM awareness as supported with previous study[11]. The result showed there is no significant difference observed between level of DM awareness with age group, however in previous study had demonstrated that elderly people had less DM awareness between age group[5].

It is important for public to get information regarding DM from various sources. From the study, sources

Figure 1: Barriers to Physical Activity



from internet and magazine contribute significantly towards increase awareness level among subjects when compared to other sources likes television, radio, health professional and newspaper. Health professional seem to be less active in giving information about DM through health talk and make worst by the public having poor initiative in asking information from health professional[3].

A television programme surveyed carried out on 30 March 2008 through Utusan Malaysia Online, demonstrated that only 3.4% of television programme showed health issues while 70% indicated programme on entertainment show. This surveyed was carried out for all broadcast station that was popular in Malaysia (TV3, TV9, NTV7, RTM1, RTM2 and Astro Ria). As such health information programme should take effort in providing more health information as most of the public prefers to get information from electronic media. Even though more health information is easily accessible through internet, subjects showed less interests compared to Singapore and Western countries where internet is the most popular and most accessible media for sources of information.3

Surprisingly from this finding individual with family history of DM has high level of awareness unlike the findings by Caliskan et al. (2006)[5] which demonstrated otherwise. Patient with medical problem had also the lowest level of DM awareness possibly due to poor information given by health professional[12]. Even in advanced countries about 60% of American are still inactive and does not exercise despite many sorts of health promotion carried out among the public[13].

Level of DM awareness is not portrayed by their physical activity level even though most of the subjects are aware that exercise can reduce the risk of DM and prevent complication. Possible reason why middle age was more highly physical inactive compared to elderly was that they were too busy with their hectic work schedule while most of the elderly groups spend their time at home with family to look after the grandchildren. The barriers to physical activities were similar to finding by King et al. (2000)[14] such as lack of time, less motivated and tired was the forth barriers to be active.

Conclusion

Level of DM awareness among the public in Cheras, Kuala Lumpur was moderate. Educational level was found to be the determining factor that influences the lack of awareness on DM with better awareness among the highly educated individuals. However it does not influence the level of physical activity among individuals. From the study, the main barrier to physical activity was lack of time. It is recommended that physiotherapist should play an important role in enhancing higher level of physical activity such as 'Exercise While Working' programme to create awareness among public especially those who are having DM. Advice on use of stairs case are encourage than using escalator or lift services during every day activities.

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Efficacy of Interval Training in Improving Cardiorespiratory Fitness in Metabolic Syndrome

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Abstract

Objective

To find out the effect of interval training to improve cardiorespiratory fitness in persons with metabolic syndrome.

Study Design

Comparative.

Participants

28 male patients between the ages of 40-55 years.

Method

Patients were divided into interval training group and conventional groups by random assignment method.

Intervention

Total treatment time for both groups was 45 minutes, 5 days a week for two weeks. The interval training group (Group A) during their 25 minutes of resistance exercise alternated between 30% of baseline peak work rate for 2 minutes and then 70% of baseline peak work rate for 3 minutes on the cycle ergometer. The conventional group (Group B) during the 25 minutes of resistance exercise performed cycling at 50% of the baseline peak work rate (PWR).

Outcome measure

Six Minute Walk Test distances.

Result

All participants of both the groups showed significant improvement in the six minute walk distances. For the interval training group the mean pre test six minute walk test distance was 542.93 m (±37.08) and that of the post test was 588.00 m (±40.73). For the conventional group the mean pre test six minute walk test distance was 538.00 m (±18.07) and that of the post test was 565.64m (±22.95). On comparison of the post test distances of both groups, the distances of the interval training group showed significant improvement over the conventional group.

Conclusion

The present study shows that interval training seems to be beneficial in those with metabolic syndrome in improving cardiorespiratory fitness.

Key Words

Interval Training, Cardiorespiratory Fitness, Metabolic Syndrome.

Introduction

Metabolic syndrome (MetS) is a cluster of the most dangerous cardiovascular risk factors namely diabetes, abdominal obesity, high cholesterol and elevated blood pressure. As early as 1923, Kylin described the clustering of hyperglycemia, hyperurecemia and hypertension. He put forward the theory that those who develop cardiovascular disease have multiple risk factors. The clustering of these risk factors did not receive much consideration until 1988, when Reaven in his Banting Lecture to the American Diabetes Association introduced the term “Syndrome X”. Syndrome X referred to a group of connected disorders characterized by impaired glucose tolerance, dyslipidemia, hypertension, associated with increased risk of type 2 diabetes and cardiovascular disease. Kaplan also described this clustering as ‘deadly quartet’, referring to the combination of upper body fat accumulation, hyperglycemia, hypertriglyceridemia, and hypertension.

Over the years many definitions and criteria of diagnosis of MetS have come up. In 2005 the American Heart Association (AHA) and National Heart, Lung and Blood Institute (NHLBI) proposed clinical criteria for the diagnosis of MetS. Presence of any three of the five constituents was essential for a diagnosis. The five constituents being elevated waist circumference ≥90 cm (35 inches) in men and ≥80 cm (31 inches) in women (cutoff for Asian Population), elevated triglycerides ≥150 mg/dL (1.7 mmol/L) or on drug treatment for elevated triglycerides, reduced HDL-C <40 mg/dL (1.03 mmol/L) in men and <50 mg/dL (1.3 mmol/L) in women or on drug treatment for reduced HDL-C, elevated blood pressure ≥130 mm Hg systolic blood pressure or ≥85 mm Hg diastolic blood pressure or on antihypertensive drug treatment, elevated fasting glucose ≥100 mg/dL or on drug treatment for elevated glucose (Scott M Grundy et al., 2005). This criteria for diagnosis of metabolic syndrome was taken in this present study as the requirement for waist circumference to be elevated was not essential for diagnosis and that the presence of any three other components was enough, and also due to the fact that the cut off for Asian population was also specified.

The metabolic syndrome seems to have three potential etiological categories: obesity and disorders

of adipose tissue; insulin resistance; and a constellation of independent factors (e.g. molecules of hepatic, vascular, and immunologic origin) that mediate specific components of the metabolic syndrome. Physical inactivity has also been found to be very favorable in the development of these risk factors and there by causing a person to be classified as being of metabolic syndrome. Insulin resistance on the other hand has been implicated in the progression on to the formation of diabetes. South Asians are at greater risk due to the fact that they show insulin resistance at all levels of obesity leading to the development of type 2 diabetes or coronary heart disease even at lower levels of obesity than other populations.

Many studies have been undertaken to find the prevalence of MetS in India. A study of 1800 subjects of urban India set the prevalence rate at 22.9% in men and 39.9% in women (Rajeev Gupta et al., 2004). In a large cross-sectional survey on urban Asian Indians, the Chennai Urban Rural Epidemiology (CURE) Study, the prevalence of the MetS was found to be 23%, 18% and 26% using the World Health Organization, ATP III and International Diabetes Federation definitions respectively (Deepa M et al., 2006). The International Diabetes Foundation in 2003 projected a 108% increase in the number of diabetics in south East Asia which includes India. Modernisation and increased food intake coupled with the sedentary lifestyle has caused Indians to have a high rate of prevalence of MetS.

Although the separate components pose increased risk of cardiovascular morbidity and mortality, the risk is more pronounced when metabolic syndrome itself is present. The more components that are present, the higher the risk of cardio-vascular mortality rate. The risk of the development of hypertension and diabetes is more prevalent in those with MetS. A sedentary lifestyle has also been implicated for the development of the syndrome. Lifestyle interventions is the primary treatment modality of persons with metabolic syndrome. Physical inactivity and uncontrolled food habits have caused man to become more prone to the deliterious effects of this syndrome. An increase in the physical activity of a person affected by the syndrome has not only shown to improve cardiovascular status of the person but has also been found to reverse MetS (Chen Andrew et al., 2006).

The mainstay of treatment should be in the reversal of possible metabolic risk factors, thereby reducing the chances of the development of the cardiovascular complications. Physical activity and/or exercise has been shown to be beneficial for all components of the metabolic syndrome. As most persons with MetS have central obesity with or without being overweight, a modest reduction in the weight of the person can give all round benefits. Although the benefits of dietary modifications can not be understated, an increase in the physical activity and also a systematic exercise programme helps in the maintenance of the successful weight loss. A scientific statement brought out by the American Heart Association in 2005 has recommended regular moderate-intensity physical activity; at least 30 min of continuous/ intermittent (preferably 60 min) 5 days/week, but preferably daily (Scott M. Grundy et al., 2005). Emmanuel Gomes Ciolac and Guilherme Veiga Guimaraes, (2004) recommend the following: aerobic exercise: frequency of 3-5 days a week; intensity, start with 50% progressively increasing up to 70% of the VO2max (60 to 85% of the maximal cardiac frequency); Duration of 30 to 60 minutes; Modality = walking/running, cycle ergometer or swimming. The benefits of physical exercise noted were to improve cardiovascular risk factors, improve functional capacity and welfare and increase participation in domestic and recreational activities. In a systematic review of exercise and metabolic syndrome the authors conclude that a consensus could be reached on the recommended dose of physical activity. The majority of randomised controlled trials recommended frequent aerobic endurance activity 3 to 5 times a week preferably of longer duration (30 to 60 minutes), at a moderate to moderately vigorous intensity (60% of aerobic capacity) (Sean Carroll and Mike Dudfield, 2004). Although the recommendations suggest increase in physical activity, many persons with metabolic syndrome have exercise initiation and compliance problems.

Lifestyle modifications must include education about the course and nature of the syndrome, improving physical activity and exercise, and dietary modifications as appropriate. Drug management should be started only if lifestyle modifications have proved ineffective in improving parameters. Even with the start of drug management, exercise and maintenence of physical activity levels have to be continued. The Da Qing Impaired Glucose Tolerance and Diabetes Study found that exercise alone proved much more effective than dietary modifications alone and also more effective than diet control along with exercise in risk reduction (Pan X R et al., 1997). In addition to risk reduction, cardiorespiratory fitness also has been shown to be improved with exercise. The inverse relationship of MetS and exercise capacity has been shown to be improved with the addition of increase physical activity in MetS. Although drug management of the components of the syndrome in uncontrolled cases is essential, improvement in the physical activity levels by means of exercise programmes is the mainstay of treatment.

Continuous exercise causes early fatigue and is also a burden for the patient due to the accumulation of lactic acid in the body especially because of the obese character of the patients. This may lead to the discontinuation of the exercise programme or the required intensity of exercise may not be achieved. The overweight nature of the patient may also lead to poor compliance with the exercise regime.

These specific problems can be tackled by incorporating interval training instead of the conventional continuous mode of exercise in these types of patients. Interval training makes use of intermittent high intensity and low intensity exercises which allow periods of recovery in-between. These periods of intermittent rest has shown to be helpful in the absorption of lactic acid which accumulates in the muscles of the body with continuous exercise. By allowing the lactic acid to be

taken up, the muscles are able to continue exercising. This uptake of lactic acid also allows the patient to perform a longer duration of exercise with an increased load of exercise. The benefits of interval training have been established in patients suffering from chronic obstructive pulmonary disease and also congestive heart failure. Improved cardiovascular fitness was also a demonstrable change in the outcomes of these patients. This improvement in the cardiorespiratory fitness in persons with MetS is also desirable.

Thus the determination of effects of interval training in persons with metabolic syndrome in improving cardiorespiratory fitness was the main purpose of the present study.

The cardiorespiratory fitness of persons has a direct relationship with the quality of life and also on the prognosis of the risk factors associated with MetS. An exercise regime will improve fitness in these patients, along with the improvements in the individual parameters of the constituents that make up MetS. One of the major benefits of using an interval training regime is that it closely resembles activities of daily living due to the intermittent high and low intensity of exercise. This will indeed improve fitness in those persons who were sedentary and also of poor fitness. Improvement in the fitness in these persons will improve quality of life and also make them more active in day to day life. A reduction in the risk factors that contribute towards cardiovascular disease will help in the prevention of occurrence of complications. This in itself will help the patient lead a more productive life. As a majority of the world is becoming more and more elderly, this is important as age related burden of cardiovascular complications will cause morbidity. Another added benefit by this is the reduction in health related costs in relation to the cost of hospitalization, treatment of complications and decreased burden on the family members.

By incorporating an interval based resistance training into their daily routine patients can lead a more healthy lifestyle. This in turn helps in reducing the incidence of cardiovascular related mortality and morbidity. Adherence to exercise programmes especially by young adults will help in the prevention of them being classified as MetS. This will significantly help in reducing health related problems for the individual. Healthy and fit individuals will therefore make healthy and a more efficient society.

If interval training in found to be effective in improving cardiorespiratory fitness in those with metabolic syndrome then it can be included in the prevention and also management of MetS.

Methodology

Research approach: The study is a comparative approach.

Research design: The study design adopted is a pre and post test, control group design.

Population for the study: Patients who were diagnosed with metabolic syndrome (according to the American Heart Association (AHA) and National Heart, Lung and Blood Institute (NHLBI) criteria, 2005

Sample size: Consists of twenty eight metabolic syndrome patients satisfying the inclusion and exclusion criteria and referred to the researcher.

Inclusion criteria

- Patients diagnosed as metabolic syndrome (according to the American Heart Association (AHA) and National Heart, Lung and Blood Institute (NHLBI), 2005) within the preceding three months.
- Age 40 to 55 years.
- Male patients only.
- Patients who do not have a predicted six minute walk distance (6MWD) according to their age, height and weight. The reference equation for predictive 6MWD in males for the Indian population:

  6MWD = 200.1 + [3.4 X Height (cms)] – [1.9 X Age (years)] – [1.1 X weight (kg)]

  (Avinash M. Srikanth et.al.,2006)
- Patients on medication and with the same drug regimen.
- Patients who are referred to an exercise program to the department of physiotherapy by the attending cardiologist or physician.
- Patients whose body mass index is less than 35 kg/ m^2.
- Patients who were willing to attend ten exercise sessions within two weeks.

Exclusion criteria

- Patients with orthopedic handicap such as limb deformities, muscular paralysis and weakness.
- Neurological impairments.
- Cognitive and mental impairments.
- Patients who have had a positive treadmill test (TMT).
- Patients who have uncontrolled resting hypertension (Systolic blood pressure ≥160mmHg and/or Diastolic blood pressure ≥100 mmHg).
- Patients with unstable angina, uncontrolled dysrhythmias, recent history of congestive heart failure, patients with hypertrophic cardiomyopathy, severe stenotic or regurgitant valvular disease, congenital heart disease, myocarditis or pericarditis.
- Patients with visual and hearing impairment.
- Patients with chronic obstructive pulmonary disease.
- Myocardial infarction, coronary artery bypass grafting, percutaneous transluminal coronary angioplasty procedure.
- History of seizures.
- Patients with exercise induced asthma.
- Patients who are contraindicated in performing valsalva maneuver.
- Non co-operative patients.

Outcome Measures

Six Minute Walk Test: Pre-intervention, a Six Minute Walk Test (6MWT) was conducted prior to the start of training. A hallway of 30 m was used for the test. Every 3 m was marked on the floor with visible tape. The starting

point was marked on the floor. The procedure was standardized and performed according to the American

Thoracic Society: Guidelines for the Six Minute Walk Test (March 2002). All precautions were taken while the test was performed.

The predictive six minute walk distance (6MWD) was determined by the equation:

6MWD = 200.1 + [3.4 X Height (cms)] – [1.9 X Age (years)] – [1.1 X weight (kg)]

(Avinash M. Srikanth et.al.,2006)

Post-intervention, a 6MWT was repeated after two weeks of the respective training groups on the last day.

Sanctions from the respective authorities was obtained before the beginning of the study. Each subject was appraised of the purpose and procedure of the study. Informed consent was also obtained by signing the consent form. Pre test evaluation was conducted prior to the start of the respective exercise schedule. Exercise was performed five days a week for two weeks. Post exercise evaluation was done on the last day after the last session with a break of two hours in between the session and the six minute walk test.

Treatment Procedure

Twenty eight patients fulfilling the criteria of metabolic syndrome were divided into two groups of fourteen each. The first group was the interval training group (Group A) which received interval training on the cycle ergometer. The second group (Group B) was the conventional group which received a continuous mode of resistance exercise on the cycle ergometer at a fixed load of resistance.

Pre intervention, an incremental cycle ergometer test was performed by each subject to find the Peak Work Rate (PWR). After a two minute rest, followed by two minutes of unloaded pedaling, each subject performed an incremental (1 minute increments of 10 W) test to the limit of patient tolerance. Peak work rate was defined as the highest work level reached and maintained at a pedaling frequency of more than 50 revolutions per minute for 30 sec.

The total treatment time per session was 45 minutes which included 10 minutes of warm up, 25 minutes of resistance exercise and 10 minutes of cool down. Warm up and cool down periods were the same for both groups.

Warm up was for 10 minutes which included 5 minutes of free exercises and 5 minutes of unloaded pedaling. Free exercises consisted of 5 repetitions of shoulder-flexion/extension, abduction/adduction, elevation, depression, retraction and protraction. Elbow flexion and extension. Wrist flexion and extension. Hip flexion, extension, abduction and adduction. Knee extensions in sitting, ankle plantar and dorsiflexion. Unloaded pedaling was performed for 5 minutes without any resistance.

Cool down consisted of 10 minutes of unloaded pedaling on the cycle ergometer.

The interval training group (Group A) during their 25 minutes of resistance exercise alternated between 30% of baseline peak work rate for 2 minutes and then 70% of baseline peak work rate for 3 minutes on the cycle ergometer. Thus the treatment procedure for Group A (Interval training group) consisted of 5 min free exercises, 5 min of unloaded cycling, 25 min of interval resistance training (alternating 30% of baseline PWR for 2 min then 70 % of baseline PWR for 3 min on cycle ergometer), 10min of unloaded cycling with a total time of exercise being 45 min.

The conventional group (Group B) during the 25 minutes of resistance exercise performed cycling at 50% of the baseline peak work rate (PWR). The same load was used for all sessions on all ten days of exercise.

Thus the treatment for the control group (Group B) consisted of 5 min free exercises, 5 min of unloaded cycling, 25 min of 50% of baseline Peak Work Rate (PWR) on cycle ergometer, 10min of unloaded cycling: Total time of exercise was 45 min.

The total duration of the treatment was two weeks. Each week consisted of 5 sessions of approximately 45 minutes of exercise each day.

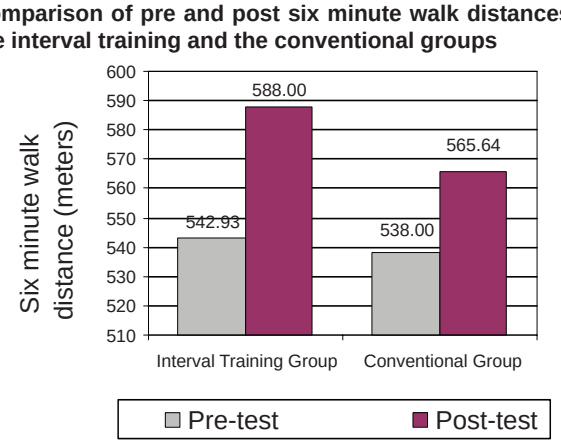
Data Analysis and Interpretation

Age: The interval training group consists of 14 patients whose mean age was found to be 45.79 years (S.D ±3.98) and conventional group consisted of 14 patients whose mean age was found to be 46.07 years (S.D ±3.61). When the total of 28 subjects are taken, 12 were of the 40-45 yr age group, 13 were of the 46-50 yrs, and 3 of the 51-55 yr age group.

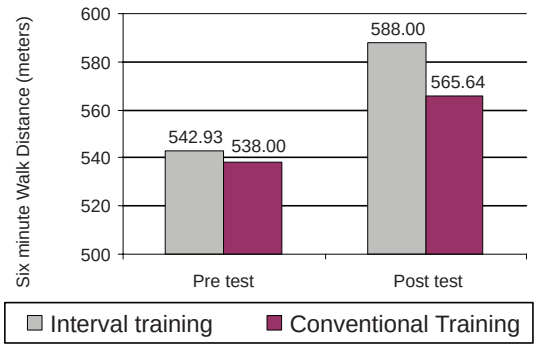
Height: The interval training group consists of 1 patient in the height range of 151-160 cm, 9 patients in the range 161-170 cm, and 4 patients in the range 171-180cm.
The conventional group consists of 2 patients in the range of 151-160cm, 8 patients in the range 161-170cm, and 4 patients in the range 171-180cm.

Weight: The interval training group consists of 2 patients in the range of 60-69 kg, 2 patients in 70-79 kg, 8 patients of 80-89 kg, 1 patient in the 90-99, and 1 patient in the 100-109 kg range. The conventional group consists of 2 patients in the range of 60-69 kg, 5 patients in 70-79 kg, 5 patients of 80-89 kg, 1 patient in the 90-99, and 1 patient in the 100-109 kg range.

Comparison of pre and post six minute walk distances of the interval training and the conventional groups



Comparison of the pre and post six minute walk distance means



Related 't'test

a) Interval Training group

The mean pre test six minute walk test distance was 542.93 m (S.D ±37.08) and that of the post test was 588.00 (S.D ±40.73). The calculated 't'= 15.726, (df=13) which was greater than the table value (1.771, df=13) at 95% significance, meaning that there is significant difference between the pre test and post test six minute walk test distances of the interval training group. This significant difference may be due to the interval training received by this group.

b) Conventional Group

The mean pre test six minute walk test distance was 538.00 m (S.D ±18.07) and that of the post test was 565.64m (S.D ±22.95). The calculated 't'= 13.481, (df=13) which was greater than the table value (1.771, df=13) at 95% significance, meaning that there is significant difference between the pre test and post test six minute walk test distances of the conventional group. This significant difference is due to the conventional exercises received by this group.

Unrelated 't'test

a) Pre test Six Minute Walk Distance

The mean pretest six minute walk distances of the interval training group and conventional group were 542.93m (S.D ±37.08) and 538m (S.D ±18.07) respectively. After application of the unrelated't' test, the calculated't'= .447 which was less than the table value (1.706 at df=26) of 't' at 95% significance. So there is no significant difference between the pre test six minute walk distances of the two groups.

b) Post test Six Minute Walk Distance

The mean posttest six minute walk distances of the interval training group and conventional group were 588m (S.D ±40.73) and 565.64m (S.D ±22.95) respectively. After application of the unrelated 't' test, the calculated 't'= 1.789 which was greater than the table value (1.706 at df=26) of 't' at 95% significance. So there is significant difference between the post test six minute walk distances of the two groups. This may be due to the effect of interval training over conventional exercises.

Discussion

This study was undertaken to find the efficacy of interval training in improving cardiorespiratory fitness in persons with metabolic syndrome. Twenty eight patients who fulfilled the inclusion and exclusion criteria were selected for the study. Fourteen patients were grouped in the interval training group (Group A) and fourteen in the conventional group (Group B). The groups underwent exercise training for ten sessions within two weeks. All the subjects were males. Predictive six minute walk distance was calculated from an equation validated for the Indian population.

The interval training group performed resistance exercise on the cycle ergometer alternating between 30% and 70% of the peak work rate. The conventional group performed the same resistance exercise on the cycle ergometer but at a constant resistance load of 50% of the peak work rate.

The mean pretest six minute walk distance of the interval training group was 542.93 m and the mean post test distance was 588 meters. The mean pretest six minute walk distance of the conventional group was 538 meters and the mean posttest distance was 565.64 meters.

On statistical analysis of the six minute walk distance using the related 't' test, both groups showed significant difference in the pre and post test distances. The significant improvement in the conventional group is due to the effect of the conventional exercise on the cycle ergometer at 50% of the peak work rate. The significant improvement in the interval training group may be due to the effect of interval training at alternating resistance loads. Interval training was performed at 30% and 70% as both resistance loads are much more similar to exercise at 50% load, rather than higher differences which were used in other studies. Higher differences in the resistance loads such as 45% and 90% (Coppoolse

Statistical Analysis and results of Six Minute Walk Test Distances Using Related and Unrelated 't' test.

Six Minute Walk Test	N	Pretest Distance mean	S.D	Unrelated 't' test value	Post test distance mean	S.D	Unrelated 't' test value	Related 't' test value	df
Interval Training Group	14	542.93	±37.08		588.00	±40.73		15.726*	13
				.447			1.789*		
Conventi-onal Group	14	538.00	±18.07		565.64	±22.95		13.481*	13

* Significant at <.05 level

R et al., 1999), 50% and 10% (Milo A. Puhan et al., 2006) and at alternating 50% and 100% (Vogiatzis S et al., 2002) are not suitable for this study as they are at extremes and it would have been difficult for those with metabolic syndrome to perform for 25 minutes. The resistance loads of 30% and 70% offer an attainable target for these persons so that an average work of 50% is done.

When the six minute walk distances were analyzed using the unrelated 't' test, only the post test distances (t =1.789) of the interval training group showed statistical significance over the conventional group. The pretest distances were not statistically significant (t = .447).

Conventional resistance exercises are being used at present based on the knowledge that resistance exercises along with improving metabolic parameters such as insulin sensitivity, lipid profile and also blood pressure to a certain extent. Metabolic adaptations such as larger and increased number of mitochondria, increased capacity of the cell to generate ATP through oxidative phosphorylation, improved capacity to metabolize lipids and carbohydrates, and cardiac adaptations such as improvement in the cardiac output, eliciting an improved oxygen extraction from circulating blood, and also causing a large increase in the total muscular blood flow during exercise are the main aerobic system changes during exercise. All of the above system changes have been shown to cause enhanced exercise performance and improved cardiorespiratory fitness in those who undergo exercise (Willam D. Mc Ardle et al., 1996). These exercises have also been shown to improve cardiorespiratory fitness. But conventional resistance exercises may make a person exhausted and extended periods of time may cause reduced exercise capacity and fatigue. This in turn may lead to non compliance with the exercise regime. This study was undertaken to find the effect of an alternative type of resistance exercise which improves cardiorespiratory fitness as well as allow the patient to undergo increased loads of exercise.

Interval training makes use of the alternating high and low loads of resistance to allow the patient to perform longer periods of exercise. This may be due to the fact that the lactic acid accumulated in the muscles during high resistance loads can be absorbed by the body during the low resistance period of exercise. Athletes are at present using this type of training to improve endurance and also to develop strength. The use of interval training has not been limited to sport activities as patients suffering from chronic obstructive pulmonary disease and also those with coronary artery disease, have also benefited from performing two to three times less work but gaining the effects as similar to that of continuous resistance exercise (Mifkova L et al., 2006). Clinical benefits are not only limited to the younger age group as it has been shown that elderly untrained adults benefited from interval training in the improvement of maximal aerobic power and submaximal exercise tolerance (Ahmaidi S et al., 1998). The improvement in cardiorespiratory fitness has also been shown in persons recovering from cardiac surgery also.

The present study utilized interval training in an age group that is very prone for the development and progression of metabolic syndrome. The progression will eventually lead to type 2 diabetes and also an added burden of hypertension and also dyslipidemia. Thus it is imperative that prevention and also the treatment of the syndrome is of utmost importance. In a country that is about to become the diabetes capital of the world in a few years time, it is of necessity that preventive measures are undertaken to stop this epidemic. Exercise has been shown to be a major factor in the primary management of the syndrome. Interval training may be used on a preventive aspect as well as for the treatment of the syndrome. Improvement in the cardiorespiratory fitness and also reduction in a patient's body weight will significantly reduce the progression of complications and also help the person lead a more healthy and productive life.

The improvements in the six minute walk tests as per the American Thoracic Society guidelines can be interpreted as an absolute value or as a percentage of the original value. But they recommend using an absolute value. In the present study the maximum improvement obtained by a subject was 57 meters. Four subjects have improvements of 55m or above. Redelmeier D A et al., (1997) suggested that an improvement of 54 m in stable COPD patients was the minimum for the patient to have any noticeable benefit from the intervention. They also suggested that an improvement of 70 m was needed to be 95% confident that the intervention was significant. Various authors have provided minimum benefit six minute walk distance improvements for various interventions. These values cannot be applied to this study because of the fact that these improvements were observed in the western populations and that there are at present no values as such that could be applied to the Indian population. In the present study we can find that the most improvement can be found in younger patients especially below the age of 43 years. This was not seen in the case of the conventional group. This increased improvement in the distance of the interval training group may be due to the interval training itself. Further research will give us more absolute values of the significant improvements in the Indian population for the six minute walk test.

The interval training group had 3 subjects with three out of five of the components of the metabolic syndrome, four subjects with four out of five components and seven subjects with five out of five components. Close examination of the improvements of the six minute walk distance shows us that those with lesser components had better improvement distance. Those with five components had varied distance improvements. This may be due to the combined effects of these five components and also may be due to the varied duration of the progressive states of the syndrome. In the conventional group two subjects had three of the components, six subjects had four components and six subjects had all five components. The same results as that of the interval training group cannot be inferred from the conventional

group because subjects with five components had better improvements than those with only three components. This may be due to the fact that the two subjects who had only three components were 47 and 49 years of age. Five out of six subjects with all five components were 45 or less than 45 years of age. This adds further evidence that those who are younger have better improvements in the six minute walk distances after resistance exercise training.

Therefore the results of the present study reinforce the fact that conventional resistance exercises do indeed improve cardiorespiratory fitness in those with metabolic syndrome. The study also gives light on the effect of interval training in improving six minute walk distances as a measure of cardiorespiratory fitness. The study also allows for further research into the effects of interval training as a means of prevention and also treatment of the metabolic syndrome.

Limitations of the Study

Study was conducted for a short period of time. Study consisted of only a small sample size of 28 patients. Only males were considered for the study. The study assessed only the short term effects and progress of the patients.

Metabolic parameters such as blood pressure, insulin levels and also lipid profile was not assessed post exercise.

Suggestions of the Study

A large sample size is required to establish the effects of treatment. To make the result more valid, a long term study can be carried out. Regular follow up can be included in further studies so as to know about the long term effects of treatment. Studies can be undertaken to find out the effects of interval training on metabolic parameters in patients suffering from metabolic syndrome. The effects of interval training may also be studied in different age groups and also with female patients.

Conclusion

In patients suffering from metabolic syndrome, the first line management is the increase in physical activity. This may be accomplished by encouraging the patient to exercise regularly for at least 30 minutes a day for at least 5 days a week. Conventional exercise regimes have been prescribed for the patients and have been shown to have benefited the patient who has a will to continue with exercise for their own benefit. But many patients have been seen to have discontinued their exercises and as the disease progresses so does the risk of a cardiovascular event, which may prove fatal and also debilitating. Interval training makes use of alternating high and low resistance loads so that the patient is much more at ease to perform the exercise and also to continue their exercise regime. This in turn improves the compliance to exercise and there are fewer dropouts. In the present study interval training was given to patients suffering from metabolic syndrome. Further studies can be undertaken on a larger scale and also for a longer time period to determine the effects of interval training over conventional training in patients with metabolic syndrome.

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Effect of Lower Limb Strength Training on Functional Performance in Geriatric Population

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Abstract

Purpose of the study

Age related decline in strength of lower limbs may be an indicator of functional deficits and increase in fall risk. This study investigated the effect of lower limb strength training on functional performance in geriatric population. The purpose of the study was to determine whether the older adults comply and perform functionally better after a strength training program.

Material and Methods

Study design- single group experimental study. (quasi experimental study)

Study Setting

Matoshree Vriddha Ashram old age home in pune.

Study Population

Male and female above 65 year of age, and having difficulty in at least one functional task in SF – 36 questionnaires.

Purposive sampling was done. Following evaluation a functional based strength training program was performed in a group of 30 people who were supervised by physical therapist. Training subjects exercised 5 days in a week over 4 consecutive weeks. Changes in performance were noted by comparing pre and post exercise score of 1 RM and score of short physical performance battery.

Assessment tool- SF 36, 1 RM, and short physical performance battery

Statistical tool- paired ''t'' test.

Intervention Tool

Self paced lower limb strength training exercises, in sitting, standing, and walking. The collection of exercise was developed according to 3 criteria: (1) applicable without access to special exercise facilities, (2) adaptable for frail older people with different functional levels, (3) possibility of progression of the exercise in 2 ways- either to increase the difficulty in a specific exercise or to change to another, more challenging, exercises.

Result

After applying t-test, statistically significant differences were found in the strength, balance, measured walk, and chair stands.

Strength	(t=5.757, p<0.0001)
Balance	(t=3.808, p<0.0007)
Measured walk	(t=5.385, p<0.0001)
Chair stands	(t=6.595, p<0.0001)
Total SPPB score	(t=7.264, p<0.0001)

Conclusion

Our results suggest that strength training exercise program can produce benefits with regards to functional performance. The result also suggests that medium intensity functional weight bearing exercise program is applicable for use, among older people, living in residential care facilities.

Key Words

Strength, functional performance, elderly.

Introduction

During the aging process, older people may experience a loss of strength & power, which then may lead to functional limitations & disability. Muscle strength is considered to be the most physiologically limiting factor of the older patients and a determinant of health status[1]. About 10% of the adult population aged 75 years & older; lose independence in one or more basic activities of daily living (ADL) each year[2]. According to the American government data, an estimated 20% of the population over the age of 65 years has difficulty in one or more ADL tasks[3].

According to the disablement model, impairment can lead directly to functional limitations, defined as restrictions in performance of activities that are essential to daily living[4].The relation of impairments in muscle strength & power to functional limitations in older adults has been examined in various studies. Earlier researches indicate that musculoskeletal impairment & functional limitations contribute to disability[5,6].

Guralnik & colleagues found that poor performance on physical test of balance, walking speed & chair rise time predicted onset of self – reported limitations in the ability to ambulate 0.8 km (0.5 miles)[7]. Lawrence & Jette further examined the relationship between the onset of lower extremity mobility problems such as difficulty in walking 0.4 km or climbing up steps & onset of difficulty in performing Instrumental activities of daily living[8]. A number of researches have examined the effect of various impairments on performance of functional tasks.

Bergstrom & colleagues found that decrease lower extremity strength was associated with self reported difficulty in functional mobility, such as rising from chair, stair climbing and the need for the assistive devices during ambulation[9]. Wolley & Colleagues found that knee extension strength & subject rating of pain while rising from the flower accounted for 28% of the variability in timed performance of this task in subjects with OA knee flexion & extension force, in combination with reported functional & body weight explained 47% of the variance in stair ascension time[10]. Other researches found that lower strength is a determinant of the minimum chair height from which an individual can rise & the speed of rising from a chair[11].

The decline in muscle strength associated with aging carries with its significant consequences related to functional capacity. A strong correlation between muscle strength preferred walking speed has been reported for both sexes.

Strength conditioning is generally defined as training in which the resistance against a muscle generate force is progressively increased over time. Muscle strength has been shown to increase in response to strength training. The preservation of muscle strength into late life can greatly decrease the risk of disability and enhance functional independence. Research into strategies to increase muscle strength in old people and to prevent the age-related loss of muscle strength should be seen as a very high priority. Exercise is an accessible form of prevention of physical decline. Several studies have found that adherence to a regular exercise program can improve muscle strength, reaction time, balance control and gait velocity significantly. Also some trial evidence has shown that exercise programs may enhance cognitive performance and effective states of the elderly as well mainly of frail institutionalized elderly, given their lack of exercise and life stimuli. Although sufficient evidence exists to recommend that older people should exercise and the findings just described suggest that exercise can increase function in he elderly, further studies are required to elucidate its role in improving function in elderly patients. This research has important practical implications, since the primary goal of rehabilitating the elderly is to contribute to a better life quality by maintaining physical function

The purpose of this study is to check the effect of lower limb strength training on functional performance in geriatric population. Due to the growing number of the individual aged 65 and older, there is a need to be some way to overcome the decline in functional status clue to process of aging. So this study can help in improving the quality of life in older individuals.

Material and Methods

Purposive sampling method was used. About 45 patient who were having difficulty in SF-36 were assessed, out of which only 32 patient were able to participate in the study .2 of them were not willing to participate in study, so total 30 patient were able to complete the study.

Inclusion Criteria

- Ambulatory people who were 65 years of age or older
- Both male and female
- People having difficulty in at least one functional task in SF – 36 questionnaire.

Exclusion Criteria

- People with any medical history of lower back or lower extremity pathology.
- Any CNC pathology (stroke, dementia, head injury, Parkinson's)
- Postural hypotension
- Cognitive impairment
- Vascular problems of lower limb.
- People who are undergoing any other exercise program that includes lower limbs.

Study Design: This is a single group experimental study. (quasi experimental study)

Procedure

Data Collection

Subjects are evaluated at the start of the therapy and reevaluated after 4 weeks to note, the changes after the treatment.

Outcome Measures

- 1RM
- Short physical performance battery

1 RM

1 RM is used to evaluate the strength of patient's lower limb. 1 RM is measured by leg press machine in kg. The 1 RM to assess strength is highly reliable and safe method of evaluating the maximal strength in untrained aged individuals[12].

Short Physical Performance Battery

The short physical performance battery scale is used for initial evaluation of the patient and to monitor effectiveness of intervention. SPPB scale measure the activities of daily living which are affected by weakness of lower limb. The Short Physical Performance Battery (SPPB) was used as a measure of functional limitations.

The SPPB assesses 3 areas: ability to maintain static balance in feet together, semi tandem, and tandem postures for up to 10 seconds; time to walk a 4-m distance at a normal pace; and time to complete 5 sit-to stand transfers as quickly as possible[13]. Each subscale is rated on a scale from 0 to 4, and scores can be added to create a summary score between 0 and 12. The SPPB has high predictive validity in identifying people at greater risk for mortality, nursing home admission, and incidence of disability over 1-year and 4-year time periods and has been shown to be sensitive to changes in health status for people with moderate functional limitations[13,14,15].

The SPPB total score and the subscale scores were used as outcome measures. The Short Physical

Performance Battery (SPPB) developed from the Established Populations for Epidemiological Study of the Elderly (EPESE) is based on standing, balance, chair stands, and gait speed. SPPB has excellent test–retest reliability and sensitivity to change[15]. Easy to administer in both epidemiological and clinical settings.

Method

The subjects received treatment five days in a week for 30-45 minutes for 4 weeks in the old age home. 30 subjects took part in study. An informed consent was taken before the study. The subjects taken for study are selected based on all the inclusion and exclusion criteria. All the subjects underwent a detailed examination. The purpose of the study and procedure explained to the subjects.

The subjects are assessed with short physical performance battery and the score of each subject is noted. In the next session by using leg press machine the 1 RM of the subjects is taken. For that the Subject should be in comfortable position, the buttocks & back of the subject remains against the seat, they have to use proper breathing pattern i.e. exhale during the concentric phase, no breath holding. They are now instructed to place their both feet on platform of leg press machine and press the platform with their feet while extending the knee with full strength. Check the maximum weight lifted in kg by the subject and record 1RM. Care is taken that they could not use their hands for assistance while extending their lower extremities. Training subjects exercised 5 days in a week over 4 consecutive weeks.

The exercise program was based on exercising in functional weight bearing position. The program included lower limb strength training exercises, in sitting, standing, and walking ,performed at medium intensity, if possible, for each participant. The collection of exercise was developed according to 3 criteria: (1) applicable without access to special exercise facilities, (2) adaptable for frail older people with different functional levels, (3) possibility of progression of the exercise in 2 ways- either to increase the difficulty in a specific exercise or to change to another, more challenging, exercises.

The intensity of the exercises was self paced, although the participants were encouraged by the physiotherapist to exercise with a medium intensity and to progressively increase the difficulty in each exercise.

The participants started each class with 10 min of warm up that include light rhythmical, low intensity aerobic activities, flexibility exercises and supported stretching exercises.

The exercises given to participants are

- Forward lunge
- Backward lunge
- Mini squats
- Single leg raise in standing
- CKC short Arc quads
- Forward lean
- Sit to stand
- Walking at different speeds
- Stationary cycling in forward and backward direction.
- Dynamic quadriceps in sitting position

Result

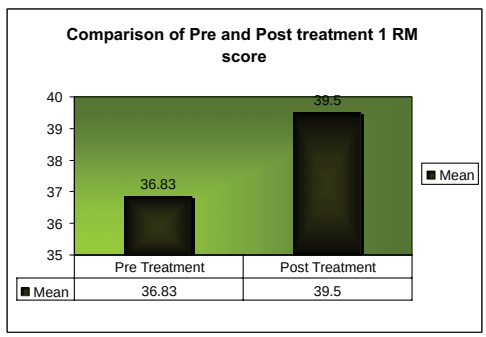
In this study 30 subject were included. Mean and standard deviation were taken pre and post training for 1 RM, endurance, and short physical performance battery. Paired't' test is used for analysis of significant difference. The significance level set for this study was $p<0.05$. Mean age of subjects were 75. When pre and post treatment parameters were compared after 4 weeks the subjects showed significant improvement in functional performance and strength.

After applying t-test, there were highly significant difference found in the strength, balance, measured walk, and chair stands.

Strength	($t=5.757$, $p<0.0001$)
Balance	($t=3.808$, $p<0.0007$)
Measured walk	($t=5.385$, $p<0.0001$)
Chair stands	($t=6.595$, $p<0.0001$)
Total SPPB score	($t=7.264$, $p<0.0001$)

Table 1: Comparision of Pre and Post Treatment 1 RM

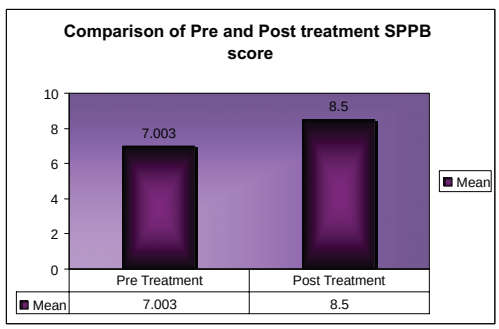
	Pre Treatment	Post Treatment
Mean	36.83	39.5
Standard Deviation	5.943	5.625
T = 5.757		
p < 0.0001		



When pre and post treatment parameters were compared after four weeks of training subjects showed a significant difference in 1 Rm

Table 2: Comparison of Pre and Post Treatment SPPB Score

	Pre Treatment	Post Treatment
Mean	7.033	8.5
Standard Deviation	1.790	1.167
T = 7.264		
p < 0.0001		



When pre and post treatment parameters were compared after 4 weeks the subjects showed a significant difference in the improvement of SPPB score.

Table 3: Comparison of Pre and Post Treatment Balance Score.

	Pre Treatment	Post Treatment
Mean	3.533	3.867
Standard Deviation	0.6288	0.3457
T = 3.808		
p < 0.0007		

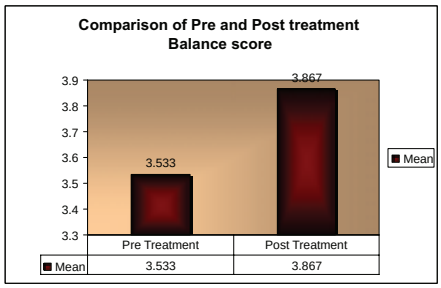


Table 4: Comparison of Pre and Post Treatment Measured Walk Distance.

	Pre Treatment	Post Treatment
Mean	1.9	2.4
Standard Deviation	0.6618	0.4983
T = 5.385		
p < 0.0001		

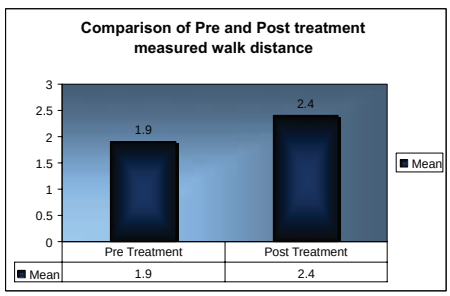
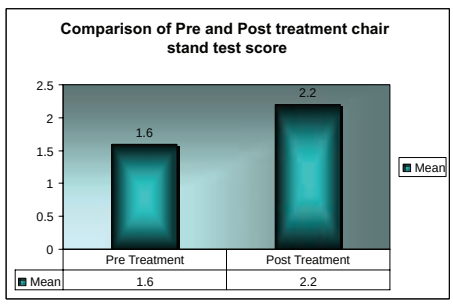


Table 5: Comparison of Pre and Post Treatment Chair Stand Test Score.

	Pre Treatment	Post Treatment
Mean	1.6	2.23
Standard Deviation	0.8550	0.7279
T = 6.595		
p < 0.0001		



Discussion

The purpose of the study was to examine the effect of strength training on functional tasks in older adults.

According to Roger and Evans, the very old and frail elderly experience skeletal muscle atrophy of type II fibers as a result of disuse, disease, under nutrition, and the effect of aging[16]. However, several studies have shown that elderly men and women retain the capacity to adapt to progressive resistive exercise training with significant and clinically relevant muscle hypertrophy and increased muscle strength[17,18,19,20]. In present study it supports this finding, showing a significant performance improvement in training group.

For other studies that addressed adaptation to resistance training in the institutionalized elderly reported improvement in strength, irrespective of the use of a high-intensity resistance program[21], a combination of isometric training and low intensity weight lifting exercise[22], seated resistance exercises[23], and rowing exercises for restrained nursing home residents[24].

Although high intensity exercise clearly may elicit sizable gains in strength, less strenuous programs have demonstrated significant gain in muscle strength. In this study also less strenuous and medium intensity exercises are used. Some studies have considered changes in functional ability in older people after training[23,25]. In this study it have been found significant improvement in the 3 functional indicator used that is Balance, Measured walk, and Chair stands.

When considering relevant improvements in functional tasks, one should consider the type of training exercises used. Skelton et al.[26], in a study with task independent training exercises (i.e., training exercises specific to increase strength of major muscle groups) and avoidance of those that mimic functional tasks, reported only minimal improvements in 2 out of 12 functional ability tests, despite significant increase in strength and muscle power. In contrast, Skelton and MacLaghlin[27] found significant improvements in chair-rise, timed-up-and-go, stair-climbing time, and floor rise-time tests, in an 8-week study, with a training program mirroring daily activities. They concluded that it might be more beneficial to train using movements that closely mirror daily activities rather than to train to increase strength and the power of individual muscle groups per se. In the current study most of exercises is closely related to the functional activities and ADL's.

It has been seen that there are number of changes seen with strength training, which improves the function of muscle. Changes that occur with strength training are[1].

- Increase in resting level of anaerobic substrates (ATP, CP, and glycogen) in skeletal muscles.
- Increase in fiber size (fast- twitch type II fibers).
- Increase in activity of anaerobic enzyme function (glycosis)
- Increased capacity for levels of blood lactic acid.
- Improved motivation.
- Improved pain tolerance.

Effect of Training on Strength

Research has consistently demonstrated that, given a stimulus of sufficient intensity, muscle strength increases in older adults. The subjects in this study increased lower body strength significantly. ($t=5.757$, $p<0.0001$). These improvements are similar to changes reported by other researchers[26,27,28]. Also noteworthy is the fact that no injuries were reported during training or 1 RM testing, which is consistent with the literature and reinforce the idea that strength training is safe and effective in older people.

The significant improvement in strength in this study supports that moderate intensity resistance training is adequate to lead to neuromuscular adaptations in older adults. The mechanisms responsible for the improvement of neuromuscular function attributed mainly to the neural adaptations (motor unit activation, coordination) a secondary to muscle hypertrophy after short-term resistance training in older adults[29,30].

Effect of Training on Balance

In this study improvement in balance is seen which is comparative little less compared to other 2 functional tasks, (measured walk and sit to stand), but there is significant difference found in pre and post group ($t= 3.808$, $p<0.0001$).

Studies have shown that there is improvement in balance as the strength increases, but there are few strength training intervention studies in the literature which found no significant improvement in balance. Both Wolfson and colleagues[31] and Buchner and colleagues[32] found no significant interaction between strength training and balance, using low intensity training protocol.

Improved balance seen is may be due to increased strength of postural muscles. And in this study we have used sit to stand as an functional exercise which has already proven as a useful tool to enhance balance[33]. Sit-to-stand is a whole body action, requiring postural control and other sensorimotor systems in addition to adequate strength[34]. It is, therefore, not surprising that repetitions of sit-to-stand had a positive effect on a balance outcome measure over time.

Effect of Training on Walking Speed

The data showed that walking speed is improved after strength training. The 12% increase in walking speed is found in post training group. ($t=5.385$, $p<0.0001$) our results suggest that lower body strength training improves walking speed, a risk factor associated with falling.

The 12% decrease in time it took to complete the walking distance, seen in this study is in line with changes demonstrated by Fiatarone & Colleagues34 and sipila and colleagues35. Both of these research groups witnessed a 12% increased in maximal walking speed after training groups of subjects aged 72 to 98 and 76 to 78 yr, respectively. Improvement seen in walking performance is may be due to increase local muscular endurance, and improved balance.

Effect of Training on Sit to Stand Performance

There is 15% decrease in the time it took to complete 5 chair rises after strength training programme. So the result of this study suggest that lower limb strength gain account for the improvement in sit to stand time, a risk factor associated with fall. Another strength training study using a slightly higher training stimulus (80% 1RM) and similarly aged subjects (61–82 years old) found no effect of training on STS61, and researchers using a less intense intervention (sand-bag ankle weights and fewer exercises) also reported no effect[36].

In one of the above studies they have done on the depressed geriatric population, but in this study the subjects were very motivated. The improvement in this study is may be influenced by a powerful learning effect because in this study sit to stand is given as an exercise for the training group.

Conclusion

Our results suggest that strength training exercise program can produce benefits with regards to functional performance improvement. The result also suggests that medium intensity functional weight bearing exercise program is applicable for use, among older people, living in residential care facilities. In line with evidence from other studies on older people this study suggested that the functional weight bearing strength training can be provide to improve the functional performance and quality of life in older individuals.

Limitations and Further Suggestion

Small sample size and no control group is a limitation of the study. Further study can be done by taking large sample size and by taking control group so different protocol and interventional programme can be compared.

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Correlation between VO2 Max by 3 Min Step Test and VO2 Max by Six Min Walk Test – A Randomised Cross Over Trial

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Abstract

Background

Maximal oxygen consumption by the whole body (vo2 max) is the gold standard measurement of quantifying cardio respiratory capacity or endurance. However, the laboratory measurement of VO2 max is cumbersome and expensive. The only clinical test that is proved to be reliable in VO2 measurement is Queensland step test. But the recent literature states that the functional test 6 minute walk test if performed under strict measures as quoted by American Thoracic Society criteria could yield the reliable VO2 measurement. No literature till date had shown relevance between the functional walk test and clinical step test.

Purpose

The purpose of the study was to correlate the maximal oxygen consumption i.e. vo2 max obtained from 6 min walk test and 3 min step test. Methods: subjects 26 college students of which (males = 9 and females = 17) of median age 21 (18 – 25 years). Randomly (computer randomization) allocated to one of the stress test either steps or walk test and after a 2 days of washout under strict environment crossed over to the next test. Predictor variables in 6 MWT regression model were age, sex, resting heart rate, resting blood pressure, rate of perceived exertion (RPE) on vas , final heart rate, final blood pressure. Predictor variable in 3minute step test were age, sex, height, body weight, BMI, heart rate.

Statistical Analysis

The variables of each test are described under descriptive analysis and the median VO2 max of step test and the walk test compared with each other using student t test. The plot graphs to illustrate the individual correlations. Results and discussion: the boys VO2 max is better than girls. Their VO2 max correlated well with the BMI. The native students outscore in VO2 max than their aboriginal counterparts. The p value of comparison between VO2 max of step and walk test had not reached the significance.

Conclusion

For, maximal oxygen consumption calculation either of the tests can be used individually. Derivation of VO2 max from one test should not be applied to other since it may lead to erroneous results.

Introduction

The new dimensions of technology help us for more accurate & faster completion of work which at the same time makes our life sedentary hence decreases our activity level in home & in office places. Hence with industrialization & with decreases level of activity our aerobic fitness1 is also getting compromised hence our cardiovascular endurance decreasing.

Recent literature states that people with good cardio respiratory fitness live longer[2]. Hence this supports the importance of aerobic exercises towards good health living. With exercises & good cardio respiratory endurance the individual can easily meet the required demands of his daily living over his body.

The cardiopulmonary endurance is measured by the clinical exercise testing. Though reliable laboratory based protocols are available, these tests are cumbersome, expensive, time consuming and needs skilled professionals. On the other hand, less reliable field tests more are less measures the cardiopulmonary endurance such as cooper run test, shuttle run and step tests. Reliability, less expensive, less skillful, easiness in scaling makes the step test as an important tool[3] in the clinical setting in the measurement of VO2 max. The predictive equations for the calculation of peak oxygen consumption by Queensland step test can be calculated using the formula of

1. Male vo2max = 111.33 – [0.42 * step test pulse rate (beats/minute)]
2. Female vo2max = 65.81 – [0.1847 * step test pulse rate (beats/min)]

The self paced walking tests especially 6 minute walk tests are used as a vital tool for the measurement of the functional ability of walking. Under the strict standards as per ATS criteria, even VO2 max can be calculated by six minute walk test. VO2 max in 6minute walk test can be calculated from Cahalin regression equation VO2 max = (0.00688*distance in feet+3.38). This regression equation found to be reliable and valid4. But no literature to date compared the peak oxygen measured by step test and self paced 6 minute walk test to apply the reliable tool in the clinical setting.

Purposes of Study

The purposes of study are

1. To derivate the normal peak oxygen consumption of Sikkim Manipal University collegiate

2. To measure and correlate the vo2max obtained from 6minute walk test and 3minute step test in young college students.
3. To describe the anthropometric data and their relation in peak oxygen consumption of young adults

Methodology

Study setting: Dept. of physiotherapy of Sikkim Manipal institute of medical sciences.

Study design: Cross-sectional cross over comparative trial.

Randomization: Simple computer generated randomization

Sampling: Convenience sampling.

Sample size: 25

Inclusion criteria

- College students of age group 17 to 25 years
- Both genders
- Any play level activity

Exclusion criteria

- Contraindication by American College of Sports Medicine(ACSM) for performance of the above two tests

Absolute

- A recent significant change in the resting ECG suggesting significant ischemia, recent myocardial infarction (within two days) or other acute cardiac event.
- Unstable angina.
- Uncontrolled cardiac dysrhythmias causing symptoms or hemodynamic compromise.
- Symptomatic severe aortic stenosis.
- Uncontrolled symptomatic heart failure.
- Acute pulmonary embolus or pulmonary infarction.
- Acute myocarditis or pericarditis.
- Suspected or known dissecting aneurysm.
- Acute systemic infection, accompanied by fever body aches or swollen lymph glands.

Relative

- Left main coronary stenosis.
- Moderate stenotic valvular heart disease.
- Electrolyte abnormalities, (e.g. hypokalemia, hypo-magnesia)
- severe arterial hypertension(systolic bp>200mmhg and or diastolic bp >110mmhg)at rest
- Tachydysrhythmias or bradydysrhythmia.
- Hypertrophic cardio myopathy and other forms of outflow tract obstruction.
- Neuromuscular, musculoskeletal or rheumatoid disorders that are exacerbated by exercise.
- High degree AV block.
- Ventricular aneurysm.
- Uncontrolled metabolic disease (e.g., diabetes, thyrotoxicosis or myxedema).
- Chronic infectious disease (e.g., diabetes, thyrotoxi-cosis or myxedema).
- Chronic infectious disease (e.g.-mononucleosis, aids, hepatitis).
- Mental or physical impairment leading to inability to exercise adequately.

Procedure

- Before performing the test a standard questionnaire was selected and were given to each participant
- 25 subjects were collected out of which there were 9(males) and 16(females)
- Informed consent was taken from the subjects.
- Subjects who gave consent were administered with 6 minute walk test and 3 minute step test.
- Six minute walk test
- As per American Thoracic Society (ATS) six minute walk test was explained to the subjects and their resting bp and heart rate was measured.
- They were asked to walk on a flat even surface (a long indoor hallway measuring 100mts/328ft approx)

Instrumentation

1. Stop watch
2. Measurement tape
3. Portable chair
4. Long indoor hallway
5. Stethoscope
6. Sphygmomanometer

Instruction

The participants were asked to walk as far as possible in six minutes .the participants were ask to maintain the pace of the walk and if while walking they have shortness of breath, chest pain, leg pain or any other symptoms then rest for a while inform the subjects about the time each minute. After the end six minute the heart rate and bp were again measured and the distance covered by the participants were noted

3minute Step Test

The person who performed the walk test also performed the step test for the step test each participant was explained about the test and a practice session was given to each of them.

Materials

1. Stepper
2. Inch tape
3. Metronome
4. Stop watch
5. Weighing machine
6. Sphygmomanometer

Instructions

The wooden stepper was taken with the height of 16 inches. The participants were asked to perform the test after a trial session after each minute the individuals were informed about the time. Metronome was used to monitor the cadence which was set at 88 step per minute for females and 96 steps per minute for males for 3 minutes. After the completion of the test 5 second rest was given and from 5th to 20th second the pulse rate was noted. The recovery heart rate was calculated by 15 seconds heart rate multiplied by 4.

Outcome measures: assessment charts having the BMI, regression equations for measurement of vo2 max from 6 minute walk test and

Statistical Analysis

Pearson's correlation test (r) by spss package 11.5

Data Analysis

Results

Age

The median age of the entire volunteer collegiate are 20.5 (18 -25 years). The boys is 20.88 where as girls is 20.34

BMI

The average BMI of the entire study subjects is 20.97 kg/m^2. The male collegiate has higher BMI (21.28889 kg/m^2) than their female counterparts (20.79625 kg/m^2) that are depicted in graph 2.

Peak Oxygen Consumption

The average peak oxygen consumption of the college students is found to be 26.72 ml/kg/min. The weight is taken into consideration since it measures only the relative VO2 max not absolute that does not take the body weight into consideration. The boy's average peak oxygen consumption (27.85 ml/kg/min) was better than the peak oxygen consumption by girls (26.0768 ml/kg/min) that is shown in graph 1.

Correlation of Average Peak Oxygen Consumption with BMI

The individual BMI and the respective peak oxygen consumption by both the step and walk test are found to be positively correlated that is depicted from the graph 4.

Peak Oxygen Consumption by Step Test and 6 Minute Walk Test

The average peak oxygen consumption by the step test is 37.02 ml/kg/min whereas by 6 minute walk test is only 16.42 ml/kg/min..

Table 1: Table shows the descriptive data regarding BMI and VO2 max through step test

Name	age	sex	weight (kg)	height (cm)	BMI	pulse	vo2 max
tsultim sangpu	19	f	48	158	19.23	160	36.26
tuboli kiba	18	f	48	157	19.47	144	39.21
snighda baruah	22	f	65	166	23.59	184	31.83
frieda p bokali	22	f	56	159	22.15	160	36.26
deboshree shah	20	f	43	145	20.45	176	33.3
shewta pradhan	19	f	45	163	16.94	152	37.74
bonikali v achumi	18	f	52	149	23.42	176	33.3
passang laden	20	f	45	159	17.8	168	34.78
thenlay lepcha	18	m	52	162	19.81	168	40.77
sherin rai	20	f	67	173	22.39	160	36.26
ujjwala gurung	21	f	50	154	21.08	156	37
rashmi dwivedi	22	f	49	152	21.21	160	44.13
naina adhikari	18	f	47	158	18.83	176	33.3
priya bansal	19	f	43	154	18.13	152	37.74
jyoti minda	23	f	60	151	26.31	152	37.74
zigdal bhutia	20	m	65	164.5	24.02	160	44.13
sachin pradhan	18	m	60	167	21.51	168	40.77
abhishek koushik	22	m	72	176	23.24	184	34.05
soumyjit	23	m	74	180	22.84	192	30.69
shashi kumar	23	m	47	161	18.13	168	40.77
manoj kharka	19	m	49	165	18	168	40.77
sanjivani rai	19	f	39	154	16.44	144	39.21
albert soren	24	m	60	159	23.73	176	33.3
swarnima rai	25	f	60	154	25.3	160	36.26
daniel rai	21	m	54	164	20.32	180	35.73

Note: the and vo2max in 3minute step test was obtained by queen's land formula –

3. male vo2max = 111.33 – [0.42 * step test pulse rate (beats/minute)]

4. female vo2max = 65.81 – [0.1847 * step test pulse rate (beats/min)]

Table 2: Descriptive data regarding FHR, FBP &VO2 MAX from 6min walk test

Name	age	sex	wt	ht	BMI	RER	RBP	FHR	FBP	vo2 max
tsultim sangpu	19	f	48	158	19.23	76	120/76	96	130/82	14.006
tuboli kiba	18	f	48	157	19.47	80	120/82	106	130/90	14.99
snighda baruah	22	f	65	166	23.59	74	120/80	132	140/90	16.37
frieda p bokali	22	f	56	159	22.15	76	110/70	128	134/80	17.15
deboshree shah	20	f	43	145	20.45	78	120/80	100	130/90	13.8
shewta pradhan	19	f	45	163	16.94	78	120/80	150	130/90	15.97
bonikali v achumi	18	f	52	149	23.42	84	120/80	152	130/82	15.97
passang laden	20	f	45	159	17.8	82	110/70	112	126/70	15.97
thenlay lepcha	18	m	52	162	19.81	86	120/82	142	140/80	18.14
sherin rai	20	f	67	173	22.39	76	120/70	144	140/90	16.17
ujjwala gurung	21	f	50	154	21.08	82	120/80	134	138/80	16.37
rashmi dwivedi	22	f	49	152	21.21	84	110/70	130	140/70	15.48
naina adhikari	18	f	47	158	18.83	96	120/80	144	140/86	17.15
priya bansal	19	f	43	154	18.13	80	110/70	156	120/82	14.79
jyoti minda	23	f	60	151	26.31	74	116/72	156	122/80	15.58
zigdal bhutia	20	m	65	164.5	24.02	80	120/80	136	140/90	17.35
sachin pradhan	18	m	60	167	21.51	82	130/80	156	150/90	19.77
abhishek koushik	22	m	72	176	23.24	95	130/90	144	130/80	15.18
So chakroborty	23	m	74	180	22.84	76	120/80	146	140/80	17.35
shashi kumar	23	m	47	161	18.13	66	120/80	168	140/100	17.94
manoj kharka	19	m	49	165	18	78	110/78	152	130/80	16.76
sanjivani rai	19	f	39	154	16.44	76	110/76	104	130/86	14.2
albert soren	24	m	60	159	23.73	82	140/80	156	160/90	18.14
swarnima rai	25	f	60	154	25.3	76	120/80	144	150/100	16.17
daniel rai	21	m	54	164	20.32	72	120/80	176	150/90	19.71

RHR - resting heart rate (beats/min)
RBP-resting blood pressure (mm of hg)
FHR - final heart rate
FBP - final blood pressure

Correlation of Average Peak Oxygen Consumption of Step over the Walk Test

Though graph 4 depicts that there might be existence of a positive correlation of the peak oxygen consumption of step test and the walk test, the Pearson correlation suggests that there was no such relationship with the Pearson correlation coefficient (r) is – 0.235 and p = 0.204 (> 0.05).

Discussion

BMI and the VO2 max correlation

As with the other earlier studies we had found that BMI is positively correlated with the peak oxygen consumption5. As the BMI increases, the peak oxygen consumption also increases that we had shown in the peak oxygen consumption difference between the boys and girls. The relative peak oxygen consumption includes an important parameter “weight” might be the reason for positive correlation of the two.

We had not find any significant correlation between age and the peak oxygen consumption as by the earlier authors

Comparison of VO2 max by step test with the walk test

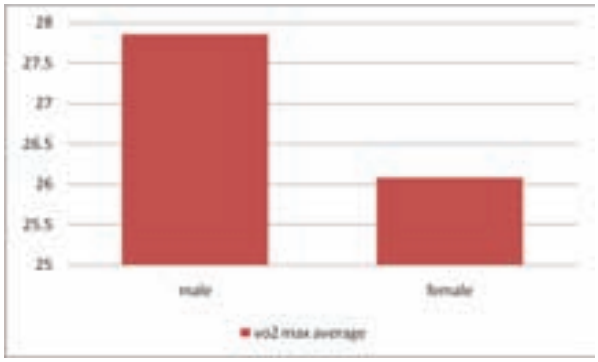
We could not establish a correlation between the vo2 peak measurements by step test and walk test. The probable reasons might be:

1. The walk test is a self paced test which might not have stressed the cardiopulmonary endurance and hence the low values of relative VO2 max values. Whereas the step test is a sudden burst of energy that also check more of muscular power rather than the cardiopulmonary endurance and hence the higher VO2 max. Hence it can be put forth that the step test overestimates[6] the VO2 max and 6 minute walk test underestimates[7].
2. The miscalculations of the peak oxygen consumptions might have been due to the inherent nature of the test itself or might be due to the regression equation derivation and heart rate recovery.

Table 3: Represents the VO2 max of samples by 6 min walk test and 3 min step test.

vo2 max by 6 min walk test	vo2 max by 3 min step test
14.006	36.26
14.99	39.21
16.37	31.83
17.15	36.26
13.8	33.3
15.97	37.74
15.97	33.3
15.97	34.78
18.14	40.77
16.17	36.26
16.37	37
15.48	44.13
17.15	33.3
14.79	37.74
15.58	37.74
17.35	44.13
19.77	40.77
15.18	34.05
17.35	30.69
17.94	40.77
16.76	40.77
14.2	39.21
18.14	33.3
16.17	36.26
19.71	35.73

Graph 1: Average peak oxygen consumption difference between males and females



Conclusion

None of the above stress test should be used as a confirmatory test for the measurement of peak oxygen consumption and further the extrapolation of the values of one test over the other is not recommended.

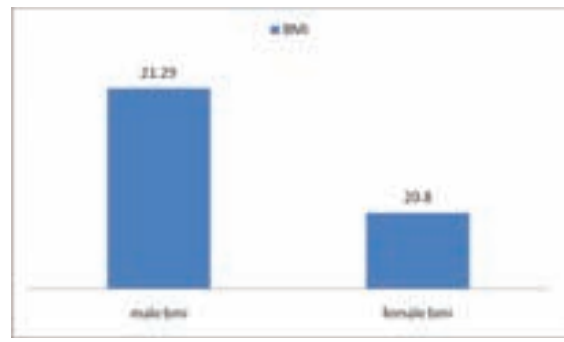
Clinical Implications

For the inexpensive, easy measurement of peak oxygen consumption either of the tests can be used individually. But the reliability and validity of both the tests cannot be trusted. Further the extrapolating the results of the either one tests over the other may lead to an erroneous results that might affect the core use of exercise stress testing.

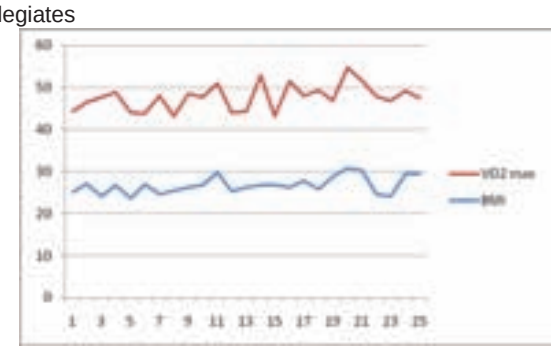
Table 4: Pearson correlation of VO2 max by step test and walk test through spss

Correlations			
		vo2 max by walk test	vo2 max by step test
6 min walk test vo2 max	pearson correlation	1	-.237
	significance		.204
	n	25	25
3 min step test vo2max	pearson correlation (r)	-.237	1
	sig. (2-tailed)	.204	

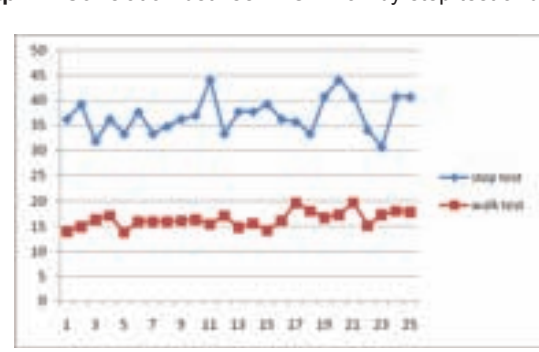
Graph 2: BMI difference between males and females



Graph 3: Correlation between vo2 max and BMI for all 25 collegiates



Graph 4: Correlation between VO2 max by step test and walk test



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Efficacy of Lateral Wedged Insole with Subtalar Strapping on the Functional Status of Medial Compartment 3rd Grade Osteoarthritis of the Knee

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Abstract

Knee osteoarthritis is the most common disease encountered in the Physical Therapy Clinic. The main outcomes of Physiotherapy treatment is based on symptomatic pain relief along with prevention of deterioration of the functional capacity and improvement in ADL. Among the various conservative treatments for knee OA, lateral wedged insole is the latest treatment concept based on correction of knee varus deformity with the change in foot position. Addition of exercise helps in the maintenance of the correction as muscle strength is required to align the bony levers. This study compares the effect of lateral wedged insole with subtalar strapping along with exercises as treatment option for knee OA with that of exercises alone.

Objectives

To find out the efficacy of lateral wedged insole with subtalar strapping along with exercises on medial compartment 3rd grade knee OA.

Methods

30 subjects were included in the study based on the inclusion and exclusion criteria and clinical criteria for diagnosis of knee OA. The subjects were divided into 2 groups containing 15 each. Both the groups were administered KOOS scale and a baseline assessment was formed for the functional status. Group I was subjected to the use of wedged insole with subtalar strapping along with a set of 5 exercises and Group II was prescribed only exercises for a period of 1 month. At follow-up, the scale were administered again and the effects of the intervention were gauged by comparing the pre intervention and post intervention values.

Results

Based on the effect size and % change, the data analysis reveals that though both the groups had significant effects of the intervention and exercises, the experimental group (group I) showed a higher effect size and percentage change compared to the control group (group II).

Interpretation and Conclusion

it is concluded that lateral wedged insole with subtalar strapping will be highly efficacious if used along with strengthening exercises for patients with medial compartment 3rd grade knee OA.

Keywords

Knee Osteoarthritis, KOOS, Functional status, Wedged insole, Subtalar strapping.

Introduction

Knee OA, also know as DJD, is one of most common disorders of middle age to elderly population and the involvement of the medial compartment of knee joint is almost three times more than the other compartments. It is a condition more often seen in women. According to researches, the incidence of OA in men is comparable to that in women, but women are more likely to be symptomatic. Although it is the most common presentation encountered in any physical therapy clinic, it also remains the most unsatisfactorily treated condition as the treatment interventions are usually directed towards symptomatic pain relief and strengthening.

With respect to treatment of knee OA, from time immemorial, various treatment regimes are used by practitioners; pharmacological and non-pharmacological including Physiotherapeutics and Surgery. Surgery remains to be the only permanent alternative. Due to the high risk of complications following surgeries like high tibial osteotomies and inability to cope up with the demands of post-surgical recuperation in old age, surgery is not always preferred and patients usually opt for conservative management.

In medial compartment OA of the knee, varum is produced in the knee due to the degeneration of medial articular cartilage. This presentation is not adequately met by any of the interventions available in current practice and thus pathomechanics is still persisting/ continuing even though the symptomology is relieved transiently through some of the treatment modalities. Therefore, there is a need for a conservative treatment to replace the permanent solution of surgery.

The purpose of this study is to develop and determine the effects of a treatment alternative aimed at biomechanical correction of the knee OA pathomechanics. The lateral wedged insole is introduced recently for the treatment of knee OA. Trails using 16mm, 12mm and 8mm elevations have reported 12mm and 8mm to be most effective. But these studies have failed to correlate their findings (i.e. specific degree of elevation) with specific grade of OA.

Aim and Objective

To find out the efficacy of 12mm lateral wedged

insole with subtalar strapping on patients with 3rd grade medial compartment OA of the knee.

Methodolgy

Materials used and the characteristics of the sample:

Wedged insole, Ankle binder and Knee Osteoarthritis Outcome Score (KOOS) are the materials used.

The population of the study is defined as having 3rd grade medial compartment knee OA and a sample of 30 females are selected randomly from the population, the source of which is ITI General Hospital and Garden City College OPD, Bangalore.

The sample is equally divided into two groups; alternate members are assigned to the two groups randomly.

Inclusion Criteria

- Patients having medial compartment osteoarthritis with grade 3 of Kellgren and Lawrence grading system for osteoarthritis, 1957.
- Patients having medial compartment osteoarthritis with at least 3 of the clinical symptoms according to Criteria for classification of idiopathic Osteoarthritis of the knee, 1986 (American college of Rheumatology)
- Full range of motion in subtalar joints

Exclusion Criteria

- Patients currently using wedged insole.
- Patients having any foot deformity
- Any peripheral or central nervous disorders.
- Patients with any other compartment of the knee involvement.

Study Design

Two-group simple randomized design.

Methods

The study includes 30 female patients randomly assigned in two groups. The patients have to undergo radiographic examination of the knee in AP view standing on one leg without the insole.

The stage of osteoarthritis is determined according to the Kellgren and Lawrence grading system for osteoarthritis, 1957.

According to this grading system

Grade 3 – moderate osteophytes and joint space narrowing, some sclerosis and possible deformity.

Patients are then assessed for the clinical symptoms according to Criteria for classification of idiopathic Osteoarthritis of the knee, American college of Rheumatology, 1986. The patient should have knee pain and at least 3 positive symptoms out of the 6 to fulfill these criteria.

To measure the functional status of the patient before and after the insertion of lateral wedged insole, they are made to fill questionnaire i.e. KOOS

The patients in group 1 are given lateral wedged insole along with a home exercise program whereas patients in group 2 are assigned only to the home-exercise program. The patients are instructed to wear lateral wedge with subtalar strapping for a period of 3-6 hours each day. The home-exercise program included a set of 5 exercises;

- Static glutei
- Static quadriceps
- Short arc quadriceps
- Long arc quadriceps
- Closed-chain short-arc knee extension

These exercises are held for 6-7 secs, and then slowly relax; rest period of 2-3 secs between squeezes, performed 3-5 times a day and each exercise repetition are 5-7 times per session (American Geriatrics Society 2001). The use of the insole and exercises continued for a period of 4 weeks duration.

The patients consent is obtained by filling the consent forms.

The KOOS questionnaire is filled again after the completion of the duration of the study.

Construction of the lateral wedged insole with subtalar strapping

The wedged insole was made of Microcellular rubber, the length of 75mm, breadth of 55mm and height of 12mm. the angulation formed was 11.2°. A base layer of 2mm ether flex was used for adhesive application on the ankle binder.

The ankle binder was purchased from MGRM Medicare limited. The size was determined based on the circumference of the ankle joint in inches;

6-8 inches circumference - small 8-10 inches circumference - medium

10-12 inches circumference - large

12-14 inches circumference- X large

Results

Data analysis is done by using Student paired t-test, which is used to find the significance of efficacy of the intervention.

Effect size of each of the domains in the KOOS is measured by Cohen's method.

Discussion

The P-value of the experimental group and the control group both showed significant improvement in the overall function of knee OA patients as measured by KOOS but in the dimension of Sports and Recreational function in

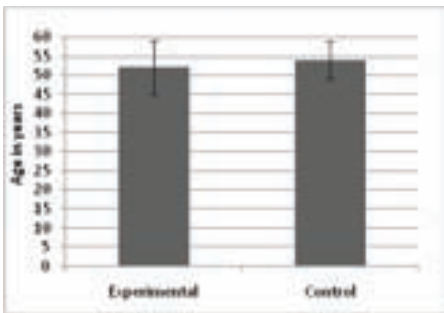
Table 1: Basic characteristics of the study based on age and onset of disease

Basic characteristics	Experimental (n=15)	Control (n=15)	P value
Age in years	52.07±7.08	54.00±4.88	0.392
Onset of disease in years	2.63±1.43	2.40±0.99	0.607

Table 2: Interventional Efficacy between the two groups using KOOS

KOOS		Experimental (n=15)	Control (n=15)
Pain	Pre	22.13±3.56	21.33±1.23
	Post	13.07±3.97	19.87±0.99
	P value	P<0.001	P<0.001
	ES	2.40	1.76
	% Change	40.94	8.98
Symptoms	Pre	13.80±4.65	14.27±1.44
	Post	8.67±3.47	12.27±1.44
	P value	P<0.001	P<0.001
	ES	1.25	1.39
	% Change	37.17	14.02
ADL	Pre	37.73±5.09	30.13±3.11
	Post	23.67±6.39	29.00±3.18
	P value	P<0.001	P<0.001
	ES	2.43	0.36
	% Change	37.26	3.75
Sports & Recreation	Pre	18.40±1.91	19.07±1.03
	Post	13.53±2.88	18.80±0.94
	P value	P<0.001	P=0.104
	ES	1.99	0.27
	% Change	26.47	1.42
Quality of life	Pre	11.93±1.03	11.07±0.70
	Post	7.87±1.73	10.13±0.64
	P value	P<0.001	P<0.001
	ES	2.85	1.40
	% Change	34.03	8.49

Figure 1a: Basic Characteristics of the study based on age



the control group there was no significant improvement as the P-value = 0.104, indicating that for sporting and recreational activities muscle strengthening alone will not be sufficient without biomechanical correction.

When comparing between the mean score differences of pre and post of experimental with that of pre and post values of control group, larger improvement is seen in the dimensions of pain and ADL indicating that the intervention is efficacious in alleviating pain and improving function in the knee OA patients.

The optimal tilt of a lateral wedge insole with subtalar strapping is affected by age. In this study, 12mm elevation

Figure 1b: Basic Characteristics of the study based on onset

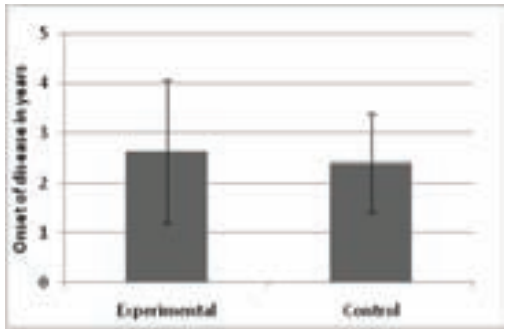


Figure 2a: Pre and Post mean score comparison of each domain of KOOS in Experimental Group

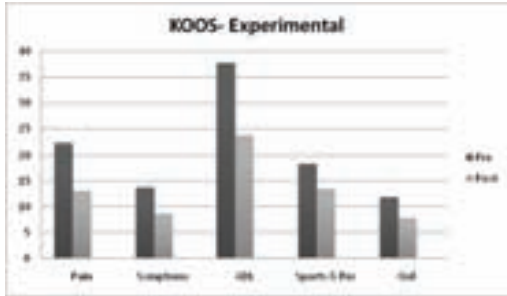
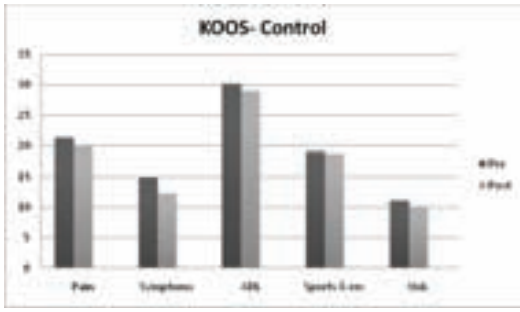


Figure 2b: Pre and Post mean score comparison of each domain of KOOS in Control group

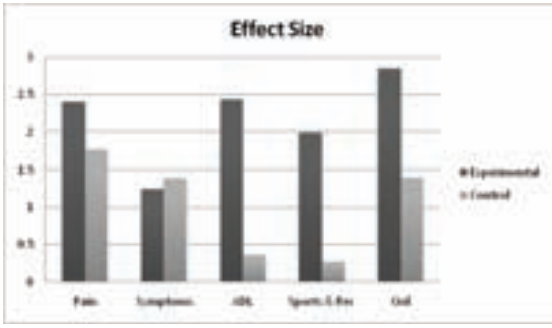


was used to assess effects on older patients with 3rd grade OA. Comparing the results of other studies, 8mm elevation was recommended for older adults. This maybe probably as the grade of OA selected was usually ≤ 2nd grade. Since our study was undertaken on 3rd grade OA, 12mm elevation proved to be efficacious. Some studies also concluded lack of effect on older population due to insufficient muscle strength to preserve the biomechanical correction. Therefore, in our study we added strengthening of lower limb muscles. The results showed that only muscle strengthening in the control group also had positive effects; hence when added to the experimental group, it proved to be a valuable adjunct to the intervention.

Conclusion

It has been concluded that lateral wedged insole with subtalar strapping is a cost effective, conservative means that improves functional status of knee OA patients. It is also easily applicable in terms of compliance with the patient as the duration of application is limited to only 3-6 hours a day.

Figure 3: Effect size comparison of each domain of KOOS between Experimental & Control group



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Functional Outcome between Ischemic and Hemorrhagic Stroke Patients after Inpatient Rehabilitation

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Abstract

Purpose

The goal of this study is to clarify whether rehabilitation results are different between ischemic and hemorrhagic stroke patients matched for several other factors or different only in stroke origin.

Methodology

This was a case control study of 70 inpatients with result of first stroke who were enrolled in identical subgroup and matched for basal stroke severity evaluated by Canadian Neurological Scale, basal disability by Barthel Index, and Rivermead Mobility Index, age, and same duration of admission (within 3 days), who were different only in terms of stroke etiology hemorrhagic or ischemic.

We compare the efficiency and effectiveness of treatment, risk factors for stroke and changes in common component of Barthel and Rivermead Mobility Index score.

Results

Hemorrhagic patients showed better neurological and functional prognosis when compared with ischemic patients. Hemorrhagic had significantly higher Canadian Neurological Scale score, higher barthel index score and higher Rivermead Mobility Index scores at discharge as compared to ischemic group. Rivermead mobility index, Barthel index and their mobility components were statically analyzed to obtain any co-relation between these two scales. It was found that there was not any statistically significant co-relation present between both the scales and their mobility components.

Conclusions

From this study, it can be concluded that hemorrhagic patients showed faster recovery than ischemic patients did. Hemorrhagic stroke patients had better chance to make complete recovery from stroke.

Key words

Hemorrhagic, ischemic, rehabilitation, stroke

Introduction

Stroke is one of the oldest recognized diseases, but remains one of the least understood. Stroke is the third most common cause of death and single largest cause of neurological disability worldwide[1]. Worldwide, 3 million women and 2.5 million men die from stroke every year[2-4].

The generally accepted definition of stroke originates with the World Health Organization (WHO) and dates back to 1980 (1): which states that “Rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin”[5].

A transient ischemic attack (TIA) is generally accepted as consisting of the same symptoms, but lasting for up to 24 hours.

Strokes can be classified into two major categories: ischemic and hemorrhagic

Ischemic Stroke

Ischemic stroke is a common form of stroke accounting for approximately 80-85% of all strokes.6-8It occurs when a blood vessel becomes occluded and the blood supply to part of the brain is totally or partially blocked.

Hemorrhagic Stroke

Hemorrhagic stroke is more deadly and occurs when a vessel in the brain suddenly ruptures and blood begins to leak directly into brain tissue and or into the clear cerebrospinal fluid that surrounds the brain and fills its central cavities (ventricles) account for 12-24% of strokes[9-11].

Regarding recovery, it is generally believed that hemorrhagic stroke survivors have better neurological and functional prognosis than non-hemorrhagic stroke survivors do, but currently available data do not definitively answer all questions. In past, very few studies were done regarding outcome after hemorrhagic stroke compare with cerebral infarction[12].

In other outcome studies, other prognostic factors such as stroke severity, age, and onset-admission interval (OAI) showed to be relevant prognostic factors in functional outcome[13-14].

In a case-control study, hemorrhagic stroke patients showed functional gains, somewhat faster than ischemic patients but their data were not support with those of a prior study[15-18]. In other outcome studies, other prognostic factors such as stroke severity, age, and onset-admission interval (OAI) showed to be relevant prognostic factors in functional outcome[18-21].

Therefore, to obtain a clear characterization of the

role of a potential prognostic factor on functional outcome, it should be necessary to perform a case-control study, with groups matched by a large number of variables, to avoid, minimize, or control for the role of several well-recognized risk factors.

The aim of the present study was to clarify whether rehabilitation results were different between ischemic and hemorrhagic patients matched for several other factors or Different only in stroke origin.

Methodology

Total 70 patients selected from stroke patients admitted to YCM Hospital, Pune for rehabilitation of sequel of their first stroke. For patient's selection purposive sampling was done. On admission, patients were submitted to clinical, neurological and functional examination. All patients must have CT scan because it is consider the most sensitive and specific test to evaluate intracerebral hemorrhage. In several cases, MRI was also available.

Inclusion Criteria

1. Individuals with first episode of stroke.
2. Admitted within 3 days.
3. Must have neuro-radiological reports.
4. All patients who were medically stable.
5. Age group between 40-70 years.
6. Any sex.

Exclusion Criteria

1. Individuals who had secondary hemorrhage.
2. Patients who had neurological deficits after surgical decompression of hemorrhage.
3. Patients had other chronic disabling neuropathology e.g. Parkinsonism, polyneuropathy, severe cardiac, liver or renal failure and cancer.
4. Patients with absence of brain lesion on CT scan or MRI were excluded to avoid enrolling transient ischemic attack (TIA).
5. Any orthopedic complications (fracture, scoliosis) associated with stroke.
6. Cognitive deficits

Matching

From the results of neuroradiological result at the time of Admission, stroke patients were divided into 2 groups, ischemic and hemorrhagic, matched by basal stroke severity (same CNS score), basal disability (same BI score and same rivermead mobility index), age (within 1 year), sex, and OAI (within 3 days).

Neurological and Functional Evaluation

To measure severity of stroke revised and validated version of the Canadian neurological scale (CNS) was used ranging from 0 to 1522.

Functional data included rehabilitation length of stay (LOS), degree of independence evaluated by barthel index, mobility status evaluated by Rivermead mobility index (RMI).

Barthel index is widely used ADL Scale with ranging score from 0to100.23

The Rivermead mobility scale is short, simple scale validated for research analysis. That assesses 15 common daily activities. The scale gives a score ranging from 0 to 15.24

Each patient was evaluated by Canadian neurological scale, barthel index, and Rivermead mobility scale at the time of admission and discharge. All score were noted down.

Matching from the result of neuro-radiological report at the time of evaluation, stroke patients were divided into two groups ischemic and hemorrhagic matched by basal stroke severity, basal disability, age, and same duration of admission within three days.

Same physiotherapist for all patients designed exercise. Physiotherapy session was performed once a day for six days a week.

Physiotherapy started within 24 hours of admission. Same therapist treated each patient. Physiotherapy continued throughout the hospital stay.

Ethical clearance for the study was obtained from the ethical clearance committee of department of Physical Medicine and Rehabilitation, College of Physiotherapy, Nigdi, Pune.

Treatment (Physiotherapy)

The rehabilitation plan, essentially conventional physical therapy based on ADL skills included:

- Passive range of motion exercises
- Active assistive exercises
- Active exercises
- Resistive exercises
- Exercises in different functional positions
- Weight bearing exercises
- Weight shifting exercises
- Reaching exercises in sitting, kneeling and standing.
- ADL activities (Brushing, Combing, Cutting, Drinking, Eating etc)
- Gait training

These exercises prevent complications of immobilization and improve ADL skill at the earliest. This helps in preventing contractures and development of abnormal postures[25-26]. These exercises start with simple movements and subsequently complex movements and actions are tried.

Data and Statistical Analyses

We compared demographic, clinical neuro-radiological and functional data of the age-matched subgroups was using parametric or non-parametric analysis.

Comparison was performed between both the groups first at baseline level. Then again, comparisons were done at discharge level as well as from baseline to discharge level and results were noted.

Data analysis was performed with the SPSS10.0 statistical package.

Results

We successfully matched 70 ischemic patients with hemorrhagic patients for stroke severity, age, basal disability, risk factor and sex.

Clinical characteristics of the subgroups are shown in Table I. As shown, characteristics of the 2 groups were the same except for hypertension (significantly more frequent in hemorrhagic patients), diabetes, and heart diseases (significantly more frequent in ischemic patients).

Table I: Baseline Characteristics of the 2 Subgroups After Matching

	Ischemic	Hemorrhagic	P value
No of patients	35	35	
Age	64.8±5.49	64.29±4.416	NS
Sex (male)	68.5%	60%	Ns
Stroke left	23	21	NS
CNS Score at admission	4.75	4.74	NS
BI Score at admission	17.28	16.00	NS
RMI Score at admission	1.22	1.02	NS
Hypertensive%	37.14%	74.28%	
Diabetes %	11.42%	14.2%	
Heart disease%	51.42%	11.42%	

Both the groups were compared at the time of discharge by using non-parametric test of Mann Whitney in, which it was found that hemorrhagic patients had statistically significant, gain on all three scales.

Discussion

The controversy about recovery after hemorrhagic and ischemic stroke still exists.

There are few studies on functional outcome of hemorrhagic stroke patients. In total stroke population, only 15% are hemorrhagic in which 59-72% dies within three months making it difficult to compare it with same no of ischemic population.

In this study it was observed that hemorrhagic patients had a better prognosis but only in the absence of other more powerful prognostic factor like age, sex and same duration of admission. This is an impact of type of lesion on rehabilitation that is clearly significant in this study and earlier studies also show the same results[16-22]. If two patients at the beginning of rehabilitation had the same basal neurological severity (evaluated by Canadian Neurological Scale), same basal functional disability, same age, and same duration of admission as shows in table (I) Hemorrhagic patients showed better neurological and functional prognosis when compared with ischemic patients as it shows in Table II, III and IV and graph I, II, II and IV.

This better functional recovery in hemorrhagic patients is probably due to a better neurological recovery, which is visible as the hemorrhagic patients had higher CNS scores at discharge as shows in table II and graph II. Neurological status evaluated by CNS is considered to reflect recovery from the stroke lesion itself[12]. It may depend on the mechanism of injury.

In hemorrhagic strokes, bleeding in the brain causes hematoma. Hematoma irritates the brain tissue, disrupting the delicate chemical balance and if the bleeding continues, it can cause increased intracranial pressure. This physically impinges on brain tissue and restricts blood flow to the brain.

In these respects, hemorrhagic strokes are more fatal than their counterpart ischemic strokes. But if patient survives after having cross the initial period of high risk for fatality the recovery seen in hemorrhagic patients as the hemorrhage can be treated medically or surgically, this leads to early healing, early neurological recovery and thus resulting into better neurological and functional status.

In case of ischemic stroke the area affected within the ischemic cerebrovascular bed, there are two major zones of injury, the core ischemic zone and the “ischemic penumbra” (the term generally used to define surrounding area of core infarct cerebral tissue). In the core zone, which is an area of severe ischemia (blood flow below 10% to 25%), the loss of supply of oxygen and glucose for more than 60-90 seconds brain tissue ceases to function resulting rapid depletion of energy stores. Severe ischemia can result in necrosis of neurons and of supporting cellular elements (glial cells) within the severely ischemic area. Brain cells within the penumbra, a rim of mild to moderately ischemic tissue lying between tissue that is normally perfused and the area in which infarction is evolving, may remain viable for several hours.

After treatment when recovery occurs, it is seen only in surrounding area (ischemic penumbra) but not in the dead tissues or core area of infarct.

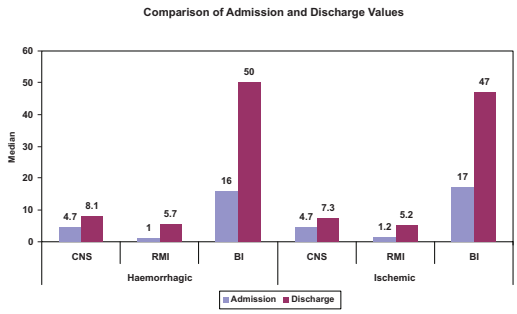
So in case of ischemic stroke affected part dies and there is irreversible injury but in case of hemorrhagic stroke hematoma irritates brain tissues rather than damaging it[9-13]. That’s why it is possible for patients to make a better neurological recovery from a hemorrhagic stroke. Functional and mobility status is improved due to neurological recovery.

Thus, this study supports the previous literature, and is seen in Indian population, as well. This data is useful in improving knowledge on rehabilitation outcome of stroke survivors.

Table II: Admission and discharge score of both the groups

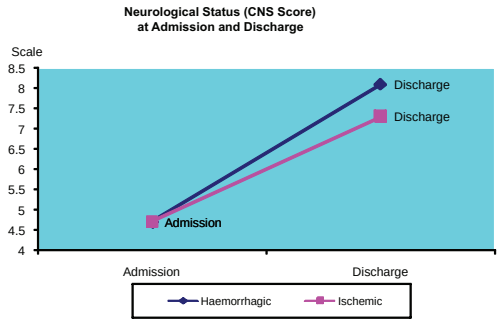
	Hemorrhagic		Ischemic	
	At admission	At discharge	At admission	At discharge
Canadian neurological score	4.74	8.11	4.75	7.30
Rivermead mobility index score	1.02	5.71	1.22	5.22
Barthel index score	16.00	50.00	17.28	47.28

Graph I:



The graph shows the scores of both the groups ischemic and hemorrhagic at the time of admission and after rehabilitation at the time of discharge on all three scales.

Graph II:



Above Mentioned graph shows that the hemorrhagic patients had higher scores on the Canadian neurological scale as compared to ischemic patients, in spite of same treatment program. Hemorrhagic group showed statistically significant higher Canadian neurological scale score discharge time. Statistically significance was at the level of (P.≤. 001).

Limitations of a Study

Length of stay could not be included as an independent variable in this study as sample size was selected from acute care hospital setup and physiotherapist were not consulted if it was appropriate for the patients to be discharged.

Future Scope of Study

Study to be carried out like the said methodology, but can be a prospective study for a longer period and therapist should be able to decide upon discontinuation of treatment so that length of stay or days of physiotherapy treatment can be included as an independent variable.

Conclusion

From this study it can be concluded that hemorrhagic patients showed faster recovery than ischemic patients in Indian population as well. Hemorrhagic stroke patients had better chance to make complete recovery from stroke.

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The Efficacy of Bilateral Training on Functional Recovery of Upper Extremity After Stroke

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Abstract

Purpose

The goal of this study is to find out that how much bilateral training is more effective as compare to the unilateral training on functional recovery of upper extremity in stroke rehabilitation.

Methodology

This was a experimental study of 30 stroke patients with unilaterally stroke had paresis or plegia of upper limb. All the subjects are enrolled in identical subgroup and divided into two equal group (15 patient in each group) one experimental and another control group. Experimental group contain bilateral activities training and control group contain unilateral activities training.

We assessed the Functional recovery of upper extremity and functional independence of all patients by Fugl-Meyer scale for upper extremity and Functional independence measure for self care and tried to find out the additional effect of bilateral activity training on stroke patients.

Results

Result shows that, both the group improved significantly but bilateral training group improved much better than unilateral training group

Conclusions

This study suggests that bilateral activities training is more effective as compare to the unilateral activities training for the functional recovery of upper extremity in stroke patients.

Key words

Unilateral training, bilateral training, stroke rehabilitation, upper extremity.

Introduction

Stroke is an increasing public health concern throughout the world; it is the second commonest cause of death and the leading cause of long term disability[1]. Stroke is a major cause of long term neurological disability in adults and has Implication for patents, caregivers, health professional and general society[2].

The generally accepted definition of stroke originates with the World Health Organization (WHO) and dates back to 1980 (1): which states that "Rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin"[3].

The Common Neurological Impairments Due T0 Stroke Are

Motor impairments are most prevalent of all deficits seen after stroke, usually with involvement of the face, arm and leg (Hemiparesis) alone or in various combinations, which include involvement of cranial nerves, muscle power and tone, reflexes, balance, gait, co ordination and apraxia[4].

Sensory deficits range from loss of primary sensation to more complex loss of perception; it can cause visual and perceptual impairments, homonymous hemianopia or cortical blindness[5].

Common speech disorder that are seen include aphasia, dysphasia. Dysphasia may be exhibited by disturbances in comprehension, naming, repetition, fluency, reading or writing[6].

Hemiparesis represent the dominant functionally limiting symptoms in 80% of patients with acute stroke within 2-5 months after stroke; patients recover a Variable degree of function, depending on the magnitude of the initial deficit[7].

Arm recovery after stroke is typically poor; with 20% to 80% of patients showing incomplete recovery depends on the initial impairment. Upper limb dysfunction in stroke is characterized by paresis, loss of manual dexterity, and movement abnormalities that may impact considerably on the performance of ADLs[8].

Grasping, holding, and manipulation objects are daily functions that remain Deficient in 55% to 75% of patient 3 to 6 months poststroke[9].

Physiotherapy Treatment for Recovery of Upper Extremity

In physiotherapy a variety of movement therapy approaches are available for retraining motor skill in adult patients with hemiplegia. Certain approaches like Proprioceptive neuromuscular facilitation, Rood, Brunnstrom, and Bobath relay on reflex and hierarchical theories of motor control and motor learning as well as the principles of neural plasticity[10].

Bilateral Training

Bilateral training is a new class of interventions aimed

at increasing the efficiency of movement in the context of using both hands together[11-12]. Previous research has typically focused on motor learning approach involving unilateral training of the hemiplegic arm. Recently bilateral training, in which patients practice identical activities with both upper limbs simultaneously, has been proposed as a strategy to improve hemiplegic upper limb control and function[13.] but currently available data do not definitively answer all questions. Therefore, to obtain a clear characterization of effectiveness of bilateral training a research study was required.

The purpose of this study to find out that how much bilateral training is effective as compare to the Unilateral training on functional recovery of upper extremity in stroke rehabilitation.

Methodology

Total 30 patients of stroke from M.M hospital Mullana, Ambala and Yamunanagar hospitals who met the inclusion criteria included in this study. For patient selection purposive sampling was done. The total 30 patient were divided into two equal group (15 patient in each group) one experimental and another control group. Experimental group contain bilateral training and control group contain unilateral training

Inclusion Criteria

1. Individuals with first episode of unilateral stroke.
2. All patients who were medically stable
3. Paresis of upper limb.
4. Mini-Mental stage examination score of at least 24/30.
5. Fugl-Meyer score between 11 and 40.
6. No clinical evidence of limited passive joint range of motion.
7. Age 46 to 80 years both male and female.
8. Able and willing to participate in a 4 weeks study.
9. Ability and willingness to sign the consent form.

Exclusion Criteria

1. Multiple clinical stroke patients.
2. Subject had other neurological, orthopedic or pain condition that might limit arm movement.
3. Clinical evidence of shoulder subluxation.
4. Any type of Cognitive deficit.

Procedure

Thirty patients of stroke who fulfill the inclusion criteria were included in this study. Total numbers of patients were divided into two equal groups, one experimental group and another control group. Each group contained 15 patients. The bilateral training for upper extremities had given to the experimental group and unilateral training for upper extremity had given to the control group. All participants were evaluated by Fugl-Meyer scale for upper extremity, Functional independence measure scale for self care and Mini-Metal status scale to know the mental status.

Fugl-Meyer scale shown to valid and reliable,12 has a top score 66. All the Fugl-Meyer scale for upper extremity was used for assessment of motor function of upper extremity in all stroke patients.

Functional independence measure scale was used for the assessment of functional recovery of upper extremity in all stroke patients. This scale has been shown to valid and reliable[13].

Mini mental status scale is a reliable and valid scale to asses the mental status of subjects used in this study[14].

At the first, the patients were informed about the purpose, procedure, possible discomforts, risks and benefits of the study prior to obtaining an informed written consent from the patient.

All patients were first assessed by Mini-Metal status scale to know the mental status.

After that all patients were assessed by Fugl-Meyer scale, Functional independence measure before and after giving intervention.

The subjects were asked not to participate in any other study or physiotherapy treatment for upper extremity from for the duration of the study and to follow the designated protocol.

Treatment (Physiotherapy)

Patients of the bilateral training group were made to start of exercise from passive/ active movements of all the joints of upper extremities including shoulder joint, elbow joint, wrist joint, metacarpophalangeal joints and interphalangeal joints with the use of both upper extremities together.

After active movements patients were made to start weight bearing and supportive reaction with the use of both upper extremity (e.g. seated weight bearing), after that reaching activities (e.g. forward supported reach with both upper extremities and shoulder in elevation, wrist and elbow in extension) than grasping, holding and releasing activities and at last patients were performed ADL activities (e.g. dressing and self feeding activities)[15].

Subjects of unilateral training group performed the same activities with the use of only the effected upper extremity.

All the exercises were performed in 45 minutes. There was no subdivision of time for each activity. Patients were performed exercises on the bases of their motor control for 45 minutes in a day and 5 days in a week for 4 weeks.

Data and Statistical Analyses

Comparison was performed between both the groups first at baseline level. Then again, comparisons were done at discharge level as well as from baseline to discharge level and results were noted.

Paired T test was used for analyzed the pre to post changes within the groups. Unpaired T test was used for analyzed the changes between the two groups. Data were analyzed using SPSS 13.0.

Results

We successfully matched 30 patients of both control and experimental group for upper extremity recovery

and functional independence. First we compared demographic and functional data of the age matched subgroup. Analysis comparison was done between both the groups first at base line and then at the end of intervention and again comparison was done between baseline score and after intervention score and result were noted.

Baselines characteristics of both the group are shown in table 1. characteristic of both the groups were same at the base line level prior to intervention.

Table 1: Baseline Characteristics of the 2 groups After Matching

	Bilateral group	Unilateral group	P value
No of patients	15	15	
Age	59.20±8.326	58.80±7.193	NS
Sex (male)	9	9	– 1
Stroke left	13	13	NS
Stroke right	2	2	NS
Mini-Mental scalescore	27.13	27.40	o.5886
Fugl-Meyer score before intervention	25.60	25.80	.910
Functional independence measure score before intervention	20.13	19.80	.670

This table shows that before intervention there was no significant difference of Fugl Meyer score between the groups (p value- .910) and functional independence score of both the groups (p value.670).

Table 2: Fugl-Meyer Scores of both the group before and after intervention

Group	Fugl-Meyer score before intervention	Fugl-Meyer score after intervention	P value
Bilateral group	25.60	49.13	.001
Unilateral group	25.80	37.53	

Above table shows that after intervention there was significant difference between both the groups (p value- .001).

Table 3: Functional independence measure score of both the group before and after intervention

Group	F I M score before Intervention	FIM score after intervention	P value
Bilateral group	20.13	36.93	.001
Unilateral group	19.80	30.67	

Above table shows that after the intervention there was significant difference between the groups (p value - .001).

Table 4: Fugl-Meyer scale and FIM score of both the group after intervention

	Fugl-Meyer score after intervention	P value	FIM score after intervention	P value
Bilateral group	49.13	.001	36.93	.001
Unilateral group	37.53		30.67	

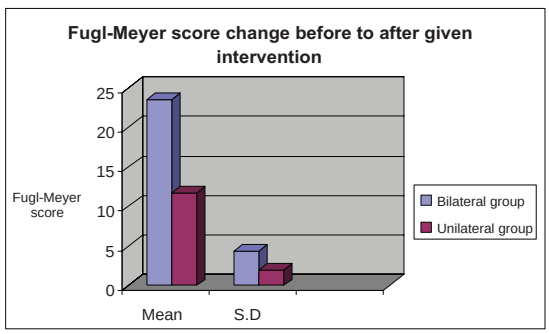
Above table is showing the score of both groups on Fugl-Meyer scale and FIM score after given the treatment. Independent sample test was used showed significant changes between both the group both the scales. On Fugl-Meyer scale p value is .001 and same for FIM score.

Above Mentioned graph and table show that the bilateral group patients had higher scores on the Fugl- Mayer score and FIM score as compared to unilateral group patients in spite of same base line score. Bilateral group showed statistically significant higher Fugl- Mayer and FIM score at the end of intervention. Statistically significance was at the level of (P.<. 001).

Discussion

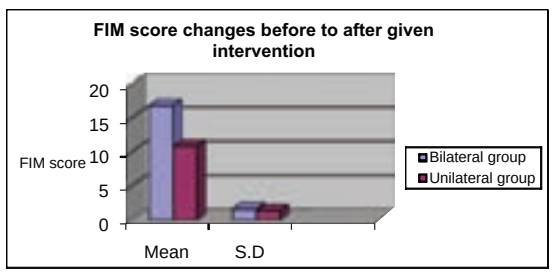
In this experimental design study, result shows the effects of Bilateral training as compare to the unilateral training on functional recovery of upper extremity in stroke patients. The results support the hypothesis that bilateral training is more effective for functional Recovery of upper extremity in stroke patients as compare to the unilateral training. Although both groups (bilateral training group and unilateral training group) improved,

Graph 1:



Above graph showing the changes in the bilateral training group and unilateral training group on Fugl-Meyer score before and after treatment.

Graph 2:



Above graph showing the changes score on FIM is more in bilateral training group than the unilateral training group.

but bilateral training group improved much better than unilateral training.

A Rationale regarding the reason why bilateral upper extremity training in the present study is more effective can be found in the motor behavior and Neurophysiology literature. Practicing bilateral movement in synchrony (and in alternation) may result in a facilitation effect from the non-paretic arm to the paretic Arm. For example, when bimanual movements are initiated simultaneously, the arm act as a unit that supersedes individual Arm action 17 indicated that both arms are strongly linked as a coordinated unit in the Brain. In addition, it is well known that even if one arm or hand is activated with moderate force, this can produce motor overflow in the other such that both arms are engaged in the same or opposite Muscle contractions although at different level of force[17].

RG Carson considerations to the various neural Mechanisms have the scope to Mediate Bilateral interactions between the Muscles of the upper limb. The patterned modulation of excitability in motor pathways projecting to the Homologous Muscles of the opposite limb, during movements that are intended to be unilateral, has been the primary objective of inquiry. The putative role of uncrossed corticofugal fibers branched bilateral corticomotoneuronal projections and segmental networks have been accorded specific attention. In addition, the potential for bilateral interactions to occur in various brain regions including the primary motor cortex, the supplementary motor area, non primary motor areas, the basal ganglia and the cerebellum might play a part. Bilateral interactions between the arms and hands are not clearly subjected to mediation of branched bilateral corticomotoneuronal projections, although it appears likely that common (i.e. bilateral) last order –synaptic input to motoneurons may play a role in the control of axial musculature. Evidently, the contraction of homologous muscles of the opposite limb gives rise to change in the excitability of segmental networks[18].

The fore going analysis suggest also that there are principal bases upon which can be understood the functional improvements in the control of a paretic limb which are realized by bilateral movement training. When the muscles of the non-impaired limb are engaged during such training, crossed facilitatory drive from the intact hemisphere will give rise to increased excitability in the homologous motors path ways of the opposite (paretic) limb[18].

In addition, to promoting the execution of the intended movement by the impaired limb, time inputs may serve to sensitize the damaged motor cortex to subsequent or concurrent training induced modification the facilitatory recovery of function[19].

In other side Mudie and matyas argued that bilateral actions trigger interhemispheric disinhibition that may allow alternative recruitments pathways to be activated[20].

This study is different from initial studies in nature of the intervention tasks. In this study participants were trained in complex multi joint functionally relevant tasks such as active movements of all the joint of upper extremities, reaching activities, weight bearing activities and activities of daily living. Thus, this study supports the some previous literature, and is seen in Indian population, as well.

Clinical Implication

The results of this study show that the bilateral training is better than the unilateral training for functional recovery of upper extremity. Thus bilateral training can be use as a rehabilitative tool for the functional recovery of upper extremity in stroke patients.

Limitations of a Study

In term of study limitations the sample size used in this study was small so that result is not generalized In this study there is no follow up period after 4 weeks, so it may be the another limitation of the study.

Future Scope of Study

Further future study need for examine the effect of bilateral training as compare to the unilateral training on functional recovery of upper extremity in stroke patients with using large sample size, using sensitive measurement tool and with large follow up period.

Conclusion

This study suggests that bilateral training is more effective as compare to the unilateral training for the functional recovery of upper extremity in stroke patients.

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Effect of Sit-to-Stand Exercise on Forward Bending test: A Prospective Study

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Abstract

Backgroud

Flexibility of soft tissues is important for functional, occupational & Recreational activities. Many therapeutic regimes are available that can be use prior to flexibility exercise to minimise risk of injury. Sit-to-Stand is a close chain activity performed commonly in day to day life.

Objective

To study the effect of sit –to-stand activity on flexibility of muscle.

Design

Analytical, Prospective, Experimental study.

Method

40 asymptomatic subjects were selected with mean age of 18-25 years & randomly divided into 2 groups. Forward bending test was used as a measure of flexibility. One group underwent 10 time sit-to stand & another group 20 times of sit-to-stand exercise. Pre & Post exercise forward bending test was done & their score were documented.

Result

A "Student t "test demonstrated a statistically significant difference ($p< 0.005$) in both the groups.

Conclusion

Sit-to-Stand exercise can be used as one of the Pre-stretching tool exercise for improving back & hamstring muscles flexibility.

Key Words

Sit-to-Stand activity, forward bending test.

Introduction

Flexibility is defined as "The absolute range of movement in a joint or series of joints that is influenced by muscles, tendons, ligaments, bone and bony structures[1] Flexibility is one of the important components of physical fitness. Flexibility enhances the ability of the proprioceptors to receive stimuli & develop the Coordination. Stretching is used as an integral part of physical fitness and rehabilitation program because it positively influences performance. To prevent the injury to the muscles during stretching an adequate rise in temperature & blood circulation is a prerequisite. This can be achieved by Hot pack, Ice pack, different modalities & light loaded exercises. It can also be achieved by proper muscle contraction preceding the stretching exercises. Satoh et al has used Quadriceps muscle contraction as a pre-stretching activity prior to Hamstring muscle stretching exercises[2]. Sit-to-Stand is frequently performed dynamic activity which recruits large groups of lower limb muscles[3]. Hence this study was undertaken to find out the effectiveness of the Sit-to-Stand activity as a pre-stretching maneuver on the flexibility of the Lower back, Hamstring muscles, using Forward bending test.

Aim

Effect of Sit –to-Stand activity on the Forward bending test.

Objective

To determine the effectiveness of Sit-to-Stand activity as a pre-stretching activity on the flexibility of the Lower back, Hamstring, Tendoachilles muscles.

Hypothesis

There will be significant difference in forward bending distance which is measure of flexibility after Sit-to-Stand activity.

Null Hypothesis

There will not be significant difference in forward bending distance after Sit-to-Stand activity.

Analysis of Sit to Stand Activity

- Sit to Stand is one of the most demanding everyday task we perform regularly[4].
- Sit –to-Stand activity is divided into 2 component
  a. Sit-to-stand
  b. Stand-to-sit
- Kinetics of Sit-to-Stand
  - Standing up occurs as a result of force generation in many mono-articular and biarticular muscles spanning the hip, knee and ankle joints. In addition trunk muscles are active to stabilize the upper body.
  - EMG analysis of Sit-to-Stand activity shows activation of following group of muscles[5,6] Erector

spinae, Rectus abdominals and lower limb muscles – Gluteus maximus, Biceps femoris, Semitendinosus, Rectus femoris, Vastus lateralis, Vastus medialis, Tibialis anterior, Gastrocnemius and soleus.

- The first muscle to be contracted around the Knee joint is Vastus medialis followed by all the other knee and hip extensors. All these are concentric. There is eccentric contraction of Gastrocnemius muscle, which slows down the knee extension avoiding joint risks and smoothing the entire task.
- Onset of contraction of hip extensors (Gluteus maximus, Biceps femoris) and knee extensors (Rectus femoris, Vastus lateralis, Vastus medialis) tend to occur almost simultaneously. Hip and knee extensors muscles demonstrate peak activity around the time the thighs are lifted off the seat.
- The simultaneous onset of the biarticular Rectus femoris and Biceps femoris helps to slow down hip flexion at the hip prior to the beginning of lower limb extension.

- Sitting down
  - Standing up and sitting down are fundamentally the same action only in reverse direction. In sitting down, the hip, knee & ankle joints flexion movements are controlled by the eccentric contraction of Lower limb extensor muscles & this action is essential to slow down the movement velocity before the impact with the seat[3].
  - Since the sitting down lacks the facilitating effects of vigorous trunk flexion, the part of the movement just before the body mass is lowered on to the seat requires considerable muscle strength and control, particularly at the knee.

Material and Methodology

Matarial

Plinth with Suspension frame, Wooden Box, Goniometer, Velcrostrap, Measuring Tape, Stop-Watch, Adjustable Chair.

Methodology

- Selection Criteria:
  - Inclusion Criteria:
    42 healthy asymptomatic female subjects between age group of 18 to 25 years were selected.
- Exclusion Criteria:
  - Acute neuromuscular or musculoskeletal pathology.
    For Example – PID, Ankle sprain, Hamstring Strain
  - Subjects at present undergoing any stretching program.
  - Subjects having any limb length discrepancy due to structural deformity in the lower limb.

Study Design

It is analytical, prospective, experimental study.

The subjects underwent forward bending test in long sitting position before and after Sit -to -

stand activity. Subjects were divided into 2 groups. Group I underwent 10 repetitions & Group II 20 repetitions of Sit-to-Stand activity.

An informed consent was taken for all the subjects. The ethics committee of K.E.M.Hospital approved the experimental protocol.

Outcome Measures

The flexibility of Lower back, Hamstring & Tendoachilles muscles was measured by using:

- Forward bending test.
- Hamstring & Tendoachilles muscles tightness.
  - Measurement of forward bending in long sitting position
    Each subject was seated in long sitting position in front of the measuring box with ankle joints fixed in neutral position and the knee joints in extension position. The subject bent her trunk to the maximal bending position with arm extending straight ahead. The sole of the foot was calibrated ‘0’ position and the distance from the ‘0’ position to the tip of the third finger at which each subject could hold for 3 seconds and was measured 3 times to score the maximal value.
  - Assessment of Hamstring Muscle Tightness
    It was done in supine position with the help of Goniometer.
    The fulcrum → Lateral condyle of the femur.
    The Fix arm → lateral side of the femur.
    Moveable arm → along the lateral side of the fibula.
    The lower extremity was fixed at hip & Knee at 90˚ with the help of suspension frame. Tightness was measured as the angle between vertical and that obtained by passively extending the leg at a point at which the therapists perceive resistance to passive extension. Lack of knee extension range is considered as criteria for measurement of hamstring muscle tightness.{fig1}
  - Assessment of Tendoachilles Muscle Tightness
    Assessment was done in supine position with the help of Goniometer.

Figure 1: Assessment of Hamstring Muscle Tightness

Figure 2: Assessment of Tendoachilles Muscle Tightness

Fulcrum → on the lateral malleolus.
Fixed Arm → along the lateral aspect of leg.
Moveable Arm → Along 5th metatarsal.
With above alignment ankle joint was maintained in neutral position. Passive dorsiflexion was done at a point at which therapist perceives resistance to passive dorsiflexion and angle was measured. {fig2}

- Sit-to-Stand activity was given on adjustable chair. The chair height was adjusted depending on the length of the lower thigh of each subject so that the subject could stand up from sitting position with knee joint angle of 90º. The load was adjusted by timing the Standing Up exercise (Once per 4 Seconds) with stopwatch.

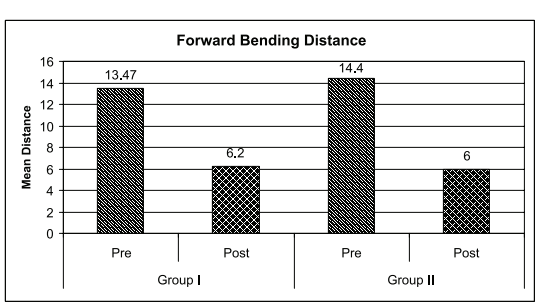
Data Analysis

The collected data was analyzed for statistical significance using Paired & Unpaired t test. For within the group comparison Paired t test was used to compare the effect of sit-to stand activity on per & post forward bending test. For between the groups comparison Unpaired T test was used to compare the effect of 10 repetitions with 20 repetitions of sit-to–stand activity.

Results

Table 1: Forward bending distance: Inter &Intra group comparison.

	Group I		Group II	
	Pre	Post	Pre	Post
Mean	13.47	6.2	14.40	6.0
% Increase	63.97		58.33	
S.D.	4.5		2.49	
P Value	<0.001(HS)		<0.001(HS)	
	<0.1(NS)			



As shown in table 1 & graph 1, there was statistically significant difference observed in pre & post forward bending distance in the both groups [Group I(SD-4.5) & Group II (SD-2.4)] which indicates increase in flexibility of lower back & Hamstring & Tendoachilles muscles but on comparison of between the 2 groups no statistically significant difference was seen (p<0.1) which means that both the techniques were equally effective.

Table 2: Hamstring muscle tightness: Inter & Intra group comparison.

	Group I		Group II	
	Pre	Post	Pre	Post
Mean	31˚	17.35˚	31.68˚	19.31˚
% Increase	44.03		39.04	
S.D.	5.44		4.72	
P Value	<0.001		<0.001	
	<0.1(NS)			

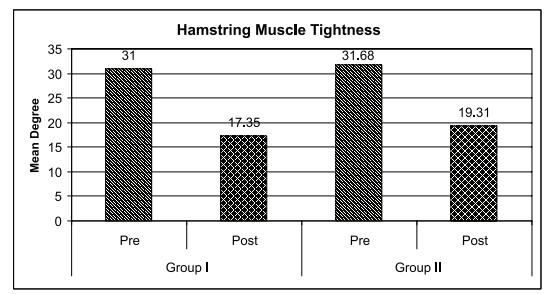
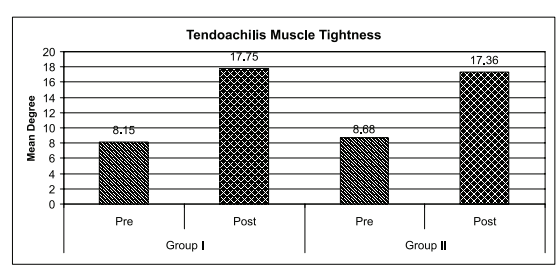


Table 3: Tendoachilles muscle tightness: Inter & Intra group comparison.

	Group I		Group II	
	Pre	Post	Pre	Post
Mean	8.15˚	17.75˚	8.68˚	17.36˚
% Increase	54.08		50	
S.D.	2.66		3.64	
P Value	<0.001(HS)		<0.001(HS)	
	<0.1(NS)			



As shown in table 2 & 3 & graph 2 & 3, there was statistically significant difference observed in pre & post Hamstring & Tendoachilles muscles tightness in the both groups which indicates there was increase in flexibility of Hamstring & Tendoachilles muscles but on comparison of between the 2 groups no Statistically significant difference was seen (p<0.1) which means that both the techniques were equally effective.

Disscusion

Flexibility of soft tissues is necessary for many functional as well as occupational or recreation activities. There are different techniques available to improve the effectiveness of stretching exercises. In this study a new method i.e. active Sit-to–Stand activity was given

as a pre–stretching tool to increase the effectiveness of stretching exercise. This was measured by the forward bending test. There was increase in forward bending distance after 10 & 20 repetitions of Sit-to-Stand activity (as seen in table 1 & Graph1) which indicates increase in flexibility of Hamstring ,Tendoachilles & back extensor muscles. This was further confirmed by isolated testing of Hamstring muscle (table 2 & graph 2) & Tendoachilles muscle (table 3 & graph 3) tightness which also showed increase in flexibility after 10 & 20 repetition of Sit-to-Stand activity. This increase in flexibility observed after sit-to-stand activity can be hypothesized due to Reciprocal Inhibition, Autogenic Inhibition & Warm-up effect. There is contraction of muscles surrounding the Hip & Knee joints during sit-to-stand activity[5,6]. These muscles undergo Autogenic & Reciprocal Inhibition during sit-to-stand activity. Inhibition techniques increase muscle length by relaxing and elongating the contractile component of the muscles. Sarcomere give will occur more easily when muscle is relaxed & give less resistance as it get elongated with following stretching[7].

The first neuropsychological basis of increased in flexibility is Reciprocal Inhibition. Reciprocal Inhibition is relaxation of antagonistic muscles on contraction of agonistic muscle. When the motor neuron to one muscle receives an excitatory impulse that causes it to contract, the motor neuron to the opposite muscle receives inhibitory signal that make them relax[8]. EMG study done by Capaday & Laveo et al on Reciprocal inhibition shows reciprocal inhibition of Soleus muscle with Tibialis Anterior muscle stimulation in several motor tasks[9,10]. Applying this principle to our study, as discussed in biomechanics of sit-to-stand activity[3,5,6] the muscles involved in this activity i.e. Erector Spiane, Rectus Abdominus, Gluteus maximus, Quadriceps muscle, Tibialis anterior that causes reflex relaxation of opposite groups of muscles. These relaxed muscles gives less resistance to consequent stretching & hence shows improve in flexibility[7]. This is further supported by study done by Staoh et al which showed an increase in the Hamstring muscle flexibility with Quadriceps femoris muscle setting exercise[2].

The second neuropsychological basis of increased flexibility is the principle of the Autogenic Inhibition, which is reflex muscular relaxation that occurs in the same muscle when Golgi tendon organ (GTO) is stimulated[8]. The local cord signal excites a single inhibitory interneuron that in turn inhibits the anterior horn neuron and hence individual muscle[11]. In our study, the muscles that would have undergone this effect are Gluteus maximus and Hamstring muscle, Gastrocnemius. The study by Yoshizaki et al reported that activation of the majority of motor neuron by maximal contraction lowered the excitability of spinal cord motor neuron pool. This made the subsequent defensive stretch reflex difficult to take place and enable extension of the muscles[12]. This is further supported by study done in department of neurophysiology, that relaxation from voluntary contraction is preceded by increased excitability of motor cortical inhibitory circuits[13]. Electromyographical studies done by Etnyre and Abraham and Guissard at al on Autogenic inhibition describes an attenuation of H-reflex that occurred immediately after muscle contraction, which improve the extensibility of muscle. Gurssard et al, found a 20% attenuation of H-reflex lasting at least 30S that was independent of the duration of the preceding muscle contraction[14]. However, there is little possibility that nearly maximal contraction occurred in the Hamstring muscles and gluteus muscles during sit-to stand activity in our study. Submaximal contraction of muscles shows that the use of submaximal contraction intensities of 20% to 60% MVC (maximal voluntary contraction) in contract-Relaxation PNF stretching of Hamstring yields comparable gain in flexibility to 100% MVC[15].

The activities of the Quadriceps femoris, Hamstring & Tendoachilles, Gluteus maximus induced relaxation of the muscle surrounding the hip and knee joints. Immediately after the contraction, the neuromuscular apparatus becomes briefly refractory or unable to respond to further excitation. Thus stretching a muscle immediately following its contraction may incrementally restore rang of motion[16]. That explains the activity of sit-to stand induces relaxation of the muscles around the hip joint and knee joint and causes statistically significant increase in the range of motion around these joints.

In sit –to –stand activity, there is continuous co-contraction of Abdominal and Erector spinae muscle take place, which are also undergo inhibition and further add in range of forward bending from Lumbar region.

The Third additional effect was Warm –Up effect. The activity used in our study was sit-to-stand activity, which acted as warm-up for further stretching. Muscle contractions increase the muscle temperature and body temperature and improve physiological functions and are closely related to motor performance[17]. Also, the ability of Golgi Tendon Organ to reflexively relax the muscle through Autogenic inhibition is enhances when muscle is heated and which help to further elongation of muscles[8].

So, collective effect of Autogenic and Reciprocal inhibition and warm-up that take place during sit-to-stand activity leads to improvement in flexibility that we could see in all graphs.

Conclusion

- There was statistically highly significant ($p<0.001$) difference observed in the flexibility after 10 repetitions & 20 repetitions of sit-to-stand activity.
- No statistically significant ($p<0.1$) difference was seen on comparison between 10 repetition and 20 repetitions of sit-to-stand activity indicating that 10 repetitions is as effective as 20 repetitions to improve flexibility.

Clinical Application

- The findings of the study enables a therapist to use the activity of sit-to-stand as a simple and safe pre-stretching tool so that consequent stretching becomes more effective.

- In geriatric age groups, sit-to stand activity can be use effectively and safely, to stretch the Biarticular muscles without any musculoskeletal injury.
- Sit-to-stand can promote reduction in joint stiffness which could be useful in the consequent exercise session. This benefit is more applicable in the geriatric age group where joint stiffness is common due to inactivity.

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Normative Scores on Pediatric Balance Scale: A cross sectional study

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Abstract

The Pediatric balance scale, a modification of Berg balance scale (PBS) is widely used for assessing balance in school age children. However, there is scant literature about the normative data for the use of this scale in children as majority of research on PBS has been done on children with mild to moderate motor impairments. Also, there is a dearth of literature on normative data using PBS in Indian population.

Purpose

This study was undertaken to find out the normative data in Indian Population using this scale.

Methods

Five hundred and sixty three children between the age group of two years six months to eight years, studying in different schools in India were identified and selected for the study. The children were tested using the PBS on fourteen tasks. The procedure was explained to the children and their parents/ teachers/guardians. After completion of each task, the child was given a score on a 0 to 4 scale. Scores obtained by the child after performing the tests as given in the pediatric balance scale was used as the outcome measure.

Data analysis

The Pearson's correlation coefficient was used to find the correlation of age group and height with the score on the PBS. An independent t – test was used to compare the scores obtained by males and females.

Results

The results showed good correlation between the age groups and the score attained ($r = 0.774$, $p = 0.00$). There was also good correlation seen between heights of children with the scores attained on the PBS scale ($r = 0.735$, $p = 0.00$). The two genders did not differ significantly between themselves in their scoring. ($p = 0.807$)

Conclusion

The scores attained increase with the age and the scores in both the genders increased similarly with the age.

This material was based on work supported by the department of physiotherapy, MCOAHS, (MAHE), Manipal.

Introduction

Each task of our daily living requires a control of posture and balance. Balance is a complex process involving the reception and integration of sensory inputs, and the planning and execution of movements, to achieve a goal requiring upright posture. It is the ability to control the center of gravity (COG) over the base of support in a given sensory environment[1,2].

Thus, balance control is very necessary to accomplish common activities of daily living such as sitting, standing and walking. Balance impairments negatively affect function, leading to disability. These impairments often restrict activity levels, especially in children, as they are very active and involved in playful activities. This may also produce abnormal compensatory motor behavior. To avoid these consequences and advance the functional status of the patient, the therapist should understand both the demands that various environments and functional tasks place on postural control systems and impairments that may diminish the ability of those systems to respond adequately. Motor development in able-bodied children proceeds in an orderly sequence. Stance control in children is different from that of adults as they are shorter and are proportioned differently as compared to adults[3].

Any delay or abnormality in this development may lead to serious problems in the later life of child hence balance assessment is very crucial in physical therapy assessment of the child. Valid and reliable measures of functional balance are of critical importance to the pediatric physical therapists. This would help in finding, not only whether interventions are needed but also would show the effect of the intervention on balance.

The Berg Balance Scale (BBS) is a functional measure developed to measure balance in the elderly in the clinical setting. The focus of BBS is performance rather than an impairment of balance[4]. Berg balance scale, which was developed by Katherine Berg, is a widely accepted tool in assessing balance in the elderly, amputees, stroke patients etc. There have been studies on the assessment of balance in the pediatric population using the Berg Balance Scale modified for children, known as the Pediatric Balance Scale (PBS). Pediatric balance scale is a modification of Berg balance scale. It was designed as a functional measure of balance for use with school age children who have mild to moderate motor impairments. The PBS has demonstrated to have a high test-retest reliability, with an ICC of 0.998 and interrater reliability, with an ICC of 0.997, when used with school age children

with mild to moderate motor impairments. The PBS was found to have an excellent test retest reliability (ICC = 0.85) when performed on forty typically developing children[4]. However, there is a dearth of literature on normative scores using The Pediatric Balance Scale in Indian population. Considering the different lifestyles and the activity level among the children in the European and Asian countries, this study was undertaken to find out the normative scores using this scale on Indian population.

Majority of research on balance in children is done on children with disabilities and very few researches are done on normal subjects. Also, adequate normative studies are not available in India on this topic. Thus, the purpose of study of this study was to establish normative scores on pediatric balance scale in age group of two years six months to eight years.

Methods

Five hundred and sixty three children between the age group of two years six months to eight years, studying in different schools in India were identified and selected for the study. The study design used was cross sectional design. The sample was selected using convenience sampling and the children were divided into eleven groups according to their ages at six month intervals, starting from two years six months to eight years of age. Written informed consent was obtained from parents or guardians, and the teachers of the respective schools, for including the children for the study.

Normal children of either gender, between age groups of two years six months to 8 years, were included for the study. Children with any musculoskeletal deformities, known cardio respiratory disorders or Mental retardation, visual impairments, speech and hearing problems were excluded from the study. Children were withdrawn from the study if they refused to cooperate during the study.

The children were tested using the Pediatric Balance Scale on fourteen tasks. A stool of appropriate height, stopwatch, an inch tape, a step stool six inches in height, chalkboard eraser, ruler and two child-size footprints were used for testing.

Table 1: Descriptive statistics

Age group	Total number	Mean height (S.D.)	Females	Males
2.5-3	41	93.10 (7.28)	23	18
3-3.5	48	93.92 (6.76)	21	27
3.5-4	70	99.26 (6.75)	37	33
4-4.5	52	101.58 (7.61)	26	26
4.5-5	60	104.67(6.54)	31	29
5-5.5	65	107.63 (6.20)	36	29
5.5-6	71	109.72 (6.25)	33	38
6-6.5	42	112.93 (6.66)	20	22
6.5-7	37	119.49 (7.40)	19	18
7-7.5	43	123.74(8.11)	22	21
7.5-8	34	125.79 (4.89)	13	21
N	563		281	282

After obtaining consent, the children were assessed for inclusion criteria. Scheduling of the test session was done according to the convenience of the children and the faculty. The date of birth and height of all the children were recorded before starting the test. The procedure was explained to the children and their parents/ teachers/ guardians. The tasks of the PBS were explained to the children and they were given one trial of the test before the test was actually administered, to make sure that the children understood what they were supposed to do.

The sequence of test items were followed as mentioned in the scale. After completion of each task, the child was given a score on a 0 to 4 scale. A score of 0 was given when the child required maximum assistance or was unable to perform the task at all. When the child performed the task without any supervision, independently, a score of 4 was given. If the child required supervision, or assistance for completing the job, the points from the score were deducted accordingly, as mentioned in the scale. After all the tasks on the scale were completed, a total score out of 56 was calculated and the child was graded accordingly. Score obtained by the child after performing the tests as given in the pediatric balance scale was used as the outcome measure.

Data Analysis

Data was analyzed using the SPSS software version 10.Descriptive statistics were used to describe the demographic data. The Pearson's correlation coefficient was used to find the correlation of age group and height with the score on the PBS. An independent t – test was used to compare the scores obtained by males and females.

Table 2: Mean Standard deviation and median scores in each group.

Age group	Mean score	Std. Deviation
2.5-3	47.71	2.38
3-3.5	47.57	3.06
3.5-4	48.90	2.73
4-4.5	51.29	2.15
4.5-5	51.76	2.25
5-5.5	52.95	1.96
5.5-6	53.56	1.96
6-6.5	54.20	1.90
6.5-7	55.24	1.28
7-7.5	55.60	1.21
7.5-8	55.79	0.55

Table 3: Correlation* between age and score.

		Agegroup	Score
Agegroup	Pearson Correlation	1.000	0.774
	Sig. (2-tailed)		0.00

* Correlation is significant at the 0.01 level (2-tailed).

Table 4: Correlation *between height and scores.

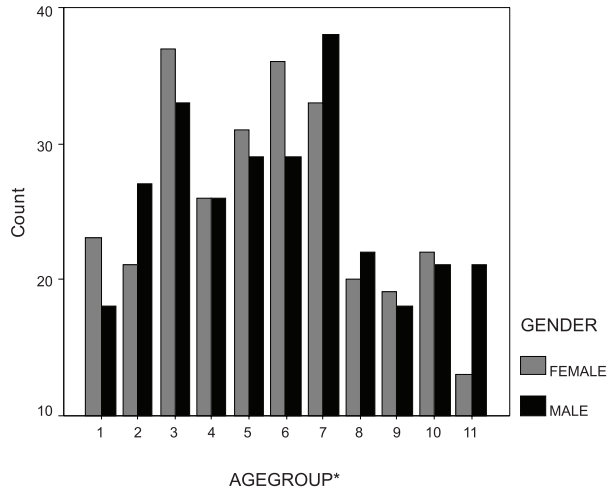
		Height	Score
Height	Pearson Correlation	1.000	0.735
	Sig. (2-tailed)		0.00

* Correlation is significant at the 0.01 level (2-tailed).

Table 5: Independent samples t-test comparing score between males and females.

	t-test for Equality of Means	
	t	Sig. (2-tailed)
SCORE	0.24	0.807

Graph 1: Gender distribution in each group



*1 to 8 on horizontal axis stands for age groups starting from the lowest, i.e. 1 = 2.5 to 3 and so on.

Results

There were 563 children in our study, out of which total number of females was 281 and total number of males was 282. The descriptive statistics are shown in table 1. The mean and standard deviation of total scores in each age group is given in table 2.

Table 3 shows correlation between age group and score. The results show a good correlation between the age groups and the score attained ($r = 0.774$, $p = 0.00$). There is also good correlation seen between heights of children with the scores attained on the PBS scale as seen in table 4 ($r = 0.735$, $p = 0.00$).

The t-test was not statistically significant for the differences in scores between the two genders, as shown in table 5. The two genders did not differ significantly between themselves in their scoring. ($p = 0.807$)

Discussion

Early identification of balance impairment in children is of prime importance to a physical therapist as it would aid in implementing rehabilitation at the earliest.

The PBS as a tool to assess balance in children with motor impairments has been studied over the years. However several questions remain unanswered with respect to the scale like- Do height, age, gender influence the score? (franjoine et al.)[4]

There is scant literature pertaining to normative data in normally developing children. We conducted this study on normally developing children to collect normative data to answer these questions and to provide reference scores in comparing normal children and children with motor impairments in Indian population.

It was observed from our study that most of the children who scored the maximum on the scale were between seven and eight years. We observed that scores show a consistent increase, with increase in the age and height, in both males and females. The results of our study indicate that there is a strong correlation between the age and height with the scores attained, thus suggesting that height and age of children does influence the scores significantly. As the child grows older and the height increases, the ability to score better on PBS increases. This finding is in concurrence to the previous work by Dr. Anuja Abraham and Savitha ravindra[9]. The possible explanation for this correlation could be explained as:

The size of head in small children is relatively large as compared to the lower extremities, which places the center of mass at about T12. Owing to higher placement as COM, the sway is greater in children and the tasks of static balance are more difficult. Previous studies have demonstrated that this sway decreases with age. As the height increases with age this COM shifts down to L5-S1, and balance becomes easier. Also according to Shumway Cook, by 7 years of age the postural responses become like those of adult[3].

We did not find any significant difference between the scores attained by males and females. The distribution of males and females in the sample was homogenous thus avoiding any confounding due to discrepancy in distribution.

Our results suggest that the balance attainment does not differ significantly across the genders. Both males and females develop postural control/balance similarly in accordance to their growth.

Bending forward to reach (task 14) was observed to be the most difficult among all the age groups. Standing with feet together (task 7) was found to be difficult in the age group three to four. Standing with one foot in front (task 8) and Standing on one leg (task 9) were observed to be difficult from three to seven years of age.

Significance of Study

This study may help to find the standard age at which the balance is attained and it may set PBS as objective tool for assessment of children in Indian population

Limitations of Study

The sample was selected from one geographical area only, which may not represent the entire Indian population. Further research is warranted using a larger sample from various regional locations all over India.

Conclusion

The scores attained increase with the age and the scores in both the genders increased similarly with the age.

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An EMG Study Analysis Between Upper and Lower Rectus Abdominis Muscles in Asymptomatic and Chronic Low Back Pain Patients

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Abstract

Aim

The aim of this study is to compare the EMG activity of upper and lower rectus abdominis in normal subjects and chronic low back pain patients.

Method

A convenience sample of 30 male subjects were participated in the study. In group A 15 healthy male subjects of mean age (24±1.7) year, height (162.6±3.5cm.) and weight (65.9±5.6) kg participated and they were not having any history of low back pain and abdominal surgery. In group B 15 patients having chronic low back pain from at least past 3 months were participated who scored more than 50% disability according to the Oswestry disability index with mean age (24.3±2.6year), height (163.6±4.8) cm and weight (67.2±6.3) kg. All the subjects were selected according to the inclusion and exclusion criteria and were divided into two groups. The subject in both the groups were performed two exercises i.e. curl-ups and leg raise. The EMG activity was recorded from URA and LRA muscles sites during curl-ups and leg raise exercise after proper placement of electrode.

Results

Analysis of activity of URA & LRA between group A & B was showing no significant difference of URA & LRA activity during curl-ups & leg raise (P>0.05). Analysis of EMG activity within exercises for group A during Curl-ups and Leg-raises showed no significant difference (P>0.05). Analysis of the EMG activity of URL & LRA within exercises for group B showed no significant difference (P>0.05). Analysis of the amplitude of EMG activity of URA during leg raise and curl ups showed significant difference. The activity of URA during curls-up was more than during leg raise (P<0.05).Analysis of the activity of LRA also shows significant difference between the exercises i.e. curl- up & leg raise. The activity of LRA was also less during leg raise & more during curl-ups (P<0.05). Analysis of EMG activity of URA and LRA between exercises in group B also showed significant difference. The URA and LRA activity more in curl-ups than in leg raise exercise (P<0.05).

Conclusion

The result of this study showed that there was no significant difference in EMG activity of URA & LRA between healthy subjects and chronic low back pain patients. The URA & LRA showed equal activity within the exercise in both groups, but EMG activity of URA & LRA showed significant difference between the exercises i.e. during curl-ups the URA & LRA showed more EMG activity/amplitude than during leg raise exercise.

Clinical Relevance

In this present study we have seen that there was no significant difference in EMG activity of URA & LRA between healthy individuals and low back pain patient, but URA & LRA showed more EMG amplitude during curl ups than in the leg raise. So curl-up exercise was more strenuous on rectus abdominis than leg raise. So curl-ups exercise can be used to strength the Rectus abdominis.

Key Words

Chronic Low back pain, Surface EMG, Upper & Lower Rectus abdominis, Curl ups, Leg raise, Oswestry Disability index

Intoduction

Low back pain (LBP) is an important clinical and public health problem and it is the most common cause of disability among younger adults. More than 50% of adult population had experienced at least one episode of Low back pain. The low back pain is characterized by low frequency of physical activity and decreased spinal function. Back pain is most expensive cause of work related disability in terms of workers compensation and medical expenses. The consistency and high rates of reports of LBP provoked by manual work and sitting. The study findings suggests that insufficient strength and stability of low back musculature is an important factor for both concurrent and future low back pain in adolescents. There seemed to be a causal relationship between the early evolution of degenerative process of lower lumbar discs and frequent low back pain in several subjects. So the cause and prevention of LBP needs to be focused on adolescence age.

Patient with chronic LBP reports problem with diverse activities. The most common problem to be identified by patients was walking tolerance. There is a significant decrease in strength of trunk and lower extremity muscles in LBP patients.

Numerous changes in muscle recruitment have been identified in LBP population. The strength deficit are a major factor in deconditioning syndrome associated with

chronic low back pain(CLBP) and this may be due to pain avoidance behavior. The CLBP patients fatigue faster than healthy controls during an isometric back extension task due to subsequent deconditioning of muscles. The pattern of Para spinal and abdominal activation were found to be different for LBP patient pattern compared to pain free controls and also the activity of gluteus maximum during flexion extension cycle is reduced in CLBP patients. The patients with LBP had a significant less EMG activity and smaller increase in transverse abdominis thickness compared to control group. But no difference was found between group for internal and external oblique muscles.

Vera Garcia et al (2000) found that there is significant increase in abdominal muscle activity on labile surface than on stable surface in healthy individuals. They also found that there is some difference in upper rectus abdominis and lower rectus abdominis activity during some tasks. A. Moris in 2004 also found that on gym ball exercises the upper rectus abdominis is slightly more active than lower rectus abdominis but this difference was not clinically significant.

But Lehman G.J. in 2001 measures the activity of upper rectus abdominis and lower rectus abdominis in healthy individuals during curl ups and straight leg raise exercises and have found that there is no significant difference in upper rectus abdominis and lower rectus abdominis activity. But activity of upper rectus abdominis and lower rectus abdominis is hardly seen in patient with low back pain and it hardly compared with healthy individuals.

So purpose of our study is to compare the activity of upper rectus abdominis (URA) and lower rectus abdominis (LRA) between LBP patient and asymptomatic subjects.

Methodology

A convenience sample of 30 male subjects were participated in the study. All the subjects were taken from the college campus i.e. Dolphin institute of Biomedical and natural sciences. In group A 15 healthy male subjects of mean age (24±1.7) year, height (162.6±3.5cm.) and weight (65.9±5.6) kg (Table I) participated and they were not having any history of low back pain and abdominal surgery. In group B 15 patients of chronic low back pain from at least past 3 months were participated who scored more than 50% disability according to the Oswestry disability index with mean age (24.3±2.6year), height (163.6±4.8) cm and weight (67.2±6.3) kg (Table I)

Inclusion Criteria for Group A

1. The healthy subjects were taken without any history of LBP.
2. Subjects with age between 20-40 year old.
3. Subjects with body weight between 60-80 kgs.
4. Subjects with height between 160-170 cms.

Inclusion Criteria for Group B

1. The patients having chronic low back pain (CLBP) for at least 3 months were participated who had scored more than 50% disability according to Oswestry disability index (See appendix).
2. Subjects with age between 20-40 year old.
3. Subjects with body weight between 60-80 kgs.
4. Subjects with height between 160-170 cms.

Exclusion Criteria for Both Groups A and B

1. Structural deformities of spine.
2. Any neurological deficit.
3. Radiating pain.
4. Disc prolapse.
5. Abdominal and spinal surgery.
6. X-rays abnormalities (Spondylolisthesis)
7. Cardiac problem.
8. Subjects who are performing regular gym exercises.
9. Abdominal hernia.
10. Psychological problems.

Instrumentation

Oswestry Disability Index (ODI)

The oswestry disability index 2.0 version was used to select the patient of low back pain. The ODI consist of 10 section and each section have six statements .The total score for each section is 5 if the first statement is marked the score is 0 and if last statement is marked the score is 5. The total score is calculated by adding the score of each section and the percentage of the score was calculated.

Surface EMG

Surface EMG is non-invasive technique to assess the muscle activity. It is mainly used to detect the activity of superficial and large muscles. In this study the single channel Neuro-Perfect unit of EMG was used to record the amplitude of activity of left upper rectus abdominis and lower rectus abdominis. The silver-silver chloride electrodes with 1cm. diameter were used in this study.

Protocol

All the subjects were selected according to the inclusion and exclusion criteria and were divided into two groups. The subject in both the groups were performed to exercises i.e. curl-ups and leg raise. The EMG activity was recorded from URA and LRA muscles sites during curl-ups and leg raise exercise after proper placement of electrode.

Procedure

All the subjects were taken according to the inclusion and exclusion criteria into group A and group B.

Skin Preparation- It was done by rubbing the skin with an alcohol- water solution to reduce skin resistance magnitude and shaving of excess of hair if required.

Electrode placement - The silver- silver chloride disc electrode with one cm diameter were used to collect the EMG signal from two different muscle locations as follows:

1. From the upper portion of the left rectus abdominis 3cm lateral to the midline and approximately 3cm superior to umbilicus on second to topmost rectus bead
2. From the lower portion of left rectus abdominis 3cm lateral to midline and 2 cm inferior to the umbilicus

The distance between two-disc electrodes was 2 cm. and they firmly attached to the skin with conducting gel adhesive taping and a strap. The ground electrode was placed below the disc electrode on abdominal muscles and it was firmly attached to skin by adhesive taping and strap. The raw EMG signals were recorded by using single channel Neuroperfect unit of EMG. Settings: Sweep time: 10 milliseconds. Sensitivity: 500 microvolt. A low cut frequency of 100 hertz and high cut frequency of 5 kilohertz was used to reduce the movement artifact and notch filter to reduce the power interference.

After proper skin preparation and electrode placement, each subject was assigned to do curl ups and bilateral straight leg raise exercises, as follows.

1. **Curl ups:** In this exercise/task all subjects were positioned in crook lying position and both hand under the low back. During curl ups, the subject raised their neck and shoulders off the support surface while curling the rib cage towards the pelvis and holds this position for minimum 2 second
2. **Leg-raise:** In this task/exercise the neck and shoulder of subjects were raised and supported approximately at the height reached when performing curl-ups with both hand under low back. The subjects then raised both legs approximately 25 cm. off the support surface and hold this position for minimum 2 second

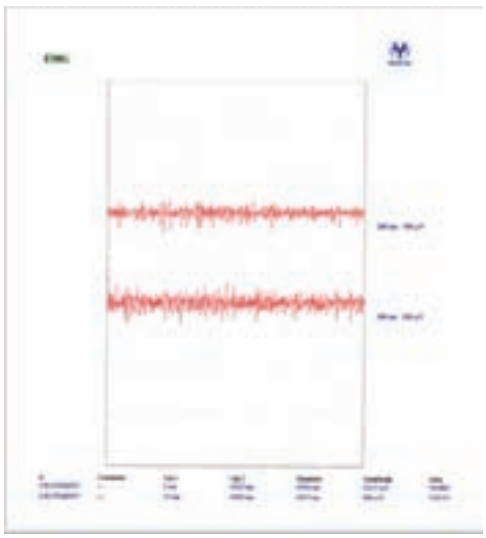
Each exercise was performed with hand under the low back in an attempt to maintain a consistent level of spinal flexion. The EMG signals were recorded from left upper rectus abdominis and lower rectus abdominis while holding the each task/exercise for minimum two seconds.

Instructions to the Subjects

1. The subjects were instructed not to take meal two hours before the study.
2. The CLBP patient instructed not to take any pain killer during study

Fig. 3.1: Electromyogram showing activity during Curl-ups

Lt. upper rectus curl-up



Data Analysis

The SPSS 12.0 software was used to analyze the data. The independent t- test was used to see the difference of URA and LRA between the group A and group B. The paired t- test was used to observe the difference of EMG activity of URA and LRA within groups. The significance level for this study was 0.05.

Results

Analysis of Age, Height & Weight showed no significant difference between two group A and group B i.e. (P>0.05) (Table 5.1). Analysis of activity of URA & LRA between group A & B was showing no significant difference of URA & LRA activity during curl-ups & leg raise (P>0.05) (Table 5.2). Analysis of EMG activity within exercises for group A during Curl-ups and Leg-raises showed no significant difference (P>0.05) (Table 5.3). Analysis of the EMG activity of URL & LRA within exercises for group B showed no significant difference (P>0.05) (Table 5.3). Analysis of the amplitude of EMG activity of URA during leg raise and curl ups showed significant difference. The activity of URA during curls-up was more than during leg raise (P<0.05) (Table 5.4). Analysis of the activity of LRA also shows significant difference between the exercises i.e. curl- up & leg raise. The activity of LRA was also less during leg raise & more during curl-ups (P<0.05) (Table 5.4).Analysis of EMG activity of URA and LRA between exercises in group B also showed significant difference. The URA and LRA activity more in curl-ups than in leg raise exercise (P<0.05) (Table 5.4).

Table 5.1: Demographic Data

Variables	Group-A (mean±SD)	Group-B (mean±SD)	t value	p value
Age (yr)	24 ± 1.7	24.3 ± 2.6	0.322	0.750
Weight (kg)	65.9 ± 3.5	67.2 ± 6.3	0.518	0.609
Height (cm)	162.6 ± 3.5	163.4 ± 4.8	0.577	0.568

Fig. 3.2: Electromyogram showing activity during Leg raise

Lt. upper rectus leg raise

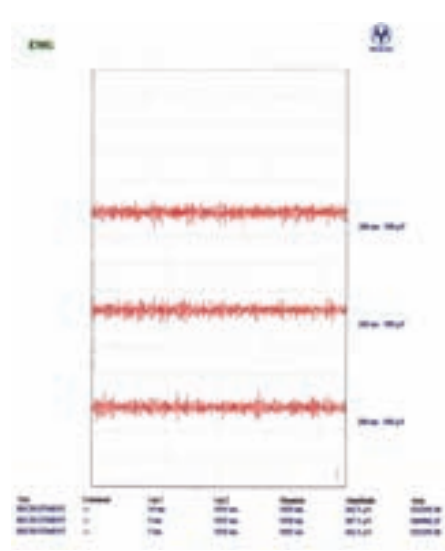


Table 5.2: Independent t- test between group A and Group B

Variable	Group -A Mean ±SD µv	Group -B Mean ± SD µv	t value	p value
Lt. URA Curl-ups	553.3±248	428.3±83.7	1.849	0.075
Lt. LRA Curl-ups	509.6±239.3	440.8±126.8	0.984	0.334
Lt. URA Leg- raise	328.3±107.4	276.6-±80	1.493	0.147
Lt. LRA Leg-raise	349.5±139.5	283.3±70	1.644	0.111

URA =Upper Rectus abdominis
LRA =Lower rectus abdominis

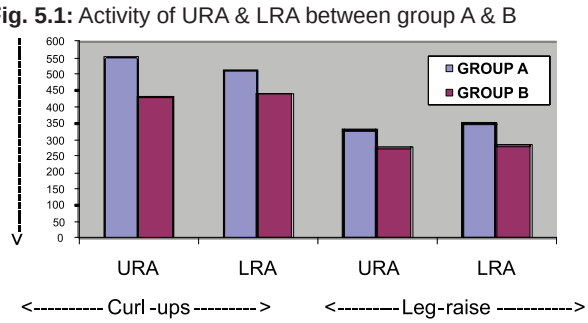
Table 5.3: Paired t-test within group A and B (within exercise)

Group	Variable	Mean±SD (µv)	t value	p value
A	Curl-ups URA & LRA	5553.3±248 509±239.3	1.063	0.306
	Leg-raise URA & LRA	328.3±107.4 349.5±139.5	0.699	0.496
B	Curl-ups URA & LRA	428.3±83.7 440.8±126.8	0.405	0.692
	Legraise URA & LRA	276.6±80 283.3±70	0.199	0.845

Table 5.4: Paired t-test within group A &B (between exercises).

Group	Variable	Mean±SD (µv)	t value	p value
A	URA Curl-up & Leg-raise	553.3±3+248 328±107.4	5.266	0.000
	LRA Curl- up & Leg-raise	509.6±239.3 349.5±139.5	4.195	0.001
B	URA Curl-up & Leg-raise	428.3±83.7 276.6±80	8.884	0.000
	LRA Curl-up & Leg-raise	440.8±126.8 283.3±70	6.214	0.000

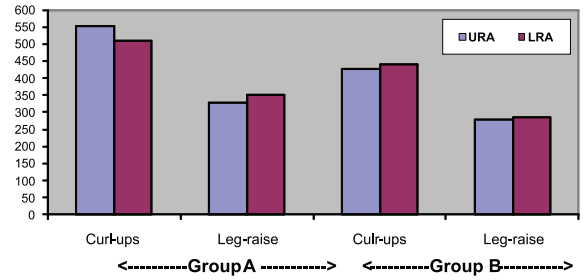
Fig. 5.1: Activity of URA & LRA between group A & B



Discussion

The result of this study showed that there was no significant difference of EMG activity of upper rectus abdominis and lower rectus abdominis between healthy individuals and patients with chronic low back pain.

Fig. 5.2: Activity of URA & LRA within the group (A & B)



The EMG activity of URA & LRA portions was same within exercise for both groups i.e. during curl-ups/leg raise the URA & LRA muscles showed equal activity. But URA & LRA muscles showed more activity during curl-ups rather than leg- raise i.e. between the exercises there was a significant difference in EMG activity of URA & LRA for both groups.

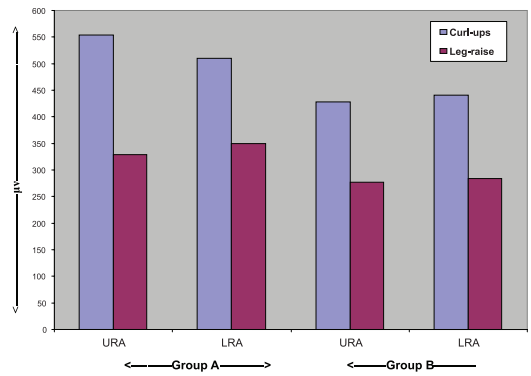
In the previous research done by 'Arokoski et al' revealed that the chronic low back pain patient performed therapeutic exercises for abdominal and back extensor muscles with similar activity in the same way as the healthy subjects.

'Joseph K-F et al 'in their study revealed that there was not any significant difference in EMG activity of Abdominal muscles & back extensor muscles in between the healthy subjects & low back pain patients. But they observed difference in EMG activity of all the muscles during the different direction of movement i.e. the direction of movements for all the muscles have significant effect on EMG activity and the rectus abdominis showed maximum activity during trunk flexion only.

In another previous research done by 'Cheryl L. et al' on low back pain patients showed that URA & LRA muscle EMG was not differ significantly from each other but external oblique muscle produced significantly higher activity than rectus abdominis in both, abdominal hollowing & pelvic tilting exercises.

In this present study, the LRA & URA shows more EMG amplitude in curl-ups than in leg raise. This was supported by 'Andersson E.A. et al they observed that abdominal muscles showed higher amplitude only in trunk flexion exercises and hip flexors showed higher

Fig. 5.3: Activity of URA &LRA within groups (A&B) between the exercises



activity in hip flexion exercises. The rectus abdominis showed maximum activity during trunk flexion than leg lifting exercises. Our study was also supported by 'Richard K. Shields et al', they compared the EMG activity of abdominal muscles during curl-ups and double straight leg lowering exercises and observed that external oblique muscle showed higher activity during double straight leg lowering exercise than the rectus abdominis, but during curls-ups all muscles of abdomen showed equal activation.

'Johanne Vezina et al also observed that EMG activity of URA & LRA was not showing any difference within all abdominal exercises and pelvic tilting exercise. Their result also showed that external oblique muscle was more active during pelvis tilting exercise than rectus abdominis. 'A Mori' in his research also reported that there was no significant difference in URA & LR A activity during abdominal exercises.

Some researches which are contradictory to present results are, 'Lehman et al' in their study observed that URA & LRA EMG activity during curl- ups and leg raise exercises was same within the exercises. But during different exercised i.e. between the exercises the activity of URA & LRA is also same. In this present study the URA & LRA showed significance difference in EMG activity between the exercises so above study of Lehman et al was contradictory to this study.

Our results also contradicted by few other researches. 'Arie Nouwen et al showed that EMG activity pattern of abdominal and Para spinal a muscle was different for low back brain patient compared to pain free subjects.

'Faria Negrao et al also contradicted our results that great majority of individuals showed difference between three portions [Superior, middle & inferior] of rectus abdomens activity i.e. there was not a common behaviour pattern in activity of three portions of rectus abdominis. 'Sarti et al also reported that URA & LRA showed difference in EMG activity during curl- ups and posterior pelvic tilting exercises. The URA was more active than LRA in curl-ups and LRA was showing little large amplitudes during posterior pelvic tilting exercise.

From this discussion it was clear that there was no significant difference between URA & LRA EMG activities is healthy subjects and low back pain patient during curl-ups and leg-raise. The URA & LRA showed equal activity during same exercises (with in exercise) but their activity was different during different exercise (i.e. between the exercises) and the URA & LRA was more active during curl-ups than in the leg raise.

Conclusion

The result of this study showed that there was no significant difference in EMG activity of URA & LRA between healthy subjects and chronic low back pain patients. The URA & LRA showed equal activity within the exercise in both groups, but EMG activity of URA & LRA showed significant difference between the exercises i.e. during curl-ups the URA & LRA showed more EMG activity/amplitude than during leg raise exercise.

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A Comparision Study of the Effects of Massage Therapy with and without Ultrasonic Therapy in Medial Epicondylitis

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Abstract

Aims and Objectives

1. To compare different clinical methods for the treatment of golfer's elbow.
2. To check out which modality is better for the treatment of golfer's elbow.

Hypothesis

There will be significant changes between the results of the two modalities used in the treatment of golfer's elbow.

Study Design

Experimental

Subjects

20 subjects with golfer's elbow participated in the study.

Methodology

Based on the inclusion and exclusion criteria subjects were included in the study. Convenient samplings was done for patients with random allocation into the following two groups:
GROUP A: (Control Group) Ultrasonic therapy (10 patients).
GROUP B: (Experimental Group) Ultrasonic with massage therapy (10 patients).

Conclusion

The present study provides evidence that massage therapy with ultrasonic therapy is more beneficial in treating pain and increasing functional activity in golfer's elbow patient and can be used as a safe alternative in patients with medial epicondylitis.

Key Words

Flexor carpi radialis (FCR), Pronator teres (PT), Flexor diditorum ficialis (FDS), Flexor carpi ulnaris (FCU), ultrasonic therapy (UST), VAS- Visual Analogue Scale

Introduction

Medial epicondylitis, also called as Golfer's elbow, was first described in 1882 by Sir Henry J. Morris in a lancet. It is an overuse syndrome characterized by pain at the flexor- pronoto tendinous origin. The flexor carpi radialis (FCR) and the pronator teres (PT) are commonly involvedat the insertion of the medial epicondyle. The flexor diditorum ficialis (FDS) and the flexor carpi ulnaris (FCU) are less likely to be involved. Ulnar neuropathy may be associated in approximately 50% of cases.
Medial epicondylitis is reported to be the most common cause of medial elbow pain. However, it is less common than lateral epicondylitis. The predominant male to female ratio is 2:1. The peak incidence is noted to be between third and fifth decade of life. The dominant elbow is involved in approximately 60% of cases.

Mechanism of Injury[7]

Medial epicondylitis is seen in sports activities with repetitive valgus stress, flexion and pronation, such as golf, baseball, tennis, fencing, and swimming. This condition is also seen with occupations that require hand, wrist and forearm motion.

- Overload with increased tension on soft tissue around medial head.
- Inadequate forearm endurance.
- Extreme torque or repetition.
- Sudden increased activity of wrist flexors on an unconditioned forearm.
- Improper Equipment and Surface.
- Lack of Flexibility.

There is no evidence relating mode of onset to pathology although it is generally acknowledge that golfer's elbow is caused by repetitive micro trauma/overuse. Originally inflammation was thought to generate the pain in medial epicondylitis. MRI and histology shows micro tear in the flexor- pronoto tendinous origin with out inflammation. Histological evaluation following surgical treatment has revealed angiofibroblastic hyperplasia and fibrillar degeneration of collagen. Nirsch uses the term tendinosis and angiofibroblastic degeneration to describe the path physiology of this disorder as micro tears in the tendon with poor healing response. An acutely inflammatory component may be seen, but the tendon may degenerate over weeks to months.
Accurate diagnosis requires a through understanding of the anatomic, epidemiologic and pathological factors. Clinical features may include pain and tenderness over medial epicondyle of the humerus. Pain is burning and radiating to forearm, decrease in grip strength, elbow range limited in chronic cases, tightness and inflexibility of forearm muscles and in some cases morning stiffness[8].

Preventive Measures

- Pre strengthening of elbow, forearm and wrist muscles.
- Increased Flexibility.
- Warm Up & Cool Down sessions.
- Use of proper Equipment i.e. larger grip, reduced racquet string tension etc.
- Proper Playing surface/field.
- Activity Modification e.g. avoid grasping.
- Aerobic Training
- Climate Fluid & Hydration Bracing
- Bracing

Other non operative treatment involves rest, ice, ultrasonic therapy, non steroidal anti-inflammatory agents, and possibly corticosteroid injection followed by guided rehabilitation and return to sport. Many studies have been done in the past to compare the effectiveness of various modalities for the treatment of golfer's elbow present study compares the effect of massage therapy with ultrasonic therapy (UST) and ultrasonic therapy alone in golfer's elbow.

Study Design

Methodology

20 healthy subjects (10 males and 10 females) with golfer's elbow participated in the study. The subjects were recruited from Department of physiotherapy, Susheela Tiwari Govt Hospital Haldwani. Subjects were randomly allocated into two groups. The mean and standard deviation of age for subjects in Group A were (45.7+10.81) yrs. and in Group B it was (49.3+8.2) yrs.

Inclusion Criteria

1. Patients having tenderness on palpation at the medial epicondyle of the humerus
2. Patients having pain in resisted wrist flexion
3. Age group between 18-45 years

Exclusion Criteria

1. Any infectious disease like osteomyletis around the elbow
2. Any bone tumor around the elbow.
3. Fracture around the elbow joint.
4. Ligament injury around the elbow
5. Trauma around the elbow
6. Narcotic abused patients.
7. Blood coagulative disease
8. Age above 45 years.
9. Any nerve injury.
10. Contracture around elbow.

Instrumentation:

- Ultrasonic machine

Variables

Dependent variable

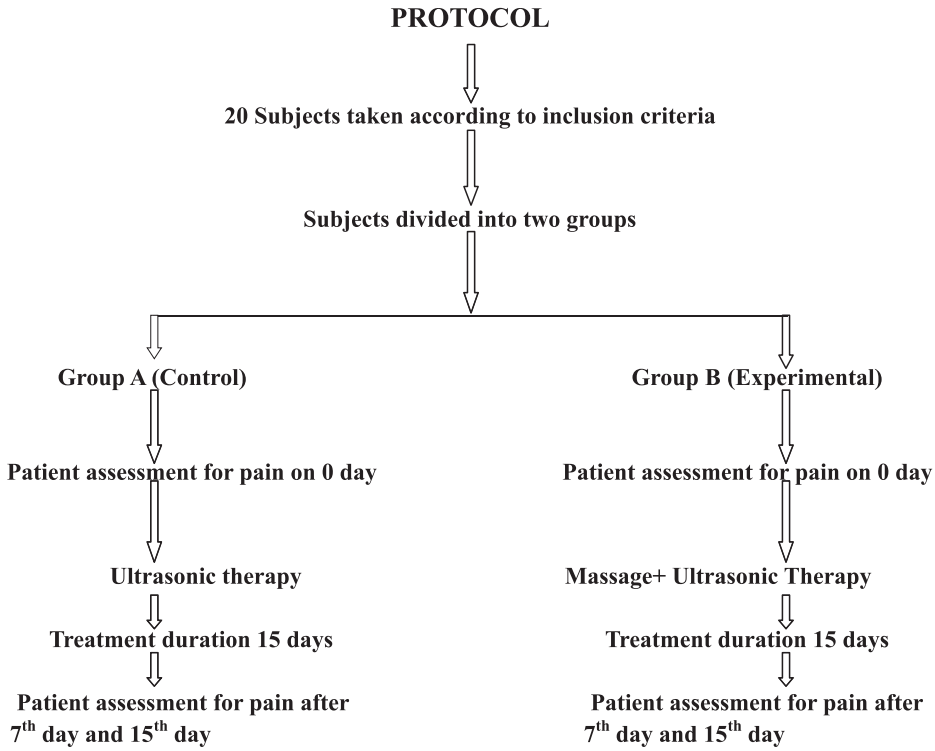
VAS

Independent variable

- Ultrasound
- Massage Therapy
- Pain

Protocol

Based on the inclusion and exclusion criteria subjects were included in the study. Convenient samplings were done for patients with random allocation into the following two groups:



GROUP A: (Control Group) Ultrasonic therapy (10 patients).
GROUP B: (Experimental Group) Ultrasonic therapy with massage (10 patients)

Procedure

Group A (Control Group)

Position of the patient: Sitting with back support
Position of Hand: Resting on chair's arm with pillow under the elbow
Position of the Therapist: Sitting
Technique: After positioning the patient, ultrasonic gel is applied on the affected area around the medial epicondyle and then the UST machine is set up at pulse mode and intensity of 1.2w/cm2 for 8 minutes is applied. After the treatment treated part is cleaned with cotton swab.
The above procedure is repeated daily continuous for 15 days.

Group B (Experimental Group)

Position of the patient: Supine lying or sitting with back support
Position of the Therapist: Sitting
Technique: This group received UST with massage for 15 days. After positioning the patient, massage mainly kneading and friction massage is given over the medial epicondyle as advocated by Cyriax 9 briefly the technique consisted of vigorous 10 minutes frictional massage applied perpendicular to the structure of interest and then UST is applied as mentioned above.
The above procedure is repeated daily continuous for 15 days.

Data Analysis

The data analysis was done using SPSS software version 11.0.

Results

Results were calculated using 0.05 level of significance. Paired t test was applied to compare the mean values between different sessions (0, 7 and 15) with in Group A and Group B. Unpaired t test was applied for comparing the mean difference between the Group A and Group B. The significant level taken in the present study was ($p<0.05$).

Table 1: Mean and Standard Deviation of age for subjects of Group A and B

	Group A Mean + SD	Group B Mean + SD
Age	45.7 + 10.8	49.3 + 8.2

Table 2: Mean and SD of subjects at 0, 7 and 15 session for Group A, Group B.

Groups	0 session Mean + SD	7th session Mean + SD	15th session Mean + SD
Group A	7.56 + 1.5	4.4 + 0.6	2.9 + 0.99
Group B	8.4 + 0.99	4.55 + 1.06	1.7 + 0.67

Table 3: Comparison of mean value 0 Vs 7 session and 15 session and 0 Vs 15 session within Group A and Group B.

Sessions	Group A		Group B	
	T value	P value	T value	P value
(0 Vs 7) session	6.18	P< 0.05	9.44	P< 0.05
(7 Vs 15) session	3.5	P< 0.05	6.6	P< 0.05
(0 Vs 15) session	8.98	P< 0.05	16.09	P< 0.05

Table 4: Mean differences and SD of subjects at (0-7), (7-15) and (0-15) sessions for Group A and Group B.

Group	(0-7) sessions Mean + SD	(7- 15) sessions Mean + SD	(0-15) sessions Mean + SD
Group A	3.2 + 1.63	1.5 + 1.3	4.7 + 1.6
Group B	3.95 + 1.32	2.75 + 1.31	6.7 + 1.31

Table 5: Comparison of mean differences at (0-7) session, (7-15) session and (0-15) session between Group A and Group B

Group	Group A Vs Group B	
	T value	P value
(0-7) sessions	-1.12	P< 0.05
(7- 15) sessions	-2.09	P< 0.05
(0-15) sessions	-2.99	P< 0.05

Discussion

The result of the study shows that there were significant changes between the different sessions within Group A (Control group) and Group B (Experimental group). On comparing both the groups, Group B (Experimental group) gave better results than Group A (Control group). Therapeutic ultra sound is often used in the treatment of golfer's elbow, but alone it does not appear to be beneficial. Ultrasound in combination with massage therapy appeared to provide improvement in functional outcomes the results suggest the patients treated with massage therapy with ultrasound recovered well after 2 weeks and were able to resume their duties whereas the patients receiving ultrasound alone had complaint of pain even after 2 week.
Ultrasonic therapy is often used in the treatment of golfer's elbow, but alone it does not appear to be beneficial. According to De Bruijn R., et 6 Deep frictional massage increased the width way stretching across the fibers, separating them to lengthen the cross bridges between the collagen fibers restoring inter fiber mobility, frictions have been found to produce hyperemia which can be use full in healing and chronic scaring., transverse friction also leads to immediate pain relief - the patient experiences a numbing effect during the friction and reassessment immediately after the session shows reduction in pain and increase in strength and mobility, applying UST immediately would have further increased the healing as the sound waves would have further penetrated deep into the tissues which are being treated

supporting the findings of the present study.

Further, Christopher R Carciapt et al stated that like wise for our modalities such as ultrasound or massage, they are not a "generic" modality. The mechanical and thermal effects of these interventions are distinct, and believe that the outcome depends on applying the modality correctly[5].

According to results of this study, a decrease especially in pain and accordingly improvement in functional condition and activities of daily living were observed in the patients with medial epicondylitis receiving US treatment with massage therapy Therefore, we conclude that US treatment with massage is a safe treatment alternative in patients with medial epicondylitis. However, the short monitoring period is the limitation of the study. Thus, studies with longer monitoring periods are needed.

Conclusion

The present study provides evidence that massage with ultrasonic therapy is more beneficial in treating pain and increasing functional activity in golfer's elbow patients and can be used as a safe alternative in patients with medial epicondylitis.

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A Study to Determine Developmental Trends for Gravitational Insecurity Assessment

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Abstract

Objective

To determine developmental trends for Gravitational Insecurity (GI) assessment (Revised Version) to strengthen the psychometric properties of GI assessment

Method

The GI assessment consists of 9 items with two behavioural categories-Emotional Response (ER) and Postural Response (PR). Four hundred fifty (n=450) children, aged 3-10 years (Mean age = 5.5 years ±3.03 years) were taken from normal schools. The GI assessment was administered to children in their schools.
RESULTS
There is statistically significant difference between the age groups 3-10 years. Further analysis revealed that there is no statistically significant difference in performances of age groups of 3-5 years in six months interval. There is no statistically significant difference between the genders.

Conclusion

Developmental trends were determined and norms can be established for 3-10 years in one year interval. This norm can be used as cutoff score to identify children with GI.

Key Words

Gravitational Insecurity, Construct Validity

Introduction

People with sensory over-responsivity respond to sensation faster, with more intensity or for a longer duration than those with typical sensory responsivity. Gravitational insecurity refers to difficulty maintaining balance and coordination of movements along variable surfaces and inclines, such as stairs, a gravel walk way, or icy sidewalk. Oftentimes, gravitational insecurity is a result of an inadequately functioning vestibular and/or proprioceptive sensory system[1] (Prestla, Smith and Myles, 2007). Ayers[2] identified symptoms that included fear of falling, fear of inverted head positions, inability to jump or have the feet leave the ground, inability to perform a somersault and reluctance to lie supine.
Gravitational insecurity is conceptualized as a subtype of sensory integration dysfunction and is mainly caused by vestibular system dysfunction. The vestibular system measures movement and pull of gravity. It is measured by two types of receptors in the inner ear, the semi circular canals and the otolith organs. The utricle is a linear accelerometer that detects linear head movement and head tilt[3] (Fisher & Bundy, 1989). In vestibular system dysfunction these receptors won't function properly. The Gravitational insecure child prefers to stay low to the ground lying down or seated (often in W- sitting), rigidly fixing his body to prevent any possibility of movement and avoiding most active physical tasks[4] (Biel & Peske, 2005)
Identification of gravitational insecurity has been based on a subjective process involving informal assessment and clinical observation of behaviors reflecting symptoms of the disorder. A domain specification study as the first step in the development of an attitude scale to identify children with gravitational insecurity5. May-Benson6 developed an objective 15 item assessment of gravitational insecurity in children. They conducted pilot study on 28 children with GI and matched typically developing children. Based on this study results GI assessment was revised from 15 items to 9 items. Reliability of revised version of GI assessment was established in 2007. Construct validity was done with small sample size and they found that developmental trends was present to GI assessment. Hence current study was carried out with large sample size to establish construct validity for GI assessment for strengthen the psychometric properties.

Method

Participants

Ten typically developing children were included from each age group (5 – 10 years) in the pilot study. Sample size was determined based on pilot study results. Four hundred and fifty (n=450) typically developing children, aged 3 – 10 years (M=5.5 years, SD = 2.03 years) were recruited from normal schools. These children met the following criteria: average intelligence, no history of physical handicaps, no language problems, no history of educational remediation, normal hearing, normal or corrected vision, no past or present occupational or physical therapy services based on parent and teacher reports, and no behaviors characteristic of gravitational insecurity.

Instrument

Gravitational Insecurity Assessment (Revised Version).

The revised nine-item GI assessment, developed by May-Benson., is an individually administering test. Administration time is about 15 minutes. Intra-class correlation coefficient for rater pool was .959. Inter-rater reliability (ICC= .91, p<.001; ICC=.91, p<.001; ICC= .96, p<.001 for emotional responses, postural responses, and total scores respectively) and test retest reliability (ICC= .96, p<.001; ICC= .85, p<.001; ICC= .97, p<.001 for emotional responses, postural responses, and total scores respectively) were good. Internal consistency of the test items (α= .98) and split half reliability (r=.62 for GI group; r=.97 for overall) were acceptable level7.The revised GI Assessment has a three-point scoring system with two behavioral categories. Behavioral categories include Emotional Responses and Postural Responses. The point scoring is: 3 - Typical response, 2 - Moderate / Mild GI, and 1 - Definite GI. The nine items of the assessment are listed in Table 1.

The GI Assessment required the following materials: the GI Assessment manual, scoring sheets, pencil, floor mat, standard 100cm meter / yard stick, standard gymnastic ball (65cm), standard hard seat adult chair with seat height 40-45cm, 45 x 45 x 6cm tilt board, and masking tape.

Procedures

The purpose of the study was explained to the appropriate authorities of the schools and informed consent form was obtained from parents. Testing was conducted in separate classroom with good lighting, ventilation and distraction free environment. The first author administered revised version of the GI assessment on 450 children. The evaluation was conducted in the standardized format according to the protocol developed for the GI Assessment by May-Benson. All subjects were oriented to the tasks. The directions were given for each task in English language and children were requested to complete the tasks two times. Average score was taken for data analysis.

Table 1: Test items of Gravitational Insecurity Assessment

Item No	Items	Description
1	Jumping	Participant jumps up and down with feet together
2	Height Jump	Participant jumps over a stick raised to 10 cms (4 inches) off ground
3	Stand on Chair	Participant step up on seat of chair
4	Jump off Chair – eyes closed	Participant hops off chair with eyes closed
5	Forward Roll	Participant does a forward somersault.
6	Backward Roll	Participant does a backward somersault.
7	Tilt Board Step	Participant steps on tilt board, then steps off backward.
8	Supine on ball – active	Participant lies back on ball, then stands up
9	Supine on ball – Passive	Participant lies supine on ball as rater quickly tips it backward.

Data Analysis

Data was analyzed using 15.0 versions. One way ANOVA was used to find out the significant difference in behavioral categories of GI assessment between the age groups. Pearson correlation was computed to find out the correlation between age and GI assessment.

Results

There is statistically significant difference (Table 2,3 & 4) in performances between the age groups in Emotional Response (F (8, 441) = 122.772; p<.001), Postural Response (F (8, 441) = 319.692; p<.001) and Total Score(F (8, 441) = 340.027; p≤.001) of GI assessment. Further, Post hoc analysis revealed that there is no statistically significant difference in six months interval from 3-5 years and positive correlation (r=.821, .909 & .917 for Emotional Response, Postural Response & Total Score respectively) between age and GI assessment (Table 5). There is no statistically significant difference in gender performance on emotional response, postural response and total score of Gravitational Insecurity(GI) assessment (t = .000, p>.05;t= 1.299 p>.05; t= .825, p>.05)

Discussion

Gravitational Insecurity (GI) assessment (Revised version) consists of 9 items that include balance and gross- motor activities. Literatures supported that development of balance and gross motor skills increases with age. The current study was carried out to determine the developmental trends for GI assessment.

The performance of children on Gravitational Insecurity (GI) assessment

There is statistically significant difference (Table 2) in performances between the age groups in Emotional

Table 2: The performance of children on GI assessment

Age interval	N	Mean		
		Emotional Response (ER)	Postural Response (PR)	Total Score (TS)
3.0- 3.05	50	21.76	15.58	37.14
3.06- 3.11	50	21.96	15.64	37.60
4.0- 4.05	50	23.04	16.53	39.57
4.06- 4.11	50	23.30	16.82	40.12
5.0- 5.11	50	23.93	18.89	42.82
6.0- 6.11	50	24.97	22.32	47.29
7.0- 7.11	50	26.57	24.08	50.18
8.0- 8.11	50	26.70	24.80	51.50
9.0- 9.11	50	26.90	25.91	52.81
TOTAL	450	24.35	20.06	44.34

Table 3: The correlation between age and GI assessment:

Age	ER (r)	PR (r)	TS (r)
3.0-9.11	.821	.909	.917

p≤.01

Response (ER), Postural Response (PR) and Total Score (TS) of GI assessment. Further, Post hoc analysis revealed that there is no statistically significant difference in six months interval from 3-5 years and positive correlation (r=.821, .909 & .917 for ER, PR & TS respectively) between age and GI assessment (Table 3). These findings supported differences in performance among younger and older children, reflecting a developmental trend. Children who experience sport activities will have good balance and gross motor skills than the others who don't participate in it. Children's sports experience should make them feel good and have confidence in themselves8 (Humphrey.J.H, 2003). As age increases children's participation in various gross motor activities increases. They can develop in gross motor skills along which their emotional responses develop. This may influence the children's emotional response in various age intervals on GI assessment. Children who are practicing dance, tennis, karate and other corresponding activities, will have good balancing skills. Harrison and Keane (2007)9 analyzed the effects of variable and fixed practice on the development of physical ability in young children and found that children will learn more skills if they are encouraged to engage in a varied range of tasks rather by repeating the same skill. Various researches found that long and high jump techniques have developmental effect on coordinative capacities best before age of 11 to 12 years. Kathleen and Getchell (2009)10 found that balance, somersault, one leg standing, and stair climbing activities have developmental phases. Therefore, these literatures support the current findings which determined that there is an increase in children's performance on GI assessment as when the age increases.

The comparison of gender performance on GI assessment

There is no statistically significant difference (Table 4) in gender performance on GI assessment. Current study findings were supported by Roshchupkin and Gogin (1989). They examined that there are no major differences in the physical development of boys and girls until the age of 11 to 12 years. Only after the age of 11 to 12 years the girls surpass the boys in height and weight and this is linked to an earlier sexual maturation. There is a fact that children up to the age of 11 to 12 years are more capable of running, jumping and performing strength exercises. Hence, there is no significant difference in gender performance on balance and gross motor activities.

Recommendations

- Norms should be established for GI assessment (Revised version) with one year age group interval.
- Research should be done to know how gravitational security development influences on children who are skilled in skating, swimming and other similar activities.
- Reliability and validity studies can be carried out to strengthen the psychometric properties of GI assessment (Revised version).

Table 4: The comparison of gender performance on GI assessment.

Categories	Mean		't' value
	Boys	Girls	
Emotional Response(ER)	24.29	23.11	0.000
Postural Response(PR)	20.28	19.74	1.299
Total Score (TR)	44.53	44.04	0.825

Conclusion

The study identified developmental trends for Gravitational Insecurity (GI) assessment. This can be used to screen the children with GI. This tool can be used as the assessment tool as well as the outcome measure.

Acknowledgements

We immensely thank all the participants for their participation and co-operation without whom this study would not have been possible. This study was completed in partial fulfillment of the primary author's requirements for bachelor degree in occupational therapy at SRM University, Chennai, Tamilnadu, INDIA.

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A Randomized Clinical Trial of Autonomic Nervous Dysfunction by Valsalva Maneuver (V.M) and Sustained Hand Grip (S.H.G) Responses in Middle Aged Subjects having Hypertension and Diabetes Mellitus

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Abstract

Purpose of Study

To assess Autonomous Nervous System responses in the middle aged persons by using Valsalva Maneuver and Sustained Hand Grip tests in different postures.

Material and Methods

67 subjects reporting to department of physiotherapy of K.L.E.S Hospital and MRC were evaluated after inform consent and they were subdivided into grouped into 4 groups (Group 1 control; Group 2 H.T. Group 3 D.M; and Group 4 H.T with D.M) by simple random sampling method taking into inclusion and exclusion criteria. Baseline data for study were noted with respect to DBP;P.R;G.S.R level in 3 positions and body composition (fat and BMR). Then the participants were subjected to V.M and S.H.G tests and DBP;P.R;G.S.R level changes were noted.

Results

The DBP fall after VM and S.H.G tests in all above 3 groups in different positions was not statistically significant; whereas combined group which showed a statistically significant DBP fall with 'P' value = <.001. The P.R increase after V.M and S.H.G tests in all above 3 groups in different positions was statistically significant with 'P' value = <.0001, except in the combined group which was not defined. G.S.R showed no change statistically in any group.

Conclusion

Taking in to account of fall of D.B.P and increase in P.R following post V.M and post S.H.G tests in 3 different positions; it is concluded here that V.M and S.H.G tests are simple, reliable and bedside clinical tests which can be used to assess the ANS dysfunction in subjects with Dm, HT and DM+HT.

Key Words

Valsalva maneuver (V.M) sustained hand grip (S.H.G) pulse rate (P.R); diastolic B.P (D.B.P); diabetes mellitus (D.M) and hypertension (H.T). G.S.R Galvanic Skin Resistance.

Introduction

Autonomic Nervous System (ANS) is an important involuntary nervous system which controls and integrates the unconscious regulatory functions of the body. The functioning of this system is dependent upon the situations and physical activities. It controls functions of the vital body organs. Any condition which directly affects this system, may be responsible for hyperfunction or dysfunction of this system. Presently people with stress and strain of life are prone to hypertension as reported in various studies. Valsalva maneuver (VM) is a commonest test to artificially activate or inhibit this systems functions. This maneuver is used to assess the integrity of autonomic cardiovascular control mechanism; consists of voluntary elevation of intra-thoracic and intra-abdominal pressure provoked by blowing against pneumatic pressure[1]. Other situation which can stimulate the activity of ANS is sustained hand grip (S.H.G) which results in rise in systolic B.P and pulse rate (P.R) due to withdrawal of vagal influence. So it is intended to understand autonomic nervous changes in middle aged persons by using V.M and S.H.G is 3 different positions i.e., supine; sitting and standing.

Methodology

Source of Data

Data was collected from physiotherapy OPD of KLES Dr. Prabhakar Kore Hospital and MRC, during the study period of Oct 2000 to July 2001.

Study Design

The study design used for this research was randomized clinical trial. For this R.C.T ethical clearance was obtained from the institutional ethical committee, JNMC, Belgaum before commencement of the study

Study Sample

The study sample consisted of both male and female participants referred to the physiotherapy outpatient department There were 67 participants were included in the clinical trial.

Inclusion criteria

- Normal middle aged 40 to 65 subjects.
- Subjects with hypertension without any complications.
- Subjects with DM without other systemic manifestation.
- Subjects with H.T + D.M.

Exclusion criteria

- Subjects with general debility, malignancy.
- Cardiac problem.
- PVD.
- Pulmonary complications.
- Recent surgery.

- Thrombotic or embolic history.

Procedure

The demographic data of all the participants consisting name, age, sex, height, weight & BMI were collected. This study included 67 subjects divided in to 3 groups with 20 subjects in each group. Group 1 (control group) consisted of 20 subjects (i.e., male 10 subjects and female 10 subjects), the group 2 (hypertension group) consisted of 20 subjects (M=10, F=10); The group 3 (D.M. group) consisted of 20 subjects (M=10; F=10) while group 4 (combined group i.e. HT+DM) consisted of HT + DM with 7 males subjects only.

The materials used in study were

- A standard mercury sphygmomanometer.
- A single tube stethoscope of Litman Company.
- A manual handgrip dynamometer with calibration in Kg of Incon Ambala India.
- Galvanic skin resistance (G.S.R) Biofeed-back (Biotrainer) with calibration in Kohms with digital display manufactured by Biotech India Company.
- Body fat analyzes manufactured by maltron; BF-905 made in England.

All the subjects were subjected to V.M and S.H.G tests separately and B.P and P.R responses before and after above tests in supine; sitting and standing position were measured. Pre and post values for BP and PR changes with respect to V.M and S.H.G tests in different positions were noted. Similarly all the subjects were assessed for G.S.R changes to V.M and S.H.G tests in all the 3 above mentioned positions before and after testing were noted. And body composition was also assessed for each individual.

Statistical Analysis

Simple statistical analysis measures that is mean, S.D, and 't' test were used for data analysis. The 'P' value was also determined at confidence level of 95%.

Results

After the processing of data, the data's were analyzed with respect to V.M and S.H.G tests followed by G.S.R changes and body composition assessments. These findings are presented comprehensively below as follows:

1. **Demographic profile analysis:** The first 3 groups were equally matched with respect to gender i.e., 10 males and 10 females except the group 4 which had 7 males only. Height (Ht) and body weight (wt) parameters of subjects of 4 groups were with range between 150cm to 168cm and wt range was 56 to 69 Kg respectively.
2. **Study parameters analysis:** This study outcomes were analyzed with respect to DBP responses, P.R. changes, G.S.R responses and body composition components [(i.e. Fat, Basal metabolic rate (B.M.R) etc] separately and they are stated briefly below as follows:

Table 1: Presents Pre and Post Valsalva maneuver DBP readings, sex wise, in three postures namely supine, sitting and standing, along with the reading of the pulse rate, in the "Control Group"

Position	D.B.P						Pulse Rate					
	Pre Valsalava		Post Valsalava				Pre Valsalava		Post Valsalava			
	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P
Supine lying Male	81	3.61	81	3.61	0	1	62.06	1.53	63.4	1.42	8.510	<.0001
Supine Female	80	0	80		0	1	61.2	1.32	62.3	62.3	11	<.0001
Sitting Male	81	3.61	81	3.61	0	1	61.1	1.10	62.4	1.34	8.510	<.0001
Sitting Female	80	0	80	0	0	1	61.0	0.82	62	0.82	œ	-
Standing Male	81	3.61	81	3.61	0	1	62.0	1.25	63.2	1.13	9.00	<.0001
Standing Female	80	0	80	0	0	1	61.7	1.06	62.7	1.06	11	<.0001

Table 2: Presents Pre and Post Valsalva maneuver DBP readings, sex wise in three postures namely supine, sitting and standing, along with the reading of the pulse rate, in the "Hypertension Group"

Position	D.B.P						Pulse Rate					
	Pre Valsalava		Post Valsalava				Pre Valsalava		Post Valsalava			
	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P
Supine lying Male	91	8.76	91	8.76	0	1	84	8.27	88.4	8.53	26.944	<.0001
Supine lying Female	95	5.27	95	5.27	0	1	84.7	5.33	89.5	5.42	36.0	<.0001
Sitting Male	91	8.76	91	8.76	0	1	74.1	6.59	78.1	6.83	22.021	<.0001
Sitting Female	95	5.27	95	5.27	0	1	70.2	3.85	75.3	3.50	21.857	<.0001
Standing Male	91	8.76	91	8.76	0	1	76.2	6.20	81.0	6.3	36.0	<.0001
Standing Female	95	5.27	95	5.27	0	1	72.4	4.12	77.2	4.08	36.0	<.0001

Table 3: Presents Pre and Post Valsalva maneuver DBP readings, sex wise in three postures namely supine, sitting and standing, along with the reading of the pulse rate, in the "Diabetes Mellitus Group "

Position	D.B.P						Pulse Rate					
	Pre Valsalava		Post Valsalava				Pre Valsalava		Post Valsalava			
	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P
Supine Male	87	9.49	87	9.49	0	1	73.3	7.80	77.8	7.80	16.744	<.0001
Supine Female	81	3.16	81	3.16	0	1	71.9	4.63	76.7	5.17	19.242	<.0001
Sitting Male	87	9.49	87	9.49	0	1	69.6	8.97	74.2	8.80	20.804	<.0001
Sitting Female	81	3.16	81	3.16	0	1	67.8	5.13	72.5	5.06	22.020	<.0001
Standing Male	87	9.49	87	9.49	0	1	68.7	9.36	73.3	9.32	27.0	<.0001
Standing Female	81	3.16	81	3.16	0	1	68.6	4.65	73.1	4.68	27.0	<.0001

(i). Diastolic B.P (D.B.P) responses with respect to post V. M and SHG

A. Post VM DBP changes analysis : responses showed no change in DBP in all the 3 groups namely control; H.T and D.M, in 3 different postures except in the combined group [(i.e. H.T with D.M] where decrease in D.B.P was in standing position only and was with S.D of 88.86±3.02 with 't' value = 14.99 and 'P' value = <.001 which was statistically significant. [Tab 1,2,3 and 6A].

B. Post SHG test DBP analysis : Post S.H.G results showed no change in D.B.P in all the first 3 groups namely control; H.T and D.M in all 3 positions; except for the combined group (i.e. H.T. with D.M) which showed fall in D.B.P [(i.e. DBP decrease in sitting was with S.D of 88±7.9 with 't' value = 2.499 and 'P' value = <.05 which is significant statistically and DBP decrease in standing position was with S.D of 87.71±2.14 with 't' value = 14.995 and 'P' value = <.001 which was highly significant statistically). These changes are presented in tables such as (Table 4,5,6 and 6A).

(ii) P.R responses with respect to post V.M and Post S.H.G tests

A. Post V.M P.R changes : Post V.M results showed statistically significant increase in P.R in all first three groups in all 3 positions ('p' value = <.0001); but in combined group 4 it was not defined (Tab 1,2,3,6A).

B. Post SHG PR changes: Similarly post S.H.G results showed statistically significant increase in P.R in all 1st 3 groups in all 3 positions. (P value = <.0001); but in combined group 4 it was not defined (Tab 4,5,6,6A).

(iii) GSR changes to V.M and SHG tests: On analyzing G.S.R change to V.M and SHG tests, it was found that there was no statistically significant GSR changes in any groups (Tab 7).

(iv) Body composition analysis: Fat composition : There was statistically significant percentage of fat in H.T and D.M group ('P' value = <.001) while in control group it was not significant (Table 8).

(v) BMR analysis: It was found that BMR was statistically significant for H.T and D.M groups ('p' value = <.0001) but it was not significant for control group ('P' value = <.7) as presented in Table 8.

Discussion

This study involved 67 middle aged subjects without any history of heavy work or manual occupation (Table 2).

All subjects in different groups had very minimal deviation with respect of their body ht and wt (Table 3). The study outcome with respect post V.M, DBP change in both males and females in different positions such as supine; sitting and standing were not significant in all 1st 3 groups. This was substantiated by 't' values. In combined group, D.B.P changes following post V.M was decreased significantly and was substantiated by 'P' values Eduardo E. Benarroch, Paola Sandroni and Philip A. Low (1993) published a comprehensive study of V.M and its responses and reported that there used to be changes in B.P responses due to change in posture[2]. In

Table 4: Presents Pre and Post sustained handgrip DBP readings, sex wise in three postures namely supine sitting and standing, along with the reading of the pulse rate, in the "Control Group"

Position	D.B.P						Pulse Rate					
	Pre S.H.G		Post S.H.G				Pre S.H.G		Post S.H.G			
	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P
Supine Male	81	3.16	81	3.16	0	1	62.01	1.53	63.4	1.51	8.573	<.0001
Supine Female	80	0	80	0	0	1	61.2	1.32	62.4	1.51	9	<.0001
Sitting Male	81	3.16	81	3.16	0	1	61.7	1.70	62.8	1.75	11.0	<.0001
Sitting Female	80	0	80	0	0	1	61.0	0.82	62.0	0.82	œ	<.0001
Standing Male	81	3.16	81	3.16	0	1	62	1.25	63.3	1.06	8.510	<.0001
Standing Female	80	0	80	0	0	1	61.7	1.06	62.6	1.07	œ	<.0001

Table 5: Presents Pre and Post sustained hand grip DBP readings, sex wise in three postures namely supine, sitting and standing, along with the reading of the pulse rate, in the "Hypertension Group"

Position	D.B.P						Pulse Rate					
	Pre S.H.G		Post S.H.G				Pre S.H.G		Post S.H.G			
	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P
Supine Male	91	8.76	91	8.76	0	1	84	8.27	88.7	8.58	30.768	<.0001
Supine Female	94	5.16	94	5.16	0	1	84.7	5.33	89.7	5.33	œ	-
Sitting Male	91	8.76	91	8.76	0	1	74.1	6.59	79.1	6.61	23.717	<.0001
Sitting Female	95	5.27	95	5.27	0	1	70.2	3.85	75.1	3.81	49	<.0001
Standing Male	91	8.76	91	8.76	0	1	76.2	6.20	81	6.50	20.804	<.0001
Standing Female	95	5.27	95	5.27	0	1	72.4	4.12	77.3	3.97	49	<.0001

Table 6: Presents Pre and Post sustained hand grip DBP readings, sex wise in three postures namely supine, sitting and standing, along with the reading of the pulse rate, in the "Diabetes Mellitus Group"

Position	D.B.P						Pulse Rate					
	Pre S.H.G		Post S.H.G				Pre S.H.G		Post S.H.G			
	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P
Supine Male	87	9.49	87	9.49	0	1	73.3	7.80	78.3	7.94	19.365	<.0001
Supine Female	81	3.16	81	3.16	0	1	71.9	4.36	76.7	5.25	16.517	<.0001
Sitting Male	87	9.49	87	9.49	0	1	69.6	8.97	74.9	9.06	12.531	<.0001
Sitting Female	81	3.16	81	3.16	0	1	67.8	5.18	72.6	4.88	24.0	<.0001
Standing Male	87	9.49	87	9.49	0	1	68.7	9.36	73.6	9.30	49	<.0001
Standing Female	81	3.16	81	3.16	0	1	68.6	4.65	73.2	4.39	28.169	<.0001

our study we have not seen such statistically significant decrease in DBP but there was statistically significant DBP decrease in combined group. This study also co-relates with Tondon et al (1985) study about the effect of V.M in ANS dysfunction in supine and in standing positions in patients with D.M.3The DBP change to post S.H.G in different groups in different positions was not statistically; except in the combined group. These study findings with respect to post S.H.G are not co-relating to the study of Ewing D.J (1974) with respect to 1st three groups except in the combined group[4]. The P.R response (i.e., PR increase) with respect to post V.M and post S.H.G showed statistically significant increase in all 1st 3 groups but the same was not defined for the combined group. This study co-relates with the study of Ewing D.J (1981) with respect to P.R changes in D.M in different positions. He concluded that increase of P.R in D.M are due to cardiac parasympathetic damage alone in some patients and combine parasympathetic cardiac sympathetic damaged in others[5]. It must be recalled that both the H.T and D.M in this combined 2 risk groups 2 and 3 were detected earlier and were treated with appropriate medications. This early intervention may be considered in favour of ANS function towards stability and their detection in experimental group could be questionable. Also they could have been moderated by early intervention of drugs leading to control of autonomic dysfunction. In order to verify the relevance of these tests and to increase their sensitivity, a separate group called as the combined group (i.e. H.T + DM) having 7 males patients with both risk factors were subjected to these test (V.M. & S.H.G). There was a fall of DBP in this group following these two tests. This indicates that ANS dysfunction is due to V.M and S.H.G tests. So, V.M and S.H.G tests can be considered as bedside screening tests for ANS dysfunction. G.S.R changes with respect to post V.M and post S.H.G of all above groups in both genders measured by using biotrainer apparatus were not significant statistically (Table 10). With respect to G.S.R changes, the H.T group had overall lower readings (i.e.,) somewhat reduced sympathetic activity and is attributable to vasodilator drugs, not a characteristic of H.T groups by itself. The DM group had similar trend, which could not be explained on the basis of drug alone. In combined group there was uniform GSR level lowering and it was attributable to effect of antihypertensive drugs. In this study; it is also found that body mass index (BMI) of diabetic female was more than 27 which is towards obese side; whereas BMI in the other groups were less than 25. It signifies that majority of the subjects were not obese. On analyzing body composition it was found that females of all the groups were having fat percentage more than 25 percentage but in control group males were having more than 30 percentages as a fat content. Male population of other groups were having less than 25 percentage of body fat; water percentage was less than 49.6 percentage in all the groups significance of body composition in this study is that the conductivity of impulse is depend upon fat and water content. BMR was 1340 in control group and >1600 in rest all groups. BMR was found to be raised in H.T and D.M groups and in combined group.

Table 7: G.S.R values in different groups

Groups	Position	Valsalva Maneuver							
		Male n=10				Female n=10			
		Pre		Pre		Post		Post	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control (n=20)	Supine	945.1	130.76	945.3	130.59	961.17	109.85	961.17	109.85
	Sitting	945.1	130.76	945.3	130.59	961.17	109.85	961.17	109.85
	Standing	645.1	130.76	945.3	130.54	961.17	109.85	691.17	109.85
H.T (n=20)	Supine	656.5	378.7	657.3	378.62	287.1	51.94	288.1	51.94
	Sitting	562.1	312.56	563	312.49	220.3	56.25	221.3	56.25
	Standing	752.8	369.8	753.7	369.64	489.6	224.9	490.6	224.9
D.M	Supine	492.2	297.29	503	317.75	684.4	371.86	685.3	371.86
	Sitting	390.6	244.1	391.5	244.14	582	238.63	582.9	238.63
	Standing	584.6	368.48	585.5	368.54	670.1	264.35	671	264.35
Combined (n=7)	Supine	340	43.56	341	43.56	-	-	-	-
	Sitting	344.29	71.23	345.29	71.23	-	-	-	-
	Standing	462.29	177.56	463.29	177.56	-	-	-	-

Groups	Position	Sustained Hand Grip							
		Male n=10				Female n=10			
		Pre		Post		Pre		Post	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control (n=20)	Supine	945.5	130.49	945.1	130.8	961.2	109.9	961.8	109.6
	Sitting	945.5	130.49	945.1	130.8	961.2	109.9	961.8	109.9
	Standing	945.5	130.49	945.1	130.8	961.2	109.9	961.8	109.6
H.T (n=20)	Supine	657.3	378.62	656.5	378.7	287.1	51.94	288.1	51.94
	Sitting	563	312.49	562.1	312.6	220.3	56.25	221.3	56.25
	Standing	753.7	369.64	752.8	369.8	489.6	224.9	490.6	224.9
D.M	Supine	503	317.75	492.2	297.3	684.4	318	685.3	371.9
	Sitting	391.5	244.14	390.6	244.1	582	238.8	582.9	238.6
	Standing	585.5	368.54	584.6	368.5	670.1	264.4	671.1	264.4
Combined (n=7)	Supine	341	43.56	340	43.56	-	-	-	-
	Sitting	345.3	71.23	344.3	71.23	-	-	-	-
	Standing	463.8	177.56	462.3	177.6	-	-	-	-

Table 8: Body composition differences in Male and Females subjects

Groups	Fat %						Water %						Basal Metabolic Rate (BMR)					
	Male		Female				Male		Female				Male		Female			
	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P	Mean	SD	Mean	SD	't'	P
Control (n=20)	30	6.1	27.83	5.01	1.04	>.3	50	6.5	53	3	1.315.	>.2	1340	75	133	31	0.3	<.7
H.T (n=20)	18	3.3	26.77	1.63	7.35	<.0001	64	9.6	58	5	1.7	>.1	1797	300	###	119	4.1	<.001
D.M	19	4.2	28.8	5.75	4.5	<.0001	62	5.6	55	3	4.1	<.001	1787	170	###	102	5.4	<.001
Combined (n=7)	25	3.6	-	-	-	-	55	3.1	-	-	-	-	1659	290	-	-	-	-

Limitations of this study

- Small sample size in each group.
- Subjects were under medication in DM and H.T groups.
- Invasive and other non-invasive methods were not used to assess ANS dysfunction.

Conclusion

Taking in to account of fall of D.B.P and increase in P.R following post V.M and post S.H.G tests in 3 different

positions; it is concluded here that V.M and S.H.G tests are simple, reliable and clinical bedside tests which can be used to assess the ANS dysfunction or changes in subjects with Dm, HT and DM+HT.

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Standardization of Self Rating Prospective & Retrospective Memory Questionnaire (Tamil Version) in Chennai Population

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Abstract

Objective

The purpose of this study was to develop Tamil version of the self-rating Prospective and Retrospective Memory Questionnaire (PRMQ) in Chennai population.

Method

The original version of self-rating Prospective and Retrospective Memory Questionnaire which has 16 standardized components (Smith.G.et.al. 2000) was translated in Tamil. It was administered to a sample of the general adult population (N = 552) with equal number of participants (276) in either of the gender and across the three age groups (17-45, 46-65 and above 66).

Results

Internal consistency was assessed with Cronbach's alpha. The reliabilities (internal consistency) of the Total scale (0.92), prospective scale (0.88) and retrospective scale (0.88) were acceptable. One way ANOVA, Independent't' test, were used to analyze the influence of age and gender on PRMQ scores ($p < 0.05$). Though statistically significant difference was found in age and gender, the effect size as measured by Cohen's 'd' is small in magnitude ($d = 0.2$, $r = 0.1$). Therefore the normative data was simplified.

Conclusion

The Tamil version of self-rating PRMQ has been found to be high reliability. It provides a useful measure of everyday memory for use in clinical research and practice.

Key Words

Memory, Prospective memory, Retrospective memory, Cognition, Every day memory, Questionnaire.

Introduction

Memory is the retention of and ability to recall, information, personal experience and procedures (Skill and habits) [1]. These memory deficits may affect the patients' ability to recall past events (Retrospective memory) and to carry out future intention (Prospective memory).

"Prospective memory" refers to situations in which a person forms the intention to carry out an action at some future time, and then either remembers or forgets to carry out that action[2]. Prospective memory is concern with the timing of when thing are remembered, where as retrospective memory is concerned with what should be remembered. Prospective memory may be a more important determine of our ability to live independently than retrospective memory[3]. The literature on memory deterioration in normal aging has also focused on deficits of retrospective memory[4]. Typically older people perform more poorly on explicit memory tasks than do younger people, and the difference varies with the degree of difficulty of the tasks; for example recall is more impaired by normal aging than is recognition[5].

One way to gain insight into any distinction between prospective and retrospective memory performance in everyday life is through the use of self – rating questionnaire. Pervious works using self report of memory ability have all but ignored any distinction between prospective and retrospective memory[6]. For Example the cognitive failure questionnaire[7] includes only 2 items out of 25 that said can be to ask about prospective memory. Also the Everyday memory questionnaire[3] contains only 3 items out of 28 that probe prospective memory abilities. But recently developed from the self report of prospective and retrospective memory questionnaire (PRMQ)[6] was distinction between prospective and retrospective memory. It is a brief 16 items, self report questionnaire. Eight of the items enquire about prospective memory and eight about retrospective memory. Literature strongly suggested that cultural variation influence to memory. In order to overcome and to understand any differences in memory across culture, it is necessary to establish norms for the populations being examined and standardization has to be done. Hence this current study has been done to form the Tamil version on the self-rating PRMQ and to strengthen its psychometric properties, reliability has been done in Chennai population.

The purpose of the present study was to standardize self-rating version of Prospective and Retrospective memory Questionnaire (PRMQ) in Tamil Language for Chennai population.

The study had four principal objectives:

1. To develop standardized Tamil version of the Prospective and Retrospective Memory Questionnaire (PRMQ-self rating) in Chennai population.
2. To test the reliability of the self-rating PRMQ (Tamil version) in Chennai population.
3. To determine whether, age and gender influence the self-rating PRMQ scores (Tamil version) in Chennai population.

Table 1: Normative data of total PRMQ score (Tamil version)

			95% confidence limits	
Raw score	T score	True score	Lower	Upper
16	74	72	66	78
17	74	71	65	77
18	73	70	64	76
19	72	69	63	75
20	71	68	63	74
21	70	67	62	73
22	69	67	61	72
23	68	66	60	71
24	67	65	59	71
25	66	64	58	70
26	65	63	57	69
27	63	61	55	67
28	62	60	55	66
29	61	59	54	65
30	60	59	53	64
31	59	58	52	63
32	58	57	51	63
33	57	56	50	62
34	56	55	49	61
35	55	54	48	60
36	54	53	47	59
37	52	51	46	57
38	51	51	45	56
39	50	50	44	55
40	49	49	43	55
41	48	48	42	54
42	47	47	41	53
43	46	46	40	52
44	45	45	39	51
45	44	44	38	50
46	43	43	38	49
47	42	43	37	48
48	40	41	35	47
49	39	40	34	46
50	38	39	33	45
51	37	38	32	44
52	36	37	31	43
53	35	36	30	42
54	34	35	30	41
55	33	34	29	40
56	32	34	28	39
57	31	33	27	38
58	30	32	26	38
59	28	30	24	36
60	27	29	23	35
61	26	28	22	34
62	25	27	22	33
63	24	26	21	32
64	23	26	20	31
65	22	25	19	30
66	21	24	18	30
67	20	23	17	29
68	19	22	16	28
69	18	21	15	27
70	16	19	14	25
71	15	18	13	24
72	14	18	12	23
73	13	17	11	22
74	12	16	10	22
75	11	15	9	21
76	10	14	8	20
77	9	13	7	19
78	8	12	6	18
79	7	11	6	17
80	5	10	4	15

Table 1 shows the list of the normative data of total PRMQ (Tamil version) in terms of Raw score, T Score, True score and 95% confidence limit (lower and upper). T score were calculated from reflected raw scores so that raw scores reflect poor self rated memory.

4. To estimate the normative data of self-rating PRMQ (Tamil version) in Chennai population.

Null hypothesis

There is no statistically significant reliability, and no statistically significant difference in scores of self-rating Tamil version of PRMQ in between the two genders and between the three age groups.

Methodology

This is a quantitative research with cross sectional study design. Complete data from the self rating version of PRMQ was collected from 552 healthy adult populations (276 females, 276 males) between the age range of 17 to 94 years from a wide variety sources in and around Chennai city. The sampling method used was convenience sampling and consisted of equal number of subjects in 3 groups of age (17 to 45, 46 to 65 and 66+). Participants included college students, faculty members & volunteers from the commercial areas, public organization service and old age homes. Subjects were purely selected based on the following criteria.

Inclusion Criteria

1. Subjects age between 17 - 94 years.
2. Both male and female with normal corrected vision and hearing.
3. A minimum education qualification of 10th grade.

Exclusion criteria

1. Subjects with comprehension and reading deficit
2. Subjects with neurological problems and other degenerative disease.
3. Subjects have any medication or medical conditions that affect their alertness and concentration.

Procedure

The permission was asked from the professor Robert. H.Logie, university of Aberdeen, UK to translate the

self rating version of the prospective and retrospective memory questionnaire (PRMQ) in Tamil language for Chennai population. This was translated in Tamil with the guidance of two professors, and back translation also done with higher expertise. With reference to consent form participants are included in the study. The PRMQ was distributed and described as a set of questions to test their memory skill based on day to day life activities. According to 5 point scale (very often, quite often, sometimes, rarely, never) the participants were requested to complete the questionnaire. Following ratings were assigned numerical values of 1 (never) to 5 (very often).

Data Analysis

1. Cronbach's alpha (internal consistency) test was used to find out the reliabilities of total scale and prospective and retrospective subscales.
2. Independent't' test was used to analyze the gender influence. One way ANOVA and post hoc test (Tukey HSD).
3. Cohen's'd' was used to analyze the effect size on age and gender.

Results

Reliability statistics for PRMQ

The reliability (internal consistency) of the Tamil version of PRMQ was estimated Cronbach's alpha. High level of reliability was found in the total scale (r = 0.92), as well as in prospective (r = 0.88) and retrospective (r = 0.88) subscales.

Influence of gender on Tamil version of PRMQ scores

The independent sample't' test was used to compute the data. It is found that there is statistical significant difference across the gender in total scores ('t' = 2.629; $p < 0.05$) as well as the prospective score ('t' = 2.871; $p < 0.05$) and retrospective score ('t' = 2.852; $p < 0.05$). Hence there is significant difference across both genders.

Effect size of gender

Cohen's'd' statistic was used to compute the effect size. It is found that effect size is small in prospective (d = 0.2228; r = 0.1107), retrospective (d =0.2439; r =0.1210) and total scores (d = 0.2422; r = 0.1202). The effect size of the difference is small in magnitude.

Influence of age on Tamil version of PRMQ scores

The one way ANOVA test was used to compute the three means of different groups. It showed that there is statistically significant difference between male and female in prospective ('f' = 53.4; $p<0.05$), retrospective ('f' = 57; $p<0.05$) and total scores ('f' = 60.0; $p< 0.05$). Hence there is significant difference between the three age groups. The post hoc analyze were done using Tukey HSD. Statistically significant difference is found between 17 - 45 and 66+ age groups as well as 45 – 65 and 66+ age groups in total, prospective and retrospective score ($p<0.05$). But comparison between 17 to 45 and 46 to 65 age groups showed no significant difference in all the three age scores. ($p>0.05$)

Effect size on age groups

Cohen's 'd' statistic was used to compute the effect size. It is found that effect size for prospective subscale was small in 17 to 45 Vs 46 to 65+ (d = 0.235; r = 0.116) but effect size was moderate in 45 to 65 Vs 66+ age groups (d = 0.771; r = 0.359) and 66+ Vs 17 - 45 (d = 0.976; r = 0.438). Retrospective subscale effect size was small in 17 - 45 and 46 - 65 (d =0.102; r =0.051) and 46 - 65 and 66+ age groups (d = 0.035; r = 0.042) but 17 – 45 and 66+ age groups (d= 0. 868; r = 0.398). The effect size of total scores is small in among all the three age groups (d = 0.181; r = 0.090).

Table 2: Normative data of prospective score (Tamil version)

			95% confidence limits	
Raw score	**T score**	**True score**	**lower**	**Upper**
8	74	70	64	77
9	72	69	62	75
10	70	67	61	74
11	68	65	59	72
12	66	64	57	70
13	64	62	55	69
14	62	60	54	67
15	60	59	52	65
16	58	57	50	64
17	56	55	49	62
18	54	54	47	60
19	52	52	45	59
20	50	50	44	57
21	48	49	42	55
22	46	47	40	54
23	44	45	39	52
24	42	44	37	50
25	40	42	35	48
26	38	40	34	47
27	36	39	32	45
28	34	37	30	43
29	32	35	29	42
30	30	33	27	40
31	28	32	25	38
32	26	30	24	37
33	24	28	22	35
34	22	27	20	33
35	19	24	18	31
36	17	23	16	29
37	15	21	14	27
38	13	19	13	26
39	11	18	11	24
40	9	16	9	22

Table 2 shows the following list of the normative data of prospective scores in items of Raw score, T Score, True score and 95% confidence limit (lower and upper). T score were calculated from reflected raw scores so that raw scores reflect poor self rated memory.

Discussion

Standardized Self-rating PRMQ in Tamil version

Original version of PRMQ (Self-rating) was developed by Smith[6]. This self-rating PRMQ scale was translated in Tamil language. The goal of the self-rating PRMQ Tamil translation was to recast the meaning of the source version in the target language rather than to translate literarily the words of the source version.

Influence of Gender and age on self-rating PRMQ (Tamil version) scores

One basic objective of the present study was to examine the influence of gender in Tamil version of PRMQ scores. Result showed both male and female age groups showed memory deficit in prospective and retrospective memory. In gender, the females performed better than males. Based on interaction with the male subjects, it was found that stress has been one of the major factors leading to poor performance in memory. Vedhara[8] found that increased levels of stress and depression would affect the memory status. Even in earlier study done by Johann[8] it's been found that women performed better than man on a recognition memory test of all retention intervals. Though in the current study a similar difference in gender is found, the effect size is small. There by, gender does not influence the PRMQ score. Hence the presentation and interpretation of normative data (Table 1) is simplified. Hence the null hypothesis is rejected.

Another basic objective of the present study was to examine the influence of age in Tamil version of PRMQ scores. Result showed statistically significant difference in memory across all the three age groups. When comparing between the age groups 17 to 45 years Vs 46 to 65 years it was found that no statistically significant difference exist in PRMQ scores. 17 to 45 Vs 66+ and 46 to 65 Vs 66+ years showed significant difference in age groups. Aging may be the influencing factor decline in memory in the older age groups. Maylor[9] have found that age related decline affects the prospective and retrospective memory. Though the result showed statistically significant difference across the age groups the effect size is small. Hence the null hypothesis is rejected.

Table 3: Normative data of retrospective score (Tamil version)

			95% confidence limits	
Raw score	T score	True score	lower	Upper
8	71	67	60	74
9	69	65	58	72
10	67	64	57	71
11	65	62	55	69
12	63	61	54	68
13	61	59	52	66
14	59	57	50	64
15	57	56	49	63
16	55	54	47	61
17	53	53	46	60
18	51	51	44	58
19	49	49	42	56
20	47	48	41	55
21	45	46	39	53
22	43	45	38	52
23	41	43	36	50
24	39	41	34	48
25	37	40	33	47
26	35	38	31	45
27	33	37	30	44
28	31	35	28	42
29	29	33	26	40
30	27	32	25	39
31	25	30	23	37
32	23	29	22	36
33	21	27	20	34
34	19	25	18	32
35	17	24	17	31
36	15	22	15	29
37	13	21	14	28
38	11	19	12	26
39	9	17	10	24
40	7	16	9	23

Table 3 shows the list of the normative data of retrospective scores in terms of Raw score, T Score, True score and 95% confidence limit (lower and upper). T score were calculated from raw scores. Therefore lesser the raw score, the greater will be the T score which means poorer in the self-rated memory and vice versa.

Reliabilities and normative data

High level of reliability was found in the total scale (r = 0.92), as well as in prospective (r=0.88) & retrospective (r= 0.88) subscales. Furthermore, age and gender did not influence PRMQ score considerably (effect size is small). Computing normative data of self rating PRMQ (Tamil version) was done using the program accessed in http:www.abdn.ac.uk/psy03/dept/PRMR-EXE.HTML[10]. The conversion tables (Table 1-3) was made to use for converting raw scores to T scores, estimated true scores and obtain 95% confidence limits of all three scales. It can be used to both gender and all adult age groups.

Clinical Implication

1. Self-rating PRMQ can be used in clinical setting for screening purpose.
2. It could also be used for clinical research to check out the memory problems and prognosis of Alzheimer disease, dementia and other neurological condition affecting memory.
3. Tamil version of self-rating PRMQ can be useful for occupational therapist in documentation process for clients in Tamil community.

Limitation

1. Convenience sampling method.
2. Being a self administered questionnaire, there is chance for misinterpretation of the questions especially among the subjects who were relatively silent without asking for clarification.

Conclusion

The self-rating PRMQ (Tamil version) was designed systematically, following methodologically sound steps, leading to the development of a measure that is able to evaluate prospective and retrospective memory. Furthermore, the Tamil version of PRMQ (Self-rating) has been found to possess highly reliability. The PRMQ has a potential advantage over other self-report scales in that it balances prospective and retrospective items. Age and gender have influence on PRMQ scores considerable the effect size is small and hence single normative data is devised. Therefore, self-rating PRMQ (Tamil version) is a useful measure of everyday memory for use in clinical research and practice.

Recommendation

This study provides a foundation for future research.
To examine self-rating PRMQ in various cultures in our country (India is a multi cultural country).
Self-rating PRMQ can be examined in clinical population.
Proxy-rating (i.e. rating by spouse or others) version of PRMQ is also available. It can also be standardized for Tamil community people.

Acknowledgements

My hearty sincere thanks to my guide **Mr. B. S. Ganesh Kumar**, Assistant Professor, M.O.T., SRM College of Occupational Therapy, SRM University and to **Mr. Robert. H. Logie** and **Mr. J. Crawford,** Professor. University of Aberdeen, UK for given permission to translate into Tamil version and also to **Mr. Jayachandran**, lecturer, M.O.T., UiTM, Malaysia to make the study successful. Last but not the least I express my thanks to my **subjects** and **family**.

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Normative data for Functional Reach Test in Indian Children

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Abstract

Background & Objective

The maturation of the postural control in children occurs around 10 to 12 years of age. There are various neuromuscular disorders in pediatric age groups that can lead to impairment of balance. Therefore, balance assessment is a very important part of the physical therapy assessment. There are various scales used for balance assessment of which the Functional Reach Test is commonly used. The normative data for the Functional Reach Test has been determined for the older age group of 20-87 years by Duncan P et al and for American pediatric group by Betsy Donahue et al . Differing environmental and social experiences can indirectly impact the motor and balance skills of children belonging to different cultures. No study has been done to formulate normative data for functional reach in Indian population Therefore, in this study the normative data for 5-15 years in Indian population has been determined for the same. And also the correlation of age, height, weight arm-length and gender with the Functional Reach Test has been determined.

Methodology

Two hundred and two healthy children aged 5-15 years were asked to perform the Functional Reach Test for 3 trials. The maximum reach for each trial was then calculated. The subject performed the reach test without losing balance and with any comfortable strategy.

Results

The normative data for the functional reach test was then determined. The critical values for the reach were calculated using 95% of the confidence interval. There was good correlation between the mean reach and age and height.

Conclusion

This study has determined the normative data for the Functional Reach Test for 5-15 years healthy indian children. Also it has been concluded from the obtained data that the age and height are the major predictors of the mean reach.

Key Words

Functional Reach Test, Functional Reach.

Introduction

Balance is both the ability to recover from instability (as in a response to an external perturbation) and the ability to anticipate and move in ways to avoid instability (as in a response to an internal perturbation, or self-initiated movement)[1]. Various tests are available to evaluate static and dynamic balance[2,3].

Functional reach is defined as the maximal distance one can reach forward beyond the arms length while maintaining a fixed base of support in the standing position. Functional reach can be used to assess balance. Duncan et al developed the functional reach test (FRT) in 1990[4]. FRT was used originally in adult population to test the dynamic standing balance. Duncan et al. found a strong correlation between the functional reach and the excursion of the center of pressure. Test – retest reliability of Functional reach test is about 0.92 and inter-rater reliability is about 0.98. The functional reach test proved to be age sensitive in the adult population and the reach values decreased as age increased. This measurement tool is quantitative inexpensive, easily applicable in clinical setting and relevant to a variety of functional situations. Normative data for this measurement tool has been developed on subjects aged 20-87 yrs[1].

The reliability of the Functional Reach Test was determined by Betsy Donahue et al on children without disabilities between the ages 5-15 years. The analysis of variance and intraclass correlation coefficient were used to determine the intra-rater, inter-rater and test re-test reliability for four test trials.The results demonstrated high levels on inter-rater reliability, good intra-rater reliability and fair test re-test reliability[5]. The construct and concurrent validity was performed by Doreen Bartlett and Trevor Birmingham on nineteen typically developing Canadian children between the ages of 3-12.5 yrs of age. They found that the correlations between the standing section of the PRT and laboratory tests of limits of stability had an “r” value of 0.42 to 0.77. Correlations between the standing section of the PRT and a laboratory test of steadiness in quiet stance was “r” =0.79[6].

FRT is an appropriate functional and reliable measure of dynamic balance for children aged between 4.5 – 5 years5,7 and for adults[4,8,9]. In a study conducted on American children by Betsy Donahue et al in 1994 outlined the normative values for FRT for age groups 5 – 15 year olds. For 5-6 year olds the normative range was 16.79 to 24.91cms, 20.56-27.96 for 7-8 year olds, 25.56- 31.64 for 9- 10 year olds, 29.68- 36.18 for 11-12 year olds, 29.58- 36.08 for 13- 15 year olds[4].

Differing environmental and social experiences can indirectly impact the motor and balance skills of children belonging to different cultures[10]. No study has been done to formulate normative data for functional reach in Indian population.

Keeping in view the above, this study is intended to use the functional reach test to formulate the normative reach values for the particular age groups and also to find the correlation of the mean reach for these age groups with the height, weight arm length and gender of the individual. And also to determine the critical reach values for those age groups.

Methodology

A total number of 500 hundred subjects were screened out of which 202 subjects were selected for the study. Test sample consisted of equal number of male and female volunteers between the age group of 5-15 years. The subjects were taken from various primary and secondary schools in Mangalore. The purpose of the study was explained to all the subjects and their guardians and an informed consent was obtained.

Children with the History of any previous lower limb injury and neurological problems, Abnormal tone in the upper and lower extremities, Impaired range of motion and strength of the extremities were excluded from the study

Tools used for the Study

- A calibrated yardstick to measure the maximum reach in centimeters.
- A masking tape to secure the yardstick to the wall.
- A flexible measuring tape to measure the height and arm length of the subject.
- A goniometer to measure the range of motion.
- A weighing machine to measure the weight of the subject.
- A stop watch to record the hold time and the relax time.
- Recording sheets to record the data.

Procedure

The subject's height, weight and arm length were measured. The subject was then asked to stand erect near a wall with his lateral side towards the wall. A point was then marked on the wall at the level of the subject's right acromion process. A leveled yardstick was attached to the wall at this point with the help of the masking tape. Subject was then asked to stand in a relaxed stance with his shoulders perpendicular to the yardstick. Neither shoes nor socks were worn during the testing. To maintain the foot placement during test, the foot position was traced on the floor with the help of a chalk. Subjects were instructed not to touch the wall. They were asked to extend their elbow with the shoulder at 90o of flexion, make a fist and hold the position for 3 seconds. The placement of the third metacarpal was recorded as position[1]. The subjects were then asked to reach as far forward as they comfortably could without stepping off the outlined foot templates or losing their balance and to hold for 3 seconds. The end of the third metacarpal was recorded as position[2]. Each subject took Two practice trials and three additional test trials were administered. Mean of these 3 trails was considered. A 5 second rest was given between the trials. If the subjects touched the wall or took a step during the testing, the data was discarded and the trial repeated.

Functional reach was recorded as the difference between positions 1 and 2. Practice trials were not recorded. Subjects were guarded from falling during testing, and no attempt was made to control the subject's method to reach. They were allowed to reach with whatever strategy they wished as long as they did not touch the wall or took a step. The subjects performed the reach with their own comfortable speed. The data obtained was then grouped depending upon the subject's age.

Table 1:

					95% confidence interval for mean			
	N	Mean	Standard deviation	Standard error	Lower bound	Upper bound	Minimum	maximum
5-6	22	20.9005	2.82723	.60277	19.6469	22.1540	14.33	25.66
6-7	20	21.0530	2.82577	.63186	19.7305	22.3755	15.00	25.33
7-8	20	23.0145	4.72308	1.05611	20.8040	25.2250	14.66	33.66
8-9	20	23.1325	3.90129	.87235	21.3066	24.9584	16.33	28.60
9-10	20	24.0920	4.30204	.96197	22.0786	26.1054	12.16	30.16
10-11	20	26.3420	5.73857	1.28318	23.6563	29.0277	19.30	42.66
11-12	16	28.1125	1.83916	.45979	27.1325	29.0925	25.00	31.60
12-13	20	29.7055	3.23163	.72261	28.1931	31.2179	26.00	38.53
13-14	24	30.3433	2.32520	.47463	29.3615	31.3252	25.00	33.60
14-15	20	32.3235	2.99402	.66949	30.9222	33.7248	24.33	39.10
Total	202	25.8966	5.29223	.37236	25.1624	26.6308	12.16	42.66

Table 1 Shows the mean functional reach, standard deviation, standard error and the lower bound and upper bound of the 95% confidence interval for the mean reach values for the 5-15 years of age group. The lower bound value represents the critical reach value.

Results

Table 2:

	Age	Height	Arm length	Weight
Pearson correlation Mean reach	0.726	0.748	0.562	0.578
Significance	0.000	0.000	1.000	1.000

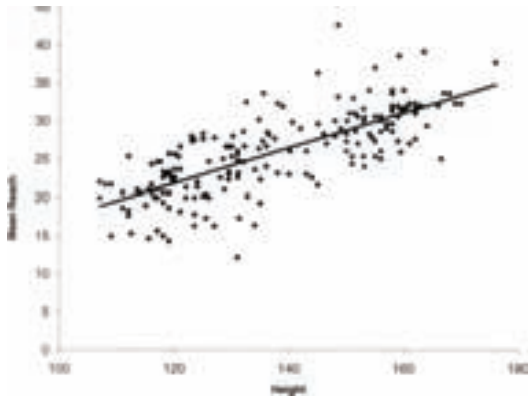
Table 2 shows the correlation of mean reach with the age, height, arm length and weight. It shows that the age and height are significantly correlated with the mean reach.

Table 3:

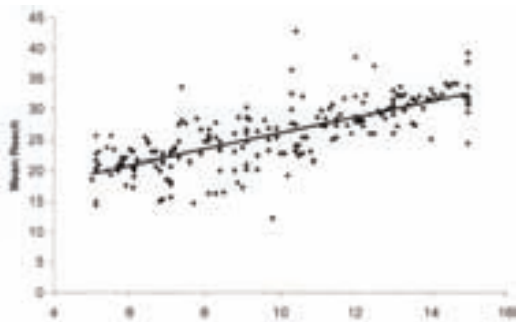
Age	15% mean reach	50% mean reach	85% mean reach
5-6 years	17.31	21	23.48
6-7 years	17.81	21.66	23,98
7-8 years	17.85	22.83	27.83
8-9 years	18.01	24.66	27.9
9-10 years	20.16	25.15	28.08
10-11 years	22.31	26	31
11-12 years	26.5	28.45	31.1
12-13 years	27.	29	31.91
13-14 years	27.45	30.95	32.3
14-15 years	30.55	32	34

Table 3 shows the distribution of mean reach among various age groups. The 15th, 50th and 85th percentiles are depicted in this table.

Correlation between the Height and Mean Reach



Correlation between age and Mean Reach



Age

Discussion

Measurement of balance is an important component for balance rehabilitation. Balance measurement assess the patients initial limitations and also provides quick reassessment of the patients progress throughout the treatment. Balance is maintained by the interaction between various systems of the body, thus affection of any of these systems can cause balance impairment.

This study has investigated the normative data for the functional reach test in healthy children. In our study, two hundred and two healthy children aged 5-15 years, out of which 50% were male children and 50% were female children were assessed for balance using the functional reach test. Each subject was screened to fulfill the inclusion and exclusion criteria. Then the subject was asked to perform 2 practical trials, after which a 5 minute break was given to relax the subject. Then the subject performed 3 trials with a rest period of 5 seconds in between each trial, in order to prevent fatigue. The subject performed at his own comfortable speed as no particular speed was predetermined to perform the test. The mean of 3 trials was taken and the age related functional reach scores for children aged 5-15 years were determined. The percentiles for the age, height and the mean reach were calculated along with the critical values for the various age groups.

All subjects performed the functional reach test easily and without difficulty. Starting position 1 was readily attained in relaxed stance with neutral shoulder and hip postural alignment. It was noted that the subjects achieved end-reach position 2 with more frequent use of hip flexion than ankle strategies.

The functional reach seemed to increase with age group and also with increase in height. All the Standard Error of Measurement (SEM) range from 1-2 cms and were less than 10% of the mean reach, and 95% confidence interval were small, indicating small measurement variations within each age group. Therefore, functional reach has the potential for reliably quantifying balance in children aged 5-15 years. This study suggests that when testing functional reach on 5-6 years old children, the normative data range would be 19.64 to 22.15cms with the mean of 20.90cms and the critical value of 19.64cms. FR values for 6-7 years olds would be 19.73 to 22.37 cms with a mean of 21.05cms and the critical value of 19.73cms.The FR range for 7-8 years olds would be 20.80 to 25.22cms with the mean of 23.01cms and the critical value of 20.80cms. FR values for 8-9 years olds would be 21.30 to 24.95cms with a mean of 23.13cms and the critical value of 21.30cms.

The normal FR range for 9-10 years olds would be 22-07 to 26.10cms with the mean of 24.09cms and the critical value of 22.07cms. The FR scores for 10-11 years olds would be 23.65 to 29.02cms with the mean of 26.34cms and the critical value of 23.65cms. The normative range for 11-12 years olds would be 27.13 to 29.09cms with the mean of 28.11cms and the critical value of 27.13cms. The FR scores for 12-13 years olds would be 28.19 to 31.21cms with the mean of 29.70cms and the critical

value of 28.19cms. The normative data for the FR for 13-14 years olds would be 29.36 to 31.32cms with the mean of 30.34cms and the critical value of 29.36cms. Similarly, the normative data for the FR in 14-15 years olds would be 30-92 to 33.72cms with the mean of 32.32cms and the critical value of 30.92cms.

Values less than the critical values signify a delay in the reacting skills and also that there is some impairment in the balance for that particular age group. In our study as the age increases the mean reach has increased which is supported by the results of Habib and westcoat[12] Unlike, Fisher and Bundy's study[11], the functional reach was affected by the age and the height, and the addition of the other variables of weight, gender and arm-length did not significantly affect the functional reach. Therefore, the main factors influencing the functional reach seem to be age and height.

Shumway Cook who has concluded that as the height increases from childhood to adulthood, the center of gravity shifts from T12 to L5-S1 in adults[2], supports this. This lowered center of gravity provides better stability to the body and provides better postural control. Also it is hypothesized that, as the age increases there is increased maturation of the neuronal system, musculoskeletal system and the anticipatory mechanisms, which in turn provide better postural stability if these components are not affected by any pathological condition.

Also unlike Kesenia Kozak et.al. who conducted each test with two different speeds and concluded that more the speed more is the reach value[13], our study does not take speed into account, as it is impractical to use this in neurologically involved children as all the children cannot perform the test at a particular speed.

The data obtained for the normal values for the FR can be used by the clinician while screening the pediatric population for balance. Also the critical values can help the clinician in early diagnosis of any balance impairment which can lead to early treatment intervention and better prognosis.

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Balance Maturity of Indian Children Using CTSIB

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Abstract

Back Ground and Objectives

Balance assessment is as major component of physical therapy assessment. Among the various scales used for assessing balance, the CTSIB is an inexpensive, easily administered test. The CTSIB is based on the concept developed by Nashner (1982) and requires the subject to maintain standing balance for 30seconds under six sensory conditions that either eliminates input or produces inaccurate vision and surface orientation inputs. Using this balance assessment tool, studies have been done on younger, middle and older age groups with and without neurological deficits. But very few studies have been done on pediatric population. However no studies have been done which takes into account the interaction of different sensory conditions, age and gender on balance. Therefore this study is intended to determine the influence of different sensory interactions, age and gender on balance in children.

Methodology

Four hundred and eighty children aged 8-12 years were screened to fulfill the inclusion and exclusion criteria. Then all subjects were divided into two groups according to age and they were again divided into two groups according to gender. Then the subjects were explained about the procedure, and asked to maintain tandem standing position under six sensory conditions, they had to keep on standing with each foot in position until the examiner said “stop”. Then the subject was tested under all six sensory conditions for maximum of 30 seconds.

Results

The data was then tabulated and subjected to statistical analysis to determine whether correlation existed between the mean CTSIB score and the age, gender and different sensory conditions.

After analyzing data following inferences were drawn

- The study determined that there is significant effect of age and gender on balance.
- A correlation existed between the sensory interaction and balance maturation in children.
- And there was no significant difference between C-1(eyes open on the floor) and C-3 (wearing conflict dome on the floor) on balance performance in children.

From this it was concluded that with the increase in age the balance performance will improve and during childhood girls appear to do better than boys in balance performance. It was also concluded that there is influence of different sensory interactions on balance.

Key Words

Clinical Test For Sensory Interaction and Balance, Sensory Interaction, CTSIB.

Introduction

Balance and postural control was defined as the ability to maintain equilibrium in a gravitational field by keeping or adjusting the COM (Centre of Mass) over the Base of Support[1,2]. Many studies have been done to know the development and maturation of postural control in children. Some studies have documented that children achieve well organized muscular responses by 7-10 years of age[3,4].Shumway cook and Wollacott determined that children with 7-10 years age group demonstrated mature postural control and showed adult like ability to resolve sensory conflict[5]. But recent research findings provide contradicting results that the postural control maturity in children happens only between 10 – 15 years[6,7].

Immaturity of the different systems could be the reason for differences seen in postural control in children. But the visual and vestibular system is matured well before children achieve adult like balance maturity. So the difference in maturity could be because of the processing or integration of Visual, proprioceptive and vestibular information. The nervous system appears to be mature in its myelination of major tracts by the age of 10 years.

To assess the balance there are various scales and tests designed. The commonly used tests are Clinical Test For Sensory Interaction And Balance, Functional Reach Test, Berg Balance Test, Performance Oriented Mobility Test and the Timed Up and Go Test etc. Of these tests the Clinical Test For Sensory Interaction And Balance and Berg Balance Test are commonly used to assess balance.

The Clinical Test of Sensory Interaction and Balance (CTSIB) is a method for clinically assessing the influence of sensory interaction on balance in standing position.8 The CTSIB is a clinical version of sensory organization test.9 The CTSIB is based on the concept developed by Nashner (1982) and requires the subject to maintain standing balance for 30seconds under six sensory

conditions that either eliminated input or produced inaccurate vision and surface orientation inputs[1].

The CTSIB is useful screening tool for examining the static standing balance and a clinical version of Somatosensory Organization Test. It assesses the influence of vestibular, somatosensory and visual inputs on postural control. CTSIB can identify and quantify functional problems in selective sensory conditions[10].

This study is intended to know the balance maturity in children between 8-12 years and to know the influence of different sensory interactions on standing balance.

Methodology

480 Healthy children aged between 8 -12 were included or the study. It consisted of equal number of male and female from various schools in Mangalore. The purpose of the study was explained to all the subjects and guardians and informed consent was obtained from parents.

Children with neurological, hearing, visual and musculodkeletal problems were excluded from the study.

Tools used for the Study

1. A stop watch: to record the time.
2. 18x18x3 inch piece of medium density foam: for inaccurate sometosensory information.
3. A dome: for inaccurate vision.
4. A blind fold: to occlude vision.
5. A goniometer: to measure the range of motion.
6. Recording sheets: to record the data.

Procedure

Volunteers who met the inclusion criteria were invited to practice in this study. They were told about the testing procedure and their parents signed informed consent. Then all the children were divided in to two groups (I and II) according to their age with 240 in each groups. Again they were divided into two groups according to gender.

Group I- 240 subjects (120 girls 120 boys) age 8-10 years.

Group II- 240 subjects (120 girls 120 boys) age 11-12 years.

All children were assessed by using CTSIB which involves timing in tandem stance position under six sensory conditions, utilizing different supporting surface and visual conditions to a maximum of 30 seconds. Tandem stance is with the toe of the preferred foot touching the heel of the opposite foot[8].

The six sensory conditions are

1. Standing quietly on floor looking straight ahead. (Vestibular, vision, somatosensory accurate)
2. Standing quietly on floor with eyes closed. (Vestibular, somatosensory accurate)
3. Standing quietly on floor, wearing doom. (Vestibular and somatosensory accurate, vision inaccurate)
4. Standing quietly on foam looking straight ahead. (Vestibular and vision accurate, somatosensory inaccurate)
5. Standing quietly on foam with eyes closed. (Vestibular accurate, somatosensory inaccurate)
6. Standing quietly on foam, wearing doom. (Vestibular accurate, vision and somatosensory inaccurate)

Prior to starting the test, the subject was explained that the duration of each condition was 30 seconds and to keep on standing with each foot in position until the examiner said “stop”.

The length of the time the subject can maintain balance was recorded. The trial was terminated if the subject changed the position of arm or feet[8].

Results

Mean and Standard deviation of CTSIB scores of Group-I (8-10 years) among the males and females

CONDITIONS	GENDER	MEAN	SD
C-1	FEMALE	29.91	.389
	MALE	29.93	.264
C-2	FEMALE	28.47	1.782
	MALE	27.98	2.665
C-3	FEMALE	29.38	1.979
	MALE	29.62	.769
C-4	FEMALE	29.08	1.559
	MALE	29.03	1.556
C-5	FEMALE	24.20	2.668
	MALE	22.86	4.316
C-6	FEMALE	27.74	1.989
	MALE	27.31	2.700

Mean and Standard deviation of CTSIB scores of Group-II (11-12 years) among the males and females

CONDITIONS	GENDER	MEAN	SD
C-1	FEMALE	29.98	.183
	MALE	30.00	.000
C-2	FEMALE	29.71	.803
	MALE	29.93	.282
C-3	FEMALE	29.95	.865
	MALE	29.99	.091
C-4	FEMALE	29.93	.347
	MALE	29.88	.471
C-5	FEMALE	28.04	1.784
	MALE	27.40	2.084
C-6	FEMALE	29.43	.876
	MALE	29.10	1.531

Mean and Standard deviation of CTSIB scores of Group-I (8-10years) and Group-II (11-12years)

CONDITIONS	GROUP	MEAN	SD
C-1	GROUP-I	29.91	0.33
	GROUP-II	28.99	0.12
C-2	GROUP-I	28.19	2.32
	GROUP-II	29.81	0.61
C-3	GROUP-I	29.50	1.50
	GROUP-II	29.99	0.61
C-4	GROUP-I	29.02	1.55
	GROUP-II	29.90	0.41
C-5	GROUP-I	23.39	3.84
	GROUP-II	27.71	1.96
C-6	GROUP-I	27.50	2.38
	GROUP-II	29.25	1.25

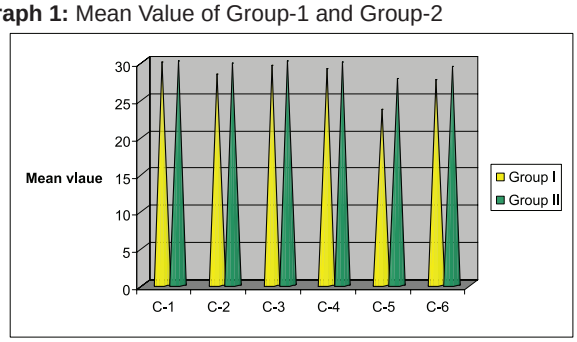
Multiple comparison between sensory conditions in CTSIB

(I) Sensory conditions	(J) Sensory conditions	Mean difference (I-J)	Std. Error	P	
C-1	C-2	0.9438	0.13018	0.000	HS
	C-3	0.1974	0.13018	1.000	NS
	C-4	0.3039	0.13018	0.347	NS
	C-5	3.3875	0.13018	0.000	HS
	C-6	1.5667	0.13018	0.000	HS
C-2	C-3	-0.7464	0.13039	0.000	HS
	C-4	-0.6398	0.13375	0.000	HS
	C-5	3.4437	0.13018	0.000	HS
	C-6	0.6229	0.13018	0.000	HS
C-3	C-4	0.1066	0.13018	0.928	NS
	C-5	4.1909	0.13039	0.000	HS
	C-6	1.3693	0.13039	0.000	HS
C-4	C-5	4.0836	0.13075	0.000	HS
	C-6	1.2627	0.13375	0.000	HS
C-5	C-6	-2.8208	0.13018	0.000	HS

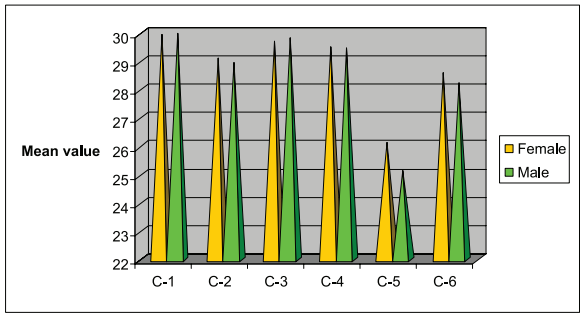
Discussion

Measurement of balance is an important component for balance rehabilitation. Balance measurement assesses the patient's initial limitations and also provides quick reassessment of the patient's throughout the treatment. Balance is maintained by the interaction between various systems of the body, thus abnormality of any of these systems can cause balance impairment.

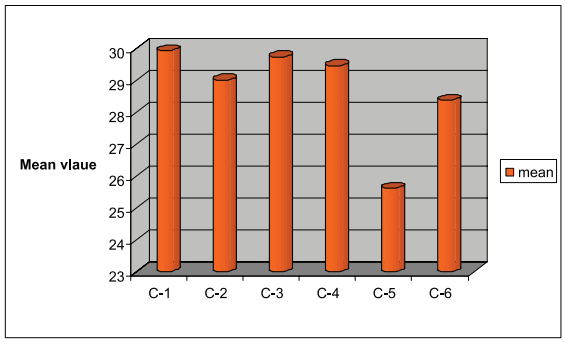
Graph 1: Mean Value of Group-1 and Group-2



Graph 2: Mean Value of Females and Males



Graph 3: Mean Valus of all the Six Conditions



This study has investigated the influence of different sensory interaction, age and gender on balance in healthy children. In our study, four hundred and eighty healthy children aged between 8-12 years, out of which 50% were male and 50% were female children were assessed for balance using clinical test for sensory interaction and balance.

In our study, each subject was screened to fulfill the inclusion and exclusion criteria. Then all subjects were divided into two groups according to age and they were again divided into two groups according to gender. Then the subjects were explained about the procedure, and asked to maintain tandem standing position under six sensory conditions, they had maintain the tandem leg position until the examiner asked the subject to "stop". Then the subject was tested under all six sensory conditions for maximum of 30 seconds.

All subjects performed the CTSIB easily and without any difficulty. Nevertheless some of the subjects in both the groups had moderate difficulty in maintaining balance for 30 seconds during condition 2 and 5 and some of the subjects in both the groups had mild difficulty in maintaining balance for 30 seconds during condition 4 and 6 but all the subjects performed condition-1 and 3very well.

The tandem standing balance seemed to increase with the age. When comparison between males and females was done females were having better balance than males. And this study shows that mostly all the children ranging age 11-12 year were able to complete 30 seconds under each sensory condition but they found little difficulty in tandem standing with eye closed on the foam surface [condition-5.] It shows that the children have difficulty when vision is absent and sometosensory inaccurate.

My study results show that the mean value for 8-10

years female children is ranging from 24.20 to 29.91 and for male 22.86 and 29.9, and mean value for 11-12 year female children is 28.04 to 29.98 and for male 27.40 to 29.98.

This result reveals that in timed scoring among both the age groups female scored more than that of the boys in tandem standing balance performance under all six sensory conditions. This result is supported by Dona Cech, Suznne Tink Martin who suggested that during childhood, girls appear to do better than boys on balance activities[11]. R Steindle, K Kunz. et.al. determined that there is age and gender related changes are present in maturation of sensory systems and balance control[12].

My study result also shows that, while comparing both the age groups 8-10 and 11-12 year of age, in 11-12 year age group all the subjects scored more than the 8-10 year of age. And also in group-II by 12 years of age all the children were able to perform tandem standing balance for maximum of 30 seconds under six sensory conditions. This represents postural stability for controlling balance in difficult and altered sensory conditions in children is achieved by 12 years of age.

This result is supported by Plaiwan Suttanon, in his study he concluded that 7-10 year age had more steeping strategies, which represent postural instability for controlling balance in difficult and altered sensory conditions than the 11-15 year age. It also suggest that the ultimate development of vestibular system for postural control is present at around 15-16 years old[13].

But my study result is contradicted by Siegel JC, Marchetti M, Tecklin JS, they found that there is no age and gender related difference during maturation of balance. The difference in the result of this study from my study may be due to the different methodology as they did study with the hearing impaired children and balance was measured by the use of the balance subtest of the Bruinknk Oseretsky Test of Motor Prwjiciency. For each group, a Z test was used to compare the subject's scores with the Balance subtest standard scores[14].

Finally study results shows that, 8-10 year were not able perform well in C-2, C-4, C-5 and C-6, so are said to have difficulty in sensory selection during these years of age in children and during these ages children are highly dependent upon the sensory information for maintaining the standing balance. And this result is supported by Suzane Tink Martin, Mary Kessler, they suggested that, by 7 years of age the child depends primarily on the proprioception for maintaining balance in standing position. The vestibular and visual systems are used as secondary source for maintaining standing balance. They also suggested that the nervous system appears to be mature in its myelination of tracts by age 10.

Conclusion

Our study leads to following conclusion

- The age and gender related difference is present during maturation of balance in children.
- There is influence of different sensory interactions on balance.

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A Comparative Study between the Efficacy of Therapeutic Ultrasound and Soft Tissue Massage (Deep Friction Massage) in Supraspinatus Tendinitis

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Abstract

Background

Supraspinatus tendinitis is the common condition faced by general population. In clinical setting it is treated by conservative management and Physiotherapy. Ultrasound (US) and Deep Friction Massage (DFM) is one of the treatment approaches.

Objective

To study the effectiveness of US and DFM treatment and to compare them over the period of 10 days.

Method

40 subjects with Supraspinatus tendinitis were randomly assigned to US or DFM treatment group. US group received 6– 8min of pulsed US at 0.6 w /cm^2, with 1 MHz frequency, every day for 10 days. DFM group received 10– 12min of DFM in transverse direction with tip of the index finger re-enforced by middle finger, every day for 10 days. Subjects were evaluated for Pain with VAS and Shoulder Abduction AROM at the start and end of the treatment of 1st, 5th and 10th day. Student t- test was used to analyze data.

Results

At the end of 10 days of treatment, both the groups showed significant improvement in pain on VAS (US = 3.55, DFM = 4.40) and in shoulder Abduction AROM (US = 25.95 degrees, DFM = 32.65 degrees). But when they both were compared, DFM showed significant improvement over US in pain on VAS ($p = 0.014$) and Shoulder Abduction AROM ($p = 0.023$).

Conclusion

We concluded that both the interventions reduce pain and increase Abduction AROM but DFM has slight edge over US.

Key Words

Tendinitis; Supraspinatus; Physiotherapy; Ultrasound Therapy; Friction Massage.

Introduction

Shoulder pain is one of the most common of all peripheral joint disorders with the point incidence amongst the general population said to be as high as 20%[1]. It has been reported that often the cause of non-traumatic shoulder pain is nothing but the inflammation of the structures around the shoulder joint[2]. Most of the individual with shoulder pain suffer due to Supraspinatus tendinitis, as it is the commonest tendinitis lesion at the shoulder joint[3]. Tendon responses to excessive load and that response can be mechanical or physiological. Physiological response is nothing but the inflammation and degeneration. Over use or repetitive micro-trauma sustained in overhead position and repetitive motion at work place causes degenerative changes and contributes to supraspinatus tendinitis. Excessive rubbing and squeezing of the tendon cause tendinitis of supraspinatus. Tendon of supraspinatus has a zone of avascularity and is called as critical portion of the tendon or codman's zone and is prone for degenerative changes. Even the enlarged or degenerative subacromial bursa causes impingement of supraspinatus tendon. Which in turn lead to ischemia resulting in reactive inflammatory process. Ischemia of the muscle or tendon also occurs due to persistent high intra muscular pressure (more than 30mm of Hg.). As supraspinatus reaches this level at fairly low contraction, the repeated elevation of shoulder can lead to ischemia[4]. Frequent forceful overhead activities cause repeated compression of subacromial contents. The results eventually summate as the activity persists. The ensuing inflammatory reaction involves vascular congestion and oedema into the tendon and bursa further reduces the subacromial space leading to further impingement[5]. Thus we can define supraspinatus tendinitis as the non-traumatic, inflammatory and / or degenerative changes of tendon. This condition is common in athletes involving repetitive overhead activities and even in persons involving these repetitive overhead activities at their work places. Tendinitis of supraspinatus manifests as pain on lateral aspect of shoulder, painful arc and/ or pain on full elevation of shoulder and tenderness at greater tuberosity of humerus[3,6]. Jobe et al (1982)[7] and Ellenburger et al (1989)[8] demonstrated that empty can test is the most important test to diagnose the supraspinatus tendinitis, apart from clinical examination. Commonly used treatment protocol is conservative management with rest, anti-inflammatory medicines and physiotherapy. Physiotherapy includes ice, heat, ultrasound therapy, high voltage galvanic stimulation, transcutaneous electrical nerve stimulation (TENS), and exercises as put forth by Rene Calliet in 1992. Therapeutic ultrasound is commonly used electro-physical agent for many

musculoskeletal conditions. Two schools of thought have developed concerning the therapeutic mechanism of ultrasound. First one depends on thermal effect with the use of high intensity and other one on mechanical and biological effects with the use of low intensity and pulsed mode[10]. As per Young S R and Dyson M, ultrasound has potential to accelerate normal resolution of inflammation provided the inflammatory stimulus has been removed[11]. Munting E (1978) reported an improvement in painful shoulder with the use of ultrasound. But there is also literature stating that ultrasound therapy is ineffective in the treatment of soft tissue shoulder disorders[12]. Soft tissue massage (deep friction massage) is also one of the therapeutic approaches for treating supraspinatus tendinitis. The most famous exponent of friction massage was 'James Cyriax'. Deep friction massage provides therapeutic movement over a small area and one of the potential advantages of it over other forms of massage is that it allows pressure to be applied to greater depth in the tissues. This is carried out by fingertip or by thumb. Recent study suggests the use of fabricating material in administrating deep friction massage for better effect and to overcome the fatigue to therapists[13]. According to Cyriax, deep transverse friction causes traumatic hyperaemia, which results in increased blood flow and decrease in pain. It also increases tissue perfusion and stimulates mechanoreceptors[14]. When we talk about the effect of deep friction massage in tendinitis around shoulder, it stimulates circulation, which overcomes the congestion within the tendon, reduces/ prevents adhesion formation. It breaks down the adhesion thus preventing contractures as collagen cross-links are re established[15]. Researcher says that deep transverse friction treatment produces a cascade of ultra structural changes. Whether these changes are potentially beneficial and facilitate healing or would merely add to a pre existing injury is not known.

Hence, this study has been designed to compare the efficacy of therapeutic ultrasound and soft tissue massage (Deep friction massage) in case of supraspinatus tendinitis over the period of ten days.

Methodology

This study consists of 40 patients (OPD of Shree Devi College of Physiotherapy, Mangalore) suffering from Supraspinatus tendinitis (both male and female) with mean age of 30.62 ± 5.48 years. After considering about the inclusion (point tenderness at greater tuberosity of humerus, positive empty can test & painful resisted abduction etc.) and exclusion (history of trauma around shoulder, Corticosteroid injection, Infective conditions, surgery around shoulder & bony changes on radiological investigation etc) criteria the individuals were randomly divided in two groups with 20 subjects in each group.

Group – A: 20 subjects(M= 9, F= 11) with mean age of 30.35 ± 5.76 years, were treated with therapeutic ultrasound with the intensity of 0.6 w/cm2, pulsed mode at the rate of 1:4 for 6-8 minutes for 10 sessions 11. Group – B: 20 subjects (M= 12, F= 8) with mean age of 30 .90 ± 5.33 years, were treated with deep friction massage for 10-12 minutes for 10 sessions in transverse direction with the tip of index finger 6. Both the groups were given Codman's exercise in common. They also were advised not to do any strenuous work with the affected upper limb so that it won't stress the affected shoulder.

Tools Used for the Study

- Standard Ultrasound Machine: In this study we used 'Electroson 408-ultrasound therapy unit', Physiomed Electronics Pvt. Ltd. (SL. No.- 2506). The diameter of transducer head was 3cm2 & frequency was of 1MHZ.
- Universal Goniometer 18
- Visual Analogue Scale16

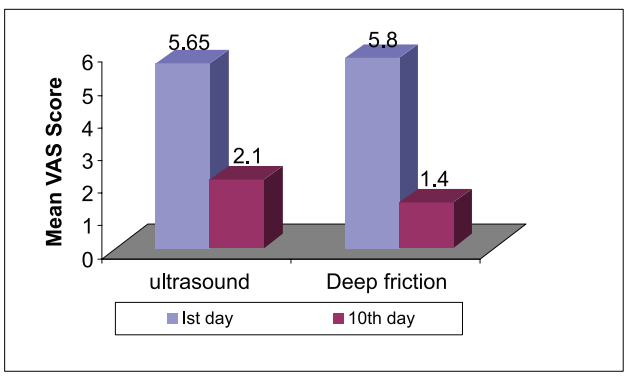
Procedure

Subjects with positive empty can test and other symptoms were selected in the study. (Patient is positioned in sitting. Patient's shoulder is abducted to 90° with neutral (no) rotation. Examiner provides resistance to abduction. Shoulder is then medially rotated and angled forward 30° so that the patient's thumb point towards the floor (empty can position). Examiner again gives a resistance. Pain or weakness reflects positive test[19]).

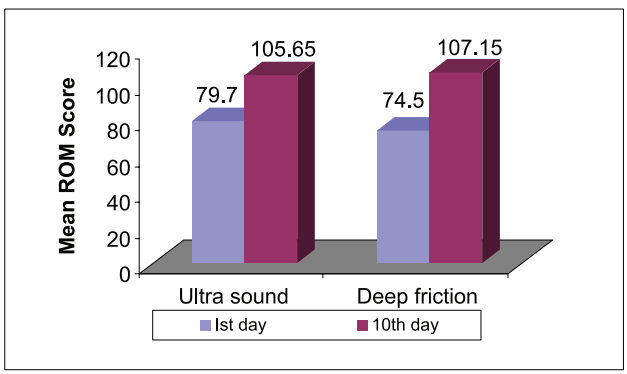
Visual Analogue Scale (VAS) recording

Each patient was given a chart with the scale marked 0 -

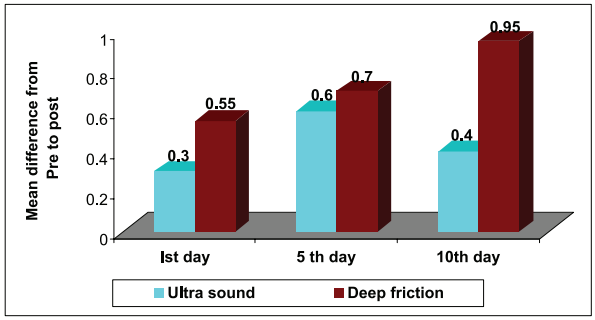
Graph 1: Intra- Group Comparison of Mean VAS Score of Pre-Treatment & Post- treatment Session.



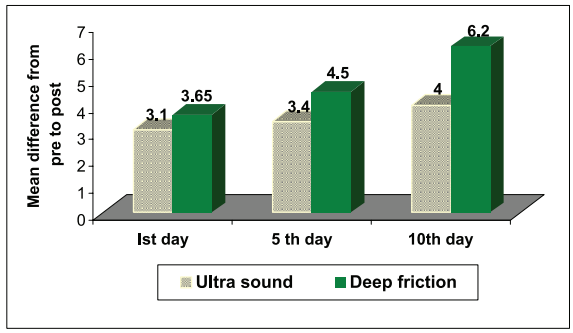
Graph 2: Intra- Group Comparison of Mean AROM Score of Pre-treatment & Post- treatment Session.



Graph 3: The Comparison of Mean Difference of VAS Score of Pre & Post- treatment (Day wise) Between Group A and Group B.



Graph 4: The Comparison of Mean Difference of AROM Score of Pre & Post- treatment (Day wise) Between Group A and Group B.



10 on it, before the treatment started and was explained the method of marking on it considering intensity of pain. '0' representing 'no pain' and '10' as 'maximum pain'. The pain rating was done by patient on the basis of the pain felt by him before and after treatment session[16,20]. Shoulder Abduction Range of Motion recording: Patient made to sit in a chair. The fulcrum of goniometer was placed close to the posterior aspect of the acromial process. Then proximal arm was aligned parallel to spinous processes of the vertebral column. Ask the patient to abduct the arm till he/ she experiences the pain and cannot move his/ her arm further and hold the position. The distal arm was aligned with the lateral midline of the humerus, using lateral epicondyle as reference[17]. With the completion of initial measurements, patients in each group were treated with respective physiotherapy intervention for 10 sessions.

Treatment Protocol

Ultrasound Therapy: Patients in the group A; Patient made to bend his/ her elbow to 90° and put forearm behind his/ her back so that the shoulder was in medially rotated position. Then ultrasound was applied to the supraspinatus tendon in a circular manner. The intensity used was 0.6w/cm 2 with pulsed rate of 1:4 for 6- 8 minutes[21]. Deep Friction Massage technique: Patients in the group B; receiving soft tissue massage (deep friction) were made to bend his/ her elbow to 90° and put forearm behind his/ her back, then lean back in half lying position. Thus arm was fixed in adduction and medial rotation. Deep friction massage was given to supraspinatus tendon with the tip of index finger, which was reinforced by middle finger. It was given in transverse direction for 10 - 12 minutes[6,14]. Codman's Exercise: Patients in both the groups were taught these self-mobilization techniques that use the effects of gravity to distract humerus and thus to relieve the pain. Patient was asked to do pendulum or swinging motion of the arm in flexion, extension, and horizontal abduction, adduction, and circumduction. The arc of motion was increased as tolerated[22].

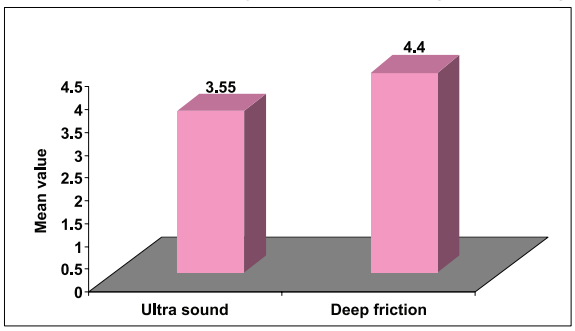
Organization & Analysis of Data

Mean, S.D and S.E are being calculated to perform the entire statistical test. Student t-test was done to find out the effectiveness of intervention given in both the groups and also for the intergroup comparison to check which between the two groups are more effective.

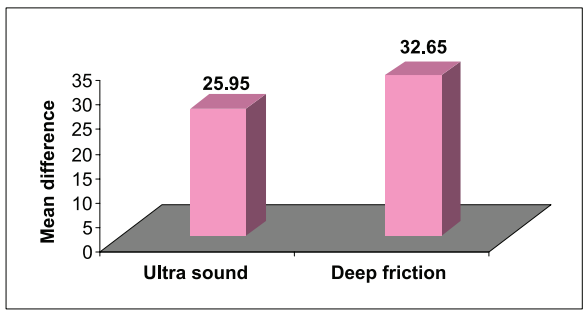
Results

Therapeutic Ultrasound group showed an improvement of 25.95 degrees in mean Shoulder Abduction Range of Motion (ROM). There was an improvement in mean Visual Analogue Scale (VAS) score of 3.55. While Deep Friction Massage group also showed an improvement in Mean Shoulder Abduction Range of Motion (ROM) of 32.65 degrees. The improvement in VAS score was 4.4. The findings of the t- test suggested that Therapeutic Ultrasound is effective in reducing pain ($t = 17.898$, $p = 0.001$) and increasing range of motion ($t = -20.468$, $p = 0.001$). Deep Friction Massage also showed significant improvement in pain profile ($t = 16.567$, $p = 0.001$) and also in shoulder abduction range ($t = -12.867$, $p = 0.001$).

Graph 5: The Comparison of Total Improvement in Mean VAS Score Within 10 Days between Group A & Group B.



Graph 6: The Comparison of Total Improvement in Mean AROM Score within 10 Days between Group A & Group B.



Thus both the interventions were effective in treating supraspinatus tendinitis. But when both the groups were compared Deep Friction Massage demonstrated better improvement over Therapeutic Ultrasound in VAS score ($t = 2.564$, $p = 0.014$) and AROM score ($t = 2.362$, $p = 0.023$).

Discussion

According to this study, Therapeutic Ultrasound is effective in treating supraspinatus tendinitis, which supports the results of Naslund (2001) who found that ultrasound was effective in seven randomized controlled trial in the review of Medline literature and few other studies24. The possible explanation for the findings of this study showing Ultrasound relieved the pain and increased the range of shoulder abduction can be its biological effects. Heating is traditionally thought of as the main biological and potentially beneficial effect of Ultrasound but it is also pro-inflammatory in nature thus speeds up the whole process of inflammation[25]. Ultrasound has effect of on cells, such as platelets, macrophages and mast cells. Ultrasound changes the permeability of the cell membrane and causes degranulation and release of growth factors. It stimulates fibro-blastic proliferation. Pulsed ultrasound has mechanical effects like Acoustic steaming and micro-massage with is beneficial. Few researchers believed that Ultrasound has only placebo effect. But the results have contradicted this statement as it showed improvement not only in VAS score, which is subjective, but also in AROM score, which is objective analysis. According to results of Deep Friction Massage technique, we can state that Deep Friction Massage is highly effective in treating Supraspinatus tendinitis. Position of patient's arm behind the back was used in this study as it bends the supraspinatus tendon through the right angle passing from base of coracoid process directly forwards over the head of humerus. Massage was given with tip of index finger, as it is an effective method. The possible reason for the improvement in VAS score and shoulder abduction AROM with Deep friction Massage can be its four-fold effect, which includes traumatic hyperaemia, movement, increased tissue perfusion and mechano-receptor stimulation. The enhancement of blood supply diminishes the pain. Apparently it acts by increasing the speed of destruction of Lewis p- substance. As we had given Deep Friction Massage in transverse direction, it moved the tendon to and fro which makes the structures free from adhesions both actually present and in the process of formation. It also increases tissue perfusion at the damaged area and stimulates the mechano-receptor cells. Since impulses from moving parts take precedence over afferent sensory stimuli, pain is relieved. It also increases the rate of phagocytosis. When both the techniques had compared for relative improvement in VAS and AROM score, Deep Friction Massage showed better improvement than Ultrasound over the period of 10 days. But the long-term effect of both the interventions was not considered in the study. Deep Friction Massage showed better results may be because of its mechanical effects, which restored the mobility of the tendon, decreased inflammation by increasing blood supply and also prevented adhesion formation. But this difference in improvement was not very large. Ultrasound showed little less improvement in VAS and AROM score as compared to Deep Friction Massage. The possible explanation for this can be the lack of standard calibration of machine. According to Paul A Artho et al (2002), about 81 % of machines used in clinical setting are out of the standard power output ($\pm$ 20 %) this factor could have affected the treatment outcome as the exact dosage was not delivered to the patient. A further study is required with these two treatment modalities combined together.

Conclusion

Therapeutic Ultrasound and Deep Friction Massage both the interventions are effective in managing the supraspinatus tendinitis and show gradual improvement in symptoms of supraspinatus tendinitis over a period of 10 days. Although, Deep Friction Massage has little edge over the Therapeutic Ultrasound in Supraspinatus tendinitis over a period of 10 days.

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Effect of Neural Mobilization on Altered Vibration Perception Threshold (VPT)

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Abtract

Background

Upper Limb Neurodynamic Test (ULNT) has been advocated for assessment and treatment of Adverse Neural Tension (ANT) and has been suggested as a means of restoring normal neural physiology, mobility, and alleviating pain. In Early stages of nerve compression the symptoms are intermittent and the histopathologic changes in the nerve are minimal, this can be detected by vibration perception threshold (VPT). ULNT's effect on the quickly adapting receptors, which is assessed by VPT, has not been established yet.

Objective

To find the correlation between ULNT and VPT, and to find the effect of neural mobilization in cases of adverse neural tissue tension in asymptomatic individual.

Method

Study was done in 2 phases. Phase 1 was a cross-sectional study where 30 asymptomatic individuals were taken and their VPT and ANT (the range of restriction of elbow extension) was recorded in sitting and ULNT position, this was followed by finding correlation between them. Phase 2 was an intervention study where 50 asymptomatic individuals with VPT more than 0.25 microns and neural tissue tension greater than 30 degrees of restriction of elbow extension in ULNT1 position were included. Six sessions of ULNT1 neural mobilization program was given. The outcome measure of VPT was recorded at the first day and at the end of the sixth session.

Results

In phase 1, there was positive correlation between the range of restriction of elbow extension and the VPT (r=0.71 for right, r=0.68 for left). In Phase 2 there showed significant difference in resting VPT with pre and post ULNT1 neural mobilization program (p = 0.01).

Conclusion

VPT can be used for the identification of any subclinical pathology. Six days of ULNT1 neural mobilization program decreases the VPT in asymptomatic individuals with ANT. So ULNT1 neural mobilization program will be useful in improving the neural function in subclinical stage.

Key Words

Adverse Neural tension, Vibration threshold, ULNT1.

Introduction

Upper limb Neurodynamic test (ULNT) alters the neuroaxial or meningeal tension and provides the clinician with screening maneuver to examine patient's nervous system and its accompanying interfacing tissues[1]. An aim of using these tests in assessment is to stimulate mechanically and move neural tissues in order to gain impression of their mobility and sensitivity to mechanical stresses[2]. Changes in neural physiology and mobility may result in the development of the patient's symptoms and the limitation of motion confirmed with ULNT. It thus checks the adverse neural tension (ANT) of the nervous system[3]. The use of ULNT has also been advocated for the treatment of ANT. This treatment has been suggested as a means of restoring normal neural physiology and mobility, and alleviates pain originating in the nervous system[4]. The utilization of ULNT and nerve mobilization (NM) of gliding as an evaluation and treatment approach require that the clinician understand neural biomechanics and the consequences of neuropathology, pain, and movement dysfunction. Presently, no clear guidelines or research supports the most effective treatment protocol to mobilize the nerve and bring the physiology back to normal[1].

Unlike nerve conduction velocity studies that test the nerve only in a limited distance, VPT testing reflects the entire somatosensory pathway[5,6]. Electro-diagnostic tests are often negative when measuring minor peripheral nerve pathology. Not all sensory evaluation tools will be equally effective in detecting abnormalities in nerve injury in the different stages of nerve compression[4]. In the early stages of nerve compression, all sensory tests may be normal because symptoms are intermittent and the histopathologic changes in the nerve are minimal. It has been proved that VPT can detect early signs of minor nerve damage, and even detect the sub clinical pathology, since the large diameter afferent nerve fibers (A- beta), which mediate the sensation of vibration, are more vulnerable to injury than other nerve fibers. VPT has been shown to be a reliable and valid method of measuring nerve function[5,7]. Therefore, VPT has been used as a method of detecting early minor peripheral nerve damage in a number of patient groups[8,9]. VPT has been recently used as a measure of nerve dysfunction to identify whether those individuals who participate in repetitive activity are vulnerable to nerve injury[4,10].

Asymptomatic individual can also have a positive ULNT[11,12]. So finding a relationship between these two and analyzing the effect of neural mobilization on VPT will help us to determine if the mobilization program is effective in bringing the altered pathomechanics in the nerve tissue to baseline. Altered neuromechanics and its effect maybe evident in the later stages of pathology related to nerves[11]. It is essential to find out altered neuromechanics and its effects in subclinical stage to prevent nerve dysfunctions and its mechanics. There has been dearth of literature on the relationship between the range of restriction elbow extension in ULNT1 position and the VPT in asymptomatic individuals. So the objectives of the study are to find the correlation between the range of restriction elbow extension in ULNT1 position and the VPT and if there is a positive correlation, to find the effect of ULNT1 neural mobilization on resting VPT.

Methodology

Advertisement in the Physical Therapy department was given in the form of Posters and lectures for voluntary participation of the subjects in the study. All participants signed a written consent form prior to participating in the experiment.

The study was done in 2 phases. Phase 1 was a cross sectional study where 30 asymptomatic individuals with an age range 20 to 60 years and having ULNT positive were selected by Convenience sampling. In this study, individuals who obtained signs of neural tension like tingling, paresthesia, pain, etc was considered to have positive ULNT[13,14,15,16]. Subjects were excluded if the Individuals had known history of upper limb and cervical symptoms (neural or non-neural) recently or in the past. The procedure involved 2 testers, tester 1 performed the ULNT and tester 2 recorded the range of restriction elbow extension and VPT. First, the participants were screened and VPT was recorded using a standard bioesthesiometer capable of delivering vibration at a constant frequency of 100 Hz. Subjects were comfortably seated on a chair with hand and arm completely supported on a pillow. They were shielded from the Vibrometer display, testing was done on the tip of the thumb.

Each subject was given a practice trial on the instrument. The tester had increased the vibration to a point where the subject could detect the stimulus. Then the intensity was slowly reduced till the point where the subject was not able to perceive the stimulus. After this procedure the intensity was again increased to the point where the first sense of vibration was felt. This value was taken as VPT. The average of the three trials was considered the threshold value. The application of the stimulus was at the pulp of the thumb (fig: 1).

The median nerve bias position was used to check for the presence of neural tension. Tester 1 used the pressure biofeedback system (fig: 2).17 It was first inflated to 20mmHg and later was increased to 60mmHg to maintain shoulder girdle depression. The subsequent movement of abduction to 110 degrees, external rotation, forearm supination, wrist and finger extension and elbow extension was taken the level of P1 (where, P1 is also considered the normal response to ULNT assessment). Tester 1 recorded the angle of restriction of elbow extension. Participants who got symptoms before the addition of elbow extension were excluded.

Fig. 1: Recording resting VPT

Table 1: Correlation between elbow R.O.M and VPT

	MEAN (SD)	PEARSONS CORRELATION (r)
ROM of right & Resting VPT of right	50 (22.21) 0.30 (0.12)	0.71
ROM of left & Resting VPT of left	32.90 (20.73) 0.15 (0.07)	0.68

SD: standard deviation, R.O.M: Range of Motion, VPT: Vibration Perception Threshold

The phase 2 was an intervention study where 52 asymptomatic individuals with positive ULNT greater than 30 degrees of restriction of elbow extension were included. The inclusion criteria also included age of 20 to 60 years of both gender, and VPT equal or more than 0.25 microns. Individuals with known history of upper limb and cervical symptoms (neural or non-neural) recently or in the past were excluded. The same procedure was done as in phase 1, after which 6 days neural mobilization program was given. This mobilization program included 3 sets of grade 3 mobilization of 10 repetitions with a rest of 10 sec between each set. This was followed by 3 sets of grade 4 mobilization of 10 repetitions with a rest of 10 sec between each set. The outcome measure resting VPT was recorded at the first day and at the end of the sixth session.

Data Analysis and Results

Data were analyzed using the SPSS statistical package (Version 11.5). In phase 1, Karl Pearson correlation was done between the range of restriction of elbow range of motion and VPT in resting position. In phase 2, Wilcoxon signed ranks test was used to analyze the effect of neural mobilization on the resting VPT. A significance level of 0.05 was set for all analyses.

In phase 1, there was positive correlation between the range of restriction of elbow and the VPT. More the restriction of elbow, higher was the resting VPT. In phase 2, the statistical analysis showed significant difference in resting VPT taken after mobilization program (p= 0.01) as showed in table 2.

Fig. 2: Recoding the presence of neural tension by measuring the restriction of elbow ROM

Table 2: Pre - Post comparison of VPT after 6 days of mobilization

VPT	Right side			Left side		
	Median	IQR	p Value	Median	IQR	p Value
Baseline vs.	0.36	0.49	0.001	0.25	0.38	0.005
6th day post mobilization	0.25	0.20		0.25	0.20	

IQR: inter-quartile range, VPT: Vibration Perception Threshold

Discussion

The first phase of the study analyzed the correlation between the vibration threshold and the neural mobility. An increase of vibration threshold measured at resting position corresponded to the decrease in the neural mobility or increase in the range of elbow restriction. This can be attributed to the changes in the intraneural blood flow and decrease in the function of its neural conduction in the presence of adverse neural tension[11]. Porter and Wharton had examined the effect of nerve function by occluding the nerve's blood supply[1]. They found the nerve conduction was reduced after occlusion of vessels. The restriction to the neuromeningeal mobility caused by fibrosis would be detected by tension tests and expressed as decreased neural mobility during testing. This tension within the nerve, affecting the intraneural blood flow leads to decrease in its function thus the vibration threshold was higher with the decrease in neural mobility[1]. There are alterations in the mechanical and physiological properties in ULNT position, when the nerve is in tension, its capacity to perform the normal function of conductance of impulses reduces. Which is due to the reduction in blood flow to the nerve and the reduction in axonal transport because of the compression on the nerves in the tension position[2].

In this study, the restriction of elbow range of motion was used as the marker for neural mobility and this neural mobility was found to be much reduced in the dominant arm than the non-dominant. Also the correlation between restricted ROM and VPT was more significant in the dominant arm than the non-dominant, in either of the test positions. It may be possible that the frequent use of dominant hand for daily activities may lead to sub clinical neural inflammation within the nerve or between the nerve and the nerve bed, as may happen in overuse syndromes for muscles and tendons[18]. This subclinical inflammation may lead to scarring or adhesion formation and reduce the intraneural mobility of nerve fibers or with respect to its nerve bed[12]. As a consequence, it may lead to development of more tension in the nerve during movements at the expense of reduced mobility. This may be the reason why the subjects, though asymptomatic, showed a positive response to ULNT on the dominant side.

The result of the study provides evidence to support the hypothesis that the neural mobilization program leads to changes in the biomechanical and physical properties of the nerve tissue thus leading to decrease in the VPT[11]. Usually a higher VPT would indicate deterioration in function of the large diameter afferent nerve fibers, suggesting a change in neuronal function possibly due to reduction in the neuronal circulation or fascicular damage[5,19]. In this study, individuals having a high VPT within the normal range may be predicted to have some alteration in the neural tissue function which was to a certain level reversible in these 6 days of mobilization program.

Studies on keyboard workers have demonstrated an elevation in VPT compared to non-keyboard users. The former group usually presents with symptoms of median nerve compression or symptoms of neural tension.5 Since this study has shown that neural mobilization program can correct altered mechanics and function of the nerve tissue, therefore for this group of people a neural mobilization program could help in alleviating their symptoms.

A study which tried to find out the effect of mobilization by SLR in runners and non-runners[4]. The study showed no difference in the vibration threshold, the mobilization program was of one session for 3 min. Maybe the mobilization program might not have been sufficient enough to lead to changes in the properties of the nerve tissue; the results of our study indicate that a 6 days mobilization program is sufficient enough to produce some significant change in the properties of the nerve.

Our study had various limitations; one is that our sample size was small, so the result may not be applicable to a larger population. The sample size was small because, many subjects did not complete the mobilization program because of their inconvenience to follow up every day and one was excluded due to the development of pain in the arm and neck after the first day of mobilization. The other limitation is that, the recordings of the outcome measure were done on the first and the 6th day, whereas, everyday recordings of the outcome measure would have shown any daily variation if it existed or if any plateau occurs in the VPT. The study could have included a home program to maintain the neural mobility. A follow up after few weeks would have explored the long term effect of this mobilization. Moreover, from this study it cannot be commented that an increased VPT is an indication of development of later symptoms, since the subjects in the study were asymptomatic.

Conclusion

There is a positive correlation between the neural tension and resting VPT. And six days of neural mobilization program decreases the VPT in asymptomatic individuals.

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Mulligan's Manual Therapy Treatment Dosing for Subacute Mechanical Neck Pain – A Comparison between Loading and Movement Disorders of Cervical Spine

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Abstract

Background and Purpose

Evidence is inconclusive regarding comparison of Mulligan's manual therapy treatment dosage and efficacy of standardized treatment regimes between loading and movement disorders of cervical spine. Primary purpose of this study was to compare number of Mulligan's manual therapy treatment sessions required to achieve a significant improvement between loading and movement disorders of cervical spine and. Second purpose was to compare the immediate, short term and long term efficacy of Mulligan's mobilization between the groups.

Subjects

30 patients with subacute mechanical neck pain were classified into two groups, loading disorders and movement disorders according to their dominant impairment of spinal function.

Methods

Study was carried out as a pre test - post test experimental design. Standardized treatment regime including Mulligan's manual therapy along with remedial exercise was prescribed to both the groups. Patients were considered for discharge when they rated their pain intensity ≤ 1 for 3 consecutive treatment sessions. Primary outcome was difference in the minimum number of treatment sessions required to achieve a significant improvement between the groups. Other outcomes measures included were NPRS, NDI, and Cervical ROM (only for symptomatic movements in movement disorder group).

Results

Kaplan Meier curve demonstrated that all the patients with loading disorders showed probability of getting discharged by 7th treatment session as compared to 10th treatment session in movement group. It was also observed that both the groups achieved a significant improvement in neck pain and disability following intervention

Discussion and Conclusion

Classification system of mechanical neck pain patients into movement and loading group carries prognostic significance and appears to be a useful indicator treatment dosing required to achieve a significant response to specifically standardized physical therapy treatment.

Key Words

Classification, Mulligan's manual therapy, subacute mechanical neck pain, treatment dose

Neck pain is a common musculoskeletal complaint in modern, industrialized countries,[1,2,3] with lifetime prevalence between 67% - 71%[1,4,5] and point prevalence between 10% - 22%[1]. Patients with neck pain constitute approximately 25% of all patients encountered in outpatient physical therapy practice6 and in about 90% cases[7] it is diagnosed as mechanical neck pain[8]. Once serious medical pathology and specific diseases have been excluded, the anatomical source of symptoms is difficult to establish and consequently the term cervical pain of unknown origin (CPUO) or mechanical neck pain or non-specific neck pain9 have been recommended to this patient group[8].

In order to classify patients with neck pain into homogenous groups, to determine their prognosis and to select most appropriate intervention strategy[10,11] many classification systems have been proposed by various authors (Werneke et al[12], Wang et al[10], Childs et al[10,15] Patrick et al[13,14]) but none of them is universally accepted for use in clinical studies[5,10]. The most recent classification, given by Clair et al (2006)[5] classifies patients with CPUO into Loading disorders and Movement disorders, according to their dominant impairment of spinal function and used multimodal approach to physical therapy to compare prognosis of both groups. They concluded that patients with loading disorders have better prognosis as they require 35% fewer treatment sessions and total lesser duration of treatment than patients with movement disorders[5]. However, analysis of treatment received by patients in each group was not conducted in Clair's study and no specification of treatment was done. Hence, it was not possible to determine whether there were consistent differences in treatment modalities or combination of modalities prescribed to two groups that may have contributed to the outcome.

Mulligan's manual therapy techniques[16-26], developed by Brain Mulligan are widely used for treating spinal problems of mechanical onset. However, there is a lack of conclusive information on guiding factors evaluating the dosimetery of Mulligan's manual therapy in loading and movement disorders of cervical spine. Dosifying

the physical therapy treatment will help in determining minimum number of treatment sessions required to achieve earliest possible recovery, hence making the management of neck pain cost and time effective[26]. Moreover, there is a lack of conclusive information on efficacy of standardized treatment regimes for both loading and movement disorders of cervical spine. Existing literature emphasized on multimodal therapies applied to both the groups, without standardizing treatment, as described by Clair et al[5].

Present study is chosen to understand the effect of a specific treatment (i.e. Mulligan's manual strategy combined with the remedial exercises) on loading and movement disorders of cervical spine and comparing the two in terms of number of treatment sessions required to achieve significant improvement as well as response to treatment, hence further evaluating the prognostic significance of classification. Primary purpose of this study was to check the prognostic significance of Clair's classification system by comparing number of treatment sessions required to achieve a significant improvement between loading and movement disorders of cervical spine. This will help in optimizing treatment dose for both the groups. Second purpose of the study was to compare the immediate, short term and long-term efficacy of Mulligan's mobilization between the two groups.

Methods

Subjects

54 consecutive patients (35 females, 19 males) referred over an 8-month period (July 2008 to February 2009) for physical therapy at a hospital based outpatient physical therapy department were screened for possible study eligibility criteria. The mean age of the patients was 26.87 years and the mean symptom duration was 1.73 months. Inclusion criteria was primarily non specific non traumatic neck pain, mechanical in nature with symptom duration more >/= 4 weeks and </= 3 months, and this duration preceded by at least one month without neck pain., NPRS score between 2-7, Base line NDI score greater than 10%, Symptom reproducibility according to Clair classification and Pain reproduced by neck movements or sustained postures. Patients excluded from the study if they were under 18 and over 45 years of age and if their symptom duration was less than 4 weeks. Other exclusion criteria were patients with inflammatory disorders, cervical radiculopathy, severe degenerative changes, red flags and yellow flags, any history of prior surgery or PIVD in cervical region or upper back, VBI (drop attacks), patients who received spinal manipulation with in one month prior to study, patient taking any anticoagulants/ corticosteroids and patients who are unable to read or understand questionnaire. The study was explained to the patient and informed consent to participate was obtained. Approval for the study was obtained from research committee as well as ethical committee of Faridabad Institute of Technology, Manav Rachna Educational Institutions, Faridabad.

Classification

Subject's selection was based on screening process for mechanical neck pain. Routine clinical assessment including full history and physical examination was conducted on each patient. The classification of patients having loading disorder or movement disorder was based on symptoms reproducibility according to Clair's classification.i.e. on the dominant pain aggravating activity or repeated movements in any direction (Table1). Subjects classified as having loading disorder reported their pain as being primarily aggravated by sustained positions or postures and on examination, there was no pain reproduction with any active or repeated movement in any direction. In contrast, subjects classified as having movement disorders described their pain as being primarily associated with single or repeated movement activities and on examination pain was reproduced on single or repeated movements. Patients were assigned to particular groups (Group A with Movement disorders and Group B with loading disorders respectively)

Table1: Criteria to classify patients into loading and movement disorders, (Clair's classification)[5],*

Loading Disorders	Movement disorders
1. Pain provoked by sustained postures.	1. Pain provoked by single movement or repeated movement activities.
2. No active movement impairment	2. Active movement impairment
3. No symptom reproduction with active movement testing	3. Symptom reproduction associated with movement testing/ movement impairment

*Inter therapist reliability of this classification showed 100% agreement between 3 observing physical therapists and examining therapist in relation to classification.

Procedure

Primary outcome measure is the minimum number of treatment sessions taken to recover from neck pain. 10 therapy sessions of assigned treatment were delivered with in first 3 weeks but treatment was discontinued prior to 10th treatment session if patient was completely recovered. Patients were considered to have completely recovered when they rated their pain intensity <1/10 for 3 consecutive treatment sessions and this was set as Criteria for discharge[28]. For the purpose of analysis of minimum number of treatment sessions day of discharge of every patient was noted in data collection form and 1st of the 3 consecutive sessions when patient rated their pain intensity ≤ 1/10 was considered as the day of discharge. Secondary outcomes were pain (measured on NPRS) and disability (taken on NDI). For NPRS, both pre and post treatment reading were collected on each treatment sessions. For baseline and pre-intervention readings; patient was asked to report average pain over last 48 hours; for post intervention reading only pain score post treatment was taken. NDI and cervical ROM reading was collected on day 1 and last day of intervention.(i.e.

day 3rd of the 3 consecutive sessions when patient when rated their pain intensity <1/10). Follow up 1 was taken 1 week after the completion of treatment Follow up 2 was taken 15 days after Follow up 1. Both follow up were taken through telephone if patient was not willing to come.

Treatments

After the classification, groups A was assigned to patients with movement disorders and group B was assigned to patients with loading disorders. Concerned therapist provided manual therapy treatment. Therapist was aware that patients had been classified into 2 groups, but patients were blinded to the classification. Both the groups received a standardized intervention including Mulligan's manual therapy (SNAGS &/ or NAGS)[16-26]; Remedial exercises[29,30] (postural correction exercises, neck retraction exercises, self-stretching for tight postural neck muscles, and strengthening exercises for weak phasic neck and scapular muscles) and Hot packs for 10-15 min (if required). For SNAGS, 6 – 10 repetition per set X 2- 3 sets were given over most painful segment in direction of movement impairment along the respective facet plane (fig1). For NAGS, 2-3 oscillations per second X < 6sec X 2-3 sets with 20 sec rest in between, were given along facet plane on most painful/ hypo mobile segment (fig2). Snags were preffered if patient had 'catch pain' during movement where as NAGS were preffered if patient presented with high SIN / multiple levels of involvement[18,19].

Data Analysis

Descriptive statistics were used to describe all derived variables including number of treatment sessions received, pain, and NDI scores, age and symptom duration. Several suitable statistical tests were applied using SPSS 12.0 version in order to verify the investigation of the study. The results were considered statistically significant if the p value ≤ 0.05. Unpaired t test was applied to analyze any difference in number of treatment sessions required to achieve a significant improvement between both the groups the, to analyze between group differences in NPRS and NDI scores before and after difference treatment sessions, and to analyze immediate effects of pain between the groups. A Kaplan Meier Curve was constructed to assess probability of remaining in the treatment (not getting discharged) at particular treatment sessions. Repeated measures ANOVA and post hoc analysis was performed to analyze the within group differences in NPRS and NDI scores at different treatment sessions Paired t-test was used to analyze within group improvement of ROM of different movements before and after treatment in movement disorder group.

Fig. 1: Procedure of SNAGS

Fig. 2: Procedure of NAGS

Results

30 patients classified as having either movement disorders, group A with n = 15 (4 males, 11 females) or loading disorders, group B with n = 15 (4 males, 11 females) completed the study. Subject's recruitment and retention is summarized in flow diagram (fig. 3). Subjects' demographics and self report measures for entire sample are shown in Table 2. Baseline characteristics for the groups were similar for all variables (p > .05) suggesting homogenous distribution of patients.

Treatment dose (minimum number of treatment sessions)

The number of treatment sessions required prior to discharge were normally distributed. The mean number of treatment sessions received by movement disorder group was 5.93 ± 2.55 as compared to 5.80 ± 1.26 for loading disorder group. Their statistical comparison gave suggested no significant difference between the groups in number of treatment sessions required to achieve significant improvement (p = .857). Further analysis using cumulative survival curve (Kaplan Meier curve; Fig. 4) showed that all patients of loading group were most likely to be discharged by 7th treatment session as compared to 10th treatment session in movement group. From the figure, it can be depicted that cumulative survival rate (i.e. probability of not getting discharged) of patients of loading group by 7th session was 0 % whereas it was 33.3% for movement group. However, cumulative survival rate of patients of movement group reached 0% by 10th treatment session. This indicates that individuals in the loading group were likely to receive lesser number of treatment sessions before discharge than patients in the movement group.

Response to Treatment

In both the groups there was a significant improvement in primary outcome measures of pain intensity and total NDI score. Moreover movement group also showed a significant improvement in impaired ROM. However, there was no significant difference in response to

Fig. 4: Survival curves for the 2 groups of patients with neck pain. Curve shows probability of patients remaining in the treatment (not discharged) as a function of number of treatment sessions. The figure indicates that individuals in the loading group were likely to receive a lesser number of treatment sessions before discharge than patients in movement group

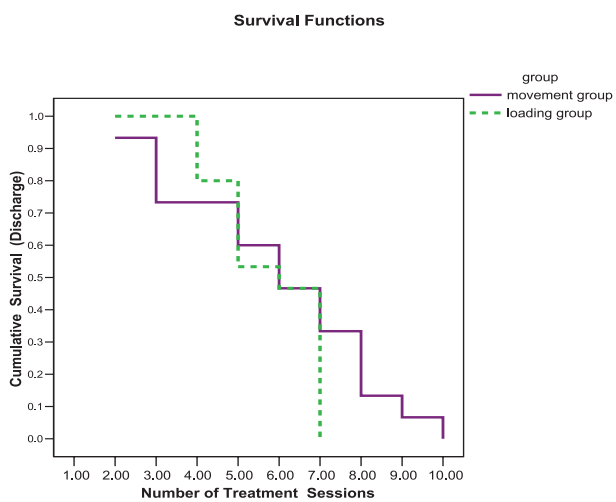


Table 2: Comparison of Demographics data and outcome measures at baseline.

Variable	MD (group A)	LD (group B)	p- value
Age, Mean (SD)	26.27 (6.52)	27.47 (7.08)	.633NS
NPRS, Mean (SD)	5.13 (0.92)	5.20 (0.94)	.846 NS
NDI, Mean (SD)	29.19 (8.14)	25.90 (5.30)	.201 NS
Symptoms duration	1.70 (0.53)	1.77 (0.65)	.760 NS

treatment between the loading and movement groups for change in pain intensity and disability at discharge and first follow up. At follow up 2 (3 weeks post intervention), between group comparison of NDI scores gave a significant p value of 0.042, suggesting that on long term basis movement disorder group show better recovery both statistically and clinically with regard to Functional Disability. (Table 3).

Immediate effects comparison

Analysis of difference of pre and post treatment readings of pain scores on day 1 and day 2 suggested that there are significant differences regarding immediate effects of Mulligan's mobilization between Group A and Group B with movement group showing significantly better immediate effects regarding pain as compared to loading groups (p = .043) at the first treatment session and (p = .011) at second treatment session. (fig .5)

Discussion

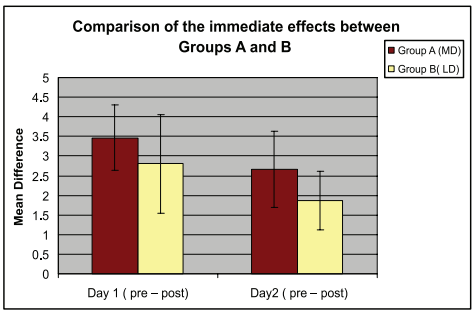
Subjects recruited in the study had comparable baseline values for all the dependent as well as demographic variables suggesting homogenous distribution of patients. Our results primarily suggested that in response to a standardized treatment regime of Mulligan's manual therapy along with remedial exercises; no statistically significant difference exists between the groups regarding minimum number of treatment sessions required to achieve a significant improvement in neck pain disorder(p = 0.778). Comparison of mean number of treatment session suggested that loading group required only 2% lesser treatment sessions than movement group. Further analysis using Kaplan Meier survival curve however, showed that all patients of loading group were most likely to be discharged by 7th treatment session as compared to 10th treatment session in movement group. Therefore, though not statistically, but clinically, the results of our study regarding number of treatment sessions correlate with the previous study done by Clair et al (2006) in which loading group required both statistically and clinically fewer treatment sessions than movement group[5].

Results of present study and Clair's study as well demonstrate that whether treatment is multimodal or specified, loading disorder group shows the probability to improve earlier and hence has better prognosis than movement disorder group. Possible explanation may be that patients of loading group have mainly posture related pain and once their pain is relieved, they have fewer tendencies to get it back if they follow all the postural care advices and perform important exercises taught to them. However, in movement group, pain is mainly due to mal tracking of the joint[18] or due to some altered kinsiological pathways[31,32,] which may have the tendency to relapse until and unless the joint

Table 3: Comparison of Pain and NDI scores between groups A & B. (NS – NON-SIGNIFICANT (P > .05), S – SIGNIFICANT (P < .05)

		Group A (MD) Mean ± SD,N=15	Group B (LD) Mean ± SD,N=15	t- value	p value
PAIN SCORE	Day of discharge	1.00 ± .00	0.93 ± .026	1.000	.334 NS
	FUP1	0.66 ± .061	0.40 ± 0.63	1.169	.252 NS
	FUP 2	0.53 ±.063	0.67 ± .062	-.581	.566 NS
DISABILITY	last intervention	8.76 ± 2.85	8.99 ± 1.85	.266	.792 NS
	Follow up 1	6.64 ± 2.48	7.24 ± 1.82	.755	.456 NS
	Follow up 2	4.49 ± 2.55	7.25 ± 2.20	2.256	.042 S

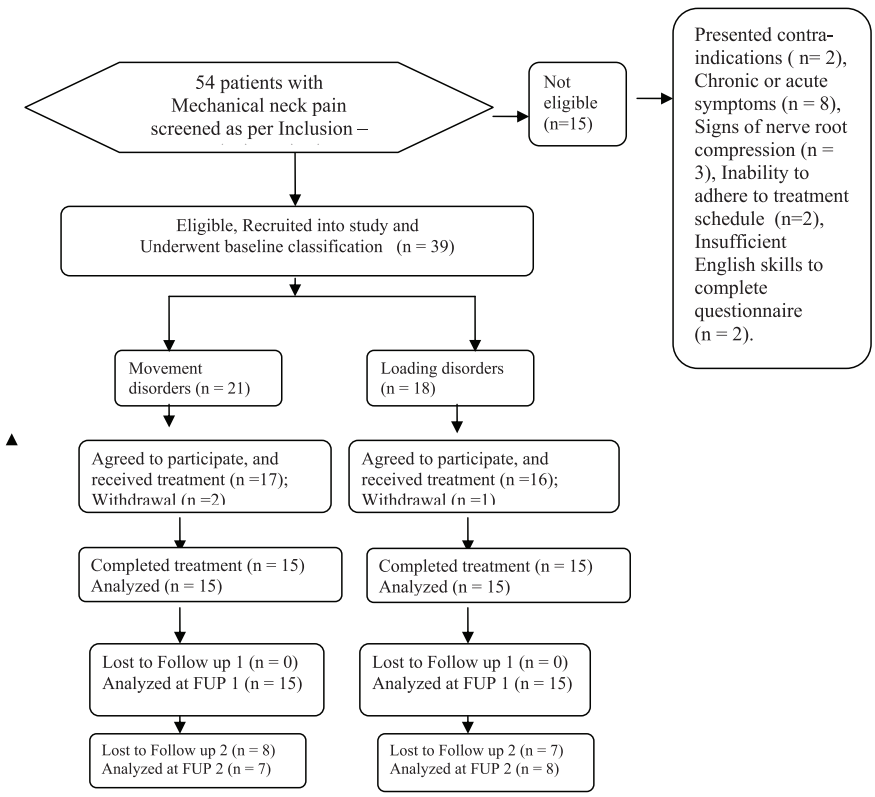
Fig. 5: Comparison of immediate effects of pain scores between group A & B



is repositioned to the very corrected position, and muscles become stronger enough to hold the joint in that corrected position, complete recovery is less likely to be achieved. This could be the reason for movement group required more treatment sessions than loading group. It was also found that patients in movement group show more heterogeneity in terms of requirement of number of treatment sessions with some patients requiring a minimum of 2 to others requiring a maximum of more than 10 treatment sessions where as patients of loading disorder maintain more homogenous requirements with most of the patients requiring a maximum of 7 treatment sessions (average range being 4-7 sessions). This shows that from the study better predictions can be made to assign 6-7 treatment sessions for loading group but no confirmatory predictions can be inferred for movement group.

Regarding second purpose of the study, our result found no significant difference in response to treatment between the groups for improvement in pain scores. Within Group Analysis of Pain Scores showed a total improvement of 87.13% in movement group and a total improvement of 87.11 % in loading group. These results were also consistent with the results by Clair et al. and suggested that both the groups have the tendency to improve to equal extent irrespective of the fact that whether treatment is individualized or standardized. Analysis of disability scores suggested non-significant difference between the groups at the completion of treatment. However, at 3 week follow up significant difference appeared between the groups for disability ($p = 0.042$) with a total improvement of 84.6 % in movement group and 72 % in loading group. This suggested that on long term basis, movement group show better recovery in terms of disability as compared to loading group. Possible explanation may be that in movement disorders, Mulligan MWM techniques bring about improved joint tracking, reduce spasm, and associated muscle inhibition rendering pain free movement 21. If it is accompanied by proper therapeutic exercise regimen same tracking problem does not relapse and patients shows consistent improvement throughout. In loading disorders Mulligan techniques though treat the patients in weight bearing,15-25 the position in which their initial pathology actually lies, patients tend to get back their pain (though to a less extent) as soon as they resume their jobs or functional activities in demands of their occupation of sustaining positions for prolonged periods.

Fig. 5.1: Flow diagram for subject's recruitment and retention.



Hence, postural correction needs to be emphasized to avoid relapses in these patients.

Movement impairment is considered as a common feature of Cervical Pain of Unknown Origin (CPUO) and is commonly indicated as a primary outcome measure in clinical trials. Few studies have specifically investigated the proportion of patients who have symptom related movement restriction5. In present study, patient with loading disorders does not complain of any movement related pain and did not have symptomatic limitation of active movement on physical examination. Since almost 50% of the patients in present study showed no active movement impairments resulting from joint pathology, no attempt was made to perform between group analyses regarding ROM. Within group analysis for impaired movements in movement disorder group showed statistically significant improvements in all symptomatic ranges. ($p < .001$ for extension, $p = .01$ for right rotation and $p = .001$ for left rotation). ROM in movement disorder group was considered to increase as a result of Mulligan's mobilization for that it repositioned the joint into its correct alignment and tracked it properly thereby normalizing its proprioceptive discharge and inducing analgesia leading to improved ROM both qualitatively and quantitatively. An extra improvement of ROM, ranging from 2-8% was also seen in patients with all asymptomatic movements of loading as well as movement disorders and this ROM was thought to be increased as a result of flexibility and stretching exercises which patients performed as a part of treatment regimen.

Analysis of immediate effects of Mulligan's mobilizations between both loading and movement disorders suggested that movement group had significantly better immediate effects on first 2 treatment sessions as compared to loading groups. ($p = .043$ on 1st treatment session and $p = .011$ on 2nd treatment session). Moreover where movement group is more advantageous in showing immediate effects of pain relief, loading group is advantageous in sustaining these effects. Clinically, though recovery appears to be immediate in movement group, very often they get back their pain soon. Recovery appears to be bit slower in loading group, but whatever they recover; they tend to sustain it for a longer time period.

With-in-group, analysis showed highly significant improvements in both the groups ($p < .001$). The mechanism of reduction of pain was supposed to be Mulligan's mobilization along with Mc-Kenzie's retraction exercises. Mulligan's mobilization was selected as a main treatment intervention for both loading and movement groups on the basis of principles of Mulligan's concept. Patients of movement disorders show pain on active or repeated movements5. According to Mulligan, pain and movement impairments result from minor positional faults of joints or mechanical block from inert structure with in the joint or due to reflex splinting of muscles, which prevents further damage & reduces nociceptive discharge from joint by holding it in mid range. Mulligan techniques by 'improved joint tracking' sedates agitated nervous system, particularly the dorsal horn by bombarding it with painless normality it has always been patterned to receive18. Normal affront discharge provokes a reciprocal normal efferent discharge to the structure controlling joint movement thereby overcoming symptoms generated by neuromuscular imbalance. Therefore Mulligan techniques by gently repositioning the joint into its correct alignment, normalizes its proprioceptive discharge, hence quieten the CNS thereby leading the pain to disappear spontaneously19. It also releases inhibition or hyper tonicity of relevant musculature thereby increasing its strength. Therefore, manual repositioning of joint is considered as a good clinical approach for movement impairments, and the process is called 'mobilization induced analgesia'22.

Patients with loading disorders complain of pain on weight bearing (WB); and on performing some functional activity for prolonged time period. When pain arises on WB, Mulligan has advocated that mobilization in WB should be performed because when improvements take place in functional positions (Weight bearing positions); they are most likely to be retained21-25. He also advocated that while conventional mobilizations can results in immediate improvements in function with patient is in lying position, it is often lost when they resume a weight bearing position. So in order to advocate the mobilizations specifically in weight bearing for better and prolonged retention of effects, Mulligan techniques were selected for loading disorder group. Also, as a result of sustained loading lower cervical spine goes into flexion and there is loss of normal lordotic curvature of cervical spine .Applying Extension Snags to patient with loading disorders may help in providing proprioceptive input for unfamiliar movement pattern which is actually lost lower cervical spinal extension, enhancing corrected movement patterns and achieving normal cervical lordosis. Thus extension Snags in loading disorders can be used to facilitate functional movement patterns. .Similar concept has been advocated by Mulligan (2002) in a patient presenting with loss of lower lumbar spine segmental lordosis and excessive upper lumbar spine extension19. He demonstrated that a SNAG can be applied to stiff lumber joints while patient performing localized anterior tilt with the upper lumbar spine fixed in some degree of flexion30. This may help in providing proprioceptive input for this unfamiliar movement pattern and in achieving corrected movement pattern.

Classification provides a means of breaking down a larger entity into more homogeneous subgroups of patients; guide determination of patient's prognosis and selection of most appropriate intervention strategy10. First step in the development of the classification system is to direct patients towards the optimal treatment10. Also, it has been demonstrated that classified groups showed better outcomes when interventions matched to the classifications are received rather than unmatched interventions10. This guides towards the standardization of treatment regimes. Hence our study supports use of standardized treatment regimen along with set protocol and emphasizes on standardized type, frequency, and duration of treatment for the classified disorders of

mechanical neck pain. The advantage of present system of classification is that it is based on key elements of the patient's examination that would be routinely conducted. The small number of elements and limited choice within each element tend to strengthen inter-therapist agreement. It is worth mentioning here that the inter-therapist reliability of the classification system was found to be very high in Clair's study5.Patient classification according to symptom responses during functional activities and clinical movement testing enhances the relevance to clinical practice, and these factors are central to selecting appropriate treatments methods and in monitoring treatment response. In summary, we found that this classification carries prognostic significance loading group showing better prognosis than movement group in response to both standardized and individualized treatment strategies.

Limitations of the study include use of preliminary classification system with some inherent shortcomings. The classification itself was not found to be very mutually exclusive as patient may fall into one group regarding their history and another group regarding their examination. For the purpose of accuracy, patient's presentation at the time of examination was taken in present study. Another limitation of study was that for long term effect, follow up was taken only after 3 weeks of completion of treatments (6 weeks from baseline) due to time constraints. Also, study was conducted on a sample size of 30 patients which is actually very small to generalize the results of a new classification system.

Clinical relevance depicts that accepting the patient classification system of mechanical neck pain into loading and movement disorders has helped in optimizing minimum number of manual therapy treatment sessions, evaluating its response and checking prognosis of both loading and movement groups. Our work emphasizes on importance of use of Clair's classification for mechanical neck pain and helps in sorting out various other terminologies used for classifying the same. This relatively simple method of classification of patients with neck pain carries some prognostic significance and appears to be a useful indicator of treatment dosing required to achieve a significant improvement. Moreover, this classification system promotes standardization of treatment regimens and dosing of treatment sessions thereby making treatment cost and time efficacious.

Future research examining the validity of this classification system would be of interest. Further research is needed to co-relate this new classification system with other existing classification systems and comparing them in terms of prognostic and therapeutic significance. Future research should emphasize on incorporating other treatment strategies for mechanical neck pain on same classification and finding out their dosimetry. Future research incorporating control groups for both the disorders and longer follow ups will make the study more treatment efficacious an prognostically significant respectively. .

Conclusion

At least clinically, loading group required fewer treatment sessions as compared with movement disorder group in response to a standardized treatment regime. Hence, it is concluded that this relatively simple method of classification of patients with neck pain carries prognostic significance and appears to be a useful indicator of treatment dosing required to achieve a significant response to specifically standardized physical therapy treatment. Moreover, the study demonstrated that both loading and movement groups have the tendency to improve to similar extent in outcome related to pain but on long-term basis, movement disorder group tends to gain better recovery in terms of functional disability. In addition, patients with movement disorder show relatively better immediate effects as compared to loading group.

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Comparative Study of the Effectiveness of Wound Healing by Constant Galvanic Current Stimulation and by Normal Surgical Dressing Process

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Abstract

Purpose

The purpose of the study is to compare the effect of constant Galvanic current stimulation and normal surgical dressing process in wound healing.

Inclusion Criteria

Both sex i.e. male and females, participated in the study. Patients having traumatic wounds, surgical wounds, non healing diabetic wounds, pressure sores, ischemic ulcers and who were above the age of ten years were included in the study. Patients whose minimum wound size was five centimeters square, maximum wound size was twenty centimeters square, maximum depth was three centimeters & those patients who were assessed and examined pre treatment and for fifteen days during the treatment, gave their written consent were also included in the study.

Key Words

Wound healing, galvanic current stimulation, bioelectric system.

Methods

Two groups were made; keeping twenty patients in each group Group 1 patients were given constant galvanic current stimulation + surgical dressing with calandulla antibiotic homeopathic cream, Group 2 patients were only given surgical dressing with calandulla homeopathic cream. Length, bredth and depth were the dependent variables.

Results

The results on all the three readings i.e. on day five, day ten and day fifteen showed that constant Galvanic current stimulation + Surgical Dressing is significantly better than only surgical Dressing process.

Conclusion

Constant Galvanic current stimulation is much effective in wound healing than normal surgical dressing process.

Introduction

Wound Healing is the replacement of the lost tissues either by the cells and tissues of the same kind or more often by cells of & tissues of a different and simpler kind. The wounds which are difficult to heal by medical and surgical methods are referred to physiotherapy for further management. The effect of ultra violet rays, Ultra sound, infra red and zinc ionization on wound healing are well known facts.

In recent years it is found that the use of high voltage pulsed monophasic current (H.V.P.C.), Low intensity direct current and constant Galvanic current stimulation in the healing of wounds is equally beneficial and has already been accepted by the medical community. Constant Galvanic current stimulation causes acceleration in the growth of granulation tissues & also causes bacteriocidal effects[5,8,10].

Changes taking place during wound healing:

1. Formation of clot and crust.

The destruction of tissues by injury of any kind inevitably involves blood vessels and lymphatics in the the affected area. The gap is filled up in the first instant by clotted blood and clotted lymph including the tissue fluid. The clot thus formed holds together, the sides of wound. If it reaches to the surface, it dries to form a crust.

2. Removal of debris

The wounds contains degenerating and dead tissues (slough) neutrophils and especially macrophages gather on the margins of slough and also invade the clot. Enzymes from dead tissue cells and also from neutrophils and macrophases softens the clot ans slough. Macrophages phygocytose the red cells. With the formation of Heamosiderin and haemosidine in their cytoplasm, they also phagocytose fibrin and cellular debris. Small slough can be removed by enzymatic liquification and phagocytosis. To fasten the repair, large slough can be removed by surgical debridement.

3. Formation of Granulation tissues which includes:

A. Vascularisation

The endothelium of neighbouring pre – existent blood vessels migerate forward. At the same time endothelial cells are divided by mitosis proximally. In this manner solid vascular sproutings invade the clot from all sides within a few hours. The solid buds develop a lamina and the blood flows through them. At this stage anastomosing capillaries forms a series of arches, which are adaptable to the metabolic needs of the tissues under repair. The arches can be straight or obliterated and the source can be converted into arterioles or veins. The newly

Sex Ratio

Male - 34 Female - 06				
Total	Male		Female	
	Patients treated with Galvanic current + Surgical Dressing	Patients treated with Surgical Dressing	Patients treated with Galvanic current + Surgical Dressing	Patients treated with Surgical Dressing
40	20	14	00	06

formed arterioles even receive vasomotor nerve supply. Accompanying blood capillaries are the newly formed lymphatics, which arise from the preserved lymphatics at the margins of wound[2,3].

B. Proliferation of fibroblasts

Fibroblasts proliferates simultaneously with endothelial cells and in close contact with them, further they invade the clot.

The intercellular spaces are full of proteinous fluid which becomes gelutinous and shows increased quantity of acid mucopoly – saccharides.The intracellular fibers are laid down in the wound fluid (ground substance or matrix).Initially they are fine, later they become coarse, thick and stain by routine connective tissue stains (collagen fibers). These fibers are remodeled to suite local mechanical stress. The end result is the formation of a tough membrane of laminated collagen Thus the clot is gradually replaced by newly formed capillaries and fibroblasts. This new tissue is known as granulation tissue.

As more and more collagen fibers are laid down, the granulation tissue becomes less and less cellular & less and less vascular. The capillaries which are unnecessary, looses their potency and are turned into lumanless solid columns. This conversion of granulation tissue into fibrous scar is termed as Cicatrisation.

4. Epithelialization

As soon as blood of granulation tissue is ready, the epithelial cells from the margins of the wound flatten, elongate and begin to migrate across it as a continous sheet of cells. It lasts till the gap is completely covered and the normal architecture of the covering is reestablished. The nature of stimulus of migration and proliferation is not known. It becomes stratified and keratinized later on.

5. Tensile strength of the wounds

Tensile strength of the wound depends on the amount of collagen present in it. On an average, the collagen content in a wound reaches its maximum in 80 days. The tensile strength of the wound continues to increase with time which is believed to be due to cross linkage between the collagen fibers[2,3].

Factors enhancing wound healing

Young age, good nutrition rich in vitamin A,B,C,D & K, fluid and electrolyte balance, optimal temperature, ultra violet rays exposure, rich blood supply in the wound area, infection free wounds with no foreign bodies enhances wound healing[6,7].

Bar diagram showing mean improvement (%)

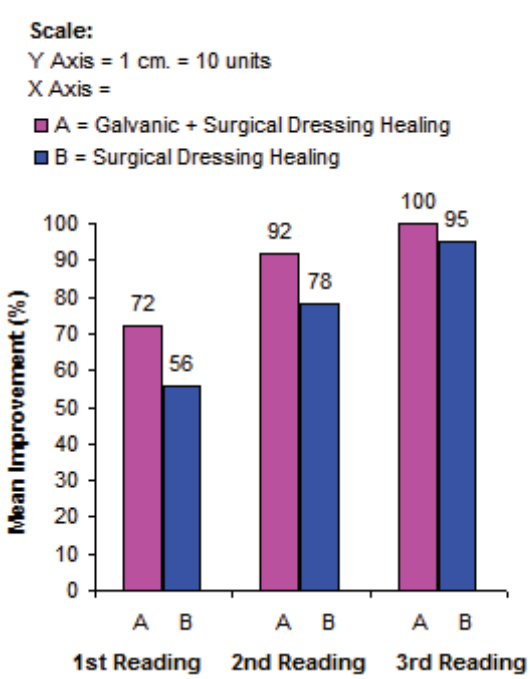

Photo 1: Photo showing the wound on first reading i.e. start of Treatment

Photo 2: Photo showing the wound on second reading

Photo 3: Photo showing the wound on third reading

Photo 4: Photo showing equipments and materials used

Bioelectric system

The body has its own Bioelectric system. This system influences wound healing by attracting the cells of repair, changing cell membrane permeability, enhancing cellular secretions through cell membrane & originating cells structures. A current termed the current of injury is generated between the skin and inner tissues, when there is a break in the skin. The current will continue until the skin defect is repaired, healing of the injured tissues is arrested, if these currents no longer flow while the wound is open. A moist wound environment is required for the bioelectric system to function. A rationale for applying galvanic stimulation is that it mimics the natural current of injury & will jump start or accelerate the wound healing process. Galvanic current stimulation enhances the wound healing by stimulating the growth of granulation tissues, by increasing the blood circulation, by producing bacteriocidal effects by the bioelectric system[3,5,7].

Transmission of current in the wound:

Galvanic current is passed to the body by means of saline soaked Wet pads. At the junction of metal electrodes with the electrolyte of pad (saline), chemical changes will occure.These are known as changes of electrolysis. At positive electrode (anode) acid will be formed & at negative electrode (cathode) bases will be formed. Although these reactions occurs at the junctions where metal electrodes touches the saline but their effects spreads to the skin. The area of contact with the epidermis determines the total resistance. Larger the cross sectional area, the smaller is the resistance. The value of this resistance will determine the current for any given voltage.Therefore what matters from a therapeutic point of view is the current/unit area (i.e. current density) [5,9,11].

Physiological effects and Therapeutics uses of Galvanic current

Acceleration in wound healing, stimulation of sensory and motor nerves, hyperemia, iontophorosis, local anesthesia, relief in idiopathic hyperhidrosis, relief in neurogenic pains and bacteriocidal effects are some of the physiological effects and therapeutics uses of galvanic current[1,4].

Which wounds heals faster by Galvanic current

- Traumatic wounds.
- Surgical wounds.
- Non healing & Diabetic wounds.
- Pressure sores.
- Ischemic ulcers.

Material and Methods

Age wise distribution of patients in tabular form

Age in years	Total No. of Patients	Patients treated with Galvanic current + Surgical Dressing	Patients treated with Surgical Dressing
10 - 20	04	02	02
20 - 30	24	10	14
30 - 40	04	02	02
40 - 50	02	00	02
50 - 60	02	02	00
60 - 70	04	04	00
Total	40	20	20

Over a period of 1 year, forty (40) patients were observed for wound healing. Two groups were made.

Group 1 - Galvanic stimulation + Surgical Dressing Group 20 Patients.

Group 2 – Surgical Dressing Group 20 Patients

Prior to the treatment, the gauze pieces, cotton balls, laboratory wears, artery forceps, lint, tracing papers were all sterilized. Spirit was used to clean the electrodes.The cleaning of the wound and the nearby area was done under all aseptic conditions using savlone, hydrogen per oxide solutions.

The tracings of the wound were taken with the help of tracing papers every fifth day. The area, depth, margins of the wound, granulation tissue and slough were all recorded. Saline, two plate electrodes, pads, ropes/ bandages to tie the electrodes were also taken.

Technique for patients treated with galvanic current and surgical dressings.

The dressings were opened. The area all around the wound was cleaned with savlone and hydrogen per oxide solutions. A cotton soaked in saline is placed over the wound. Now the pad containing the active electrode is placed over this cotton soaked in saline and tied with a rope or bandage in order to get a perfect contact with the skin all around. The indifferent electrode is applied at some convenient area in order to complete the circuit. Galvanic current is passed for half an hour once a day, twenty minutes with positive polarity and ten minutes

with negative polarity in order to achieve a bacteriocidal effect.

Intensity of the current was such that it may not produce a muscle contraction. For each patient different intensity was used ranging from ten to thirty amperes depending on his / her tolerance. Minimum wound size was five centimeters square, maximum wound size was twenty centimeters square and maximum wound depth was three centimeters.

After the treatment is over, the pad is removed and the wound is examined. Finally a dressing of dry sterile gauze with calendulla antibiotic homeopathic cream is done. The position of the indifferent electrode is changed everyday to avoid any skin irritation .Three readings were taken i.e. on day five, day ten, and day fifteen.

Technique for patients treated with only surgical dressings

The observation group of patients were evaluated on the first day. Their readings were taken and an alternate day dressing were done with calendulla antiseptic homeopathic cream. Three readings were taken i.e. on day five, day ten and day fifteen. All aseptic measures were taken during the dressing.

Discussion

The results on all the three readings i.e. on day five, day ten and day fifteen showed that constant Galvanic current stimulation + Surgical Dressing is significantly better than only surgical Dressing healing process.

Conclusion

Constant Galvanic current stimulation is much effective in wound healing than normal surgical dressing process.

Interests of conflicts

I hereby declare that there are no interests of conflicts.

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Effects of Certain Domestic Activities on Low Back Pain During Pregnancy

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Abstract

Objective

The effects of certain categories of domestics activities on low back pain (LBP) experienced during pregnancy were investigated.

Methods

Semi-structured questionnaire were used to collect socio-demographic data and experience of LBP from all the respondents.

Results

For category of activities carried out on standing, pressing of clothes was responsible for LBP among 37% of the respondents and also exacerbated LBP (15%). While on sitting on low stool without back rest, washing of clothes or plates was responsible for LBP among 52% of the respondents and also exacerbated LBP among 23% of the respondents. For category activities carried out on sitting on a low stool with back rest, washing of clothes or plates was responsible for 22% of LBP. Whereas 55% of the respondents had LBP after engaged in sweeping of floor.

Conclusion

In conclusion, domestic activities carried out by pregnant women could be responsible for low back pain or exacerbating normal LBP in pregnancy.

Key Words

Low back pain, pregnancy, domestic activities.

Introduction

Low back pain is a common experience during pregnancy[1-7]. This experience has been regarded by Obstetrician as part of normal experience during pregnancy1. The aetiology of low back pain in pregnancy is of many factors, however in most cases is related to the biomechanical and physiological changes experience during pregnancy[8].

The largest occupational risk factors that have been associated with high frequency of low back pain and pelvic pain in pregnancy have been identified as activities having to do with twisting and bending for several hours[4,9]. Pregnant women employed as hospital orderlies launderers and nurses had more sick leave days than other hospital employees. The risk factors identified for long term sick leave were much of walking or standing, long working days, high work level, little practical support from supervisors and colleagues, low job controls, much lifting and night or shift work10. Apart from the scheduled of activities at places of work, pregnant women of African background have also been observed to involve in certain domestic activities. These domestic activities could be carried out while on sitting, standing or bending posture in any part of residential apartment such as kitchen, toilet, bathroom and sleeping room. Precisely, there is dearth of reported studies on the effects which these activities have on experience of low back pain during pregnancy. Hence, this study was designed to elucidate the effects of these activities on low back pain during pregnancy.

Methods

Semi-structured questionnaire was used to obtain all the relevant information for this study. The questionnaire administered was expected to be dully completed. Sixty volunteered pregnant women who were attending antenatal clinic in Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, participated in the study. This is the only federal teaching hospital serving the Osun state in Nigeria. Inclusion criteria taken into consideration were: each participant must give her consent, less than forty year old to rule out osteoarthritis changes11 of the spines and must have involved in domestic activity for a period not less than 30 minutes. Verbal consent was given by all the participants. All response given was treated with strict confidentiality. The questionnaire is divided into three parts. The first part requested for socio-demographic information including age, ethnicity, education level and occupation. The second part dealt with gestation period and experience of low back. The third part requested for specific effects which domestic activities have on low back pain during pregnancy. The effects could either be that it was responsible for experience of LBP or worsened the normal LBP during pregnancy. These activities were categorized into four namely, those which were carried out while on standing, sitting on a low stool without back rest, sitting on a chair with back rest and on standing with the back flexed. It was assumed that each of the respondents gave a true account of the information requested. The participants who could not read and write in English were assisted with translation by the therapists.

Results

The socio-demographic data of the respondents is presented in Table 1. The oldest age group was those respondents between 21-25 years, which accounted for 40% of the total respondents. Highest percentage indicated that their highest education level was secondary school level (55%). Majority of the respondents engaged in trading activities as their means of livelihood (53.3%). Majority of the respondents are multiparae (55%). Two of the respondents did not indicate their age, education level and occupation. Four of the respondents did not also indicate their parity.

Table II highlights the gestation in months for all the respondents. Twenty per cent had been pregnant between 5-6 months and 43% had been pregnant between 7-8 months. Table III accounts for effects of certain domestic activities carried out by the respondents at home for more than 30 minutes. These activities were carried out on standing, sitting on a low stool without back rest, or on a chair with back rest or while the back was flexed. Out of the category of activities indicated to have been carried out by the respondents on standing and responsible for experience of LBP, pressing of clothes was responsible for 37% of LBP. This was closely followed by respondents that engaged in mopping of the floor (32%). Moreover, the two activities also worsened normal LBP experienced from physiological and biomechanical changes during pregnancy for 30% of the respondents. However, 17% of the respondents did not experienced further aggravation of the LBP after engaged in pounding of yam. This is a usual activity during preparation of local staple food called pounded yam. This involves manual grinding of boiled yam inside a mortal with pestle (see Table III: 1).

For activities carried out on sitting on a low stool without back rest (Table III: 2), washing of plates had the highest effect of precipitating LBP for the respondents (52%). Kitchen activities involving making of local staple food such as 'Amala', 'Eba' or 'vegetables soups' which involved sitting for more than 30 minutes were indicated as responsible for LBP among the respondents (32%). Furthermore, among the activities in this category, which exacerbated normal LBP during pregnancy, washing of plates contributed mostly (23%).Others activities which have similar effect include making of domestic food (17%), laying of bed (13%) and nursing children (12%). However, in this category, washing of plates did not affect normal LBP of 17% of the respondents. And 15% of the respondents who engaged in making of domestic staple foods did not experience worsening of their normal LBP in pregnancy.

The effects of category of activities which were carried out when the respondents was sitting on chair with back rest is presented in table III: 3. The activities include eating or drinking, washing clothes or plates, pressing of clothes, laying of bed, nursing of children. In this category washing of plates or clothes was responsible for fresh experience of LBP among 22% of the respondents. Besides, both washing of clothes or plates and pressing of clothes exacerbated normal LBP of 16% of the respondents.

The last category of activities was carried out with the respondents' back held in flexion while on standing. These include sweeping of floor, lifting of bucket water or food items and drawing of water from well. Sweeping of floor was responsible for fresh experience of LBP among 55% of the respondents. Moreover, 53% of the respondents gave fresh experience of LBP after engaged in drawing of water from well (see Table III: 4).

Table 1: Socio-demographic data

Socio-demographic	Percentage(%)	Number(n)
(i) Age(years)		
12-15	1.7	1
16-20	5.0	3
21-25	40.0	24
31-35	30.0	18
36-40	20.0	12
Unspecified	3.3	2
(ii) Educational level		
12-15	1.7	1
16-20	5.0	3
21-25	40.0	24
31-35	30.0	18
36-40	20.0	12
Unspecified	3.3	2
(iii) Occupation		
Civil servant	10	6
Health worker	1.7	1
Farming	3.3	2
Trading	53.4	32
Fashion designing	15.0	9
House wife	3.3	2
Unemployed	1.7	1
Others	8.3	5
Unspecified	3.3	2
(iv) Parities		
0	45	27
1	13.3	8
2	28.3	17
3	5.0	3
4	1.7	1
Unspecified	6.7	4

Table II: Gestation

Months	Respondents	Percentage
1-2	3	5.0
3-4	4	6.7
5-6	12	20.0
7-8	26	43.3
9	12	20.0
10 and above	1	1.7

Discussion

Daily activities which were carried out by pregnant women without conscious care for back in good posture could precipitate LBP[4]. Certain activities involving twisting and bending of back when pregnant women were engaged in there place of work had been identified as one of the causes of LBP during pregnancy[10]. The same postural abnormalities were identified in this present study as

Table III: Effects of domestic activities carried out for more than 30 minutes.

Categories of domestic activities out on:	Caused fresh experience of LBP in pregnancy		Exacerbated normal LBP in pregnancy		Did not affect normal LBP in pregnancy	
(1) Standing	**Respondents**	**%**	**Respondents**	**%**	**Respondents**	**%**
a) Pressing of clothes b) Pounding yam c) Mopping of floor d) Washing clothes / plates e) Carrying load on head	22 17 21 19 18	37 28 35 32 30	9 5 9 8 12	15 8 15 13 20	9 10 8 5 7	15 17 13 8 12
(2) Sitting on Low stool without back rest						
a) Washing clothes / plates b) Making domestic staple food e.g 'Amala', 'Eba' or 'Vegetables soups' c) Laying the bed d) Carrying/nursing for the children	31 19 12 8	52 32 20 13	14 10 8 7	23 17 13 12	10 9 6 7	17 15 10 12
(3) Sitting on a chair with back rest						
a) Eating / Drinking b) Washing clothes / plates (c) Pressing of clothes (d) Laying the Bed (e) Nursing children	7 13 10 7 4	12 22 17 12 7	3 5 5 4 4	5 8 8 7 7	19 13 12 12 11	32 22 20 20 18
(4) Bending down from standing						
a) Sweeping the floor b) lifting bucket of water and food (c) Drawing water from the well	33 27 32	55 45 53	17 15 15	28 25 25	10 13 8	17 22 13

predisposing factors among the respondents who gave experience of LBP. Examples of such activities identified were the category of domestic activities whose nature demand on the back to be held in flexion namely, sweeping of floor drawing of water from well and washing of plates in the kitchen. These activities were carried out without preservation of normal anatomic thoracic kyposis and lumbar lordosis.

Precisely, it was assumed that none of the respondent suffered from osteoarthritis changes of the lumbosacral spines since all the respondents were below forty years[11]. Besides the stress incurred from abnormal posture which was unavoidable from many of the categories of domestics activities identified in this study, pregnancy itself taxes the musculoskeletal system. The enlarging gravid uterus also alters the maternal body's center of gravity. Moreover, it mechanically stresses the axial and pelvis system, and further compounds the stress that the hormone level fluctuation and fluid retention exert[12-13]. This would explain why the activities carried out with evidence of poor back support and posture were indicated as worsening factors for LBP experience normally from preganacy[1,8]. Such activities identified in the study were those carried out when the respondents sat on low stool without back-rest namely, washing of clothes or plates and during making of local staple foods.

The physiological changes are normally experience during pregnancy. These include changes in serum relaxin hormone. This hormone causes softening of tendons and ligament, which give strong anatomical support to the spine and pelvis. The effect of relaxin hormone has been cited as contributory factor for low back pain in pregnancy especially as this is advancing toward the end of third trimester[12]. Incidentally, about 64% of the respondents were on their third trimester (Table III) and the relaxin hormone might have been on its peak level under normal condition. The additional stress placed on the low back might have been from additional discomfort incurred after engaged in any of the category of domestic activities identified, especially those which exacerbated normal low back pain during pregnancy in the study. Activities which sustained back continually in flexion for more than 30 minutes such as drawing of water from well and sweeping of floor could impose additional stress on back. The paravertebral muscles spasm is unavoidable in such condition[14].

It is therefore very important that education on conscious protection of back from stress and bad posture is emphasized in antenatal clinic by the physiotherapists. Pregnant women should be advised to avoid domestic activities which could be responsible for LBP or exacerbate normal LBP from advancing foetus[15] and effect of relaxin hormone[13]. Those activities include drawing of water from well, sweeping of floor with short broom and sitting on low stool without adequate back rest during preparation of local foods in the kitchen.

In conclusion, domestic activities which do not protect back from external stress during pregnancy could either cause low back pain or worsening normal LBP from biomechanical and physiological changes during pregnancy. The activities identified were those carried out with back held in flexion, sitting on a low stool without back rest or continuous standing for more than 30 minutes.

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Effectiveness of Multiple Plane Relaxed Passive Movements given along with Conventional Physiotherapy in Cervical Spondylosis

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Abstract

Cervical Spondylosis refers to common age related changes in the area of spine at the back of the neck. With age the vertebrae gradually form bone spurs, and there shock absorbing disks slowly shrink. These changes can alter the alignment and stability of the spine. The gradual prognosis of cervical spondylosis cannot be stopped: however it doesn't always cause symptoms. For individuals who experience problems, conservative treatment is very effective in managing the symptoms. The main aim of this study is to prove the difference of effectiveness of multiple plane relaxed passive movements given along with conventional physiotherapy versus conventional physiotherapy alone.

There were two groups of subjects. Pre test values of pain and neck disability were measured on NVAS (Numerical Visual Analog Scale) and NDI (Neck Disability Index) on the first day of the treatment. Both the groups received treatment for minimum 5 days/ week, having each treatment session of 30 minutes per day. Total therapy was given for 2 weeks. After 2 weeks post treatment measurements were again taken for quantitative analysis.

Major Findings

There is significant difference between the values of Group-A, Group-B (t-value 0.812, $p<0.05$) for Numerical Visual Analog Scale, and (t-value 2.618, $p>0.05$) for Neck Disability Index.

Key Words

Cervical Spondylosis, Multiple Plane Relaxed Passive Movements, NDI, VAS, Conventional Physiotherapy.

Introduction

Spondylosis is a degenerative disorder that may cause loss of normal spinal structure and function. Although aging is the primary cause, the location and the rate of degeneration is individual. The degenerative process of spondylosis may impact the cervical, and/or thoracic or lumbar regions of the spine affecting the intervertebral disc and facet joints. (John J Regan, 1998).

It often affects the following spinal elements- intervertebral discs- as people age certain biochemical changes occur affecting throughout the body. In the spine, the structure of the intervertebral discs (annulus fibrosis, lamelle, nucleus pulposis) may be compromised. The degenerative effects from aging may weaken the structure of the annulus fibrosis causing the 'tire thread' to wear or tear. The water content of the nucleus decreases with age affecting its ability to rebound following compression (e.g. shock absorbing quality). The structural alteration from degeneration may decrease disc height and increase the risk for disc herniation.

Facet joints or the Zygapophyseal joints are coated with a specific tissue- cartilage. Facet joint degeneration may cause loss of cartilage and formation of osteophytes (bone spurs). These changes may cause hypertrophy or osteoarthritis also known as degenerative joint disease.

Osteophytes may form adjacent to the end plates, which may compromise blood supply to the vertebra. Further the end plates may stiffen due to sclerosis; a thickening/ hardening of the bone under the end plates.

Ligaments are bands of fibrous tissue connecting spinal structures and protect against the extremes of motion. However degeneration may cause ligaments to lose some of their strength. The ligamentum flavum may thicken and/or buckle posteriorly (behind) toward the dura mater (a spinal cord membrane).

Symptoms of cervical spondylosis may appear in those as young as 30 years and are most commonly in those aged 40-60 years. When cervical spondylosis develops in a young individual, it is almost always secondary to a predisposing abnormality in one of the joints between the cervical vertebras probably as the result of previous mild trauma.

Both sexes are equally affected. Cervical spondylosis usually starts earlier in women than in men. The risk factor for neck pain was higher in women because of smaller stature and lower strengths of shoulders. No apparent correlation between race and cervical spondylosis exists. (V. Bregqvist, 1995).

The common sites of involvement are Cervical-C4-C6, Lumbar-L2-L4, Thoracic-T4-5-6. The complexity of the cervical anatomy and its wide range of motion make this spinal segment susceptible to disorders associated with degenerative changes. The degenerative changes which occur in cervical spine occurs in three different regions. It can include- upper cervical region, middle cervical region, lower cervical region. (Ann Thomson, 2001).

1.2. Objective of Study

To compare the effectiveness of multiple plane relaxed passive movements given along with conventional physiotherapy versus conventional physiotherapy treatment in reducing pain and neck disability in cervical spondylosis patients.

1.3. Hypothesis

Alternate Hypothesis: There is a significant difference between the effects of multiple plane relaxed passive movements given along with conventional physiotherapy versus conventional physiotherapy treatment in reducing pain and neck disability in cervical spondylosis patients.

Null Hypothesis: There is no significant difference between the effects of multiple plane relaxed passive movements given along with conventional physiotherapy versus conventional physiotherapy treatment in reducing pain and neck disability in cervical spondylosis patients.

Material and Methods

Study Design and Methodology

3.1. Study Design: Quasi Experimental design, comparative in nature.

3.2. Study Setting: Department of Physiotherapy, Christian Medical College and Hospital, Ludhiana, Punjab.

3.3. Population and Sampling

Population of Study: Patients diagnosed of cervical spondylosis.

Sampling Method: Randomized Sampling.

Gender: Out of 30 subjects, 5 were males and 25 were females.

Sample Size: Total 30 patients participated in the study which were randomly divided in to two groups Group-A and B.

3.4. Sampling Criteria

3.4.1. Inclusion Criteria

-Having the age group of above 40 years.
-Subjects of both genders.
-Idiopathic cause.

3.4.2. Exclusion Criteria

- History of trauma.
- Any infectious disease of spine.
- Any inflammatory disease of spine.
- Any congenital deformity of spine.
- Any surgery performed on cervical spine.
- Vertebro basilar insufficiency.
- Uncontrolled hypertension.

3.5. Variables

Independent Variables

-Multiple plane relaxed passive movements along with conventional physiotherapy.
-Conventional physiotherapy

Dependent Variables:

-Neck Disability
-Pain

Table 1: Values of mean and standard deviation of groups A&B

Groups	Mean	Standard Deviation
A (NVAS)	2.96	0.93
B (NVAS)	2.95	1.50
A (NDI)	4.65	2.06
B (NDI)	7.71	3.91

3.6. Instrumentation and Tool for Data Collection

Assessment Tools

1. Neck Disability Index (NDI)

Is a questionnaire, which is modified from Vernon, H and S Mior- The Neck Disability Index. It is divided into ten sections, which are further divided in six boxes each. Scores are categorized from no disability to complete disability.

2. Numerical Visual Analog Scale- is designed to present to the respondent a rating scale with minimum constraints. It is a subjective scale used for analyzing extent of pain in a numerical way.

INSTRUMENT

Plinth, Stool, Towels.

3.7. Technique of Data Collection

Procedure- The informed consent was taken from all the subjects. Then the subjects were divided randomly in to two groups- Group – A and Group – B. Group – A was considered as the experimental group and Group – B was considered as the control group.

All the subjects were assessed for parameters of pain and neck disability. Both the groups received treatment for minimum 5 days/week, having each treatment session of 30 minutes per day. Total treatment was given for 2 weeks. After 2 post treatment measurements were taken for quantitative analysis.

3.8. Technique of Data Analysis and Interpretation

Data collected were analyzed using Paired 't' test and unpaired 't' test to measure the changes between the pre and post test values within and between the groups.

(a) Paired 't' test

(b) unpaired 't' test

Data Interpretation

From all the information which has been gathered from observation and data analysis, it has been seen that there is a significant difference in the mean values of NDI, while no such difference can be seen in the mean values of NVAS.

Discussion

The present study done on the effectiveness of multiple plane relaxed passive movements given along with conventional treatment versus conventional physiotherapy alone in patients with cervical spondylosis has shown the results that there is improvement in reduction of neck disability and pain in both the groups, but the difference is significant in reducing neck disability only not the pain.

Table 2: Comparison of values of Standard Error, Mean, 't' and P values between groups A/B.

Parameters	S.E. Mean	't' Value	P Value	Level of Significance
A/B (NVAS)	0.474	0.812	<0.05	Significant
A/B (NDI)	1.168	2.618	>0.05	Non – Significant

Figure 1: Comparison of mean values of NDI between Group A versus B.

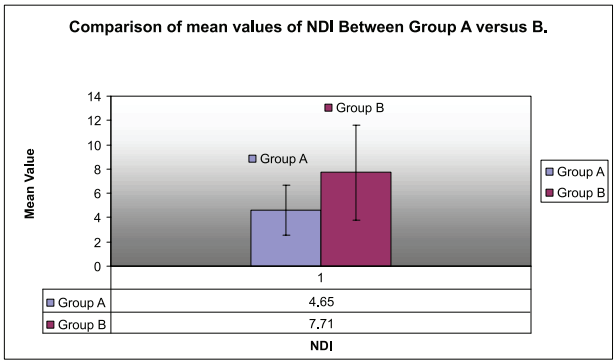
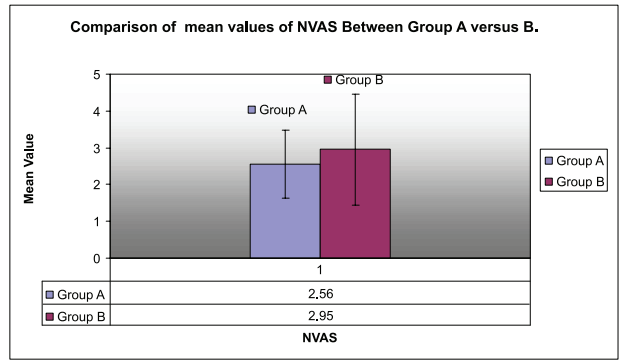


Figure 2: Comparison of mean values of NVAS between Group A versus B.



5.1 Limitations

-Very small sample size.

-Subjects were allowed to fill Numerical Visual Analog Scale and Neck Disability Index, which is very subjective in nature.

-The subjects were allowed to use any Orthosis (collar) and were not limited to the use of any single.

-Previous treatment undertaken medical or physiotherapy was not being considered.

-Other activities in family, work place and therapy schedule were not controlled.

5.2 Recommendations

Based on the outcome of the statistical analysis, it is suggested that the future studies can be modified to accommodate the following changes

-To use same form of treatment for other age groups.

-Other forms of scales can be used for assessment.

-EMG can be used for assessment.

-Possible neural mechanism can be studied after multiple plane relaxed passive movements.

Summary and Conclusion

On the basis of data analyzed, discussion and interpretation, the findings of this study can be concluded as follows.

Both the relaxed passive movements given along with conventional physiotherapy and the conventional physiotherapy alone are equally effective in reducing neck disability and pain in cervical spondylosis. But the results are more significant for reducing neck disability than reducing pain by giving relaxed passive movements given along with conventional physiotherapy than conventional physiotherapy alone.

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Effect of Therapeutic Non-Thermal Ultrasound on Post-Partum Symptomatic Breast Engorgement

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Abstract

Background and Objective

To study the effect of therapeutic non thermal ultrasound in post partum breast engorgement.

Methods

Forty postpartum women with breast engorgement were included for the study after obtaining consent, which were referred from the OBG department of S.D.M. Medical Hospital, Dharwad., Karnataka. They were randomly assigned to experimental and control group constituting of twenty subjects respectively. All the subjects in both the groups underwent evaluation for engorgement. It included assessment of Visual Analog Scale (VAS) for pain and Six Point Engorgement Scale (SPES) for engorgement. Both the groups underwent treatment for engorgement which consisted of massage, manual expression of milk and advice on appropriate latching technique for period of two days successively. The experimental group was additionally intervened with therapeutic non thermal ultrasound.

Results

Statistical analysis was done day wise within both the groups and between the groups.
The results indicated that there was significant relief in VAS and SPES scores with in the groups showing that the intervention done was beneficial. The analysis of baseline data of day 1 and follow up data of day 3 between the two groups indicates that experimental group showed statistically significant relief in symptoms

Interpretation and Conclusio

We conclude from our study that the use of therapeutic non thermal ultrasound for two sittings in two successive days in the treatment of symptomatic post partum breast engorgement accelerates relief of symptoms as compared to other interventions like massage, expression of milk and appropriate feeding technique.

Key Words

Breast engorgement, Six point engorgement scale, Ultrasound

Introduction

For the vast majority of women breast feeding is not an instinctive activity, but rather an art which mother and baby have to learn together. For those who succeed, it can be an experience of closeness and nurturing which will remain with the woman for the rest of her life – it is the logical continuation of conception, pregnancy and birth[2].
Therefore, breastfeeding and weaning have to be learned, which makes them more vulnerable to difficulties during the process of breastfeeding[1].
Breast engorgement is defined as "The swelling and distention of breasts, usually in the early days of initiation of lactation, due to vascular dilation as well as the arrival of the early milk"[1]. Breast engorgement occurs in 72%[2] to 85%3 of women. Commonly, engorgement occurs within 3-6 days after delivery, but it can occur anytime during lactation when milk is not transferred from the breast[4].
It is important to distinguish between physiological and pathological engorgement. The former is discrete and is a positive sign that milk is 'coming in'. It requires no intervention. In pathological engorgement, there is excessive tissue distension, causing great discomfort, sometimes accompanied by fever and malaise[7].
It is also characterized by pain, swelling, heat, hardness of breast tissue, breast skin tightness, flatness and discomfort. The infant may have difficulty latching to an engorged breast due to the hardness of the tissue, which can decrease the amount of milk transferred from mother to baby. The inability of the infant to transfer milk can exacerbate the engorgement[5]. Breast engorgement is a painful problem that can lead to pre-mature weaning[6].
Subjective and objective scales are used to assess breast engorgement. Visual Analog Scale is used for assessing pain 8 and Six point Engorgement Scale is used to score the level of engorgement[2].
An appropriate intervention can relieve breast engorgement. Many methods have been used to relieve the symptoms of engorgement[4]. Massage has also been used as conventional intervention for relieving the symptoms of breast engorgement which aids in expression of milk[9]. Though various interventions are available, few studies[8,12,13] support therapeutic ultrasound in relieving symptoms of breast engorgement. Therapeutic ultrasound for breast engorgement has been found to be effective[10]. It can be administered by thermal and non-thermal mode[11]. Study on thermal ultrasound attribute the relief of breast engorgement symptoms to the thermal and massage effect[8]. Heat and massage effect can also be achieved by other means apart from therapeutic thermal ultrasound.

There is evidence that unrelieved engorgement can cause damage to the alveoli in the breast, impacting potential for milk production and leading to lactation failure[10].

Many studies have evaluated the effect of thermal ultrasound on breast engorgement and hardly any studies have been published related to the use of non-thermal ultrasound for the same. Hence, a need for study arises to evaluate the effect of only non-thermal ultrasound in relieving the symptoms of post partum breast engorgement.

Methods

Ethical Clearance was obtained from the Ethical Committee of S.D.M College of Medical Sciences & Hospital prior to commencement of the study.

A method of simple randomized design was used for the purpose of the study. Subjects who met with the inclusion criteria which were referred to Physiotherapy OPD by the Obstetrics & Gynecology Department of S.D.M. Medical Sciences Hospital & College, Manjushree Nagar, Dharwad, were included.

Inclusion criteria: Symptomatic Post partum breast engorgement

Exclusion criteria: Malignant tumor of breast; Mastitis; Breast Abscess

Forty eight subjects were referred from OBG department for treatment of breast engorgement. They underwent an evaluation for engorgement prior to treatment. Among them eight were found to have symptoms of mastitis and therefore were not included in the study. They were referred to concerned department for further follow up. Hence only forty subjects took part in the study during the said period. They were randomly assigned to control and experimental group.

Evaluation was done for both the experimental and control group prior to and after the treatment. The assessment included demographic data, delivery history and engorgement details. With respect to the study certain parameters were evaluated specifically for both the groups.

This involved a subjective and an objective assessment of the engorgement. Separate scales were used for the same. Visual Analog Scale (VAS) was used as a subjective scale for assessing pain and Six Point Engorgement Scale (SPES) was used as an objective scale for assessing the severity of breast engorgement.

Procedure

Both the groups were subjected to common treatment for two consecutive days – breast massage, manual expression of milk and advice on appropriate feeding technique. The experimental group received additional treatment with therapeutic non thermal ultrasound.

Breast Massage

Massage in the form of kneading and effleurage was given to the engorged breast after assessing the severity of engorgement. Prior to the session, the subject was given clear information about the procedure and the purpose of doing it. The technique was aimed at assisting the milk ejection reflex. Breast massage was performed with utmost care considering the likelihood of damaging the glandular tissues (Cooper's ligaments - that hold the breasts upright) with improper massage.

Latching Technique

After obtaining engorgement history, the subject was asked about the feeding history, which includes; feeding from one or both breasts, latching of the baby to the breast, frequency of feed, duration of feed. Emphasis was given on the latching technique. If faulty, then the mother was taught the appropriate way of getting the baby to form a 'teat'.

The subject was also explained to maintain appropriate posture during feeding. There are 2 main positions the mother adopts while she is breast feeding. The first is lying on her side and the second is sitting up position.

Manual expression of the Breast Milk

The subject was explained about the need for expression of breast milk and was told to follow the same technique during self expression. Using the Marmet Technique26 expression was carried out.

Of all the subjects, some of them were unable to feed the baby. In those subjects who were unable to either feed nor express milk, the technique of expressing milk was taught to the subject as well as the caregiver (if accompanied)

Ultrasound Treatment Dosage

The experimental group was intervened for two consecutive days with therapeutic non thermal ultrasound[11].

Mode	Pulsed
Frequency	1 MHz
Intensity	1 W/ cm^2 – this would produce 0.5 W / cm^2 40 mm within the breast
Time	Bra cup size was used: A cup – 10 minutes; B cup – 12 minutes; C cup – 14 minutes; D cup – 15 minutes[11].

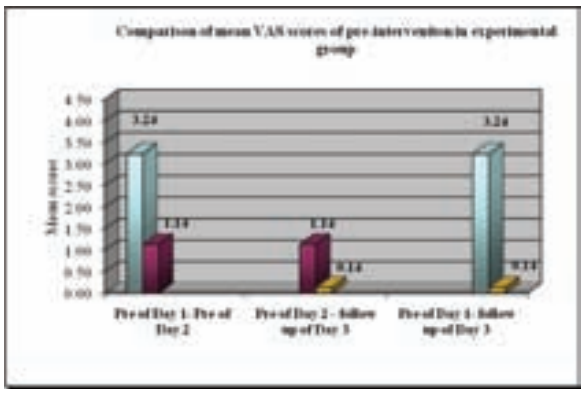
The VAS & SPE were evaluated on each day pre and post intervention for two consecutive days and also on the follow up day 3 for both the groups.

Statistical Analysis

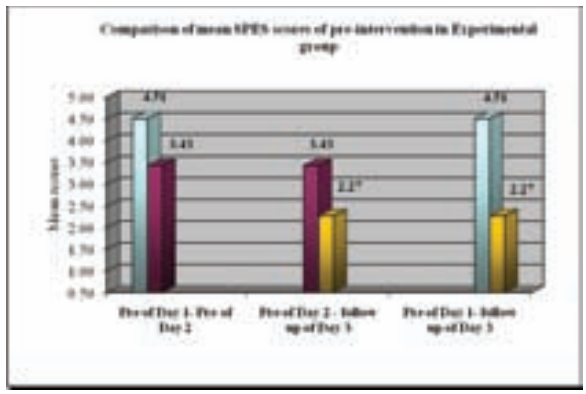
Statistical analysis was done using SPSS package. The baseline data of VAS and SPES before treatment on day 1 for the experimental and control group showed no significant difference by Mann- Whitney U-test.

The control and experimental groups were compared separately for VAS and SPES pre intervention for three days by using Wilcoxon matched pairs test. Further VAS and SPES scores were compared between the experimental & control group on all three days using Mann- Whitney U-test and gain was obtained to see whether the intervention was effective on pre intervention of day 1 to follow up of day 3.

Graph 1: VAS – Visual Analog Scale



Graph 3: SPES – Six Point Engorgement Scale



Results

Graph 1 and Graph 2 show the comparison of mean VAS scores of pre-intervention for day 1, 2 and follow up day 3 in experimental and control groups respectively.

Comparison of pre intervention of day 1 and day 2 of VAS scores within the experimental and the control group by Wilcoxon matched pairs test shows significant difference on day 1 and day 2. This indicates that VAS scores improved in both the groups on both the days, which explains that the intervention done for both the groups was effective in reducing the symptom of pain in engorgement.

At the same time, the advantage of using ultrasound for pain relief could not be directly correlated as both the groups have shown significant reduction of VAS scores. When the difference of mean values of the experimental and control groups were compared, the experimental group has shown a greater difference indicating that ultrasound was effective though statistically not significant.

Graph 3 and Graph 4 shows the comparison of mean SPES scores of pre-intervention for day 1, 2 and follow up day 3 in experimental and control groups respectively. Both the groups have shown reduction in SPES scores when compared to day 1 and day 3 data.

Comparison of pre intervention of day 1 and day 2 of SPES scores in experimental and control group by Wilcoxon matched pairs test shows significant difference on day 1 and day 2.

This indicates that SPES scores improved in both the groups on both the days. This also showed that the intervention done for both the groups was effective in reducing the symptoms of engorgement and thereby SPES score significantly.

The advantage of using ultrasound on SPES score was not proved significantly effective in experimental group on day 1 and 2 as both the groups did not have any significant difference when compared on these two days. When compared between pre treatment of day 1 and day 3 of follow up, there was significant difference between the experiment and control group indicating that ultrasound was effective in reduction of engorgement in experimental group than in control group.

VAS and SPES

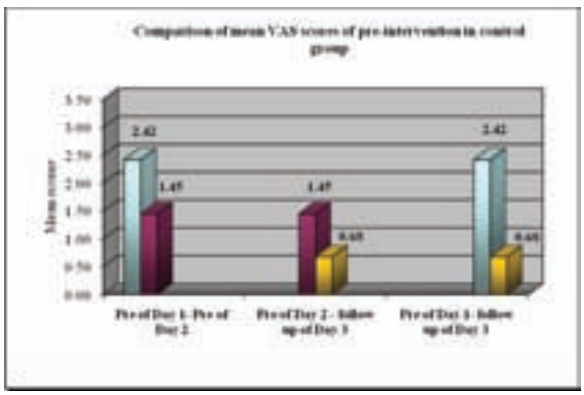
Comparison of gain between pre of day1 and follow up of day 3 in both the groups (Graph 5) showed that the experimental group has a higher gain when compared to the control group with respect to VAS and SPES scores, indicating that ultrasound is an effective intervention along with massage and manual expression in reducing the symptoms of post partum breast engorgement.

Discussion

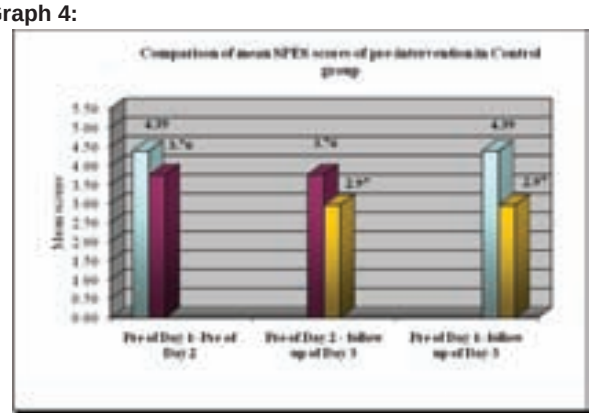
Reduction in VAS Score

There was reduction of pain in both the experimental and control group after intervention. Though experimental group showed better reduction in VAS as compared

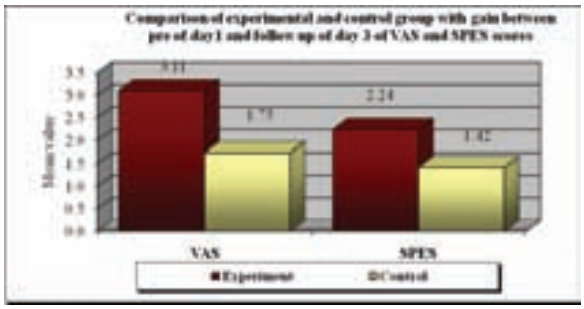
Graph 2:



Graph 4:



Graph 5:



Subject with breast engorgement in Experimental group on pre-intervention of Day 1 and follow up of Day 3

DAY 1 **DAY 3**

to control group, it was not statistically significant. The possible explanation for the reduction in VAS is as follows:

• Effect of massage in reducing pain

Pain is reduced or minimized following massage which can be explained by following hypothesis;

By the stimulation of sensory nerve endings and production of mild pain, massage blocks the pathway of pain in accordance with the Melzack and Wall's theory of pain gate.

The mechanical movement of massage stretches the individual fibres of soft tissue and reduces their tension.

Removal of metabolic waste products results due to increased drainage of the massaged area. This results in the reduction of pain, as these substances are noxious to the tissue and irritate the free nerve endings.

Increased blood flow following massage reduces the anoxic condition present in the tissue due to the compression of the blood vessels produced by the sustained muscular contraction. Thus, it reduces the danger of increased damage.

• Effect of Ultrasound in Reducing Pain

The non thermal effects of US are attributed primarily to a combination of cavitation and acoustic streaming. Pain relief is attributed to the use of thermal ultrasound as compared to non thermal ultrasound. Our study has used non thermal ultrasound; hence pain relief in all the subjects may not be attributed to the use of therapeutic non thermal ultrasound.

• Effect of expression of milk and feeding technique

Pain relief could be attributed to the secondary effects of expression of breast milk and appropriate feeding technique. As both of these measures aid in clearing the venous and lymphatic congestion, thereby, clearing the accumulated pain mediators.

Reduction in Spes Score

The goal of treatment for engorgement is to reduce vascular and lymphatic congestion and remove milk from the breasts.

• Effect of Massage

Massage aids in the mechanical emptying of the veins and the lymphatics. It facilitates the forward movement of the venous blood and the lymph and thereby reduces the chances of stagnation of the blood and the lymph in the tissue space.

The mechanical action of massage resembles with normal muscular contraction. The different techniques of massage alternately compress and release the soft tissue. This facilitates the venous and lymphatic flow: The effleurage, kneading and petrissage squeeze the veins and the lymphatic vessels and force the venous blood and the lymph towards the heart, causing an increased drainage of the blood and lymph from the massaged part/segment[22].

In case of breast engorgement, there is edema due to vascular and lymphatic stasis. If no relief is obtained, milk production is interrupted, with later reabsorption of residual milk. The increase in intraductal pressure causes the residual milk to undergo an intermolecular transformation and to become thicker[7].

Massage facilitates the venous and lymphatic drainage, thus reduces the stagnation of fluids and also speeds up the removal of waste products. According to Paikov (1986), the body contains 1200-1500 mm of lymph moving at the speed of 4 mm/sec and massage increases this by eight folds[22].

Thus massage would have helped in reducing the symptoms of engorgement such as heaviness, discomfort and tenderness.

• Influence of Feeding and Latching on Reduction of Engorgement

Breast feeding the baby frequently, at least every 2-3 hours as the milk is coming in will help in reducing the engorgement. The baby should be encouraged to feed at least 15 to 20 minutes on each breast or until one breast softens per feeding[27].

It is usual for the baby to feed infrequently on the 1st day or so, and have 6-8 hour gaps between good feeds. As the milk volume increases, the feeds tend to become more frequent and a little shorter. The baby then feeds for approximately 6-8 times in 24 hours from the 3rd day. Babies who feed infrequently may be consuming less milk than they need, or may be unwell, or both. Babies who feed very often (10-12 feeds in 24 hours after the 1st week) may be poorly attached. The feeding technique must be monitored.

Inefficient latch-on is the major cause of inefficient milk removal. If the baby is difficult to attach, because the breast tissue is inelastic, the same principle ought to apply when the mother and the baby are separated by

virtue of illness or prematurity – to teach the mother how to hand express in order to get lactation established. If the mother is still not able to feed effectively, she should express her milk in between the feeds.

• Effect of Expression

Engorgement is really a problem of poor milk flow rather than too much milk.

In order to reduce the edema, milk has to be expressed from the breast. If milk is not removed the condition gets worsened. Following massage over the breast, milk should be gently expressed using the Marmet technique. Manual expression of milk from the breast before breastfeeding increases flexibility and allows a proper latch-on to the breast. Once the baby latches appropriately on the breast, milk flow gets established. This aids in the relief of engorgement symptoms.

• Effect of Therapeutic Non Thermal Ultrasound

The non thermal effects of ultrasound are found to be cavitation and acoustic micro streaming. Cavitation occurs when gas filled bubbles expand and compress because of ultrasonically induced pressure changes in tissue fluids, with a resulting increase in flow in the surrounding fluid.

Ultrasound energy produces a mechanical pressure wave through soft tissue. This pressure wave causes:

1. Generation of microscopic bubbles in living tissues
2. Distortion of the cell membrane, influencing ion fluxes and intracellular activity.

Three mechanisms of cell membrane distortion:

1. Acoustic streaming
2. Bubble formation
3. Microstreaming

1. Acoustic Streaming

Acoustic streaming is described as a small scale eddying of fluids near a vibrating structure such as cell membranes & the surface of stable cavitation gas bubble (Burns 1981, Dyson & Suckling 1978). The compression phase of an ultrasound wave deforms tissue molecules (cell membrane). This deformation is called radiation force. This phenomenon is known to affect diffusion rates & membrane permeability. Sodium ion permeability is altered resulting in changes in the cell membrane potential. Calcium ion transport is modified which in turn leads to an alteration in the enzyme control mechanisms of various metabolic processes, especially concerning protein synthesis & cellular secretions.

2. Cavitation

Radiation force affects gas bubbles in the tissue fluids. Under this pressure wave (compression and rarefaction), these bubbles expand and contract which add further stress to cell boundaries. When bubbles expand and contract, without growing to critical size, the activity is called stable cavitation. Unstable cavitation does not occur in therapeutic range (pulsed 20% @ 0.1 to 3 W/cm2) in normal tissues except in air-filled cavities such as lungs and intestines.

3. Microstreaming

- Cavitation sets up eddy currents in the fluid surrounding the vibrating bubbles and the eddy currents in turn exert a twisting and rotational motion on nearby cells. In the vicinity of vibrating gas bubbles intracellular organelles are also subjected to rotational forces and stresses. This microscopic fluid movement is called microstreaming.
- Bubble activity augments the mechanical effect of a pressure wave.

The scale of cavitation depends on the ultrasound characteristic; bubble growth is limited by low-intensity, high-frequency, and pulsed ultrasound. Higher frequency means shorter cycle duration, so that the time for bubble growth is restricted. Pulsed ultrasound restricts the number of successive growth (excessive energy accumulation) and allows the bubble to regain its initial size during the off period[31].

The result of the combined effects of stable cavitation and acoustic streaming is that the cell membrane becomes 'excited' (up regulate), this increasing the activity levels of the whole cell. The US energy acts as a trigger for this process, but it is the increased cellular activity which is in effect responsible for the therapeutic benefits of the modality (Watson 2000, Dinno et al 1989, Leung et al 2004).

Pulsed rather than continuous ultrasound is preferred for the treatment of breast engorgement and that doses may vary[30].

The physiological effect of non thermal ultrasound in relieving engorgement is attributed to its property of improved cell membrane permeability, thereby facilitating the venous and lymphatic drainage and hence in relieving the congestion. It also facilitates the let down reflex aiding in better expression of milk.

Benefit of Adding Non Thermal Ultrasound

The statistical analysis of the intervention done for both the groups showed that there is significant relief in symptoms of post partum breast engorgement in both the groups before and after intervention in relation to VAS and SPES scores.

The analysis of pre of day 1 and follow up of day 3 showed significant relief in the experimental group when compared with the control group. Since the intervention for both the groups were common other than US being used for the experimental group. The significant relief in engorgement in the experimental group is contributed to the use of therapeutic non thermal ultrasound only.

The use of non thermal ultrasound for two successive days in symptomatic post partum breast engorgement accelerates relief of the symptoms as compared to other interventions like massage, expression of milk and appropriate feeding technique.

Conclusion

We conclude from our study that therapeutic non thermal ultrasound is effective in relieving the symptoms of post partum breast engorgement.

Though, other interventions were also effective, non thermal ultrasound had a greater effect in the

experimental group. Thus, we propose the use of therapeutic non thermal ultrasound as an adjunct to other therapies for faster relief in symptoms of post partum breast engorgement.

List of Abbreviations Used

1. VAS – Visual Analog Scale
2. SPES – Six Point Engorgement Scale
3. US – Ultrasound
4. FIL – Feedback Inhibitor Of Lactation
5. MHz – Mega Hertz
6. S. D. M – Sri Dharmastala Manjunatheshwara
7. OBG – Obstetrics and Gynaecology
8. OPD – Out Patient Department
9. SPSS – Statistical Package for Social Sciences
10. SD – Standard Deviation

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Effect of Advanced Techniques in Improving Upper Limb Functions in Patients with Stroke: A Comparative Study

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Abstract

Objective

To compare the effect of advanced techniques in improving upper limb functions in patients with stroke.

Design

Experimental design.

Study Setting

The active treatment took place at a clinic within the physiotherapy outpatient unit at Prakash Hospital, Noida, PIPRAMS (Greater Noida)

Intervention

30 participants of either sex, fitting the inclusion criteria were assigned in two equal groups,Group I who recieved Motor Relearning Program(MRP) and Group II who received Propioceptive Neuromuscular Facilitation Technique(PNF). The baseline and outcome measures of ADL were taken on the Functional Independence Measure (FIM)using sub-sections on self-care before and after the treatment.

Result and Conclusion

The results show that there is no significant differences (P>0.005) found in the distribution of age, sex and side involved between the groups. So these aspects can be considered to have no influence on the results of the present study. The conclusion of the present study is that no one technique is found to be more effective over the other Both the treatment techniques were found to improve the upper limb functions in one or the other aspect and therefore it is more beneficial if the techniques will be used in adjunct to each other for rehabilitation so that the overall all improvement could be achieved.

Key Words

Stroke, MRP, PNF, FIM.

Introduction

Although the incidence of stroke is decreasing, its prevalence in the population is increasing because of enhanced survival and growing elderly population[1]. Broad discussion of disability suggests that about half of the patients die within the first few weeks and of the survivors, one – third will remain dependent and bedfast, another third will recover leaving a remaining third with some degree of residual functional incapacity[2]. Some of the impairments related to the stroke are motor and sensory dysfunction, aphasia or dysarthria, visual field defects and mental and intellectual impairments. Impairments that interfere with functional movement of the limbs are the changes in muscle strength, tone and activation. Impairment of upper limb functions contributes greatly to functional disability after stroke[4]. The incidence of dependence in ADL is highest immediately after stroke. Most stroke patients show considerable recovery of function over the first few months, although the exact extent and duration of this recovery is less certain[3]. In general neurological recovery occurs within the first 1-3 months following stroke[1,3,4,6]. Further motor and sensory recovery may continue to occur six months5 to year later however these changes may not reach statistical or clinical significance[1]. Detailed knowledge of the time course of recovery is indispensable to rational planning of rehabilitation, discharge time, discharge placement and to informing patient and family about the prognosis and the possibility of further recovery[4]. Studies[7] analyzing the acute recovery patterns in stroke patients presents results concerning the critical factors, influencing functional outcome, like age, hemisphere involved, artery involved. Nowadays there are unlimited numbers of techniques in physiotherapy for treatment of the hemiplegia. The techniques differ in their basic concepts and the treatment effects. The Proprioceptive Neuromuscular Facilitation (PNF) technique is based on the neurophysiological aspect of the human body and promotes or hastens the response of the neuromuscular mechanism through stimulation of the proprioceptors. This technique helps in the movements of the extremities in patterns used in the daily activities and therefore facilitates movement. On the other hand Motor Relearning Programme (MRP) is the most widely used technique nowadays is based on the new concepts of motor control and motor learning and emphasizes in the correct and constant practice of tasks involving the extremities which are useful for the patient in their ADL and discourage the compensatory techniques which the patient tend to develop after stroke attack. The two techniques are quite different in their concepts but are considered to be effective in treating the same disorder.

Methods

Subjects

30 patients of either sex with age 40-60 years was

undertaken to determine whether the use of PNF or MRP is beneficial in upper limb functions of stroke patients. All patients were assessed by a neurologist confirming the diagnosis as 'stroke' within first 48 hours of onset. The subjects were randomly assigned on the basis of their order of recruitment in the study, for two protocols of treatment consisting of MRP and PNF techniques and the initial detailed neurological assessment including the tonal assessment on Modified Ashworth Scale was done. The baseline and outcome measures of ADL were taken on the Functional Independence Measure (FIM) using sub-sections on self with following Inclusion criteria:

1. First ever stroke involving an ischaemic infarct in the territory of the middle cerebral artery (MCA).
2. Impaired motor function of upper extremity.
3. Informed consent to participate.
4. Full-text, English-language publications.

Exclusion criteria were

1. No complicated medical history such as cardiac, pulmonary, orthopedic or other neurological disorder unrelated to stroke.
2. No deficit in conscience, orientation, memory, understanding and no sensory aphasia.
3. Animal and cadaver studies
   Before initiation of the study, institutional review board approval was obtained.

Treatment Protocol

Patients were divided by convenient sampling method into two groups A and B. After taking the baseline scores on FIM scales the treatment to groups I and II was given on basis of the techniques of MRP and PNF for the upper limb respectively. All the subjects were given the treatment for three consecutive weeks, five days a week making it 15 sessions in total. The time duration was variable according to the fatigue level of the patient and was seen to increase from an initial of 10 minutes to a maximum of 40 minutes for the upper limb. The researcher herself assessed all outcome variables weekly. The repeated measurements were taken on FIM scales. The final outcome was measured at the end of 3rd week after completion of the 15 sessions. The patient for the purpose of assessment performed all the activities FIM in presence of the researcher.

Data Analysis

Data collected was analyzed using Un-Paired t- Test to measure the changes between the Pre and the Post test values within the group.The significance (Probability-P) was selected as 0.05. The repeated measure ANOVA with post-hoc analysis on Bonferroni was used to see the within group differences. The data were analyzed under the supervision of an experienced and qualified statistician using STATA (8.0 version) at the Biostatistical Department of AIIMS, New Delhi.

Results

Subject Information

Age Distribution

Group I contains 15 patients age 40-60 (in yrs.). The mean is 59.26 and SD= 13.87 Group II contains 15 patients 40-60 (in yrs.). The mean is 61.53 and SD= 14.46(Table: 1) There was no significant difference for age distribution between the two groups. (p = 0.6648)

Sex Distribution

Group I contains 15 patients males = 6 and females = 9. Group II contains 15 patients males = 10 and females = 5. There was no significant difference for sex distribution between the two groups. (p = 0.143)

Side Distribution (Involved)

Group I contains 15 patients left = 7 and right = 8. Group II contains 15 patients left = 4 and right = 11. There was no significant difference for involved side distribution between the two groups. (p = 0.256)

Table 1: Showing the data of subjects

Character	Description	Group I (n=15)	Group II (n=15)
Age (in yrs.)	Mean (SD)	59.26 (13.87)	61.53 (14.46)
Sex	Male	6	10
	Female	9	5
Side involved	Right	8	11
	Left	7	4

Discussion

The aim of the study was to investigate the effect of advance techniques in upper limb functions in Stroke patients. Total 30 patients were taken. Un-paired T-Test was used to analyse the results. Patient outcomes were measured on the FIM. In FIM total scores there was a significant improvement in both the groups with every week treatment. Considering the sub-sections of FIM it was found that scores for the first two weeks for feeding, grooming and bathing and also the score for first week of toileting there was significant improvement in group of subjects treated with the PNF but no such significant improvement was seen in the MRP group during the same time frame. Activities like feeding, grooming, bathing and toileting requires manipulation as well as transportation of the objects from one place to another so therefore PNF techniques have been shown to improve impairment range of motion, co-ordination, strength and even endurance. When the final scores were considered for these sub-sections it can be inferred that the PNF techniques are rightly more effective in the initial stage as it works on the impairment level. The summary effect size for outcome variables defined on the neuromuscular level is almost three times high as for functional outcome parameters. This finding may reflect the higher responsiveness of assessment instruments for neuromuscular functioning and supports the assumptions that improvements on an impairment level are not unequivocally related to improvements in disability 27. We know that MRP deals with the upper limb tasks related to reaching, balancing, manipulation and dexterity. Our hands require placement at the appropriate place for manipulation in the working

Table 2: Reveals comparison between FIM Scores in Group A and Group B. Table also Reveals mean of differance of sub divisions of FIM scale between the Two Groups.

Sub-scale	Obser vation	Group I		Group II		t-value	p-value	Result
		Mean	SD	Mean	SD			
Feeding	0	1.06	.25	1	0	0.32	1.00	NS
	1	1.4	.50	1.53	.63	0.73	0.63	NS
	2	1.93	1.09	2.13	.99	0.69	0.52	NS
	3	2.46	1.30	2.86	1.06	0.81	0.92	NS
Grooming	0	1.06	.25	1	0	0.32	1.00	NS
	1	1.66	.89	1.8	.77	0.66	0.43	NS
	2	1.86	.99	2.33	.72	0.92	1.47	NS
	3	2.6	1.45	3.4	1.24	0.94	1.62	NS
Bathing	0	1.06	.25	1.2	.41	0.29	1.05	NS
	1	1.66	.89	1.93	1.16	0.75	0.70	NS
	2	2	1.19	2.46	1.06	0.86	1.13	NS
	3	2.73	1.53	3.46	1.64	0.89	1.26	NS
Dressing(u)	0	1.06	.25	1.46	.63	0.03	2.24	*
	1	1.8	.56	2.26	1.09	0.92	1.46	NS
	2	2.33	.61	2.86	.91	0.96	1.87	NS
	3	2.93	.59	3.8	1.14	0.99	2.60	NS
Dressing(L)	0	1.06	.25	1.4	.50	0.03	2.26	*
	1	1.6	.50	1.93	.88	0.89	1.26	NS
	2	2.06	.45	2.73	.88	0.99	2.59	NS
	3	3	.65	3.53	1.24	0.92	1.46	NS
Toileting	0	1.4	.50	1.6	.50	0.28	1.08	NS
	1	2.13	1.40	2.73	1.16	0.89	1.27	NS
	2	2.73	1.43	3.46	1.30	0.92	1.46	NS
	3	3.46	1.64	4.53	1.64	0.95	1.77	NS
Total	0	6.73	1.53	7.66	1.75	0.13	1.54	NS
	1	10.26	4.25	12.2	4.53	0.88	1.20	NS

*Significant at < 0.05, NS- non significant

environment and to transport the objects from one place to another. The muscle forces produced and the timing and sequencing of joint movement involved in a specific action are a function of the task being performed, the object, the individual's position relative to the object and the constraints of the environment. Training is designed to help the patient regain the ability to harness the degrees of freedom available so the limb functions as a coordinated unit in functional actions with many different goals. Skilled motor actions are characterized by the patterns of segmental movement which best address the spatiotemporal demands of the action. PNF techniques have been shown to improve impairment range of motion, co-ordination, strength and even endurance since the technique incorporates the motion of the body segments in the full range at all the joints into patterns that are useful in daily activities. As the results show greater improvements with the PNF in the initial weeks therefore it can be used with MRP to work on the impairment level so that the patient will be able to improve on the impairment as well as functional limitation like feeding, grooming etc. Finally the results show that no technique could show 100% improvement but they work on different aspects of disability

Conclusion

The conclusion of the present study is that no one technique is found to be more effective over the other and the hypothesis that MRP is more effective in treatment of upper limb functions in stoke patients is found to be wrong. Both the treatment techniques were found to improve the upper limb functions in one or the other aspect and there fore it is more beneficial if the techniques will be used in adjunct to each other for rehabilitation so that the overall all improvement could be achieved.

Limitations

1. Small number of subjects
2. Duration of study was small
3. Area of population was small so can't be generalized.
4. The functional scales lack the focus on the muscle strength and endurance.

Table 3: Reveals Scores of FIM Within Group I and Group II. Table also reveals mean of differance of sub divisions of FIM scale within the Two Groups.

Scale	Observ ation	Group I			Group II		
		f-value	p-value	Result	f-value	p-value	Result
Feeding	0-1	0.333	0.11	NS	0.533	0.03	*
	1-2	0.533	0.08	NS	0.600	0.01	*
	2-3	0.533	0.00	*	0.733	0.00	*
	0-3	1.4	0.00	*	1.867	0.00	*
Grooming	0-1	0.600	0.08	NS	0.800	0.00	*
	1-2	0.200	0.49	NS	0.533	0.00	*
	2-3	0.733	0.00	*	1.067	0.00	*
	0-3	1.533	0.00	*	2.400	0.00	*
Bathing	0-1	0.600	0.08	NS	0.733	0.03	*
	1-2	0.333	0.57	NS	0.533	0.03	*
	2-3	0.733	0.00	*	1.000	0.00	*
	0-3	1.667	0.00	*	2.267	0.00	*
Dressing(U)	0-1	0.733	0.00	*	0.800	0.00	*
	1-2	0.533	0.00	*	0.600	0.00	*
	2-3	0.600	0.00	*	0.933	0.00	*
	0-3	1.867	0.00	*	2.333	0.00	*
Dressing(L)	0-1	0.733	0.00	*	0.867	0.00	*
	1-2	0.267	0.24	NS	0.467	0.08	NS
	2-3	0.867	0.00	*	1.067	0.00	*
	0-3	1.867	0.00	*	2.400	0.00	*
Toileting	0-1	0.733	0.06	NS	1.133	0.00	*
	1-2	0.600	0.01	*	0.733	0.00	*
	2-3	0.733	0.00	*	1.067	0.00	*
	0-3	2.067	0.00	*	2.933	0.00	*
Total	0-1	3.533	0.01	*	4.533	0.00	*
	1-2	0.444	0.00	*	3.800	0.00	*
	2-3	4.267	0.00	*	5.600	0.00	*
	0-3	10.467	0.00	*	13.933	0.00	*

*Significant at < 0.05, NS- non significant

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Effect of Forward Shoulder Posture on Forced Vital Capacity- A Co-relational Study

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Abstract

Forward shoulder/rounded shoulder posture is one of the numerous deviations from the normal or standard posture. Forward shoulder is described as abduction and elevation of the scapula and a forward position of the shoulder, giving an appearance of a hollow chest[2,3].The etiology of FSP have been attributed to several factors that include muscle weakness and shortening. It can result from shoulder being pulled forward by overdeveloped, shortened and tight anterior shoulder girdle muscles, such as serratus anterior, pectoralis major, pectoralis minor and upper trapezius muscles. FSP can also be caused by weakness and lengthening of the muscles that function to pull the scapula towards the spine, such as the middle and lower trapezius muscles. Presence of excessive habitual flexion of the back will lead to shortening of pectoral muscles and fix the shoulders in forward position leading to FSP[4]. Muscles that become tight tend to pull the body segments to which they are attached, creating postural deviation. The respiratory pump is comprised of the muscles of respiration and the thorax is made up of the ribs, scapulae, clavicle, sternum and the thoracic spine. Muscular effort is required to enlarge the thoracic cavity and lower the interthoracic pressure. Muscles attached to the rib cage can influence the mechanics of breathing to some degree[3]. Optimal breathing capability derives from a posture of optimal muscle balance. A balanced musculature is most efficient in terms of energy expenditure. Imbalance of musculature resulting from tightness, weakness or paralysis may adversely affect the volumes and pressures that can be attained or maintained. Weakness of upper back erector spainae, middle and lower trapezius muscle interferes with the ability to straighten the upper back, thus limiting the ability to raise and expand the chest and maximize the lung capacity[2].The aim of this study was to know weather there is any effect of forward shoulder posture on forced vital capacities.

Meterials and Methodology

15 non smoking male subjects with a mean age of 35.26(SD ±15.38) diagnosed to have Forward shoulder posture (FSP) were taken for the study. FSP was assessed by plumbline method and by measurement of interscapular distance (ISD). Forced Vital Capacity (FVC) of these subjects was recorded by spirometer.

Results

The mean values of FVC, plumb line and ISD were as follows FVC 63.06 (SD±15.24), and ISD 5.16(SD±0.66). Karl Pearson's correlation coefficient technique was used to correlate the effect of ISD on FVC in non smoking subjects. Where r = -0.77(t=4.51) and ($p<0.01$), there was a negative correlation of ISD on FVC. Correlation of Plumb line with FVC was done by spearman's rank correlation coefficient technique. There was a significant correlation of plumbline on FVC where p=0.0056($p<0.05$).

Conclusion

The present study concludes that, in patients with FSP there is increase in the ISD and plumb line measurements and both these variables have an effect on FVC. As the ISD and plumb line measurement increases, there is decrease in the FVC.

Key Words

Forward shoulder posture, Intrascapular distance, Plumb Line, Forced vital capacity.

Posture is defined as a position or attitude of a body, the relative arrangement of a body parts for a specific activity or a characteristic manner of bearing once body weight[1]. Forward shoulder posture is also called a rounded shoulder posture. It is one of the postural fault or deviation from the normal standard posture. Forward shoulder posture is described as abduction and elevation of the scapulae and a forward position of the shoulder[2].

The etiology of FSP has been attributed to several factors, posture and relative alignment of body segments are affected by muscle shortening and weakness[2,3]. FSP results from the shoulder being pulled forward by over developed, shortened or tight anterior shoulder girdle muscles, such as the serratus anterior, pectoralis major, pectoralis minor and upper trapezius muscles. Along with the tightness, there is weakness and lengthening of the muscles that functions to pull the scapulae towards the spine, such as the rhomboids, middle and lower trapezius muscles[2,4,6]. FSP can be attributed to presence of excessive and habitual flexion of the back leading to shortening of Pectoralis major and fixing the shoulders into forward position[5,6]. Muscles that become tight tend to pull the body segments to which they are attached, creating postural deviation.

Posture can be assessed using a Plumb line. According to Kendall et al plumb line represents a standard. Based on nature's law of gravity, it is a tool in the science of mechanics. Plumb line enables us to see the effects of the force of gravity. The plumb line is a cord with a plumb bob attached to provide and absolute vertical line. The

point in line with which a plumb line is suspended must be a standard fixed point. Because the only fixed point in the standing posture is at the base, where the feet are in contact to the floor, the point of reference must be at the base. Hence in side view the point of reference is just in front of the lateral melleous. Deviations from the plumb alignment are described as slight, moderate or marked rather then in terms of degrees or inches[2].

Assessment of rounded shoulder was done by Patricia G Morris et al in one of their study to identify the incidence of postural abnormalities of the thoracic, cervical and shoulder regions and their association with pain. Postural assessment of rounded shoulder was done by plumb line. They graded the rounded shoulder as mild, moderate and severe. Normal and mild were considered to be within normal limits. Mild was calculated to be as the distance between the center of the land mark (acromian process) in line with or upto 1 cm anterior to the plumb line, moderate was termed as posterior border of the land mark in line with or displaced upto 1 cm anterior to the plumb line and severe as posterior border of the bony land mark displaced more than 1 cm beyond the plumb line[8].

Normal in scapular resting position, the medial borders of the scapulae are parallel and the distance between these medial borders are 3-4 inches normally[2]. Hoppenfeld suggested that the posterior midline of the body lies midway between the scapulae and that the medial borders are 5.08 cm (2 inches) from the spinous process and he added that the root of the spine of the scapulae is at the T3 vertebral level spinous process[7]. According to David G Magee the normal adult inter scapular distance is 4 inches[9].

Respiration consists of ventilation and circulation. Ventilation is the movement of the gases into and out of the lungs, while circulation is the transport of these gases to the tissues. Although the movement of gases in the lungs and tissues is by diffusion, their transport to and from the environment and throughout the body requires work by the respiratory and cardiac pumps[2]. The respiratory pump is comprised of the muscles of respiration and the thorax, which is made up of the ribs, scapulae, clavicle, sternum and the thoracic spine. This musculoskeletal pump provides the necessary pressure gradients to move the gases into and out of the lungs in order to ensure adequate diffusion of oxygen and carbon dioxide within the lungs[2].

Respiratory muscles play and important role in overcoming lung, chest wall, and airway resistances normally occurs only during inspiration. Efforts by the respiratory muscles are required to enlarge the thoracic cavity and lower intra thoracic pressure. There are more than 20 primary and accessory muscles and almost all of them have a postural function. Only the diaphragm and the anterior intercostals muscles are purely respiratory. Also during forced or deep breathing some accessory muscles help in respiration. The sternocleidomastoid draws the sternum superiorly, serratus anterior and pectoralis assists in raising the ribs and the scalene helps in raising the first two ribs[2,4]. Rhomboids have a role in stabilizing the scapula to assist the serattus in forced inspiration[2]. The stronger the abdominal muscles the greater are their ability to compress the abdomen and thus generate additional pressure during expiration[2]. All the respiratory muscles have the capacity to be recruited when need to facilitate breathing. Many of them perform vital roles in stabilizing parts of the body so that there is adequate force to move air into and out of the lung6. Breathing can be altered by the changes in position, activity level, diseases and tight garments. The respiratory muscles are capable of recruitment according to the pattern of ventilation, posture, muscle strength, airflow resistance, compliance of lungs and chest wall. Any muscles attached to the rib cage are able to influence the mechanism of breathing to some degree. These muscles help to support the skeletal structures of the ventilator pump and be able to generate pressures that ensure continued adequate gas exchange at the alveoli[2].

Optimal breathing capability derives from a posture of optimal muscle balance. A balanced musculature is most efficient in terms of energy expenditure. Imbalance of musculature resulting from tightness, weakness or paralysis may adversely affect the volumes and pressures that can be attained and maintained. Weakness of upper back erector spainae, middle and lower trapezius muscle interferes with the ability to straighten the upper back, thus limiting the ability to raise and expand the chest and maximize the lung capacity hence weakness of respiratory muscles lead to ventilator failure[2]. In disorders of the respiratory muscles, respiratory failure is usually closely related to the degree of respiratory muscle weakness but occasionally occurs with only mild impairment of muscle function. Because of the high risk of the respiratory failure associated with weak respiratory muscles, exercise to strengthen these muscles may be of critical importance[2].

There are many studies done to see the effects of postural abnormalities like kyphosis,scoliosis etc on pulmonary volumes and capacities. Based on the concept of postural abnormality in the form of FSP, and considering its effect on respiratory muscle, it is questionable to know whether FSP could alter pulmonary function. There has been only one study that has investigated this effect in women. I am not aware of any previous research that has investigated this effect on Indian population and also we need to do many studies to prove the effect of FSP on pulmonary capacities. Therefore the purpose of this study was to find the effect of Forward Shoulder Posture on Pulmonary Capacities.

Methodology

Subjects

A total of 15 non smoking subjects between age group of 28-48 years, diagnosed to have Forward shoulder posture, from Physiotherapy department of S.D.M. Medical Hospital Dharwad, were conveniently taken for the study as per their inclusion and exclusion criteria.

Inclusion/exclusion criteria

Inclusion criteria subjects were individuals having FSP. Subjects were excluded if they had history of smoking or any respiratory, cardiovascular, neuromuscular, or orthopaedic diseases. All the individuals with fixed deformities of shoulder girdle and upper quadrant were also excluded from the study.

Procedure

A routine method of evaluation and collecting the data on FSP was done. This involved history, evaluation of FSP and respiratory values. Plumb line measurement, Scapular abduction i.e ISD (inter scapular distance) and spirometer test was used to measure FSP and Forced vital capacity(FVC) respectively. Subjects willing to participate in the study were briefed about the study and the investigation. After briefing their written consent was taken.

Plumb line measurement procedure

The position of the shoulder was assessed using the side-line (lateral) view of the plumb line. Subjects were initially explained about the procedure and were asked to expose their shoulder. They were instructed to stand in relaxed position. A plumb line was dropped that was fixed from the ceiling. Subjects were asked to stand with their shoulder 20 cm from the plane white wall such that the plumb line reference falls just anterior to the lateral malleolus. The tip of the acromian process was marked with a skin marker. The distance from the tip of the shoulder (acromion processes and is termed as "landmark") and the plumb line was measured with a transparent scale. For the purpose of analysis, rounded shoulder was graded as normal or mild that is considered to be within normal limits(WNL) or grade 1 that is measured from center of landmark in line with or up to 1cm anterior to the plumb line, moderate deviations or grade 2 is measured from posterior border of landmark in line with or displaced up to 1 cm anterior to the plumb line, and severe or grade 3 is measured from posterior border of bony landmark displaced more than 1 cm beyond the plumb line.

The scapular abduction or inter scapular distance was measured using an inch tape. The intra scapular distance from root of spine of scapula bilaterally was noted and taken for the study.

Spirometry Test

To measure Forced vital capacity, an initial assessment of age, height and weight were taken. FVC, (It is the volume of air which can be forcibly and maximally exhaled out of the lungs until no more air can be expired and is done after taking in the deepest possible breath) was measured with the subjects in sitting position, using a spirometer (Spirowin 2.01,Genisis medical system). Initially the procedure was explained to the subjects, then they were asked to take few normal breaths, and later take a long deep breadth and then to exhale in the mouth piece of the spirometer. The exhalation should be as hard and as fast and for as long as possible until the lungs are completely empty then followed by deep inhalation to form flow volume loop on the computer screen. The subject then had to undergo the same procedure for three times, the highest value was taken for consideration. A nose clip was attached during the procedure. Recording of the report are noted down and a print out were taken and attached to the data sheet.

Table 1: Mean and SD of study subjects by Age, FVC and ISD

	Age	Height	Weight	FVC	ISD
Mean	35.26	162.26	57.33	63.06	5.16
St Dev	15.38	6.74	10.53	15.24	O.66

Statistical analysis

Karl Pearson's correlation coefficient technique was used to correlate the effect of Intra scapular distance (ISD) on FVC in 15 non smoking subjects. Correlation of Plumb line with FVC in these subjects was done by spearman's rank correlation coefficient technique.

Results

Table1 shows, 15 male subjects (n=15) with mean age of 35.26(SD±15.38), height 162.26(SD±6.74) and weight 57.33 (SD±10.53) were taken for the study. Their mean FVC was 63.06(SD±15.24), and mean ISD was 5.16(SD±O.66).

Table 2: Comparison of three groups of Plumb line with respect to their mean FVC in non-smokers group by one way ANOVA test

Summary	Mild	Moderate	Severe
Mean	74.0	67.0	45.25
Std Dev	8.83	8.14	15.96
F-value	7.9736		
P-value	0.0063*		

Table 2 shows that there was a significant correlation of FVC and plumb line grading of mild moderate and severe, as the severity of the plumb line measurement increased, there was a decrease in the FVC values. ($P<0.05$).

Table 3:

Karl Pearson's product moment correlation (r) was used to quantify the relationship between ISD and FVC for the sample of 15 patients. The Pearson 'r' between ISD and FVC was -0.77. There was significantly different from zero at a level of $p<0.01$. There was a significant negative correlation of ISD on FVC. It shows that as the ISD increases there is decrease in FVC.

Table 3: Calculation of Pearson "r": Relationship between ISD and FVC in nonsmoking individuals

Variables	Mean	Std Dev	r	T	p-Value
FVC	63.06	5.16	-0.77	4.5	P<0.01
ISD	5.16	0.66			

Correlation of Plumb line with FVC in these subjects was done by spearman's rank correlation coefficient technique. Where $r = -0.67$ and $p=0.0056$ ($p<0.05$). The results showed moderate negative correlation between

Table 4: Correlation among all variables with Plumb line in non-smokers group by spearman's rank correlation coefficient technique.

Variables	Plumb line with(r)	p-value
Age	0.6686*	0.0064
Height	0.2120	0.4480
Weight	0.0848	0.7638
FVC	-0.6767*	0.0056*
I.S.D (Inches)	0.9322*	0.0000*

plumb line measurement and FVC. Very high positive correlation was found between the ISD Inches and plumb line (P<0.01).

Discussion

The aim of our study was to find the effect of FSP on pulmonary values. There was a significant negative correlation of ISD on FVC in non smoking individuals (Table 3). This correlation of ISD on FVC seems important clinically because it provides evidence that those patients with increased ISD have lesser FVC in forward shoulder posture. Based on the strength of the correlation found in this study, we recommend further data collection on a larger sample to provide more accurate estimation of the true relationship between these two variables.

A Ghanbari4 et al showed that there was a significant correlation between FSP and respiratory values in women. They concluded that as there is increase in FSP degrees there is decrease in the respiratory values[4].

C. A. Bradley and N. R. Anthonisen[10] studied to see weather the Rib cage and abdominal restrictions have different effects on lung mechanics. The effects of a variety of restrictive procedures on lung mechanics were studied in eight healthy subjects. Rib cage restriction decreased total lung capacity (TLC) by 43% and significantly increased elastic recoil and maximum expiratory flow (MEF)[10]. Hence FSP can be considered as one of the external restrictive factors that affects the lung expansion.

The results showed moderate negative correlation between plumb line measurement and FVC (Table 4). This proves the clinical fact that, as the severity of the plumb line measurement increases there is decrease in the FVC. In FSP there is excessive and habitual flexion of the back leading to shortening of Pectoralis major and fixing the shoulders into forward position[5,6]. The work of breathing performed by respiratory muscles in overcoming lung, chest wall, and airway resistances normally occurs only during inspiration. Muscular effort is required to enlarge the thoracic cavity and lower intra thoracic pressure[2]. Muscles that become tight tend to pull the body segments to which they are attached, creating postural deviation. These factors might be one of the reasons for limiting the chest expansion thus having effects on FVC.

Kendall[2] et al stated that a balanced musculature is most efficient in terms of energy expenditure. Tightness, weakness or paralysis may adversely affect the volumes and pressures that can be attained and maintained. Weakness of upper back erector spainae, middle and lower trapezius muscle interferes with the ability to straighten the upper back, thus limiting the ability to raise and expand the chest and maximize the lung capacity hence weakness of respiratory muscles lead to ventilator failure[2]. A similar kind of muscular imbalance has been seen in FSP, with our study, we hypothesize that FSP reduces the ability of chest expansion adequately hence there is reduction in FVC.

There was no correlation between the plumbline measurement with height and weight (Table 4), however there was a positive correlation between age and plumbline. This factor indicates that FVC is dependent on age. There was a highly significant correlation between ISD and plumbline which signifies that both these variables are seen in FSP.

The limitation of this study was, sample size. More samples have to be taken to prove this effect and different ways to measure FSP needs to be done. This study was done exclusively in male subjects. The scope of this study is to know the effect of other values of spirometry readings on FSP and a mixed gender needs to be studied in future.

Conclusion

The findings indicate a relationship between Forward shoulder posture and Forced vital capacity. There was a significant correlation between FSP and FVC. Plumb line and intra scapular distance were taken for the measurement of FSP and both these variables were correlating to the FVC. Hence we conclude Forced vital capacity is reduced with increase in FSP.

Acknowledgment

The authors wish to thank, Dr Praveen Chandra, Dr Prashant Mukkannavar and Mr. Javali for their help.

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Effect of Deep Cervical Flexor Muscle Fatigue on Cervicocephalic Kinesthetic Sensibility

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Abstract

Objective

The aim of the study was to determine Effect of deep cervical flexor muscle fatigue on Cervicocephalic kinesthetic sensibility.

Material and Methods

25 asymptomatic young adults (age range, 18–30 years) were recruited in to the study. The subjects were measured for reposition errors (degrees) by the Cervicocephalic kinesthetic sensibility tests which include Head-to-Neutral Head Position (NHP) repositioning tests and Head-to-Target repositioning tests with Cervical Range of Motion (CROM) Device. The two repositioning tests were performed in the sagital, transverse, and frontal planes. The subjects were introduced to deep cervical flexor (DCF) muscle fatigue protocol and reposition errors were measured post fatigue protocol.

Results

The results of paired t- test for pre-post comparison of Head To Neutral Head Position and Head To Target Repositioning tests within the groups showed a significant difference in sagital plane (flexion and extension) with $p \leq 0.001$ and no difference in frontal (side flexion-right and side flexion-left) and transverse plane (rotation-left and rotation-right) movements

Conclusion

DCF muscle fatigue will alter cervical position sense in sagital plane movements. So endurance of these muscles might play vital role in maintaining cervical position sense

Key Words

Kinesthesia: Proprioception: Muscle fatigue: Deep cervical flexors

Introduction

Muscle spindle contributes to the automatic, unconscious control of posture and movement. Muscle afferents participate in phase- and task-dependent reflexes and their incoming signals are matched to the commands from the central pattern-generators, to achieve the desired movements[1]. The major role of muscle receptors is in conscious sensation, specifically, kinaesthesia, the sense of position and movement of our limbs and spine[2,3]. Proprioceptive afferent input from neck muscles plays a significant role in the control of human posture[4]. Muscle fatigue is known to modify the discharge of sensory receptors such as muscle spindles or Golgi tendon organs in the animals[5-8]. Muscle fatigue has been shown to affect joint position sense and body sway increases significantly after strenuous physical exercise possibly owing to alteration in proprioception. Little is known, however, about how neck muscle fatigue affects postural equilibrium and orientation[9-14].

The Deep Cervical Flexor (DCF) muscles are small stabilizing muscles located on the anterior and anterolateral surfaces of the cervical spine deep to the SCM muscle. Although the muscles comprising the DCFs are not clearly defined, the longus capitis, longus colli, rectus capitis anterior, and occasionally the rectus capitis lateralis muscles have been cited in the literature[15-17]. The location of the DCFs suggest that they potentially play an important role in stabilizing the cervical spine[15-17]. In upper quadrant postural dysfunction the DNF muscles are always stretched due to forward head position adapted by the subject resulting in loss of strength and endurance[15-21]. It is apparent that the afferent input originating from the deep neck flexor muscles does exert an influence in the activation of the muscles that control the cervical motion and, thus, may contribute to dynamic stability of the cervical spine[15-18]. Some researchers advocate that activation and retraining of the DCF muscles by the performance of cranio-cervical flexion exercises results in increased stability and enhanced proprioception of the head and neck system[16,18-23]. The longus colli and dorsal neck muscles form a sleeve that stabilizes the cervical spine in all positions against the effects of gravity. In the presence of neck pain and headache, weakness has been identified in the deep neck flexor muscles and patients show increased activity in their superficial flexors, presumably as a compensation strategy[22,23].

The influence of fatigue on the sense of position has been studied before in peripheral joints and showed that a subject's ability to reproduce a given angle deteriorated after fatiguing exercise and resulted in a producing a significant Proprioceptive error[24-30]. It is theorized that when muscle performance is impaired, the balance between the stabilizers on the posterior aspect of the neck and the DCFs will be disrupted, resulting in loss of proper alignment and posture, which is then likely to contribute to cervical impairment. The purpose of

this study is to see whether DNF muscle fatigue alters proprioception and neuromuscular control of the cervical spine.

Methods

Subjects

Advertisement in the Physical Therapy department was given in the form of Posters and lectures for voluntary participation of the subjects. The study included 25 asymptomatic young adults (range, 18–30 years). All subjects reported that they had no neck pain at the present time. To be considered asymptomatic, a subject could not have had any previous treatment for neck pain, and no current neck pain. Exclusion criteria included are traumatic spinal injury, whiplash associated disorder; central nervous system impairment, demonstrated by paraethesia; vestibular impairment, demonstrated by vertigo, dizziness, or motor imbalance; neck pain induced by cervical motion in the range tested for the study. The subjects were to attend two sessions. The first was to familiarize them with the equipment and reposition tasks. All participants signed a written consent form prior to participating in the experiment.

Instrumentation

Cervical Range of Motion (CROM) device

The cervical range of motion (CROM) device is a type of goniometer designed specifically for the cervical spine and was used to measure cervical range of motion. The Cervical Range-of-Motion Device (CROM) has been evaluated most often, with 7 studies assessing its reliability on healthy volunteers or symptomatic patients. The CROM has 3 inclinometers, one to measure in each plane, and is strapped to the head. One gravity dial meter measures flexion and extension, another gravity dial meter measures lateral flexion and a compass meter measures rotation with its accuracy reinforced by 2 magnets placed over the subject's shoulders. The advantage of the CROM over a single inclinometer method is that it does not need to be moved to measure movement in another plane. Studies have declared it superior to the universal goniometer and visual estimation 24 and superior to a single inclinometer. CROM Device is effectively used in clinical set up, Easy to apply and Cost effective. CROM device has good Criterion validity (r = 0.89 – 0.99) and Reliability (ICC= 0.92 - 0.96)[31-34].

Pressure Biofeedback Device

It is a three chamber pressure device that provides feedback to ensure quality and precision in exercise performance and testing. The three chamber pressure cell of the stabilizer is placed between the part of body requiring monitoring and a firm surface (e.g., floor, back of chair, plinth, bed, wall). Tighten the screw at the base of the pressure gauge. Pump to inflate the three chambers of pressure cell until it molds between the body part and the supporting surface. A pressure of 20 mmHg is suitable for the resting pressure of the inflated cell. Pressure on the cell can be increased, decreased or maintained depending on the exercise / movement required. After exercise, air is released by loosening the screw.

Measurement of Cervicocephalic kinesthetic sensibility

The subjects were asked to sit upright in a comfortable position and look straight ahead to be determined as the neutral head position (NHP). Thus, it is a subject adopted head zero position and may be influenced by the head to shoulder relationship. However, during the reposition test the shoulder position was not allowed to move. Therefore, the influence of shoulder position during repositioning test was controlled. The CROM unit was placed on top of the head and attached posteriorly using the Velcro strap. The magnetic part of the unit was then placed so that it sat squarely over the shoulders. The investigator calibrated the CROM device to a neutral head position.

For the Cervicocephalic kinesthetic sensibility tests, subjects were keeping the head in the NHP and were told to close their eyes throughout the subsequent tests. The first test is Head-to-Neutral Head Position (NHP) repositioning tests[35]. The subjects were instructed to turn the head fully to the left and back to what they considered the starting point in a controlled fashion without opening their eyes. When the subjects reached the reference position the subject's relocation accuracy was measured in degrees with CROM device. In the second repositioning test is Head-to-Target repositioning tests.36 The investigator moved the subject's head slowly to the predetermined target position, 65% of maximum range of motion. The speed of passive neck motion was very slow as higher speeds have been associated with significant differences in vestibular function according to age. The head was maintained in the target position for 3 seconds and the subject was asked to remember that position and the head was brought to neutral position and then the subject were asked to reposition actively by moving the head to the target position. The two repositioning tests were performed in the sagital, transverse, and frontal planes. When the subjects reached the reference position, the subject's relocation accuracy was measured in degrees with CROM device.

Fatigue protocol

Once the cervical reposition ranges was measured using CROM device the DCF muscle fatigue protocol was administered with the Cranio cervical flexion (CCF) test, which is performed in the supine lying position. The patient performs five incremental stages of CCF. Performance was guided by feedback from an air filled pressure sensor placed behind the neck to monitor the subtle flattening of the cervical lordosis, which occurred with contraction of longus colli. Subjects attempt to target progressive 2 mm Hg pressure increments from a baseline of 20 mm Hg to the final target of 30 mm Hg. Each level was repeated 10 times with 10 sec hold each time. The investigator analyzed the pattern of movement as well as the activity in the superficial flexors. There was progressive increasing CCF with each stage of the test.

The patient palpates the superficial flexors to avoid their inappropriate use. The subjects were asked to stop the test when the subject substitute head and neck retraction action rather than the rotation action of CCF or overuse of the sterno-cleidomastoid, hyoid, or scalene muscles when observed by the investigator or when the subject feels tired. Following the fatigue protocol the cervical reposition errors were measured to compare with the pre fatigue levels.

Statistical Analysis

Parametric Paired t-test was used to compare pre-post change in joint reposition errors within the group. The statistical analysis was done using the SPSS 11.0 for windows software. The statistical significance value will be set at 0.05 with 95% confidence interval and a p value less than or equal to 0.05 will be considered to be significant.

Results

The results of paired t- test for pre-post comparison of Head To Neutral Head Position (Table 1) and Head To Target Repositioning tests (Table 2) within the groups showed a significant difference in sagital plane (flexion and extension) with p ≤0.001 and no difference in frontal (side flexion-right and side flexion-left) and transverse plane (rotation-left and rotation-right) movements.

Table 1: Pre and post fatigue Repositioning errors (degree) of Head-to-Neutral Head Position (NHP) repositioning tests (n=25)

Head to NHP (deg)	Pre Fatigue Mean (SD)	Post fatigue Mean (SD)	Sign.
Flexion	3.1±1.01	9.04±2.45	p≤0.001
Extension	4.6±3.8	11.04±3.01	p≤0.001
Left- rotated	3.4±4.7	3.5±3.3	NS
Right- rotated	3.6±3.8	3.5±3.2	NS
Left –side-bended	1.3±3.1	2.0±3.1	NS
Right-side bended	2.9±3.4	4.0±3.9	NS

SD=standard deviation, NS=not significant

Table 2: Pre and post repositioning errors (degree) of Head-to-Target repositioning tests (n=25)

Head to Target (deg)	Pre Fatigue Mean (SD)	Post fatigue Mean (SD)	Sign.
Flexion	2.9±1.01	7.04±2.66	p≤0.001
Extension	4.0±3.8	10.26±3.45	p≤0.001
Left- rotated	3.0±3.7	3.8±4.3	NS
Right- rotated	3.6±3.8	4.1±2.9	NS
Left –side-bended	2.9±3.8	2.8±3.8	NS
Right-side bended	4.0±2.4	4.6±3.1	NS

SD=standard deviation, NS=not significant

Discussion

The results of the present study showed that Proprioceptive errors were more after fatiguing the DCF muscles. The difference was seen only in sagital movements and not in frontal and transverse plane movements. The possible reason for increased repositioning errors in sagital plane might be that the DCF muscles are more responsible for stabilization in this plane and fatiguing this muscle might modify the discharge of sensory receptors such as muscle spindles or Golgi tendon organs[37,38]. It has been stated that, if a muscle is fatigued, the sensory inputs may be disturbed due to increased inflow from free nerve ending. Central effects of fatigue-induced discharge in small-diameter muscle afferent have been already demonstrated. Muscle fatigue has been shown to affect joint position sense, and body sway increases significantly after strenuous physical exercise possibly owing to alteration in proprioception[38,39]. As in this study, our present results lead us to suggest that localized muscle fatigue of the deep neck muscles may modify sensory inputs, affecting central mechanisms of postural control. This may have occurred because of an increased inflow from free nerve endings because of ionic or metabolic changes, such as elevated interstitial potassium concentration, or insufficient oxygen input due to reduced blood flow[40,41,42].

These results would suggest that patients with cervical disorders may be more susceptible to altered proprioception by neck muscle fatigue than normal subjects. It is possible that the chronic pain state experiencing by patients could lead to disturbed postural control and its ability to compensate for abnormal neck input. Indeed, it is known that cervical pain-related input is able to provoke deficits in postural control and neck nociceptive input induces changes in the perception of the vertical. In the present study the Proprioceptive errors were not found in frontal and transverse plane this might be because the DCF muscles (Longus coli and Longus Capitus) might not be influencing side flexion and rotation movements and other surrounding muscles might have given feedback on the position sense and movement sense. Most of the subjects in the present study who had repositioning errors in sagital plane following DCF muscle fatigue has overshoot the target. This might be due to overcompensation taken by other muscles and an increased effort to reach the target. Some subjects in the study also were searching for the target which indicate that decreased proprioception input following fatiguing were taking more time to get the information from other muscles leading to increased time taken to reach the target.

Conclusion

The results of the present study proved that DCF muscle fatigue will alter cervical position sense in sagital plane movements. So endurance of this muscle plays vital role in maintaining cervical position sense, which is necessary for maintaining cervical postural control. Therefore, DCF endurance exercises should be included in daily routine to prevent nonspecific cervical pain.

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Cervical Spinal Mobilization Versus TENS in the Management of Cervical Radiculopathy: A Comparative, Experimental, Randomized controlled trial

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Abstract

Purpose of Study

The need of study was to find out whether a movement based approach along with exercises is beneficial than a non-movement based electrotherapeutic approach along with exercises for relieving upper limb radiculopathy arising due to cervical spondylosis.

Materials & Methodology

75 subjects were randomly allocated into three groups i.e. Group A: (Hot fomentation, Cervical contralateral lateral flexion mobilization and Isometric neck exercises), Group B: (Hot fomentation, Transcutaneous electrical nerve stimulation and Isometric neck exercises), Group C: (Control group: Hot fomentation and Isometric neck exercises).The duration of intervention was 3 weeks and treatment was given on The outcome measures were VAS pain score, Elbow extension range of motion measured in upper limb tension test-1 position, Northwick Park neck pain questionnaire, Neuropathic pain scale, Short form of Mc Gill pain questionnaire. Pre and post intervention values of outcome measures were recorded and also after a follow-up of 6 weeks.

Results

The participants treated within groups showed a statistically significant decrease in pain, increase in elbow extension ROM, and an improvement in the functional outcome scores as per NPQ score, NPPS and SF- MPQ score with $p<0.001$. But there was no statistically significant difference in pain scores when compared between the experimental groups ($p= 0.075$), increase in amount of elbow extension ROM ($p=0.024$) was significant, and a significant improvement in functional outcome level as per NPQ ($p=0.034$) and a non-significant improvement in NPPS and SF-MPQ score ($p>0.05$), after 3 weeks of intervention.

Conclusion

Cervical mobilization when compared to Transcutaneous electrical nerve stimulation is equally effective in relieving pain, reducing the radicular pain in upper limb and improving the functional outcome.

Key Words

Neck pain, Cervical radiculopathy, Cervical lateral flexion mobilization, TENS, Isometric neck Exercises, ULTT-1.

Introduction

Neck disorders affect 13% of adults at any one time and up to 30% of men and 50% of women in the course of a lifetime[1,2]. Some studies have stressed the importance of physical factors like faulty posture, monotonous work and unsuitable working positions[1]. Cervical spondylosis is a common degenerative condition of the cervical spine that most likely is caused by age-related changes in the intervertebral disks[3]. Cervical radiculopathy has an incidence rate of 83 per 100,000 population and a prevalence of 3.3 cases per 1000 people[4]. The radiculopathy is a result of mechanical pressure on the nerve root exerted by disk protrusion or spondylotic spurring or a combination associated with an inflammatory component[5].

Testing of nerve reaction indicates the sensory nerve root as a prominent site of pain production in a dermatomic distribution[6]. Pain of aching nature is felt proximally and a parasthesia or sensation of numbness is felt distally, pain more distal in radiation is dermatomal in distribution, whereas pain proximal to the interscapular area is more likely from posterior primary division radicular pain[7]. The recognition of the origin of the referred pain is important for both the indication and contraindication of specific physiotherapy treatment techniques[8].

Clinical practice guidelines recommend the use of manual therapy along with exercise therapy for managing mechanical neck disorders[9]. Cervical mobilization reduces pain and disability and, more specifically, with studies illustrating the benefits of a movement-based treatment approach of patients with peripheral Neurogenic pain[10]. Both manual therapy interventions combined with home exercises are effective in improving pain intensity, pain quality scores and functional disability levels[11]. Cervical lateral flexion mobilization is used in patients whose symptoms of cervical origin are unilaterally distributed, either cranially or in the neck, scapula or arm[12]. The main aim of this technique is to produce lateral flexion so as to direct the mechanism toward opening of the intervertebral foramen[12]. Release of pressure in this situation may help venous return, improve resolution of inflammatory process, reduce tissue fluid pressure and improve intraneural circulation[13].

In a survey of physicians about attitudes on treatment of musculoskeletal disease, active exercise, traction, TENS, and ultrasound were perceived to be the best methods for the treatment of neck pain[14]. In the past decade, a

number of studies have indicated that strengthening of the neck muscles in patients with chronic neck pain results in reduced pain and decrease in disability[15]. Nordemar and Thorner reported that TENS significantly increased neck mobility compared with wearing a neck collar in patients with neck pain[16].

Materials and Methodology

Materials used

1. Single channel TENS Kit. (Galtron electromedical equipments, 20E620, 100 Hz)
2. Universal Half circle plastic goniometer.
3. Hot moist pack.
   Study setting: Datta Meghe Institute of Medical science's Ravi Nair Physiotherapy College, Musculos-keletal physiotherapy OPD.

Inclusion criteria

1. Subjects between 20 to 50 years of age.
2. Subjects having neck pain and tingling numbness unilaterally in upper limb for more than one week.
3. Diagnosed cases of Cervical spondylosis.
4. Participants who gave informed consent to participate in the study.

Exclusion criteria

1. Presence of VBI syndrome
2. History of fracture cervical vertebrae
3. Cervical hypermobility
4. Bone disease: tumors or infection.
5. Diabetic neuropathy
6. Acute intervertebral disc prolapse
7. Osteoporosis
8. Rheumatoid arthritis/ inflammatory arthropathies

Methodology

Subject Recruitment: 75 subjects which were diagnosed cases of Cervical Spondylosis with history of subacute unilateral upper limb radiating pain of cervical origin in the age group of 20 - 50 years of age were referred from Department of Orthopedics to Musculoskeletal physiotherapy OPD. The subjects were then randomly assigned to three study groups. Then subject's consent was taken for their willingness to participate. All the rights of the participants were protected.

Assessment: The subjects were assessed using the assessment proforma. The testing for reduced intervertebral foraminal opening dysfunction or reduced closing dysfunction were then performed for conforming the mechanical diagnosis of the disorder.

Application of Hydrocollator packs: The part to be treated was properly exposed covering rest of the body. The subject was asked to lie prone on the treatment plinth in prone position with one pillow under the chest. The hot pack was then applied to the posterior aspect of neck.

Group A: Cervical contralateral lateral flexion mobilization (Dynamic Opener):

Depending upon the dermatomal involvement and the relevant upper limb neural tissue provocation test, the level/ levels of mobilization was/were determined[14]. Irrespective of the type of dysfunction diagnosed while performing the specific tests mentioned above, dynamic opener technique applied for the opening of intervertebral foramen was used.

Stage 1: Subject lied on his back with his head and neck beyond the end of couch supported by the therapist.

Stage 2: Initially the therapist stood at the head end of couch and took up the head and arm position i.e. the head of the subject supported by the therapist arm. The position was then altered so that the ipsilateral forearm lied behind the subject's ear almost under the occiput and the contralateral hand was brought forwards so that the palm covered the whole of ear. Without permitting any lateral flexion of the subjects head or allowing any movements of the heel of hand away from the subject's ear, the therapist moved around alongside the subject's contralateral shoulder to face diagonally across his head.

Stage 3: The final stage involved crouching to hug the subjects head while adopting the required degree of lateral flexion by displacing his neck to affected side with the contralateral hand and laterally flexing the head on the opposite side The movement was localized to particular intervertebral level by the pressure of the palmar surface of the index finger, just distal to MCP joint on the relevant level of articular pillar.

The oscillatory movement was then produced by body motion. The body movements generated a force which was transmitted to subject's neck by a much localized pressure against the articular pillar which displaced the neck away causing the intervertebral foramen to open up on to the affected side.

Amplitude: Grade II: Large-amplitude movement without moving into resistance / Grade III: Large-amplitude movement upto the limit of the range.

Frequency of oscillations: 1 repetition / 5 seconds.

No of repetitions: 10-15 oscillations.

Fig. 1: Application of hot moist pack to neck.

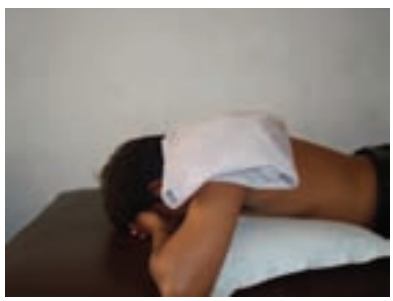


Fig. 2: Taking up the head and arm position

Fig. 3: Adopting the initial stage of mobilization

Group B: Application of Transcutaneous electrical nerve stimulation

Preparation of apparatus: All the apparatus and equipment needed were assembled and suitably positioned.

Preparation of the subject: Area to be treated was properly exposed covering rest of body.

Application: Silicone rubber electrodes were fixed to the skin with adhesive tape. The dermatomal placement method was used: One electrode was placed at the corresponding spinal nerve root level and other at the distal end of dermatome.

Type of TENS:	Conventional
Pulse duration:	50 µs
Frequency:	100 Hz.
Mode of application:	Continuous
Duration of treatment:	30 minutes

Isometric neck exercises: (Figure.)

Isometric neck exercises began with isometric contractions for neck flexors, lateral flexors, rotators, and extensors. These contractions were maintained for a period of 6-8 seconds. Subjects were asked to perform 5 repetitions in each direction.

Group C (Control group)

Subjects allocated to this group received hot fomentation applied to posterior aspect of neck region for 20-25 minutes. After the application of hot pack, they were taught the Isometric neck exercises and were asked to perform it under supervision. The procedures were the same as mentioned above.

Intervention: 10 treatment sessions were given to the subjects, on alternate days for a period of 3 weeks. They were called after period of 6 weeks for follow-up.

Outcome measurement tools:

Procedure: Assessment on the outcome parameters was performed as follows.

1. Visual Analogue Scale: Pain was rated by the subject placing a mark in one location on the line.
2. Elbow extension range of motion measured in the upper limb tension test 1 position: The recording of the range of motion was done by a therapist using a half circle plastic goniometer, who was blinded from the nature and expected outcomes of the study.
3. Northwick Park Neck pain questionnaire (NPNQ): There are 4 points given to each question for e.g. no pain =0 and worst pain=4. The subject is asked to select only one option in each question according to the present status
4. Neuropathic pain scale (NPPS): The scale measures several different aspects of pain Each pain descriptor was been given 10 points for e.g. 0= No pain and 10= the most intense pain sensation imaginable. The subjects were asked to put an 'X' through the number which best described the type of pain.
5. Short form of Mc Gill pain questionnaire (SF-MPQ): The main component of the SF-MPQ consists of 15 descriptors (11 sensory; 4 affective) which are rated on an intensity scale as 0 = none, 1 = mild, 2 = moderate or 3 = severe. The subjects were asked to rate their symptoms.

Fig. 5: Application of TENS to subject.

Results

Statistical analysis

Statistical analysis was done by the statistical package of social science (SPSS) version 14.0. The results are expressed by means and SD, confidence interval & p value for significance. Chi-squared tests were used for nominal data comparison. Also statistically three groups were compared by ANOVA & Post hoc test. Within group comparison was done by using paired t-test.

Demographic profile: The mean age of subjects in group A was 36.33±9.4 years, in group B was 37.25±9[8]. years and in group C was 39.33±8.6 years. There were 52% females and 48% males. As a result all groups were found to be homogenous regarding age; body mass index and duration of symptoms.

Within group analysis: Mean±sd reduction in VAS score in Group A was after intervention of 3 weeks was 4.49±0.76 which was statistically significant (p=0.000) and a similar result at 6th week follow-up. Improvement in the Elbow extension range of motion after intervention was 14.6º±5.94º which was statistically significant (p=0.000). Improvement in the Northwick Neck pain questionnaire score was 9.15±1.96 and this result was statistically significant (p=0.000). Mean improvement in NPPS scores after the intervention was 19.43±5.14 which was found to be statistically significant (p=0.003). Reduction in the SF-MPQ score was 14.40±5.44 which was statistically significant (p=0.000).

Mean±sd reduction in VAS score in Group B after intervention of 3 weeks was 3.53± 0.76 which was statistically significant (p=0.000). Improvement in the Elbow extension range of motion after intervention was 10.17º±4.36º which was statistically significant (p=0.011). Improvement in the score was 7.65±1.81and this result was statistically significant (p=0.006). Mean improvement in neuropathic pain scale scores after the intervention was 19.2±4.14 which was found to be

statistically significant (p=0.007). Reduction in the Short-form McGill pain questionnaire score was 11±2.16 which was statistically significant (p=0.006).

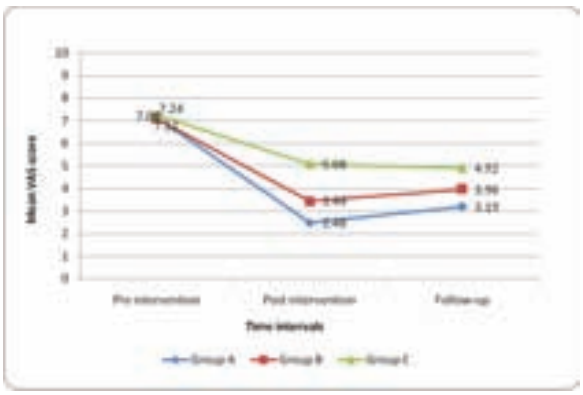
The mean±sd reduction in VAS score in Group C (control group) was 2.16± 0.8 which was statistically significant (p=0.042). The improvements in the scores of other parameters in i.e. NPNQ, NPPS and SF-MPQ were non-significant (p>0.05).

Between group analysis- All the outcome parameters of the Groups A, B & C were compared at various intervals i.e. Pre-intervention, Post-intervention (3weeks) and Follow up (6th week) using One-way analysis of variance (ANOVA) and Post HOC Tukey-HSD test.

Discussion

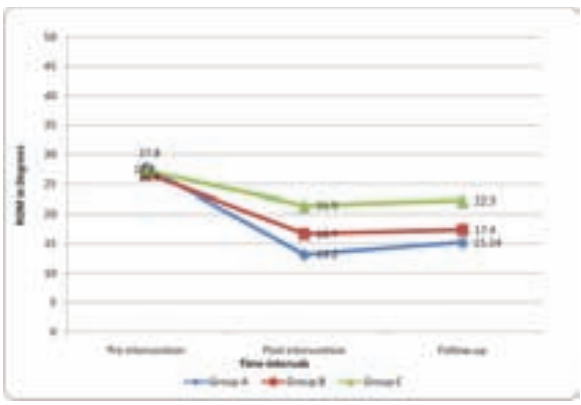
The analysis of the treatment effects revealed that significant differences could be observed between the effects of cervical mobilization and TENS when compared using a control group. The results of the study have demonstrated that the manipulative physiotherapy treatment for cervical spine and exercise protocol is capable of producing beneficial effects on pain, functional disability in subjects with lower cervical radiculopathy associated with cervical spondylosis.

1. Visual analogue scale score:



There was insignificant difference between the VAS scores of Group A&B (F= 18.49, p=0.075) and a significant difference between group A&C and group B&C (p<0.005)

2. Elbow extension ROM limitation measured in ULTT1 position:

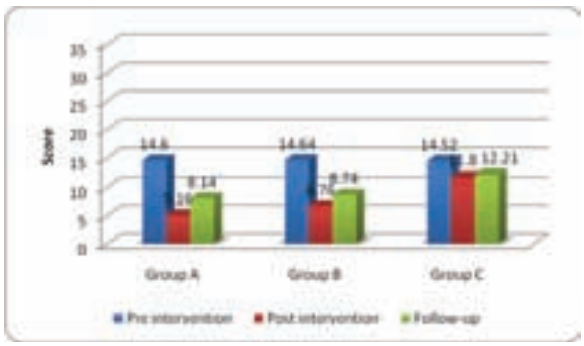


There was non significant difference in the ranges of Group A&B (F=12.01, p=0.024). But between Group B&C in which there was a significant difference (p=0.005), and also between Group A&C (p=0.000) showed a significant difference.

In a comparative group study done by Nordemar R and Thorner C16, neck collar, neck collar plus transcutaneous electrical nerve stimulation and neck collar plus mobilization were compared in the treatment of sub-acute cervical pain. The mobilization group exhibited greater improvements in short form McGill (SF-MPQ) score at 1 week, but no significant differences were noted at 8 weeks and 3 months. Our results of between group analyses revealed that there was a significant difference in the score of the two experimental groups were compared (p=0.001). In the study done by Michel W. Coppieters et al[17], analyzing the treatment effects between the 2 groups i.e. one group of subjects receiving cervical mobilization and the other receiving therapeutic ultrasound for the management of cervicobrachial pain, significant differences could be observed in the increase in the elbow extension range of motion (P=.0306). Our results of between group analyses revealed that there was a significant difference in the elbow extension range of motion between ranges of the two experimental groups (p=0.024).

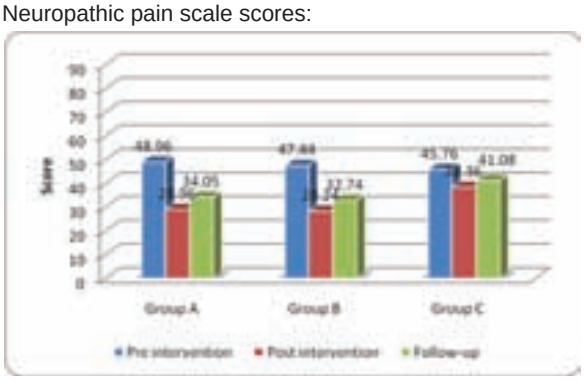
In a study done by Cowelland IM18, whereby they had obtained 55% improvement in the Northwick neck pain questionnaire score of the subject receiving cervical

3. Northwick Park neck pain questionnaire score:



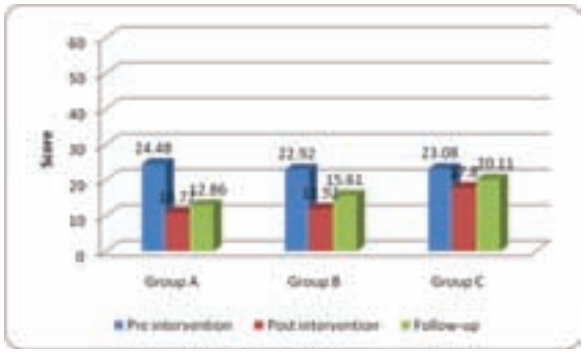
When the scores of Group A&B were compared there was statistically significant difference (F=39.28, p=0.015) between them. When scores of Group A&C was compared there was a significant difference (p=0.000) and also a similar result when groups B&C were compared (p=0.001).

4. Neuropathic pain scale scores:



When the Group A&B were analyzed there was non-significant difference between the scores (F=15.93, p=0.953) and significant difference between the groups A&C and Groups B&C (p<0.05).

5. Short form-McGill pain questionnaire score: A comparison of all the 3 groups demonstrated a significant difference in the functional outcome score subsequent to the treatment (F=28.23, p= 0.000). When the scores of Group A&B were compared there was statistically significant difference (p=0.001) between them. When scores of Group A&C and groups B&C were compared there was a significant difference (p=0.000)



mobilization. This result is similar to the result of our study, where in the subjects receiving cervical spinal mobilization had a significant improvement (62%; p=0.000) in the NPPQ score.

Also in the study group, where the subjects received TENS there was a significant improvement (53%; p=0.000). A similar result was found in a randomized clinical trial done by Thomas TW chiu et.al[19] in which they investigated the effect of transcutaneous electrical nerve stimulation(TENS) and neck exercise in chronic neck pain patients where there was a significant reduction(p=0.034) in the Northwick park neck pain questionnaire score of subjects receiving TENS. The mechanism of the analgesia produced by transcutaneous electrical nerve stimulation is explained by the gate control theory of pain modulation proposed by Melzack and Wall[20].

Rationale of the treatment by cervical spinal mobilization technique: According to classical work on neurodymamics by Michael Shacklock(2005)[13], treatment for different nerve roots problems often gravitate towards similar technique, that initially focus on reduction of pressure on the nerve root. Release of pressure in this situation may help venous return, improve resolution of inflammatory process, reduce tissue fluid pressure and improve intraneural circulation. In the case of cervical radiculopathy, the key concern is to take pressure off the nerve root and improve its blood flow and oxygenation. Thus Cervical lateral flexion mobilization was used in patients whose symptoms of cervical origin are unilaterally distributed, either cranially or in the neck, scapula or arm[20]. In such cases, when this mobilization was being used for the first time it was done with the patients head laterally flexed away from the painful side. The direction of movement, particularly of a mobilization technique, is guided by the purpose of the technique[21]. Thus the aim was to open intervertebral space of the affected side.

It is also hypothesized that with enhanced intersegmental motion, the introduction of home exercises also enabled the subject to have a physiological and remedial influence on the pathological neural tissue. In a study done by Allison GT et.al[22], the subjects receiving passive technique for mobilizing neural tissue structures and the cervical spine, showed greater improvements in pain intensity, pain quality scores and functional disability levels at 2 weeks. In the present study, where in the subjects receiving cervical spine mobilization had a significant improvement (57%; p=0.000) in the score.

Conclusion

The randomized control trial showed that Cervical mobilization when compared to Transcutaneous electrical nerve stimulation was more effective in relieving pain, reducing the radicular pain in upper limb and improving the functional outcome for a short term duration of 3 weeks. However in long term duration the results remained equivocal as subjects in both experimental groups had similar scores in the functional questionnaires.

Limitations of Study

1. Relatively smaller sample size.
2. The motor weakness present/absent in the muscles of the upper limb associated with cervical radiculopathy was not taken into consideration while comparing the effectiveness of cervical mobilization and TENS in the managing cervical radiculopathy.

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Prevalence and Predisposing Factors of Low Back Pain Among Male Underground Miners

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Abstract

Aim and Objectives

To determine the prevalence and predisposing factors of Low Back Pain among male underground miners.

Scientific Background

The work of miners requires repeated lifting of heavy burdens, vibrations, bending, twisting of the spine and prolonged standing. They also carry heavy loads such as emergency oxygen devices and batteries suspended at waist height. Biomechanical lumbo-spinal strain and intense physical work are the characteristic hallmarks of mining work. The impact of altered mechanics results in pain. Aches and pains results in enormous costs to health and industry. Hence affects the economic condition of the miner.

This study was undertaken to determine the prevalence and predisposing factors of low back pain in the underground miners, which will benefit the miners to prevent low back pain and hence maintain their quality of life.

Methodology

This was a cross sectional study on 100 male underground miners. The study design was survey design. A simple random sampling of every person with current full time employment in the mine for minimum one year duration with minimum two hours work for minimum five days a week at their current occupation at the time of the study were selected for the present study. The screening was done with the help of The Orebro Musculoskeletal Pain questionnaire (OMPQ), which is valid and reliable in predicting long-term disability. The data was analyzed using inferential statistics.

Conclusion

The prevalence of low back pain among 100 male underground miners was 67%, most of the subjects showed that the work was heavy and pain if present was worsened by physical activities such as bending and lifting.

Introduction

Low back pain is a common symptom of musculoskeletal disorders or of disorders involving the lumbar vertebrae and related soft tissue structures such as muscles, ligaments, nerves and intervertebral discs. It can be either acute, sub acute or chronic in its clinical presentation. Most often, the symptoms of low back pain show significant improvement within a few days to a few weeks from onset. In a significant number of individuals, low back pain can be recurrent in nature with a waxing and waning quality to it. In a small proportion of individuals this condition can become chronic. Population studies show that back pain affects most adults at some stage in their life and accounts for more sick leave and disability than any other single medical condition[1].

Classification

One method of classifying lower back pain is by the duration of symptoms: acute (less than 4 weeks), sub acute (4–12 weeks), chronic (greater than 12 weeks).

Prognosis

Most patients with acute onset lower back pain recover completely over a few weeks[2].

Low back pain (LBP) has been reported in many industries including mining[3]. Mining has continually been observed as being so hazardous a job that it was the preserve of only slaves and criminals. Though there has been some degree of mechanization of the mining activities, there still remains manual work involving lifting of heavy burdens.

Four work-related factors are associated with increased risk of back pain and injury:

Force: Exerting too much force on your back may cause injury. If your job is physical in nature, you might face injury if you frequently lift or move heavy objects.

Repetition: Repetition refers to the number of times you perform a certain movement. Overly repetitious tasks can lead to muscle fatigue or injury, particularly if they involve stretching to the limit of your range of motion or awkward body positioning.

Posture: Posture refers to your position when sitting, standing or performing a task. If, for instance, you spend most of your time in front of a computer, you may experience occasional aches and pains from sitting still for extended periods. On average, your body can tolerate being in one position for about 20 minutes before you feel the need to adjust.

Stress: Pressures at work or at home can increase your stress level and lead to muscle tension and tightness, which may in turn lead to back pain.

Different occupational groups are drilling, blasting,

mucking/loading, tramming, tipping /skipping /rock-breaking, supervisory and engineering, pipe / track-fitting, welding, shaft tending, pumps attendance and grouting, who spend most or their entire shift underground. These occupations are directly related to the production and removal of ore and rock, and are therefore involved in prolonged standing, twisting and turning, lifting of heavy burdens and trips and falls[4].

Need for the study

This study was undertaken to determine the prevalence and predisposing factors of low back pain in the underground miners, which will benefit the miners to prevent low back pain and hence maintain their quality of life. Also identification of workers at risk of failing to return to work due to personal and environmental factors provides the opportunity for treating practitioners to apply appropriate intervention to reduce the risk of long-term disability in injured workers.

Material and Methods

This was an Observational study on 100 male underground miners using Simple random sampling. The study was undertaken at Coal mines at Chandrapur and Ballarsha, Stone mines at Sawangi and Borgaon (Meghe) and at Acharya Vinoba Bhave Rural Hospital, Sawangi(M), Wardha. The inclusion criteria were male subjects between age group of 20-80 years with full time employment for minimum one year duration and with minimum 8 hours work for minimum 6 days a week. The exclusion criteria were any recent injury or trauma or any known systemic disease and Patients complaining of pain in areas other than low back. The screening was done with the help of The Orebro Musculoskeletal Pain questionnaire (OMPQ) and the data was analyzed using inferential statistics.

Methodology

To begin with the study proposal was sent to the institutional ethical committee. A pilot study was done in the nearby coal mine to validate the questionnaire in our set up. After clearance from the committee permission letters were obtained from the mines to be visited after explaining them about the purpose of the study. Visit was made during the working hours. Workers satisfying the inclusion criteria were interviewed personally with the help of questionnaire. Details regarding their job were also noted. The study consisted of administration of questionnaire used for calculation of prevalence of low back pain among male underground miners. The questionnaire used was such that along with prevalence the risk factors for the development of low back pain were also analyzed. Patients who complained of pain in other areas of the body were excluded.

Table 1: Prevalence of low back pain

Low back pain	No of subjects (n=100)	Percentage
	67	67%

Observations and Results

Graph 1: Prevalence of site of pain in miners.

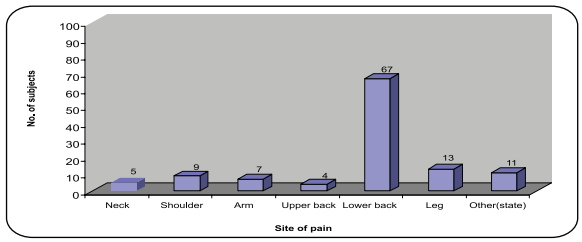


Table 2: Distribution of subjects according to intensity of work (Heavy or monotonous)

Intensity of work	No. of subjects	Percent
0-Not at all	0	0.0
1.00	3	3.0
2.00	5	5.0
3.00	0	0.0
4.00	4	4.0
5.00	6	6.0
6.00	0	0.0
7.00	0	0.0
8.00	82	82.0
9.00	0	0.0
10-Extremely	0	0.0
Total	100	100.0

Graph 2: Distribution of subjects according to intensity of work

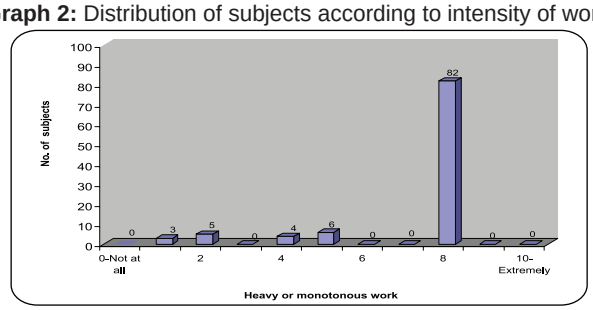


Table 3: Distribution of subjects according to pain status during the past week.

Pain status	No. of subjects	Percent
0-No pain	33	33.0
1.00	0	0.00
2.00	0	0.00
3.00	3	3.00
4.00	4	4.00
5.00	6	6.00
6.00	19	19.00
7.00	20	20.00
8.00	10	10.00
9.00	5	5.00
10-Pain as bad as could be	0	0.00
Total	100	100.0

Graph 3: Distribution of subjects according to pain status during the past week.

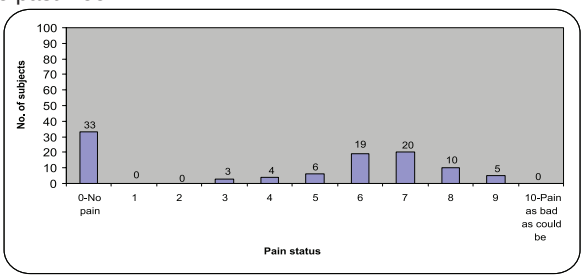
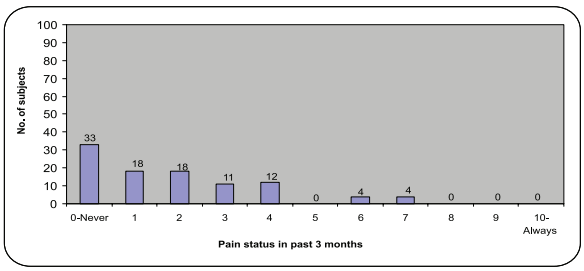


Table 4: Distribution of subjects according to pain status in the past three months

Pain status in past three months	No. of subjects	Percent
0-Never	33	33
1.00	18	18
2.00	18	18
3.00	11	11
4.00	12	12
5.00	0	0
6.00	4	4
7.00	4	4
8.00	0	0
9.00	0	0
10-Always	0	0
Total	100	100.0

Graph 4: Distribution of subjects according to pain status in the past three months



Discussion

The aim of the study was to determine the prevalence and predisposing factors of Low Back Pain (LBP) among male underground miners. This was a cross- sectional study on 100 male underground miners. The study design was observational. Miners with current full time employment in the mine for duration of at least one year, with minimum 2 hours work for minimum 5 days a week at their current occupation at the time of the study were selected for the present study.

From table no. 1 it was found that number of subjects having pain in neck were 5%, shoulder 9%, arm 7%, upper back 4%, lower back 67%, leg 13% and other(state) 11%. Study shows that more than half i.e. 67% of the subjects had low back pain.

Table no 2 was to assess that whether the work heavy or monotonous. It was seen that 82% of the subjects scored

Table 5: Distribution of subjects according to affect of physical activity on pain.

Affect of physical activity on pain	No. of subjects	Percent
0-Completely agree	0	0.00
1.00	0	0.00
2.00	0	0.00
3.00	0	0.00
4.00	0	0.00
5.00	0	0.00
6.00	0	0.00
7.00	4	5.97
8.00	54	80.59
9.00	4	5.97
10- Completely disagree	5	7.46
Total	67	100.00

Graph 5: Distribution of subjects according to affect of physical activity on pain.

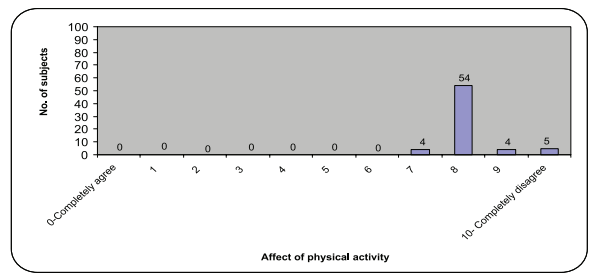


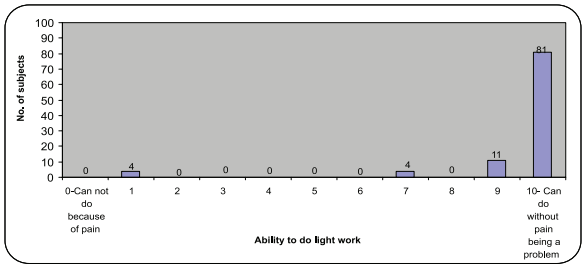
Table 6: Distribution of subjects according to ability to do light work for an hour

Ability to do light work for an hour	No. of subjects	Percent
0-Can not do because of pain	0	0.00
1.00	4	4.00
2.00	0	0.00
3.00	0	0.00
4.00	0	0.00
5.00	0	0.00
6.00	0	0.00
7.00	4	4.00
8.00	0	0.00
9.00	11	11.00
10- Can do without pain being a problem	81	81.00
Total	100.00	100.00

'8' on the question no. 8 which is about whether the work is heavy or monotonous(0-not at all and 10-extremely), 5% scored '2', four percent scored '4' and six percent scored '5'.

Table no 3 was to assess the pain status during the past week. It was seen that 33% of the subjects scored '0' i.e.

Graph 6: Distribution of subjects according to ability to do light work for an hour.



no pain on question no 9 which is related to, the pain that the subject had during the past week (0-no pain and 10-pain as bad as it could be), 20% scored ‘7’, 19% scored ‘6’, 10% scored ‘8’, 6% scored ‘5’, 5% scored ‘9’ and 4% scored ‘4’.

Table no 4 was to assess the status of pain in past three months. It was seen that 33% of the subjects scored ‘0’ i.e. never on question no 10 which is related to, on average, how bad was pain on 0-10 scale in the past three months (0-no pain and 10-pain as bad as it could be), 18% scored ‘1’ and ‘2’, 12% scored ‘4’, 11% scored ‘3’ and 4% scored ‘6’ and ‘7’.

Table no 5 was to see the affect of physical activity on pain out of 67 subjects having pain. It was seen that 54% of the subjects scored ‘8’ on question no. 18 which is related to, whether physical activity such as bending, lifting etc. makes their pain worse (0-completely disagree and 10-completely agree), 5% of the subjects scored ‘10’ i.e. completely agree and 4% scored ‘7’ and ‘9’.

Table no 6 was to check the subjects for the ability to do light work for an hour. It was seen that 81% of the subjects scored ‘10’ i.e. can do light work for an hour without pain being a problem on question no. 21 (0-can’t do it because of pain problem and 10-can do it without pain being a problem) which is about whether the patient can do light work for an hour, 11% scored ‘9’ and 4% scored ‘1’ and ‘7’.

Conclusion

The prevalence of low back pain among 100 male underground miners was 67%, most of the subjects showed that the work was heavy and pain if present was worsened by physical activities such as bending and lifting.

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Upper Trapezius Activation During Upper Limb Neural Tension Test-1 in Asymptomatic State Level Players of M.P.- An EMG Study

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Abstract

Purpose of Study

Upper limb tension tension test are widely used as a tool for evaluation of upper limb and neck disorders. The purpose of this study was to ascertain upper trapezius activity during ULTT-1 and to explore its correlation with symptom intensity during test.

Material and Methods

50 subjects (26-males and 24-females) were tested using standardized procedures for ULTT-1. The EMG activity was recorded using Myo -200 and subjective pain intensity was recorded using VAS.

Results

The results of the study showed significant relationship between upper trapezius EMG activity and ULTT-1 in asymptomatic subjects. The results of the study also showed positive correlation between upper trapezius EMG activity and VAS score in asymptomatic subjects during ULTT-1.

Conclusion

It is concluded that EMG activity is escalated during progression of the ULTT-1. There was a high correlation between the EMG activity and pain intensity, suggesting a mechanism for antalgic posture during neural tension.

Key Words

ULTT-1, neural tension, EMG, antalgic posture.

Introduction

Neck and upper extremity pain are common problems. Out of the different sources of neck and upper extremity pain one major cause is nerve tissue and its abnormal dynamics. To asses the contribution of the cervical nerve roots and peripheral nerves to upper extremity pain. Elvey developed “brachioplexus tension test” later called “Upper Limb Tension Test” or “Upper Limb Neural Tension Test”. ULTT is designed to place tensile stress on the cervical nerve roots and their associated peripheral nerves by using “Longitudinal traction force”[1]. Neural tension is associated with very common disorders of the sports persons like carpel tunnel syndrome, Guyons canal syndrome, double crush syndrome, piriformis syndrome etc. Different varieties of neural tension tests are used for diagnostic and therapeutic goals in these populations.

Upper limb neural tension test-1 was originally designed for diagnostically moving and tensioning the nervous system of the upper limb (specially the median nerve)[2]. Initially this test was used as diagnostic aid but judicious use and variations of the test can also implicate mechanical disorders of nervous system as a component of many common neuro-musculoskeletal disorders as well as treatment method for these disorders. The Upper limb neural tension test involves performance of an ordered sequence of passive arm movements, which imparts tensile forces to cervical nerve roots and their peripheral nerves[1]. The sequence involve six stages –

1. Stabilization of shoulder girdle
2. Shoulder Abduction 110 degree
3. Wrist and finger extension
4. Forearm supination
5. Shoulder lateral rotation
6. Elbow extension

The aim of upper limb neural tension test is to determine the source of pain and other sensory symptoms in hand and arm, and to evaluate any associated muscle stiffness produced during the test. In spite of widespread use of upper limb neural tension test controversy remains about the neurophysiological basis for sensory and motor responses produced during the test[3,4]. It has been suggested that increase muscle activity evoked during the upper limb neural tension test may be withdrawal response to pain that acts to indirectly protect the nerve by preventing further tensioning, but this concept has recently been challenged[3,5]. It is not known whether pain triggers a motor response that causes increased resistance or whether increased resistance to passive movements are unrelated to pain and should be explained by different mechanism.

Therefore the purpose of this study was to ascertain upper trapezius activity during upper limb neural tension test-1 and to explore its correlation with sensory response during test.

Methodology

Inclusion Criteria

Players with age group of 20 – 25 years of age
Asymptomatic players
National level players who are in sporting for more than two years

Exclusion Criteria
Subjects with history of neck pain
Any surgery in the past
Subjects with history of arm pain

Procedure: Three examiners were required.

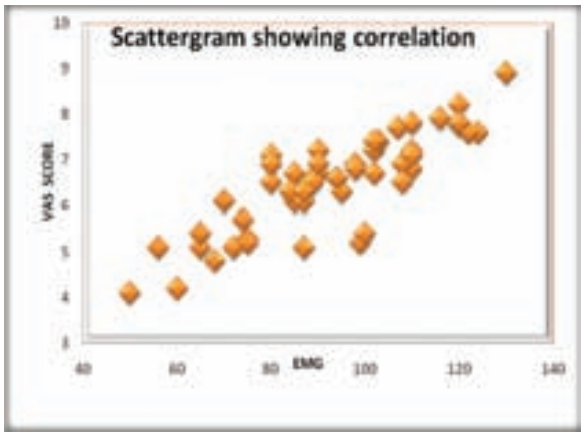
1. Subject was explained about the procedure in detail.
2. Subject skin was prepared with standard procedure.
3. Subject was asked to lie in supine position and relax completely.
4. Pair of self adhesive surface electrode is placed over the belly of upper trapezius muscle with an inter-electrode space of 2cm.
5. Upper Limb Neural Tension Test - 1 was performed by one examiner and subjects were instructed as soon as he/she feels any sensation like stretch, pain, tightness, tingling and numbness etc.
6. Sensory response intensity was recorded on VAS by second examiner.
7. EMG activity was recorded by third examiner using Myo – 200.

Data Analysis

- Descriptive analysis of the demographic and research data was done.
- Pearson co-relation coefficient analysis was used to find the co-relation between sensory responses to Upper Limb Neural Tension Test – 1 and EMG activity in upper trapezius muscle.

Results

The subjects were 26 male and 24 female ranging from 20 to 25 years with the mean age 22.04 ± 1.41 years
During test procedure all subjects showed positive sensory responses on VAS with the mean 6.53± 1.07 and EMG activity in upper trapezius muscle mean 93.2 ± 19.3



- Result of the study showed that all the subjects were having positive sensory responses during upper limb tension test - 1
- The sensory responses were described mainly as stretch, pain, pull, tightness etc.
- Majority of the sensory responses was reported during the stage of elbow extension.
- All subjects reported increased EMG activity in upper trapezius muscle during upper limb tension test – 1

Relation between upper limb tension test – 1 sensory responses (VAS) and EMG activity in upper trapezius muscle

- Pearson Product moment correlation reveals significant correlation between EMG activity in upper trapezius muscle and VAS scores (r=0.73, p=0.000).

Discussion

There is sufficient biomechanical evidence that the peripheral nerve under tension undergoes strain and glides within its interfacing tissues. Evidences supports that Upper Limb Neural Tension Test causes strain within peripheral nervous system however; it is also evident that it places strain on other multisegmental tissues[6]. Butler describes a strong but sensitive connection between the surrounding somatic tissue and the neural tissue[1]. Neural tissues may be hypersensitive (a problem of pathophysiology) or have a tension problem (mechanical) or a combination of both. Alternately the primary mechanical fault may be one of reduced sliding, which is not directly a tension problem. It could also be a compression problem that relates to the tissues that form a mechanical interface to the nervous system[7]. The currently hypothesized mechanisms linking the muscle

activity with neural tension are: mechanical sensitivity of ganglion cell bodies[8], existence of mechanoreceptors in thoraco lumbar spinal cord[5] and mechanoreceptors of peripheral nervous system[9].

These hypotheses infer that the somatic nervous system has natural mechanism, which may protect the peripheral nervous system against tensile stresses. Our findings in normal subjects suggests that mechanosenstivity of peripheral nerve to stretch may be a physiologic protective mechanism rather than a pathologic phenomenon following peripheral nerve insult. The present study suggests clear evidence that perception of sensory response and EMG activity of upper trapezius muscle is positively correlated. These findings support the assumption that increase muscle activity during ULTT or neural tension may be a withdrawal response to pain that acts to indirectly protect the nerve by preventing further tensioning. The result shows that the EMG activity increased in upper trapezius muscle, which could be responsible for antalgic posture of shoulder, neck and arm muscle in presence of nerve irritation.

Conclusion

Findings of this study suggests that increased EMG activity and its correlation with perceived sensory response during upper limb neural tension test involves the protective reflex activation of shoulder and arm muscle (UTz) suggesting a mechanism for antalgic posture. This may be mediated by mechanoreceptors in peripheral nervous system as a result of preferential mechanical stretching of median nerve during upper limb neural tension test.

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Acute Effect of a Dynamic and Static Stretching Exercise Bout During Warm up on Power in Soccer Players

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Abstract

Background

Different stretching techniques have been used during warm up routines. However, these routines may decrease force production. The purpose of this study was to compare the acute effects of a dynamic and a static stretching protocol during warm up on lower limb power.

Methods

This study was conducted to find effects of static, dynamic and no stretch warm up protocol on power performance measure by five step jump test. It was a within subject experimental design. Forty two male soccer players (age =17 ± 0.503 years, weight = 56.65 ± 3.49 kg and height = 168.92 ± 5.38 cms) performed three experimental sessions : a control session (with no stretching), a dynamic session and static session within a warm up followed by five step jump test for lower extremity power.

Results

Results indicated that the warm up with dynamic stretching conferred a significant performance enhancement in the measures of power. Results also indicated that warm up with static stretching had significant detrimental effect on performance in the measure of power.

Conclusion

From this study it may be concluded that instead of static stretching dynamic stretching should be included in the warm up for soccer players.

Key Words

Static stretching, dynamic stretching, warm up, power, soccer, five step jump test.

Introduction

Stretching exercises are usually part of warm up routines before involvement in competitive sports and physical activities. The inclusion of static stretching as part of pre - exercise warm-up routine has been common place in a multitude of sports, including soccer.

It is believed that their use will enhance subsequent performance, reduce the risk of injury, and alleviate muscle soreness symptoms. However, new research has challenged some long held concepts about common stretching practices. In particular, research suggests that a regimen of stretching provides an acute inhibition of maximal force production by the stretched muscle. Bouts of static stretching reduced the force capacity during various strength tests[7,10] and impaired vertical jump performance in some cases[2] but not in another. Changes in mechanical properties of the musculotendon unit or changes in neural activation may decrease.

On the other hand, a few studies have reported that dynamic stretching does not seem to affect force production. Unick et al[2] found no reduction in jumping capacity after hamstring and quadriceps bobbing exercises. In the same way, Bradley et al,[3] did not find reduction in vertical jumping capacity. However, Nelson and Kokkonen[8] have reported a drop in knee extension and flexion peak torque values (-5.2 and -7.2%, respectively) after hamstring and quadriceps dynamic stretching. Therefore, there seems to be no agreement on the acute effects of this type of stretching exercise on force production.

To the best of our knowledge, no study has attempted to make a direct comparison between the effects of an static and dynamic stretching protocol within warm up on power in soccer players.

Methods

In a within-subjects experimental design, soccer players conducted 3 different warm-up protocols on 3 nonconsecutive test days within 1 week. Each test day occurred more than 48 hours after a match or hard physical training to minimize the fatiguing effects of previous exercise. The warm-up protocols differed only in the mode of stretching used, whereas all other exercises used in the warm-up were identical. The stretching modes used were static stretch, no stretch, and dynamic stretch. Performance test of power was conducted after each warm up protocol.

Subjects

42 club level soccer players (excluding 4 dropouts) of age =17 ± 0.503 years, weight = 56.65 ± 3.49 kg and height = 168.92 ± 5.38 cms and having 2 years of club level soccer playing experience from various soccer club in and around Delhi were recruited for the study. Individuals with any impairment of spine and lower extremity, vestibular dysfunction, acute surgical case, pain in lower quadrant and any history of neurological disorder affecting upper and lower extremity were excluded from the study.

After satisfying the inclusion and exclusion criteria and giving their informed consent. Individuals were randomly divided into 3 groups of 14 subjects each depending on the sequence of warm up protocol to remove the carryover effect. All subjects were familiar with testing procedure used in this study before the experiment began.

Procedures

Three warm-up protocols differentiated by their stretching content were used: static, no stretch, and dynamic. Subjects conducted these 3 protocols on 3 separate days in that order. Aside from the stretching, each warm-up followed the exact same procedure, consisting of the following: 4 minutes of jogging and varied movements, including 2 minutes of jogging, 1 minute of sidestepping and back jogging, and 1 minute of further jogging. 6-7 minutes of flexibility exercises (except for nostretch protocol); 4 minutes of incremental intermittent sprint and agility runs. These initially included three-quarter pace running: 10 m forward and 5 m sidestepping, repeated twice; 30 m forward, repeated 3 times; and 45 m forward with 5×90^0 changes of direction, repeated twice. Intensity was then increased: three-quarter pace for 10 m and full pace for 20 m, repeated twice, and full pace for 30 m. 2 minutes of rest[10].

The principle locomotive leg muscle groups were stretched (gastrocnemius, hamstrings, quadriceps and hip flexors, gluteals, adductors). For static stretching, subjects held the stretch for 30 seconds on each leg before changing immediately to the contralateral side. Subjects were told to stretch until they approached the end of the ROM but within the pain threshold. Subjects performed the dynamic stretches on alternate legs for 30 seconds. This stretching was performed 5 times slowly at first, then 10 times as quickly and powerfully as possible without bouncing[15]. In the nostretch protocol, instead of stretching, subjects rested for 1 minute after the general warm-up and then proceeded to complete the specific warm up

The performance testing was done on the soccer ground. 5 step jump test[9,10,13] was used to assess the lower extremity power of soccer players.

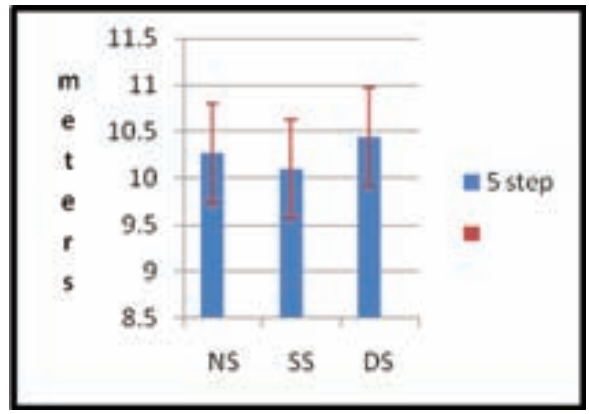
Statistical Analyses

Repeated-measures analysis of variance (ANOVA) was used to compare the performance after the 3 different warm-ups. Post hoc analysis was used to identify pairwise differences using Bonferroni adjustment. Statistical significance was accepted at $p = 0.05$.

Results

Results indicated that the warm up with dynamic stretching conferred a significant performance enhancement in the measures of power at $p \leq 0.05$ (Table 1). Results also indicated that warm up with static stretching had significant detrimental effect on performance in the measure of power at $p \leq 0.05$ (Graph 1).

Graph 1: Five step jump test



Discussion

The present results showed that dynamic stretching of muscle groups within a warm up enhances power. This finding is similar to that observed in other studies[10,14]. In a review of literature, Bishop et al in 2003 cites several reasons why warm up with dynamic stretching used in this study might improved short term performance[2].

Table 1: Mean± SD within group comparison

Test /groups	NS	SS	DS
5 step jump test	10.26 ± 0.53	10.10 ± 0.50	10.44 ± 0.56

Key: NS- no stretch, SS- static stretch, DS- dynamic stretch

Most factors are related to temperature and include decreased stiffness of the muscles and joints; increased transmission rate of nerve impulses; changes in the force-velocity relationship; and increased glycogenolysis, glycolysis, and high energy phosphate degradation. In addition to these temperature related changes, two neuromuscular phenomenon possibly activated by warm up with dynamic stretching could potentially enhance speed, power and agility performance. Post activation potentiation (PAP – an increase in muscle twitch force and rate of force development following a conditioned contractile activity) could theoretically improve speed, power and agility performance, though the optimal parameters to exploit post activation potentiation are unknown[10]. Similarly, postcontraction sensory discharge (increased neural activity measured in the dorsal roots following contraction) might enable a more rapid and forceful response to perturbations of muscle length[4].

However because muscular temperature and neuromuscular activity levels were not monitored in this study; its effect on the performance measure used in this study is purely speculative.

In the present study a total of 6 minutes of static stretching was applied in lower extremity; in 30 seconds bouts. The present study showed that static stretching of muscle groups of the lower limb was detrimental for performance. This finding was similar to that observed in other studies[2,7,10,14,11]. There are at least 2 theories – why pre-exercise stretching might decrease subsequent performance relative to more dynamic warm up. First, several researches have cited reduced neural activation

as a means by which repeated stretches reduce the number of motor unit available for contraction[1,5,7,14].

In addition, other investigators have suggested that increased compliance (i.e. the length change that occurs when a force is applied) in the tendon results in a brief moment when muscle force is taking up slack within the tendon, rather then contributing to gross movement[6,7,14].

Clinical Relevance

Our study explores the efficacy of stretching in this direction and suggests that dynamic stretching enhances power whereas static stretching has detrimental effect power. It is important that coaches, athletes, physical educators, physiotherapist and other persons involved in either undertaking or administering activities during which success can be dependent on maximal performance are aware of the potential negative e effects of static stretching before performance or competition.

The stretching induced detriment exhibited here could mean beating an opponent to the ball to create a goal scoring opportunity for the opposing team. In elite soccer, the ability of each player to perform to his or her maximal potential is especially important, because even the smallest detail can mean the difference between the winning and losing.

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A Comparative Study of Prolonged Muscle Stretch and Static Cycling on Step Length, Ankle Joint Range of Motion and Spasticity in Post Stroke Hemiparetic Patients

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Abstract

Background

The control of spasticity is often a significant problem in the management of patient with spasticity. Cyclic stretching and prolonged muscle stretch has been used for the rehabilitation of some orthopedic impairments; however, few researchers have considered its application in management of neurological disorders such as stroke. The purpose of this study was to examine the long term effects of prolonged muscle stretch and static cycling on step length, ankle joint range of motion and spasticity in post stroke hemiparetic patients.

Methods

Ten hemiparetic subjects, aged 45-70 years (Mean-55.7), both males and females were included in the study. Subjects were randomly divided into 2 groups (groupA and group B). All subjects were assessed for step length, active joint range of motion and spasticity of ankle plantar flexors. To group A, a 20 minutes of prolonged muscle Stretch with tilt table was given along with conventional physiotherapy program and to group B, a 20 minutes of static cycling was given along with conventional physiotherapy program. Total duration of treatment was of 5 days. Subjects were reassessed after 5 days and 24 hours after 5th day assessment.

Major Findings

After using ANOVA and Unpaired t-test, results shows significant changes in spasticity (Mean1 + SD=2 + 0.00, Mean2 + SD=1.40 + 0.55). Both groups (Prolonged Muscle Stretch and Static Cycling) are equally effective for all dependent variables except spasticity in group B that is Static Cycling.

Key Words

Spasticity, Gait, Hemiparesis, Step Length.

Introduction

"Stroke is a rapidly developed clinical sign of a focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours" – WHO. (Patricia A)

Stroke is the third leading cause of death and the most common cause of disability among adult in United States. Stroke incidence is defined as the number of acute strokes per year and depends primarily on the age, sex, and race mix of the population. The incidence of stroke increases dramatically with age, doubling in the decade after 65 years of age. The incidence of stroke rises with advancing age. The maximum being in the age bands of 41-70 years. (Susan B, 2007)

The pathological processes that results from a CVA can be divided into three Groups - Thrombotic, embolic and haemorrhagic. (Darcy A, 2001)

Subjects who have experienced a cerebrovascular accident may exhibit alterations in muscle tone leading to increased resistance to passive joint movement, decreased joint range of motion, and exaggerated stretch reflexes.(Lance JW, 1980). Spasticity is one of the most common disabling features of the motor disorders associated with the upper motor neuron syndrome. (Sehgal N, McGuire JR, 1998). It is a serious debilitating problem that creates great difficulty for both patients and clinicians. (Haley SM, 1990).

Spasticity has been defined as a motor disorder characterized by a velocity-dependent increase in the tonic stretch reflexes (muscle tone) with exaggerated tendon jerks, resulting from hyper excitability of the stretch reflex as one component of the upper motor syndrome. (Young RR, 1994)

In the presence of a lesion in the upper motor neuron, in addition to the typical

Upper motor neuron palsy (i.e., spastic weakness), one sees a collection of symptoms - both positive (abnormal or exaggerated behaviors) and negative (performance deficits) that constitute the upper motor syndrome. Spasticity is a component of this syndrome. (Lance JW, 1980)

Spastic hemiparesis frequently results in significant gait abnormalities due to a combination of muscle hypertonia and weakness. (Richard CL, 1991)

Hypertonia of the ankle plantar flexors doesn't allow the correct foot placement on ground in the stance phase of the gait cycle and also prevent the adequate clearance of ground in the swing phase. In addition, muscle hypertonia increases the physiological cost of ambulation. (Massin M, 1999)

Therefore, one of the important strategies of gait training in patients with stroke is to control the reversible component of spasticity with physical therapy. (V Maynard, 2004)

Prolonged muscle stretching of spastic plantar flexor muscles following stroke are aimed at reducing passive ankle joint resistance, increasing ankle joint range of motion and improving gait parameters.(Odeen I,1981)

Spasticity is reduced by spinal reflex mechanisms and the visco - elastic properties of the hypertonous muscle. (Lamontange A, Maouin F, 1998).
Prolonged muscle stretch will inhibit the spasticity by stretch reflex mechanism.(Carey JR, 1990)
It is interesting to note that the muscle spindle afferent impulses inhibit the alpha motor neurons supplying the antagonist muscles. This effect is called reciprocal inhibition. (Richard S. Snell 2006)
Static cycling will reduce the spasticity on the mechanism which is related to the thixotropic property of muscle. Thixotropy has been defined as the physical change of a substance after being mechanically agitated. For e.g. a gel substance such as ketchup may be less viscous if mechanically agitated. (Proske U, 1993)
In this study gel component of muscle (e.g. water and proteoglycans) may become less viscous after being stretched. (Bressel, 2002)

Methods

3.1 Study Design
The study design was Quasi Experimental.

3.2 Study Setting
This study was conducted in Outpatient department of Lovely Professional University Phagwara, near Jalandhar and Guru Singh Sabha hospital, Jalandhar, Punjab.

3.3 Population And Sampling
The totality or aggregate of all individuals with the specified characteristic is known as population. Sampling refers to the choosing of a sample from a population.
Population of study was stroke patients with right and left side hemiparesis. Convenient sampling method was used for data collection. 10 subjects (7 males and 3 females) with stroke in age group of 45-70 years, mean age 55.7 were participated in the study. The mean age of Group A was 60.40 and of Group B was 51.

3.4 Criteria For Sample Selection

3.4.1 Inclusive Criteria
Age: 45- 70 years.
Patients with Spasticity grade 1 to 1+ according to MAS.
Patients with minimum one week to maximum 3 months of duration after stroke.
Able to walk independently.
Alert to follow command.

3.4.2. Exclusive Criteria
Patients on antispastic medication.
Contracture of lower limbs.
Disabling arthritis of lower limbs.
Limb Length Discrepancy of lower limbs.

Table 1: ANOVA for the variables (Range of Motion, MAS and Step Length) between Pre Value, Post 1 and Post 2 in Group A

Variables	F Value	P Value
Range of Motion	22.74	P < 0.05
MAS	6	P < 0.05
Step Length	18.1	P < 0.05

Haemorrhagic stroke.

3.5 Instrument and Tool for Data Collection
Tilt Table, Static Stethoscope, Universal Goniometer, Measuring Tape, Sphygmomanometer, 50 Wedge.

3.6 Technique of Data Collection
10 hemiparetic subjects aged between 45-70 years were included in the study on the basis of inclusion criteria with a mean age of 55.7 years were selected for the study using convenient sampling method. Their demographic profile and detailed medical history was collected through individual interviewing and from available medical records. Patients were asked to sign the consent form and give their will to participate. Patients were divided in two groups- Group A and Group B. In the study, initially neurological assessment was done and then spasticity was measured by using Modified Ashworth Scale, ankle joint range of motion was measured and step length was measured by 10 meter walk test.

Group A
Subjects received prolonged muscle stretch with the help of tilt table with patients affected foot in 85o of dorsiflexion with a wedge under affected foot for 20 minutes and patient also receive conventional physiotherapy for five days.

Conventional physiotherapy includes:
1. Passive range of motion exercises of all the joints of affected lower limb 20-25 Times/session.
2. Passive selective stretching of tightened muscles such as T.A., hamstrings, hip adductors having hold of 30 seconds.
3. Strengthening exercises of lower limb muscles as required.
4. Sit to stand training 5 times /session and
5. Gait training.

Group B
Subject's received Static cycling for 20 minutes with patients affected foot was tied to pedal of cycle with the help of strap and hand was also tied to handle of cycle to maintain patient's stability. Same conventional

Graph 3.1: Comparison of mean and SD of variable (Step Length) in Group A.

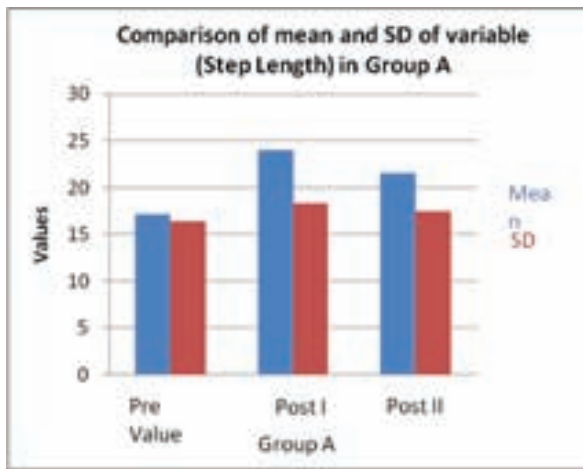
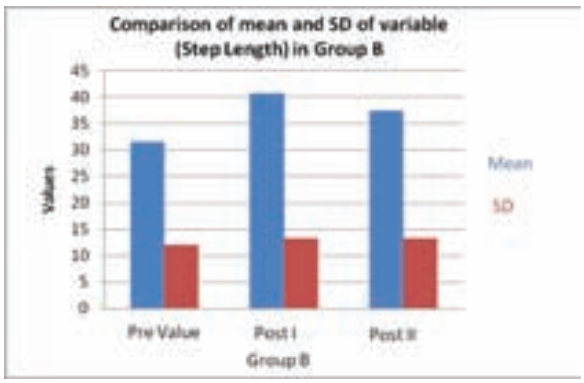


Table 2: ANOVA for the variables (Range of Motion, MAS and Step Length) between Pre Value, Post 1 and Post 2 in Group B

Variables	F Value	P Value
Range of Motion	177.8	P < 0.05
MAS	0	P > 0.05
Step Length	61.59	P < 0.05

Graph 3.2: Comparison of mean and SD of Variable (Step Length) in Group B.



physiotherapy program was also given to patient of this group for five days.

The post test 1 value was taken for both groups immediately after treatment on fifth day and patients were evaluated for spasticity, ankle joint range of motion and step length.

Table 3: Unpaired T- Test for the variable (Step Length) between Group A and Group B

Step Length		Mean + SD	t- value
Pre Test	Group A	17.14 + 16.4	1.571 NS
	Group B	31.46 + 12.0	
Post Test 1	Group A	23.96 + 18.3	1.643 NS
	Group B	40.58 + 13.3	
Post Test 2	Group A	21.58 + 17.5	1.611 NS
	Group B	37.40 + 13.2	

Graph 4.1: Comparison of mean and SD of variable (ROM) in Group A.

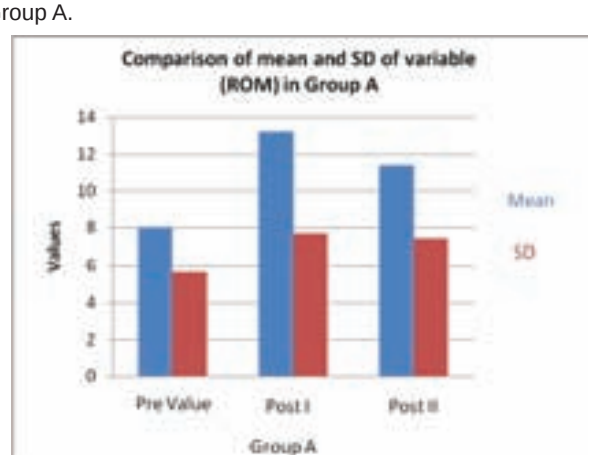
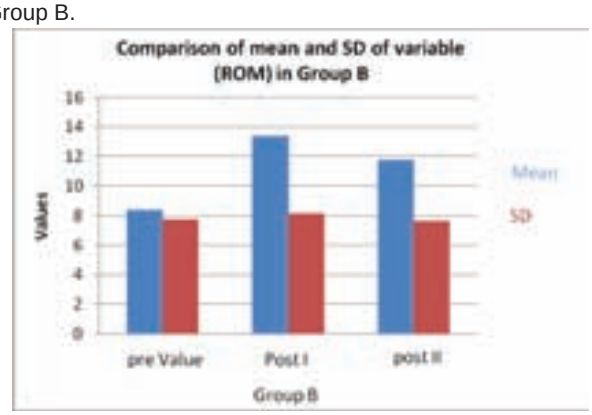


Table 4: Unpaired T- Test for the variable (ROM) between Group A and Group B

Range of Motion		Mean + SD	t- value
Pre Test	Group A	8 + 5.66	0.0931 NS
	Group B	8.40 + 7.77	
Post Test 1	Group A	13.20 + 7.69	0.0398 NS
	Group B	13.40 + 8.17	
Post Test 2	Group A	11.40 + 7.40	0.0841 NS
	Group B	11.80 + 7.63	

Graph 4.2: Comparison of mean and SD of variable (ROM) in Group B.



Then post test 2, was taken after 24 hours after post test 1 without giving any treatment to check the prolonged effect of treatment.

Data Interpretation

Statistics were performed by using SPSS 11. Results were calculated by using 0.05 level of significance. The comparison was done using ANOVA between the pre test, post test I and post test II scores of step length, ankle joint range of motion and spasticity in group A and the pre, post I and post test II scores of step length ,ankle joint range of motion and spasticity in group B. Further comparison was done using Unpaired t test between the values of step length, ankle joint range of motion and spasticity of Group A and B.

One way ANOVA was done between the Pre Value, Post 1 and Post 2 for the variables ROM, MAS and Step Length in Group A to check for the changes within the variables. The F values for ROM, MAS and step length were 22.74 ($P<0.05$), 6 ($P<0.05$) and 18.1($P<0.05$) and showed significant changes within the variables. (Table1).

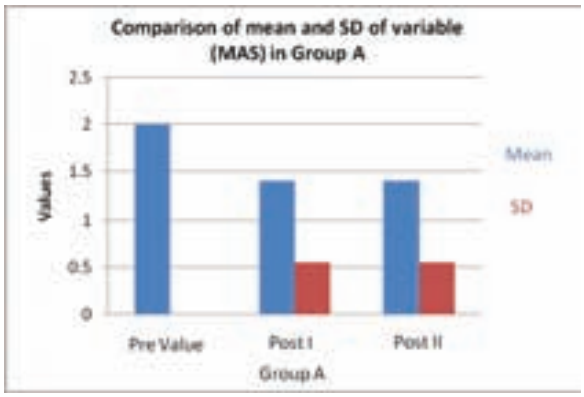
One way ANOVA was done between the Pre Value, Post 1 and Post 2 for the variables ROM, MAS and Step Length in Group B to check for the changes within the variables. The F values for ROM, MAS and step length were 177.8 ($P<0.05$), 0 ($P>0.05$) and 61.59 ($P<0.05$) and showed significant changes within the variables. (Table2).

The mean and standard deviation for the variable Step Length of the subjects for Group A were 17.14±16.4, 23.96±18.3 and 21.58±17.5 and for Group B were 31.46±12.0, 40.58±13.3 and 37.40±13.2 respectively.

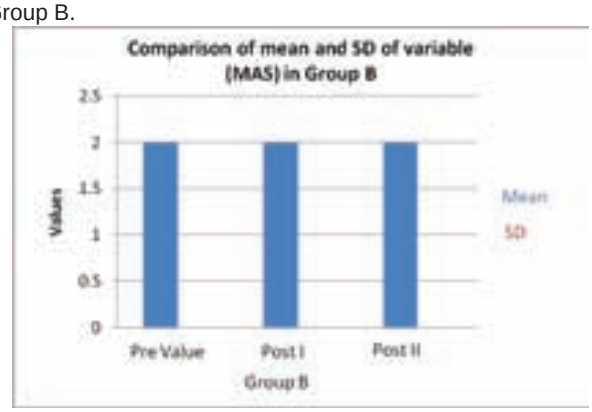
Table 5: Unpaired T- Test for the variable (MAS) between Group A and Group B

MAS		Mean + SD	t- value
Pre Test	Group A	2 + 0.00	0
	Group B	2 + 0.00	NS
Post Test 1	Group A	1.40 + 0.55	2.45
	Group B	2 + 0.00	S
Post Test 2	Group A	1.40 + 0.55	2.45
	Group B	2 + 0.00	S

Graph 5.1: Comparison of mean and SD of variable (MAS) in Group A.



Graph 5.2: Comparison of mean and SD of variable (MAS) in Group B.



The T value for Step Length was 1.571 (P >0.05), 1.643 (P>0.05) and 1.611 (P>0.05). The result for the variable was not significant which showed that there were no significant changes between the groups. (Table3).

The mean and standard deviation for the variable ROM of the subjects for Group A were 8±5.66, 13.40±8.17and 11.40±7.40 and for Group B were 8.40±7.77, 13.40±8.17and 11.80±7.63. The T value for ROM was 0.090 (P>0.05), 0.030 (P>0.05) and 0.080 (P>0.05). The result for the variable was not significant which showed that there were no significant changes between the groups. (Table4).

The mean and standard deviation for the variable MAS of the subjects for Group A were 2±0.00, 1.40±0.55and 1.40±0.55 and for Group B were 2±0.00, 2±0.00 and 2±0.00. The T value for MAS was 0 (P>0.05), 2.45 (P<0.05) and 2.45 (P<0.05). The result for the variable was significant which showed that there were significant changes between the groups. (Table5).

Results and Discussion

This study aimed to evaluate the effect of prolonged muscle stretch and static cycling on step length, ankle joint range of motion and spasticity in post stroke hemiparetic patients. Total 10 patients (5 patients in group A and 5 patients in B) participated in this study with age ranges from 45-70 years. ANOVA was used within the group and unpaired t test between the groups to analyse the effect of prolonged muscle stretch and static cycling in post stroke hemiparetic patients.

Results of this study showed significant changes in step length, ankle joint range of motion and spasticity of group A i.e. by using tilt table. Significant changes were seen in step length and ankle joint range of motion whereas less significant difference was seen in the case of spasticity in this group.

Result also shows significant changes in step length and ankle joint range of motion of group B using Static cycling. But there was no significant change in spasticity of group B.

The amount of difference is statistically more significant in pre and post test value I and less significant in post test value I and post test value II in both groups A and B.

There was effect of single session of isokinetic and isotonic muscle stretch (with or without weight bearing) of the ankle plantar flexor on spatio-temporal gait parameters in ambulatory patients with residual hemiplegia. But in this study multiple session of prolonged muscle stretch was used which resulted in significant changes on gait parameters especially step length.

There was significant increase in the range of motion of ankle dorsiflexion after 30 minutes of prolonged muscle stretching but after 30 minutes of prolonged muscle stretch no significant difference was seen in case of spasticity. In this study due to multiple sessions of prolonged muscle stretch, 3 patients of group A showed decrease in spasticity.

Multiple sessions of static stretching of the plantar-flexor muscles increased ankle

dorsiflexion and simultaneously reduced the passive stiffness of the calf muscles. Neural changes also contribute to muscle lengthening, by reducing muscle resistance caused by tonic reflex activity. When passive stiffness is reduced, it supports the idea that mechanical and neural adaptations are present after the stretching program but that their time courses are different. The significant relationship between the reduction in passive stiffness and enhanced flexibility indicates that reduced passive resistance to stretch has contributed to increase ankle dorsiflexion. Altogether, these results support the idea of an increase in muscle tendon unit compliance in a relaxed state after stretch training. The mechanism for improved joint ROM is an enhanced stretch tolerance rather than a change in muscle mechanical or viscoelastic properties. It was suggested that acute neural adaptations contributed to the greater muscle flexibility during stretching by reducing the muscle

resistance is due to tonic reflex activity. However, this effect dissipated as soon as the stretching maneuver ended, and a main question to address was whether long-term adaptations of the spinal reflex, remained after a stretch training program. This support present studies inclusion criteria of including patients with acute stroke. Tilt table wedge board standing increase the passive ankle dorsiflexion in neurologically involved patients. This conclusion supports the results that tilt table and wedge board standing showed significant change on ankle joint range of motion such as dorsiflexion.

The tilt table standing also reduces the spasticity after spinal cord injury which can be used in post stroke patients for reducing the spasticity. The long term muscle stretch significantly reduces the muscular hypertonia. The 30 minute of single session of prolonged muscle stretch on spastic muscle of stroke patients was significantly effective. The muscle stretch and weight load in patients effectively reduces the muscular hypertonus in spastic paraplegic patients. Multiple sessions of stretching helped in change of plasticity. There will be plastic changes in CNS due to repetition of movement. Plasticity helps in fast recovery. Thus this will lead to breaking of abnormal synergy pattern, which further decrease in abnormal gait deviations that will helps in advancing hemiparetic limb and help in improvement of step length. There was a change in ankle joint range of motion and step length due to change in thixotropy property of muscle. As there was continuous movement of leg during cycling which will lead to change in muscle component. Due to this less viscosity of muscle there is less resistance to movement to tendo-achillis that lead to increase in ankle joint range of motion. Plasticity leads to improve gait deviation. The cycling induced by functional electrical stimulation improved the motor control. In present study, in group B following the static cycling there is improvement in gait parameters that was because of improvement in motor control. The effect of affected leg cycling with electrical stimulation in patient with chronic stroke and concluded that a short bout of leg cycling can improve their functional performance, but the electrical stimulation has no addition effects on these patients. In this study we found the effect of static cycling in step length, ankle joint range of motion and spasticity. There were significant changes in step length and ankle joint range of motion but no change was seen in case of spasticity of Group B. Functional Electrical Stimulation and Leg Cycling Wheelchair had a positive effect on reducing spasticity immediately after treatment. But they found no significant difference between leg cycling with or without Functional Electrical Stimulation. This effect is seen due to the possible mechanism of the electrical stimulation which leads to the generalized desensitization the spinal pathway, reducing the spasticity of the plantar flexors. Electrical stimulation also affects the nerve fibres to the muscles, but could also travel to higher brain centres, potentially stimulating reorganization of neuromuscular activity. But this study showed no significant changes in case of spasticity in patients who got treatment with static cycle.

5.1 Limitations

Small sample size.

Shorter duration of intervention program.

Absence of randomization and appropriate control group.

Step length of unaffected side was not taken as outcome parameters.

5.2 Recommendations

Based on the outcome of the statistical analysis, it is suggested that the future studies should be modified to accommodate the following changes:

Large sample size can be taken. Study can be done with narrow age criteria Young stroke population can be considered. Comparative studies can be done on right and left hemiparesis. Duration of treatment with shoe lift can be increased to get the better results. Other techniques such as PNF, MRP and NDT can be compared with PMS and static cycling. Functional assessment can also be taken to see the effect of PMS and static cycling on ADL's.

Summary and Conclusion

The finding of the study was concluded as follows:

Prolonged Muscle Stretch with tilt table was effective in improving step length, active ankle joint range of motion as well as in reducing spasticity in ankle plantar flexor in post stroke hemiparetic patients.

Static cycling was effective in improving step length and active ankle joint range of motion. But no improvement was seen in case of spasticity in ankle plantar flexor in post stroke hemiparetic patients.

Prolonged muscle stretch with tilt table was more effective than Static Cycling in reducing spasticity in ankle plantar flexors. Both groups were equally effective in improving step length and active ankle joint range of motion in post stroke hemiparetic patients.

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Efficacy of Electromyographic Biofeedback Training on Pain and Functional Status in Osteoarthritis of Knee

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Abstract

Objective

To evaluate the effectiveness of Electromyographic-biofeedback as an add-on therapy with isometric exercise on pain and functional status in patient with osteoarthritis of knee.

Design

Pretest-posttest control group design.

Setting

Outpatient physiotherapy department, Majeedia Hospital, New Delhi.

Patients

Thirty patients (9 men, 21 women) with Osteoarthritis of Knee. Patients were randomly placed into two groups: biofeedback group (n=15) and a control group (n=15).

Intervention

The biofeedback group received electromyographic-biofeedback guided isometric exercise program for 5 days a week for 3 week, whereas the control group received an exercise program only.
Main Outcome Measures: Pain intensity and functional status of the patients were measured by a visual analogue scale (VAS) and the reduced WOMAC scale respectively.

Results

Significant improvements were shown for both the VAS and reduced WOMAC in both groups ($p<0.05$).On between group comparisons, biofeedback group showed significantly greater improvement in both the VAS and reduced WOMAC values at the end of 3 week and after 2 week follow-up i.e. on 5th week, than those of control group ($p<0.05$).

Conclusion

The addition of electromyographic-biofeedback to isometric exercise program has been shown to produce greater reduction in pain intensity and improved functional status than isometric exercise alone over a 3 week period. This study may provide a rationale for the clinical use of electromyographic-biofeedback.

Key Words

Electromyographic-biofeedback, Isometric exercise, Osteoarthritis of Knee.

Introduction

Osteoarthritis (OA) is one of the commonest and prevailing musculoskeletal disorders affecting a wide range of population throughout the world. It is estimated that 80% of all adults at or over the age of 65 yrs exhibit radiographic evidence of OA[1,2]. A recent World Health Organization report on the global burden of disease indicates that knee OA is likely to become the fourth most important global cause of disability in women and the eighth most important in men[3]. A recent survey in India established osteoarthritis to have a prevalence of 32.6% in rural and 60.3% in urban population[4].

The major symptomatic findings of OA are pain and physical disability. When symptoms of disease affect the knee, as in 10% of all adults, it results in a limited ability to use stairs, arise from a chair, stand comfortably, walk, and complete activities of daily living (ADLs)[5]. Pain in the affected joint is the most common symptom of OA and contributes to significant declines in functional ability, including getting up off the floor and going up and downstairs[6].

Lower extremity muscle weakness may play an important role in knee osteoarthritis. It has been well established in cross-sectional studies that individuals with symptomatic knee OA have weaker quadriceps than do age-matched subjects without knee OA[7,8]. The weakness associated with knee OA is largely thought to be the result of disuse atrophy secondary to joint pain. Results of other studies suggest that quadriceps weakness increases the risk of disability in persons with knee OA[6,7].

Treatments for knee OA have included pain relief with analgesics and nonsteroidal anti-inflammatory drugs (NSAIDs), surgical correction, and conservative physical interventions, includes thermo therapy[9]. Treatment guidelines for OA of the knee have considered exercise as an important non-pharmacological approach[10]. A growing body of evidence shows that exercise improves knee joint function and decreases symptoms[11,12,13].

Many authors recommend therapeutic exercises, especially the isometric exercises and short arc knee extension exercise at the terminal range for chronic osteoarthritic knees[14]. A possible advantage of isometric training may be that, it does not stress the joint over a functional range of motion. Reduced joint movement

may result in less pain during and after the resistance training[5,15].

In the last few years, many authors reported that EMG-biofeedback could be a useful alternative for musculoskeletal pain. Spence et al[16] investigated the effect of EMG-biofeedback on pain and they concluded that the EMG-biofeedback group significantly decreased pain. Further Newton John et al[17] studied 44 patients with chronic low back pain and compared EMG-biofeedback with cognitive behavioral treatment. Significant improvements were demonstrated at 6 months in both EMG-biofeedback and cognitive behavioral treatment groups. But still there is lack of evidence to support the clinical use of EMG-biofeedback training in osteoarthritis of knee patient. So the present study was intended to evaluate the effectiveness of EMG-biofeedback as an add-on therapy with standard exercise regime on pain and functional status in patient with osteoarthritis of knee.

Method and Materials

Subjects

A total of 30 (9 men and 21 women) patients with knee OA were included in the study. The criteria for inclusion were: radiological evidence of primary osteoarthritis with grade 2 on the Kellgren Lawrence scale; both male and female patients; age between 40-65 years; unilateral or bilateral involvement, in case of bilateral involvement more symptomatic knee was included; pain in and around knee. Subjects were excluded if they had any deformity of knee, hip or back, any central or peripheral nervous system involvement, received steroids or intra articular injection within previous three months, systemic inflammatory disease e.g. Gout, Rheumatoid arthritis, uncooperative patients and those who received physiotherapy treatment in the past 6 months. This study was passed by the ethical committee of Jamia Hamdard University, New Delhi, India.

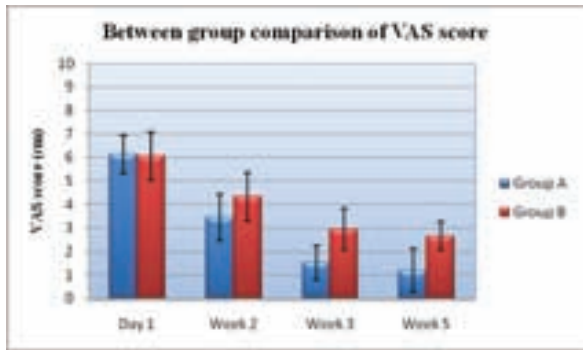
Table 1.1: Details of Subjects

	Group A	Group B
No. of Subjects	15	15
Age (Mean±SD)	54.40±7.73	55.27±7.08
Weight (Mean±SD)	64.93±5.61	65.86±4.34
Height (Mean±SD)	155.26±4.41	155.20±3.40
BMI (Mean±SD)	26.93±2.08	27.34±1.35

Study design

A pretest-posttest experimental group design was selected for testing the hypothesis, where a baseline reading was taken prior to the intervention, rest measurements were taken at the end of 2nd week, 3rd week and after two week follow-up i.e. at the end of 5th week. These reading were then compared to find out the effect on independent variables. The outcome measure or dependent variables, selected for this study were pain and knee function. These variables were measured using VAS scale and reduced WOMAC index respectively.

Fig. 1.1: Comparison of VAS between the groups.



Procedure

The subjects were screened first according to the inclusion and exclusion criteria. The subjects were randomized by computer generated number in experimental and control groups, each consisting of 15 patients. An informed consent was obtained from the subjects.

Group A(Experimental group): EMG-biofeedback guided isometric exercise and paraffin wax bath.

Group B(control group): Sham EMG- biofeedback along with isometric exercise and paraffin wax bath.

Measurement of pain intensity

The subject was asked to mark along the line of VAS scale to denote his level of pain. The distance from mark 0 was calculated in cm and was recorded. The readings were taken at baseline (before the treatment) and marked as V_0, at the end of 2nd week marked as V_2, at the end of 3rd week marked as V_3 and at the end of 5th week as V_5.

Measurement of functional index

The functional index readings were taken at baseline (before the treatment), at the end of 2nd week, at the end of 3rd week and at the end of 5th week designated as WOM_0, WOM_2, WOM_3 and WOM_5 respectively.

Intervention

Experimental group received the EMG-biofeedback guided isometric exercise program. The other group received the isometric exercise program along with sham EMG-biofeedback, without any instruction regarding muscle recruitment. Both the group received paraffin wax bath (temperature 520 C) for 20 minute prior to exercise. Paraffin wax bath (PWB) was given prior to the exercise session with patient in sitting position at the wax unit with knee joint in extended position. The patient was asked to expose the area to be treated. Seven consecutive coatings of paraffin wax were applied, using a standard paint brush, over the treatment area. The waxed area was then immediately wrapped in layer of plastic for 20 minute. At the end of treatment the paraffin wax was removed by asking the patient to do gentle flexion and extension of knee joint. Paraffin wax bath was applied for 3 week (5 days/week).

Biofeedback training: Biofeedback training was performed with a Myomed 932, a two channel EMG machine. Clear and full screen displayed the EMG signal with a curve was obtained for both the Vastus Medialis Oblique (VMO) and Rectus femoris (RF).

Electrode placement: Before the electrode placement the subject was asked to shave the part and then the part was thoroughly washed by alcohol solutions to clean the area and to reduce the skin resistance. Skin adhesive surface electrodes were used to record muscle activity. Two electrodes were placed 4 cm superior and 3 cm medial to supero-medial border of patella, that is to record the recruitment of VMO. Other electrodes were placed at the junction of the middle and lower third of the thigh, slightly medially and angled downwards and medially (i.e. midway between a line drawn between the base of patella and the anterior superior iliac spine) for Rectus femoris. The two active electrodes from each channel were placed as close together as possible along the directions of the fibers of each muscle. Reference electrode was placed below the tibial tubercle.

Exercise procedure

Group A: Four sets of exercise were given for three weeks, for five days a week.

The subjects was explained about the procedure and asked to watch the muscle activity and try to increase the activity level of VMO and Rectus femoris while performing the exercises. After each 5 second hold the subjects was then asked to take rest for 10 second. The training sessions were held 5 days a week for three weeks. Before each session the subject was asked to contract the quadriceps muscle maximally three times while the activity level of the VMO and Rectus femoris was monitored by EMG-biofeedback device. The average of these three maximum contractions was lowered by 20% for each muscle to determine their threshold levels. During the training session, subjects were instructed to contract the VMO and Rectus femoris above its threshold level and to maintain the audible signal for 5 sec.

Isometric quadriceps exercise: Patient was positioned in supine lying. A roll of towel was put beneath the knee. The patient was instructed to maximally activate their thigh muscles above its threshold level in order to straighten their knee and maintain the audible signal for 5 sec. This exercise was of 3 sets of 10 repetitions each.

Terminal knee extension exercise: The knee extension exercise was performed with the patient in a sitting position with the knee flexed from 30 to 0 degrees. The patient was instructed to maximally activate their thigh muscles above its threshold level in order to straighten their knee and to maintain the audible signal for 5 sec. This exercise was of 3 sets of 10 repetitions each.

Straight Leg Raising (SLR) exercise: Patient was positioned in supine lying. The patient was instructed to perform a maximum isometric quadriceps contraction prior to the lifting phase of exercise. Then subject was instructed to lift the leg and to maintain the audible signal for 5 sec. This exercise was of 3 sets of 10 repetitions each.

Isometric hip adduction exercise: Patient was positioned in supine lying. A small pillow was put between the knees. The patient was instructed to perform isometric hip adduction exercise as pressing the pillow between the knees, maintain the adduction contraction above its threshold level during the audible signal for 5 sec. This exercise was of 3 sets of 10 repetitions each.

Group B: Same set of exercise were given to Group B also but the electrodes was placed away from the VMO and Rectus femoris, and reference electrode was placed below the tibial tuberosity. Here the patients were doing exercises without any instruction to recruit VMO and Rectus femoris muscle.

Statistical Analysis

Statistical analysis was done using SPSS 15.0 Software. An independent t-test was used to compare the changes in VAS score in both the groups at baseline, 2nd week, 3rd week and after two week follow up i.e. at 5th week. Repeated measures of analysis of variance (ANOVA) with Bonferroni test was used to study the changes in VAS scoore in each group at 2nd week, 3rd week and after two week follow up i.e. at 5th week.

To study the changes in reduce WOMAC scale in each group at 2nd week, 3rd week and after two week follow up i.e. at 5th week Friedman test was used. MannWhitney U test was used to compare those differences between two groups. A statically significant difference was defined as p less than 0.05.

Results

Pain intensity

For both the groups the baseline value i.e. V_0 was statistically insignificant (p=0.846). The reading at 2nd week (V_2) found to be statistically significant between groups (p=0.027). The reading at the end of treatment session i.e. on 3rd week (V_3) also found to be statistically significant between two groups (p=0.000) (Table 1.2). The final reading after follow-up i.e. at 5th week (V5) were also found to be statistically significant between two groups (p=0.000) (Table 1.2)

Table 1.2: Comparison of VAS between the groups.

	Group A (Mean±SD)	Group B (Mean±SD)	Independent t-test	
			t	p
V_0	6.13±0.81	6.06±1.03	.19	.846
V_2	3.46±0.99	4.33±1.04	2.3	.027
V_3	1.53±0.74	2.93±0.88	4.8	.000
V_5	1.20±0.94	2.66±0.61	4.8	.000

Functional index

For both the groups the baseline value i.e. WOM0 was statistically insignificant (p=0.85). The readings at 2nd week (WOM_2) found to be statistically significant between the groups (p=0.04). The reading at the end of treatment session i.e. on 3rd week (WOM_3) also found to be statistically significant between two groups (p=0.009). The final reading after two week follow-up i.e. at 5th week (WOM_5) were also found to be statistically significant between two groups (p=0.006). (Table 1.3)

Fig. 1.2: Comparison of Reduced WOMAC score between the groups

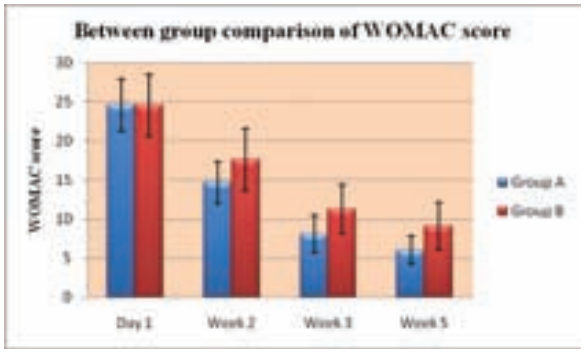


Table 1.3: Comparison of Reduced WOMAC score between the groups

	Group A Median±SD	Group B Median±SD	Mann Whitney U test	
			Z	P
WOM_0	24.60±3.33	24.53±3.99	0.18	0.85
WOM_2	14.67±2.71	17.60±3.96	1.99	0.04
WOM_3	8.07±2.40	11.27±3.15	2.61	0.009
WOM_5	6.00±1.81	9.13±3.04	2.74	0.006

Discussion

The purpose of study was to evaluate the effectiveness of Electromyographic-biofeedback as an add-on therapy with isometric exercise on pain and functional status in patient with osteoarthritis of knee.

The results of the study demonstrated that a combination of EMG-biofeedback and isometric exercises brought greater reduction in pain intensity and improved functional status. These effects were largely gained during the 3 weeks of treatment period. The Gained improvement was evaluated and found to be maintained over a period of 2 week follow-up i.e. at the end of 5th week.

The data showed that the 3 week period of intervention brought significant reduction in knee pain and improvement of function in both group at 2nd, 3rd and after follow-up i.e. at 5th week. The significant reduction of pain and improvement of function in both groups may be attributed to improved quadriceps strength and therefore increase stability of knee joint.

The findings are consistent with previous investigators who have reported that exercise can reduce pain and increase the functional abilities of OA patients. The Fitness Arthritis and Seniors Trial11 reported a modest 8% to 10% improvement in pain and functioning scores as a result of 18 months of aerobic or resistance exercise among their sample of knee OA patients. Further Deyle et al12. Falconer et al18 and Fisher et al19 found same positive effects of exercise programme on pain and function.

Further study done by Boon Whatt LIM et al20 concluded that quadriceps strengthening has beneficial effect on pain and function in patients with OA knee. The study done by Shreyasee Amin et al21 concluded that greatest quadriceps strength had less knee pain and better physical function than those with the least strength. Strong muscles stabilize joints in the proper alignment, absorb shocks that are transmitted to the joints, and reduce the effect of impact by spreading the forces out over a greater area

So, it may be hypothesized that improvement on muscle strength is one of the main cause of reducing pain and disability.

In present study, the reduction of pain and disability in both groups may be attributed to increased quadriceps muscle strength and thereby improve stability which leads to reduction of pain and disability.

Moreover the subject of both groups received 20 minute of paraffin wax bath prior to exercise over a period of 3 weeks. Centin N et al[22] in their study concluded that exercise and physical agents can reduce pain and improve function and health status in patients with knee OA.

The result of this study indicates that the adjunctive therapy of EMG-biofeedback was an effective means for reducing pain and disability. The analysis of difference between two groups, showed statistical significant improvement at 2nd,3rd and follow-up i.e. at 5th week. The biofeedback group had 22% greater reduction in pain intensity and 13% in functional disability, than control group at the end of training periods. The findings are consistent with previous investigators who have reported that EMG-biofeedback could be a useful alternative for musculoskeletal pain. Spence et al16 investigated the effect of EMG-biofeedback on pain and they concluded that the EMG-biofeedback group significantly decreased pain.

Further Newton John et al17 studied 44 patients with chronic low back pain and compared EMG-biofeedback with cognitive behavioral treatment. Significant improvements were demonstrated at 6 months in both EMG-biofeedback and cognitive behavioral treatment groups. This study is further supported by Yip and Ng.23 they investigated the effect of EMG-biofeedback on patellofemoral pain and concluded that tendency toward pain relief was greater with EMG-biofeedback group.

Thus these results show the effectiveness of EMG-biofeedback in the reduction of pain and improvement of function, possibly provided by its positive effect on quadriceps muscle strength. Our results are consistent with other results in the literature, indicating that EMG-biofeedback is a very effective modality in increasing muscle strength.

The major limitation of this study was the small sample size consisting of only 30 subjects in the study. Moreover the duration of study is not adequate to study the long term effect of the EMG-biofeedback. Double blind study would have improved the reliability of the measurement and results.

Future study may use combination of EMG-biofeedback with dynamic exercise, so that more of functional status could be evaluated. In present study we included patient with osteoarthritis of knee. So, further study may include other orthopedic conditions. Study may be done for longer duration with adequate follow-up to establish the improvement being the permanent one.

Conclusion

After analyzing the result we can conclude from the study that the addition of electromyographic biofeedback to isometric exercise program has shown greater reduction of pain intensity and improvement in functional status as compared to using isometric exercise protocol alone over a 3 week period for osteoarthritis of knee patients. This study may provide rationale for the clinical use of electromyographic-biofeedback.

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Comparing the Immediate Effect of Auditory and Visual Mental Imagery on Reaching and Grasping Task among Sub acute Stroke Patients

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Abstract

The term cereberovascular accident (CVA) is used interchangeably with stroke to refer to the cereberovascular or hemorrhagic lesions. According to World Health Organization 'stroke is defined as rapidly developed clinical sign of a focal disturbance of cerebral functional of presumed vascular origin and of more than 24 hrs duration'. Included within this definition are most cases of cerebral infarction, cerebral hemorrhage and subarachnoid hemorrhage but deliberately excluded are those cases in which recovery occurs within 24 hrs[1]. The degree of recovery from hemiperesis, however, varies considerably, and >50% of patients are left with residual motor deficits[2]. Upper-limb hemiperesis (ULH) is one of the most debilitating effects of stroke, and it is the primary impairment underlying functional disability following stroke[3-5]. Stroke induced affected arm non use often causes greater motor disability to be exhibited than that which actually exists and this can produce affected limb bone and muscular atrophy[6]. Visual imagery is the ability to retain an accurate, detailed visual image of a complex scene or pattern (sometimes popularly known as photographic memory) or the ability, possessed by a minority of people, to 'see' an image that is an exact copy of the original sensory experience[7]. Whereas, auditory imagery is the subjective experience of hearing in the absence of auditory stimulation. In this study we are comparing the effects of both type of mental imagery i.e. visual and auditory. Purpose of the study was to determine the relative efficacy of auditory and visual mental imagery to increase upper limb function among sub acute stroke patients.

Methods

30 subjects of age group 50- 70 years were selected as per inclusion and exclusion criteria. Quality of movement & Amount of use was recorded through motor activity log.

Results

All 3 groups showed improvement. Kruskal Wallis test scores showed significant differences in all three groups where QOM scores in pretests were .47 and .21 ans were 0.11 and 0.05 in posttests. Also these scores showed that video imagery proves better as compared to auditory imagery in enhancing the QOM in an individual as the test scores were 20.40, 17.85, and 8.25 respectively in the post test.

Conclusion

This study concludes that visual mental imagery appears to be a promising rehabilitaion protocol for improving affected upper limb motor function in stroke patients as compared to auditory mental imagery.

Key Words

Visual imagery, Auditory imagery, Sub acute stroke

Clinical Significance

This study may provide an effective tool along with other novel approaches for the rehabilitation of sub acute stroke patients. A lot of work has been done in the direction of rehabilitation of chronic stroke which has proved to be very useful but the approach we took has a lot left to be explored. It is an attempt at exploring the ramifications of this innovative technique and to what extent can it effect rehabilitation of sub acute stroke patients.

Introduction

Stroke is an acute onset of neurological dysfunction due to an abnormality in cerebral circulation with resultant signs and symptoms that corresponds the involvement of focal areas of brain. The prevalence of stroke in India varies in different regions of the country and ranges from 40 to 270 per 100 000 population[8-11]. The return of upper-limb function has been identified as an important rehabilitation goal. Consequently, knowledge of upper-limb impairment and its relationships to activity (e.g. performance of daily tasks) and participation is necessary in order that the clinicians plan effective and efficient rehabilitation. Unlike active and passive motor therapies motor imagery is, in principle, not dependent on residual function but still incorporates voluntary drive. For decades authors have reported that mental practice (also known as "imagery") when combined with physical practice, accelerates motor learning and improves subsequent physical performance[12-14]. Mental practice refers to the cognitive rehearsal of a task in the absence of overt physical movement 15 Studies measuring electromyographic (EMG) activity, cortical motor evoked potentials, and cerebral blood flow have also shown that the appropriate neuromotor pathways imagined as being used are actually being used and that metabolic activity of neurons is increased during mental practice as if the activity is actually being performed. Given the evidence relating mental practice, neuromuscular activation, and motor performance and considering the debilitating

effects of ULH, Page posited that mental practice could be a noninvasive, useful tool in rehabilitating patients with strokes. Breitling and colleagues reported similar activity in the motor execution cortical areas when subjects imagined finger movements in a relaxed state as compared to when they actually performed the movements[16]. These facts provided impetus to combine traditional therapy for the affected side with appropriate mental practice technique used by in patients who have had sub acute strokes. Philip L. Jackson and Julien Doyon found that mental practice, when combined with physical practice, can improve the performance of a sequential motor skill in people who had a stroke, and suggest that mental practice could play a role in the retention of newly acquired abilities[17].

Methods

A randomized, controlled, multiple baseline, pre and post test case series design was applied. After screening and signing consent forms, Motor Activity Log was administered every time before and after the procedure i.e. 2 days a week for 4 weeks. All patients received therapy in the same fashion and from the same therapist.

Subjects

Thirty Subjects of age group 50- 70 years were selected as per above mentioned criteria from various hospitals. Participants were screened acc to following inclusion criteria: 1) No excessive muscle spasticity in more affected upper limb, defined as a score of 3 or lower on Modified Ashworth Scale. 2) Stroke experienced less than 1 year before the study enrollment and is affecting dominant side of the patient. 3) A score of 70 or higher on modified Mini- Mental Status Examination 4) Age 50-70 years. 5) Able to complete the task. 6) Only having experienced 1 ischemic stroke. 7) Score of less than 2.5 on Motor Activity Log (amount of use).

Instruments Used

1. Motor Activity Log

It is used to measure each participant performance in ADL. The MAL is a semi structured interview that consist of 14 ADL items (brushing teeth, buttoning a shirt, eating). Scoring was done on two scales. i) Amount of use of scale (0-5): It rates how much the patient used his/her affected arm. ii) Quality of movement scale (0-5): It rates how well he/she used it.

Procedure

1. 1st group (Video group) includes 10 patients. After measuring score of MAL, they were made to see video of the related task twice, using Sony dig cam generated movies and then they were asked to repeat the activity 4 times. After this MAL tests were again administered and scores were measured.
2. 2nd group (Auditory group) includes next 10 patients. After measuring score of MAL, they were made to listen to the auditory commands related to the task twice and then they were asked to repeat the activity 4 times. After this MAL tests were again administered and scores were measured.
3. 3rd group (Control group) includes the rest of the 10 patients. They received the same motor therapy regimen as those in the mental practice groups.

During therapy session emphasis was placed on performing selected ADL's.

S.No	ADL's described	When administered
1	Reaching for and grasping a cup or object	1st week
2	Turning a page in a book	2nd week
3	Opening cork of a bottle	3rd week
4	Proper use of pencil or pen	4th week

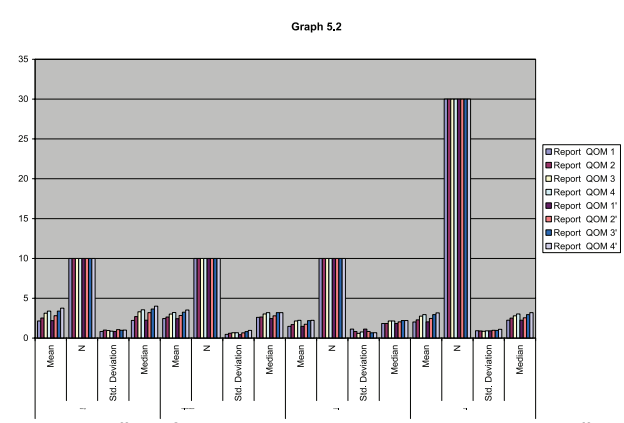
After therapy session patients assigned to group 1 & 2 were made to listen to the audio - tape recorded by a psychologist lasting 30 minutes18. It consisted of relaxation in the opening 5 minutes, asking the patients to imagine themselves in a warm, relaxing place, and asking them to contract and relax their muscles (i.e. progressive relaxation).

This portion of the tape was followed by suggestions for external cognitive polysensory images related to the task and using the affected arm, (e.g. imagine yourself reaching for a cup on the table; feel your arm and fingers extending as you reach for the cup). This was followed by refocusing into the room. Patients were asked to do home practice and to imagine the whole task in his/ her mind before doing any activity.

Result

Scores of QOM and AOU of MAL were measured both before and after the study. The mean score of QOM for all three grops were 2.1520, 2.4550, 1.4740 respectively in the first week pretesting session and were 3.7640, 3.5250, 2.2300 in the 4th week post test.

The mean score of AOU for all three grops were 1.8240, 1.8950, 1.32 respectively in the first week pretesting session and were 3.5080, 3.1700, 1.91 respectively in the 4th week post test.



QOM= Quality of Movement; QOM1,2,3,4= pretest readings for week 1,2,3,4; QOM1',2',3',4'= postest readings for week 1,2,3,4.

Table 5.2: Showing comparison of QOM in all 3 groups

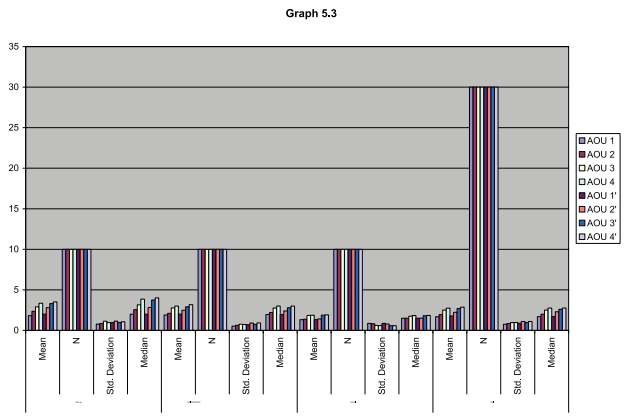
	QOM 1	QOM 2	QOM 3	QOM 4	QOM 1'	QOM 2'	QOM 3'	QOM 4'
p- value	.091	.047	.021	.013	.111	.023	.011	.005

QOM= Quality of Movement; QOM1,2,3,4= pretest readings for week 1,2,3,4; QOM1',2',3',4'= postest readings for week 1,2,3,4.

Table 5.3: Showing comparison of AOU in all 3 groups

	AOU 1	AOU 2	AOU 3	AOU 4	AOU 1'	AOU 2'	AOU 3'	AOU 4'
p- value	.399	.042	.015	.002	.259	.015	.002	.002

AOU= Amount of Use; AOU 1,2,3,4= pretest readings for week 1,2,3,4; AOU 1',2',3',4'= postest readings for week 1,2,3,4.



AOU= Amount of Use; AOU 1,2,3,4= pretest readings for week 1,2,3,4; AOU 1',2',3',4'= postest readings for week 1,2,3,4.

Kruskal wallis test scores showed significant differences in all three groups where QOM scores in pretests were .47 and .21 ans were 0.11 and 0.05 in posttests. Also these scores showed that video imagery proves better as compared to auditory imagery in enhancing the QOM in an individual as the test scores were 20.40, 17.85, and 8.25 respectively in the post test.

Similarly significant difference were seen in AOU test in all three groups with scores of .399 and .042 in pretests and were .002 and .002 in posttests.

Mann Whitney U test showed the video group is better than the auditory and the auditory is better than the control groups in which scores for QOM and AOU between vedio and auditory group were not so significant but showed significant differences when compared with video and control groups and auditory and control groups.

In addition to the above-to compare the performance of each subject in each condition, Wilcoxon Signed Rank test was applied. It compared the QOM, and AOU tests in the first week pre and post tests and subsequently for the 2nd week respectively for all 4 weeks. And the results were as follows:

Discussion

This present study examined the outcomes of visual imagery and auditory imagery methods of mental practice and attempted to discover the superiority of one method over the other. Previous pilot study results suggest that addition of mental practice to affected arm rehabilitation increases outcomes[19].

In our study Motor Activitiy Log Amount Of Use (AOU) scores showed that all subjects not only met the criteriaion of an AOU score of 2.5 or lower, but also that they barely used their affected limbs for ADLs. Most subjects and their caregivers confirmed during pretesting that they did not use their more affected limbs and had not made attempts to use it for ADL's. After intervention both visual and auditory group subjects showed appreciable increase in the use of the more affected arm for ADL's, as reflected by a means reported AOU scores of 3.5 and 3.17 respectively in 4th week of the study shown in graph 5.3 which were otherwise only about 1.8 in the first week

Table 5.5: Showing comparison of QOM between video & auditory group, video & control group and auditory & control group

	QOM 1	QOM 2	QOM 3	QOM 4	QOM 1'	QOM 2'	QOM 3'	QOM 4'
P value for video and auditory groups	.621	.940	.647	.471	.595	.762	.649	.401
P value for video and control groups	.140	.069	.021	.012	.140	.041	.010	.004
P value for auditory and control groups	.031	.015	.015	.012	.044	.007	.010	.009

QOM= Quality of Movement; QOM1,2,3,4= pretest readings for week 1,2,3,4; QOM1',2',3',4'= postest readings for week 1,2,3,4

Table 5.6: Showing comparison of AOU between video & auditory group, video & control group and auditory & control group

	AOU 1	AOU 2	AOU 3	AOU 4	AOU 1'	AOU 2'	AOU 3'	AOU 4'
P value for video and auditory groups	.642	.359	.619	.233	.760	.492	.205	.318
P value for video and control groups	.304	.020	.019	.003	.183	.009	.003	.004
P value for auditory and control groups	.206	.074	.009	.003	.138	.025	.004	.002

AOU= Amount of Use; AOU 1,2,3,4= pretest readings for week 1,2,3,4; AOU 1',2',3',4'= postest readings for week 1,2,3,4

Table 5.8: Showing comparison of QOM,AOU, & ARA test between post test and pre test results in every week.

GP		QOM 1' - QOM 1	QOM 2' - QOM 2	QOM 3' - QOM 3	QOM 4' - QOM 4	AOU 1' - AOU 1	AOU 2' - AOU 2	AOU 3' - AOU 3	AOU 4' - AOU 4
VideoGroup	P- value	.735	.018	.018	.012	.078	.018	.018	.043
Auditory group	P - value	.655	.017	.018	.042	.157	.066	.109	.109
Control Group	P - value	1.000	.317	.109	.492	1.000	.317	.180	.059

QOM= Quality of Movement; QOM1,2,3,4= pretest readings for week 1,2,3,4; QOM1',2',3',4'= postest readings for week 1,2,3,4.
AOU= Amount of Use; AOU 1,2,3,4= pretest readings for week 1,2,3,4;
AOU 1',2',3',4'= postest readings for week 1,2,3,4

of the study. Although the immediate levels of AOU i.e immeditely in the 2nd week of the study were not as high as the postintervention levels reported in the 4th week of the study. Moreover significant changes for immediate results were found only in video group as shown in table 5.8. This showed superiority of Visual imagery over the auditory imagery. Table 5.3 depicts significant results when all the three groups were compared for AOU.

The changes we found were clinically meaningful. Indeed, after the intervention, patients reported performing ADL's with their more affected hands that they had not performed in months, such as eating and writing and performing various grooming activities (e.g using a toothbrush)using the more affected limb. Similar changes were found in a study done by Stephen J. Page in 2005, who concluded that mental practice protocol increases a stoke patient's use of his/her more affected limb. The Quality Of Movement (QOM) data trends were similar to AOU data trends for Mental practice patients. Specifically, before the intervention, all patients motor deficits were reletively stable and patients scores did not change substantially in the initial 2 weeks. The changes were meaningfull in the 4th week of the study. The mean scores of QOM were 3.76 for visual imagery group and 3.52 for auditory imagery group in the 4th week as shown in graph 5.2. On the other hand, scores of patients of control group were remain only around 2.2. When all the three groups were compared, as shown in table 5.2, significant results were found in the 2nd, 3rd and 4th week of the study.

Levine P also found in his study that mental imagery is beneficial for the relearning of motor function. On the contrary in 2004 Karen P. Liu did not find any significant improvements in the motor abilities of patients in the mental imagery group.

Some studies in balance training for elderly women have reported that mental practice combined with relaxation technique have demonstrated better results. In our study progressive relaxation technique was used before making the participant take part in the mental practice task. Relaxation may have contributed to significant improvements.

The increased use and motor function changes exhibited more by Mental practice group confirmed our hypothesis that their may be change in task performance after visual mental imagery and auditory mental imagery among sub acute stroke patients, though the changes were more in visual mental imagery group as compared to auditory mental imagery. Moreover no significant results were found in studies that used audiotape – directed instructions of mental practice done by Kanten and Neol in 1970.

Data obtained in this study suggest that nonuse of the more affected limb can be overcome by participation in MP. The QOM data further support the finding that participation in MP can elicit functional changes. The immediate results for both groups showed weak significance in the initial weeks but were significant in the 3rd and 4th week of the study as shown in table 5.8. Moreover, table 5.8 shows significant changes in video group as compared to auditory group. Results were highly significant for QOM scores as compared to AOU scores.

Conclusion

Our study concludes that visual mental imagery appears to be a promising rehabilitaion protocol for improving affected upper limb motor function in stroke patients as compared to auditory mental imagery

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Physiological and Body Composition Profile of Punjab Police Volleyball Players

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Abstract

One team of professional volleyball players playing for Punjab police have been analyzed for their body fat measurement using skin fold caliper (15.317 ± (4.854) % body weight) The same group of players were made to under go 20 meter shuttle run / beep test for their VO2 max measurement (44.2893 ± (10.176) ml/kg/min) under standard conditions and proper method, they have also undergone I minute sit-up (67.67 ± (7.92) repetitions) and I minute push up test (38.59 ± (16.03) repetitions) for abdominal and upper body strength. Agility was measured using 505 agility test (2.765 ± (0.221) seconds) and power using static stand and reach vertical jump difference (1.675 ± (0.3545) feet) their physiological profile and body composition were far low when compared with the other Athlete around the world.

Introduction

Volleyball is an Olympic team sport in which two teams of 6 active players are separated by a net. Each team tries to score points by grounding a ball on the other team's court under organized rules. a player on one of the teams begins a rally by attempting to serve the ball (tossing or releasing it and then hitting it with a hand or arm), from behind the back boundary line of the court, over the net and into the receiving team's court. The receiving team must not let the ball touch their court; they may touch the ball as many as three times, typically using the first two touches to set up for an attack, an attempt to direct the ball back over the net in such a way that the serving team is unable to prevent it from touching their court. The rally continues in the same manner, with each team allowed as many as three consecutive touches, until either: a team makes a kill, grounding the ball on the opponent's court, thus winning the rally; or a team commits a fault, thus losing the rally. The team that wins the rally is awarded a point, and serves the ball to start the next rally. This game recruits both aerobic and anaerobic pattern with greater emphasis on power and endurance. In this particular study we tend to find the basic strength, aerobic capacity, agility, vertical stand reach of elite athletes playing for Punjab police along with their body compositions using skin fold caliper method.

Method

12 subjects who are professional players playing for Punjab police have been analyzed for their body fat measurement using skin fold caliper by taking 4 skin fold measurements from the biceps triceps sub scapular and supra iliac region and these were analyzed to find out fat percentage using Durnin / Womersley 4-folds formula The same group of players were made to under go 20 meter shuttle run / beep test for their VO2 max measurement under standard conditions and proper method they also undergone I minute sit-up and I minute push up test for abdominal and upper body strength .

Agility was measured using 505 agility test under standard test conditions static stand reach vertical jump was measured difference between the standing reach height and vertical jump height.

All these test were conducted under normal environment with players asked not to perform any exercise program prior to test except for warm-up session

Results	Mean (Standard deviation)
Age	25 ± (4) yrs
505 Agility	2.765 ± (0.221) seconds
1 minute situps	67.67 ± (7.92) repetitions
1 minute pushups	38.59 ± (16.03) repetitions

S.no.	Age(yrs)	505 Agility test(sec)	1 minute situp (repetitions)	1min pushups (repetitions)	stand & reach (feet)	beep test (stage)	VO2 max (ml/kg/min)
1	22	2.7	68	16	1.7	13.3	58.002
2	26	2.57	70	37	2	11	50.26
3	20	2.72	67	29	2.1	11.3	51.14
4	31	2.66	75	20	1.5	9.5	44.92
5	20	2.95	70	42	1.7	11	50.26
6	22	2.9	76	38	0.7	6.5	34.76
7	25	2.88	56	42	1.7	8.1	40.21
8	32	2.35	71	75	1.8	11.6	52.02
9	28	3.17	63	31	1.7	3.9	26.33
10	26	2.56	76	60	1.9	11.4	51.43
11	24	2.76	70	38	1.5	9.5	44.92
12	22	2.96	50	35	1.8	4.3	27.22

Vertical stand and reach	1.675 ± (0.3545) feet
VO2 Max	44.2893 ± (10.176) ml/kg/min
Fat %	15.317 ± (4.854) % body weight

Skin fold measurements						
S.no.	biceps	triceps	sub scapular	supra iliac	fat percentage	
1	4	7	9	5	25	10
2	4	6	14	9	33	12.6
3	3	5	9	5	22	10
4	3	10	12	8	33	15.2
5	4	16	10	14	44	16.6
6	5	15	21	15	56	19
7	3	8	10	10	31	11.2
8	3	6	11	10	30	14.2
9	5	15	20	14	54	19
10	4	6	11	6	27	10
11	7	16	25	20	68	22
12	9	19	25	28	81	24

Discussion

From the above results it was found that their upper body strength {38.59 ± (16.03)} was less than those compared with others like Gaelic footballers, hurlers, and soccer players measured as 46.8± (10); 42.8 ±(10);59.1 ±(15) respectively (4) with no respective comparisons available found for 505 agility test and vertical stand and reach. Also their VO2 max {44.2893 ± (10.176) ml/kg/min} was comparatively less when compared with badminton 46.4 ± (4.2) ml/kg/min;soccer 60.5 ± (2.6) ml/kg/min; kabbadi 59.1± (4.9) ml/kg/min; boxers 47.82 ± (3.68) ml/kg/min; Gaelic footballers 46.8 ± (10) ml/kg/min; hurlers 42.8± (10) ml/kg/min and soccer players 59.1 ± (15) ml/kg/min (7) (6) (5) (2) (4) and their fat percentage 15.317 ± (4.854) % body weight more than other athletes around the world with volleyball players in India measuring 10.04± (2.9); 10.03± (3.43) (1) in Gaelic footballers, hurlers, and soccer players 13.4± (3) 18.4± (3) 12.2± (2) respectively (4) in elite hong kong soccer players 7.3 ± (3) (5) and in canoe and kayak (males, 13.0 ± 2.5%) swimming (males, 12.4 ± 3.7%);boxing (males, 6.9 ± 1.6%) wrestling (male, Junior World Freestyle 7.9 ± 2.7%), athletes (male 100 and 200 meters, 6.5 ± 1.2%) marathon (males, 6.4 ± 1.3%) (8) all these comparisons show that volleyball players of Punjab police require more training to get a cutting edge in comparison with other athletic population around the world

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Hamstring Index in School Children- A Cross-Sectional Study in Belgaum City

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Abstract

Background and Objectives

Flexibility is important for any individual to be physically fit and hence flexibility is routinely used to asses physical fitness in children, athletes and those involved in physical activity throughout the world. Hamstrings group is an important antigravity muscle of the lower limbs and its flexibility is important for maintaining normal posture and gait in both adults and children. After a review of literature, it was determined that there is dearth in the area of normative values for lower extremity muscle length in children. It is therefore the purpose of this study to measure hamstring length by using 3 clinical tests to establish normative values of hamstring length to help to identify children with decreased flexibility.

Methodology

The present cross sectional study was conducted on 400 children from nursery and elementary schools in Belgaum city which included 200 males and 200 females during the period of April 2008 to December 2008. A written informed consent from all study subjects and institutional ethical clearance was obtained. Children were divided into 3 groups according to age i.e. Group A: 4 to 8 yrs which included 162 subjects, Group B: 9 to 12 yrs included 126 subjects and Group C: 13 to 16 yr which included 112 subjects. Hamstring muscle length was measured using Sit &Reach Test (SRT), Straight Leg Raise and Popliteal angle (PA).

Results

From the results it can be concluded that for children of 4 to 8yrs, SRT ranges from 5 to 9 cms, PA 105 to 150 degree and SLR ranges from 55 to 80 degree. Children of age 9-12 yrs SRT ranges from 5 to 11 cms, PA 110 to 125 degree and SLR ranges from 60 to 72 degree. For 13 – 16 yrs children 9-12 yrs SRT ranges from 8 to 14 cms, PA 95 to 125 degrees and SLR ranges from 55 to 75 degree.

Conclusion

On the basis of present study, a normative set of data for Belgaum city was established as a reference which can help the clinician to compare children who have tightness in hamstring muscle. It can also help determine a person's flexibility, and guide interventions to address these deficits. The data set can be used as a reference in both male and female children while assessing hamstring flexibility.

Key Words

Flexibility, Popliteal angle, Straight Leg Raise, Sit & Reach Test, Hamstring muscle, Tightness

Declaration

We, the authors of this article, hereby declare that this is an original work done by Varuna Gawas, under the guidance of Dr. Snehal Dharmayat & Dr. Peeyoosha Nitsure, Faculty of KLE University's Institute of Physiotherapy, Belgaum as part of the Post Graduate Dissertation. It has not been submitted to any other journal/s for consideration.

Introduction

Physical activity is an integral part of every human's life. Physical activity can be considered as "any movement of the body by the skeletal muscles that results in energy expenditure." Exercise may, on other hand, be considered as one subset of physical activity being defined as planned, structured and repetitive movements aimed at improving or maintaining one or more components of physical fitness in both adults and children[1]. Physical activity is a complex variable which is difficult to assess. Physical activity is commonly described in various dimensions i.e. duration of any given activity, intensity of activity, frequency of activity sessions and mode or type of activity sessions[2]. The ability to perform everyday physical activities is important for quality of life in both children and adults. Performing daily physical activities requires a certain level of physical fitness.

Physical fitness is defined by WHO as "the ability to perform muscular work satisfactorily"[3]. Physical fitness includes components such as cardiovascular endurance, muscular strength, flexibility, balance, speed and reaction time. Compared with young people, older people perform worse on tests for endurance, strength and flexibility[4]. Physical fitness is the capacity to meet successfully the present and potential physical challenges of life. It is a set of attributes that people have or achieve that relates to their ability to perform physical activity. Health related physical fitness includes the components of cardio respiratory endurance, flexibility and body composition. Skill related physical fitness components are agility, balance, coordination, speed, power and reaction time[5].

Flexibility of a muscle can be tested by measuring the range of motion of the joint which perform the action e.g. dorsiflexors flexibility can be performed by measuring the ROM at ankle joint[6]. Flexibility is important for any individual to be physically fit. Flexibility is the ability to move a single joint or series of joints through an unrestricted pain free range of motion. It is dependent upon the extensibility of muscles, which allows muscles that cross a joint to relax, lengthen and yield to a stretch force. Flexibility and length of the muscle is related to age, sex and physical activity[7]. The term flexibility and muscle length are often synonymously used when referring to the ability of any muscle to be lengthened up to the end range. Range of motion at each joint is dependent upon the individual joints but varies between each person.

The different types of flexibility according to Kurz are

Dynamic flexibility: (also called kinetic flexibility) is the ability to perform dynamic (or kinetic) movements of the muscles to bring a limb through its full range of motion in the joints.

Static active flexibility: (also called active flexibility) is the ability to assume and maintain extended positions using only the tension of the agonists and synergists while the antagonists are being stretched.

Static passive flexibility: (also called passive flexibility) is the ability to assume extended positions and then maintain them using only your weight, the support of your limbs, or some other apparatus.

Various factors influence an individual's flexibility which can be divided into two types i.e. internal factors and external factors.

External factors are age, gender, temperature & exercise history; internal factors are type of joint, proprioceptors[8].

Flexibility is routinely used to assess physical fitness in physical education classes in elementary and secondary schools throughout the world. Regular physical activity is an important part of a healthy lifestyle. National and international researchers agree that regular physical activity in childhood and adolescence facilitates participation in active lifestyle in adulthood and helps reduce the risk of chronic diseases in later life[9].

Fitness assessments encompass a variety of measures designed to provide individualized feedback regarding one's overall fitness status and physiological responses to physical effort. Fitness assessment can and should be developmentally appropriate. The purpose of fitness assessments is not solely to rate an individual's fitness. In fact, an education assessment might provide physiological feedback regarding a process that can then be used to explain and illustrate fundamental fitness principles. It is important to assess physical fitness in school children as part of the curricular activity.

Fitness assessment should be used in curriculum to:

- Provide an opportunity to teach and reinforce essential concepts related to the benefits and importance of choosing to live a healthy life style now and in future.
- Provide an opportunity to teach students how to self assess their own health related fitness throughout their lives.
- Provide an opportunity to critically reflect on how individual differences, including genetic and maturity levels and/or goal setting and programming accuracies or errors might have impacted perceived or expected fitness progress[10].

It is common practice for physical therapists to assess muscle length and flexibility as part of the examination of subjects or patients muscle with musculoskeletal conditions. The length and flexibility of a muscle is measured indirectly by measuring the adjacent joint range of motion. It is important to asses muscle length in children so as to give normative ranges as it will help the physical therapist to compare it with the ranges of children with orthopedic or neurological conditions, so that early intervention, can help prevent or control muscular tightness or spasticity in children. The resultant limitation of knee and hip flexion adversely affects gait and, when severe, affects sleeping posture also[11].

There seems to be no consensual definition for flexibility in the specialized literature. The definition adopted, in this study, considers flexibility as the capacity to move joint through its available range of motion (ROM), without producing excessive myotendinous stress. Based on the relation between flexibility and joint ROM, clinical tests are applied to evaluate the presence of limitations in the ROM. These tests are characterized by movements that increase the distance between the origin and insertion of muscle, literally stretching the muscle in question with the objective to test it.

The most important muscles to be assessed for flexibility in humans are biceps, triceps, hamstrings, quadriceps and tendoachillies. In lower extremity, it is important to establish normative values for the muscles because a decrease in flexibility may be associated with development of pain and muscle injury in the lower extremity.

Decreased muscle flexibility in children is associated with muscular tightness or spasticity in neuromuscular disorders such as Cerebral Palsy (CP). Decrease in muscle flexibility can be associated with muscular tightness. The term tightness is used to describe a change in the physiological length of the muscle.

Tightness is classified into three types

1. **Normal physiological tightness:** Normal amount of resistance to the extremes of motion in joint
2. **Excessive physiological tightness:** Resistance to the extreme of motion of joints for more than half of the range. It is seen in many individuals as normal accompaniment of aging.
3. **Pathological contracture:** There is no motion of joint usually after trauma, surgery or immobilization. The degree of restricted range is significant and often associated with scar formation and muscle contractures. It is important to distinguish it from tight muscle secondary to bony pathology[12].

Hamstring (HM) is an important antigravity muscle in lower limbs and its flexibility is important for maintaining normal posture and gait both in children and adults.

This group performs an important role in the antero-posterior pelvic tilt, indirectly affecting lumbar lordosis. Therefore, altered flexibility of the HM may produce postural deviations and affect the functionality of the hip

joint and lumbar spine. Thus, the execution of flexibility tests becomes necessary in the process of assessment and intervention in physical therapy. Hamstrings operate most effectively as knee flexors from position of hip flexion by increasing the length and tension in the muscle group. Trunk positioning is also important and the activity of hamstring is enhanced with trunk flexion, as it increases the length of both hamstring and gluteus maximus. If the hamstrings become tight, they offer greater resistance to extension of the knee joint by quadriceps femoris, which imposes greater work load on the quadriceps femoris muscle group[13].

Clinically, HM length may be measured indirectly by having as a possible reference the movement of the hip joint. Thus, while observing diminished hip ROM associated to the evidence of absence of neurological symptoms, it is often considered as a measurement of muscle flexibility9. Several tests are clinically used to assess HM flexibility, among them the Sit-and-Reach[14] and active or passive extension of the knee,[15]. Two tests widely used, and that were not still submitted to comparisons are the Straight Leg Raise Test (SLR) and the Fingertip-to-Floor Test (FTF)[16]. An essential aspect to be considered for the choice of a clinical test is the reliability of the measures, and this may be defined as the consistency of measurements of certain phenomenon, that is, the extent to which the measures are repeated by people and instruments leading to similar results. The fingertip-to-floor (FTF) test has shown to be reliable and can be considered a valid measurement of the hamstring flexibility[17].

Tully and Stillman suggest it as a valid measurement of this muscle's flexibility. In the same way, the straight leg raise test can be considered as a measurement of the flexibility of the hamstrings, possibly possessing clinical validity.

Suzy L. Cornbleet and Nancy B Wooley (1996) did a study to asses hamstring muscle length in school aged children using sit and reach test and the inclinometer to measure hip joint angle. SRT values were 24cms and HJA was 81 degree and concluded that there was no difference between males and females[18].

Kuo et al assessed the limit of hamstring tightness in 369 children by using 3 clinical tests and showed that SLR of less than 60 to 70 degree have hamstring tightness, popliteal angle of less than 110 to 120 degree, and toe touch test of less than 10 to 15 inches is considered hamstring tightness[19].

According to muscle testing and function by Kendal, sit & reach test reaching behind the toes usually denotes excessive flexibility of the back and excessive length of hamstring & hence affects the result according to different age groups[20].

Katz, Kalman et al did a study to assess hamstring muscle contracture in children using popliteal angle in 482 normal children, 1-10 years of age. Using 360 degrees goniometer, the popliteal angle was measured with the hip held at 90 degrees flexion to indicate hamstring muscle tightness. Between the ages of 1 and 3 years, angle was 6 degrees (range 0-15). A popliteal angle of greater than 50 degrees in the above age groups indicates abnormal hamstring tightness[21].

Marek Jozwiak, Szymo Pietrzak (1996) conducted a study on 920 healthy children in the age range of 3 to 19 yrs to assess the incidence of hamstring muscle and plantar flexor tightness using 2 clinical test i.e. popliteal angle and dorsal foot flexion angle and concluded that at age of 3 to 5 yr Popliteal angle is 45 degrees, and 6 to 15 yr 50 degrees foot dorsi flexion, range at 3 to 4yr is 7 degrees, 5 to 13 yr is10 degrees and 14 to 19 yrs is 9 degrees[22].

Sylvia Ounpuu et al studied the relationship between knee function in gait in CP & normal children between 1 to 5yrs children by measuring hamstring length using popliteal angle & straight leg raise test. They reported that a normal SLR is between 55 to 60 degrees & popliteal angle is between 45 to 50 degrees[23].

The sit-and-reach test was developed to measure hamstring and lower back flexibility and was first described by Wells and Dillon (1952). Most sit-and-reach tests include several varieties of a two-leg "floor, raised platform or chair" sit-and reach with or without a sit-and-reach box[24].

Li et al (1996) measured the importance of the length of the hamstring in 362 normal individual by performing straight leg raise test and found that SLR of less than 70 degrees has hamstring tightness[25].

Study done in Saudi Arabian children and adolescents by Khalid S. Almunzaini to find the relationship of anthropometric characteristics during growth in 44 subjects between age groups of 11 to 19 yrs in boys using flexibility test i.e. SRT, vertical jump, isometric grip strength and isokinetic strength, concluded that there is significant decrease in the test score as the age progresses[26].

McCarthy conducted a study to asses relationship between relationship between tight hamstrings and lumbar hypolordosis in children with CerebralPpalsy to assess the influence of tight hamstrings on the sagittal alignment of the thoracic and lumbar spine in twenty children with mean age of 9.4 yrs using Cobb's angle and popliteal angle for hamstring tightness and found a statistically significant correlation between the sitting lumbar curve and popliteal angle (Pearson correlation value -0.77, P < 0.01). As the popliteal angle increased, the amount of lumbar lordosis decreased[27].

Study done by Hopkins DR, on twenty children of age 6 yrs to asses hamstring tightness using SRT, concluded that anthropometric factors such as disproportionate length of limbs relative to the trunk, influences the ability of the children to perform sit and reach test[28].

Thompson et al conducted a study to compare physical activity in male and female children & also to determine whether maturation matters in differences in physical activity levels in boys and girls. The study was conducted on 138 children between age of 9 -12 yrs, outcome measure was Physical Activity Questionnaire for Children (PAQ-C) and results concluded that level of physical activity decrease with increase in chronological age in both sexes[29].

Marie Corkery conducted a study to assess normative values for lower extremity muscle length in 72 college students for hamstring, iliopsoas, rectus femoris and gastrocnemius muscles using the assessment techniques of Active Knee Extension (AKE), modified Thomas test and Thomas test. For hamstring SD was 35.0+/- 11.3, rectus femoris SD was 49.1+/- 9.4 and iliopsoas SD was 2.4+/- I.8[30].

Methodology

Design: Observational, cross-sectional study done in Belgaum city, Karnataka, India , with one time assessment of Hamstring flexibility done on a sample of 400 school children divided into groups on the basis of age as Group A- 4 to 8 yrs, Group B- 9 to 12 yrs, Group C -13 to 16 yrs. Written informed consent was taken from the parents of the children & school authorities as required.

Procedure: Demographic data of all the children was taken prior to measurements of the outcome measures. Main outcome measures were range of motion of knee joint & 3 flexibility tests for the Hamstring group.

3 clinical tests were used for measuring hamstring muscle length namely SRT, Popliteal angle & Straight leg raise (SLR).

Popliteal angle

For measurement of popliteal angle, the starting position of the child is in supine lying. The examined hip and knee were put in 90 degrees of flexion, each and then the knee was passively extended until the moderate resistance was met in the muscle. The angle subtended on the popliteal surface by the long axis of the tibia with the femur was recorded as popliteal angle. The opposite leg was kept extended on the couch. The angle was measured in degrees with a goniometer. The measurement was repeated thrice and an average of the three readings were noted.

Straight leg raise test (SLR)

The test was performed, based on Kendall et al and Gajodsik et al. For this, the child was made to lie supine on the plinth. The child was then instructed to flex the examined hip with the knee kept in full extension. The contralateral leg was kept flat on examination table. The examined leg was lifted up till the knee started flexing. At this point, the angle between the raised leg and horizontal was measured using a universal plastic goniometer in degrees. The procedure was repeated thrice and the average of three readings was noted.

Sit and reach test or toe touch test

To perform this test, the position of the child was in long sitting position with both the knees fully extended and ankles in neutral position with feet resting in neutral position. The child was then instructed to place one hand on another and slowly reach forward as far as possible while keeping the knees straight. The hands were kept aligned as the subject reached the toes. The distance between the tip of the middle finger of the hand and the toes was noted on the wooden scale. The child was instructed to perform the test for three times and the average of three was noted in centimeters.

Results

Data was analyzed using the statistical software SPSS Version 13. Participants age, height and weight was subjected to statistical analysis and mean and standard deviation was calculated for each age group for both males and females and both sex combined together . (Table No. 1).

All the 400 hundred children reported their right leg as dominant leg so the right leg range of motion was considered for statistical analysis.

Straight leg raise test according to age group was measured using universal goniometer in degrees. The average of SLR for children with 4 to 8 yrs of age mean value was 67.10 with SD ±7.20 and mean values for females of same age was 68.50, SD of ±6.68, the median value 700 with minimum of 550 and maximum of 800. Both groups combined, mean was 67.80 with SD of ± 6.95, with 95%CI upper limit was 68.910 and lower limit was 66.770. SLR for 9 to 12 yrs maximum mean value was 64.80 with SD ±4.61 for males and for females 64.20 with SD of ±4.45 median value for this age group was 650 with minimum of 600 and maximum of 720 and both groups combined together mean 67.80 and SD± 4.52; with 95%CI upper limit was 65.190 and lower limit was 63.620. For 13 to 16 yrs maximum mean value for males was 65.20 and SD ±5.13 for females 65.60 SD ±4.72 and both combined together mean 65.40 and SD ±4.91with 95%CI upper limit was 66.300 and lower limit was 64.480. The median value for this age group was 650 with minimum of 550 and maximum of 700 (Table No. 2, 3, 4).

Popliteal angle was measured using universal goniometer

Table 1: Demographic Profile

		HEIGHT (Cms)				WEIGHT (Kgs)			
Age	Sex	Mean, SD	Median	Min	Max	Mean, SD	Median	Min	Max
4-8 YRS	Male	110.9±15.32	114	92	127	15.3±4.35	14	8	24
	Female	107.8±10.3	110	86	124	13.9±3.75	13	8	24
9-12 YRS	Male	134.7±7.21	137	120	146	28±3.1	28	20	36
	Female	130.4±6.31	128	120	143	24.8±2.71	24	20	32
13-16 YRS	Male	149.9±6.24	151	138	158	44.1±8.14	46	29	56
	Female	146.7±7.57	149	131	154	35.7±5.58	35	26	46

Table 2: SLR Ranges for Males

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	67.1±7.20	75	55	80
9-12 YRS	64.8±4.61	65	60	72
13-16 YRS	65.2±5.13	65	55	80

Table 3: SLR Ranges for Females

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	68.5±6.68	70	55	80
9-12 YRS	64.2±4.45	65	60	72
13-16 YRS	65.6±4.72	65	55	75

Table 4: SLR Ranges for both groups combined

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	67.8±6.95	70	55	80
9-12 YRS	64.5±4.52	65	60	72
13-16 YRS	65.4±4.91	65	55	75

with the average popliteal angle for children with 4 to 8 yrs maximum mean value was 135.70 with SD of± 15.36 for males and 137.90 and SD of ±15.06 for females and the median value 1450with minimum of 105 degrees and maximum of 150. Both groups combined together mean was 136.80 SD was ±15.21; with 95%CI upper limit was 139.180 and lower limit was 134.90. For 9 to 12 yrs maximum mean value was 115.80 with SD 3.83 for males and for females 116.20 with SD of 3.56 and median value 1150 with minimum of 1100 and maximum of 1250. Both groups combined together mean 115.90 and SD ±3.69 with 95%CI upper limit was 116.470 and lower limit was 115.200. For 13 to 16 yrs maximum mean value for males was 109.30 and SD ±4.20 for females 110.10 SD ±5.35 and median value 1100 with minimum of 950 and maximum of 1200 both combined together mean 109.70 and SD± 4.80. With 95%CI upper limit was 110.50 and lower limit was 108.690. (Table No. 5, 6, 7).

Sit and reach test according to age group was measured using wooden scale. The average of SRT for age of 4 to 8 yrs maximum mean value was 5.3 cms with SD of ±1.67 for males and 4.7 and SD of ± 1.35 for females, median value 5 cms with minimum of 3 cms degrees and maximum of 9 cms. Both groups combined together mean was 5.04 and SD was ±1.55. 95%CI upper limit was 5.28 and lower limit was 4.80. For 9 to 12 yrs maximum mean value was 9.6 cms with SD ±1.90 for males and for females 7.5 with SD of ±1.26 and, median value 8 cms with minimum of 5 cms degrees and maximum of 14 cms both groups combined together mean 8.6 and SD ±1.93. 95%CI upper limit was 8.93 and lower limit was 8.25. For 13 to 16 yrs maximum mean value for males was 11.6 cms and SD 1.70 for females 11.2 SD ±11.71 and median value 12 cms with minimum of 8 cms and maximum of 14 cms both combined together mean 1.4 and SD 1.71 95%CI upper limit was ±11.69 and lower limit was 11.06. (Table No. 8, 9, 10). From the above results, it was noted that there is gradual decrease in range of motion after 6 yrs of age and there is an increase in SRT scores.

Discussion

As there is an increasing emphasis on early detection and treatment of neuromuscular disorders, a need exists for normal quantitative data for joint range of motion in children. The presence of tight hamstring muscles may alert one to suspect underlying pathological conditions, but the lack of normative values can make the assessment difficult in mild cases.

Popliteal angle measurement is a widely used clinical measure of hamstring muscle tightness and contracture in children as reported in literature. In CP patients, it is used as one of the effective measures of hamstring lengthening surgery. It has been widely used in newborn period as a measure of gestational age. Limitation of knee extension is more pronounced in new born with increased gestational age. There are difficulties with analysis of popliteal angle and defining the angle in literature. Some authors have used the definition of the angle as the angle of the popliteal surface by the long axes of the tibia with the femur, where as other authors have recorded the supplementary angle to this[31,32].

In the present study, the first method was used as it is more widely used and the age group comparison can be interpreted more easily. Some authors assessed the popliteal angle with the hip flexed to 900 where as others used knee to chest position or knee to lateral position .For the study, the method suggested Katz et al was used. In this method, the starting position of the child is in supine lying. The examined hip was put in 900 of flexion and then the knee was passively extended until the moderate resistance was met in the muscle. The angle subtended on the popliteal surface by the long axis of the tibia with the femur was recorded as popliteal angle. The opposite leg was kept extended on the couch. The angle was measured in degrees with goniometer. This method was used as it is more consistent and not affected by the differences in abdominal bulk of the children. It is important to note that the largest angle that can be

Table 5: Popliteal angle Ranges for Males

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	135.7±15.36	145	105	150
9-12 YRS	115.8±3.83	115	110	125
13-16 YRS	109.3±4.20	110	95	120

Table 6: Popliteal angle Ranges for Females

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	137.9±15.06	145	105	150
9-12 YRS	116.2±3.56	115	110	120
13-16 YRS	110.1±5.35	110	95	120

Table 7: Popliteal angle Ranges for both groups

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	136.8±15.21	145	105	150
9-12 YRS	115.9±3.69	115	110	125
13-16 YRS	109.7±4.80	110	95	120

Table 8: SRT Ranges for Males

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	5.3±1.67	4	3	9
9-12 YRS	9.6±1.90	8	5	11
13-16 YRS	11.2±1.71	11	8	14

Table 9: SLR Ranges for Females

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	4.7±1.35	4	3	9
9-12 YRS	7.5±1.26	8	5	11
13-16 YRS	11.2±1.71	11	8	14

Table 10: SRT Ranges for both groups

AGE	MEAN SD	MEDIAN	MIN	MAX
4-8 YRS	5.04±1.55	5	3	9
9-12 YRS	8.6±1.93	8	5	11
13-16 YRS	11.4±1.71	12	8	14

measured is 180 degree[33].

Reimers et al (1993) did a study on 769 school children in Denmark to find normal ranges of hamstring tightness in boys and girls using popliteal angle measurement and found that 75% of boys and 40% of girls over 10years have tight hamstrings with popliteal angle greater than 40 degree; 10% of boys of age of 10 years had angles greater than 60 degree[34]. Thus the result of this study was also similar to present study which suggested that popliteal angle was 137.9 degree and then remains at a plateau till 10 years.

Katz et al measured the popliteal angle in a group of 482 normal children younger than 10 years of age and concluded that at the age of 1 and 3 years the mean angle is 174 degree. The angle decreases to 163 degree in girls and 153 degree in boys by the age of 4. After the age of 5 years, the popliteal angle averaged 154 degree with little change. They defined an angle < 130 degree as indicative of hamstring tightness. The result of the present study also demonstrates similar trends where the average popliteal angle values were slight higher for age group of 4 to 8yrs with average of 135 degree[35].

Straight leg raise test is a sensitive test throughout the age spectrum. It is a passive test and therefore particularly used in the younger age groups in which co-operation may be difficult or impossible. SLR test was, based on the method described by Kendall et al. and Gajdosik et al[36]. The subjects were classified into two groups according to the angle between the long axis of the leg and the horizontal line. Thus, individuals who obtained values equal to or greater than 65º were classified as with normal flexibility, while the subjects who obtained values lower than 65º were classified with reduced flexibility. Precautions were taken during the test's execution: contralateral thigh fixation of all individuals with a tape, instructions for the subject to relax and standardization of a slow raising velocity, to minimize errors during measurement. In the present study, it was noticed that there was not much difference in SLR in boys and girls and it remained at plateau after 6 years of age, because of decrease in lumbar lordosis which is seen at this age.

In the present study it was seen that the popliteal angle and SLR continue to plateau up till 10 years and then gradually decreases. This is because of increase in lumbar lordosis and anterior pelvic tilt inclination that usually starts after 4 years of age. The forward tilt of the pelvis is counterbalanced by hamstring contracture, which is expressed by increased popliteal angle. The wide range of decrease in popliteal angle in older children may be result of different degree of pelvic tilt among them. 37 Sit and reach test or toe touch test is performed using the combined movements of lumbar spine and lower limb muscle length. A reason for absolute values for SRT is not alone measure of hamstring tightness, this being influenced by the size of the child. SRT can also be limited by a decrease in hamstring length even if there is decreased flexibility of the lumbar spine. Sit-and-reach test requires less time to perform and provides the same information as a modified test; it seems prudent for teachers, coaches, and fitness enthusiasts to use this test for quick and easy monitoring of lower back and hamstring extensibility. Most sit-and-reach tests include several varieties of a two-leg "floor, raised platform or chair" sit-and-reach with or without a sit-and-reach box. According to the American Alliance for Health, Physical Education, Recreation and Dance, a modified SRT was one in which sit and reach box is used and the child is asked to reach as far as possible on the box with a wooden scale on it[38].

Flexibility (as measured by the Sit-and-Reach) improves consistently in girls ages 5–18, but exhibits a "U-shaped progression" in boys, and the values for girls are generally higher than for boys. This is because of increase in anthropometric measurement such length of legs and height of participants as age progresses. In the present study girls showed more score for SRT compared to boys of same age. Children with long legs and short trunk, failed to reach the toes even if they have acceptable hamstring flexibility length because of decreased spinal mobility and the length of their limbs is greater. In the present study, SRT scores were same for both males and females. The result of the present study indicated that even children with normal popliteal angle showed increase score on SRT because of decrease in shoulder girdle mobility and proportional differences between arms and legs.

Conclusion

On the basis of present study, a normative set of data was established which can help the clinicians as a reference to compare children who have tightness or spasticity in hamstring muscle. It can also help determine person's flexibility, and guide interventions to address these deficits. The data set can be used for reference in both males and females for hamstring flexibility.

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Stress Assessment among BSF Personnel at Bangalore base Camp - A Cross-Sectional Study

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Abstract

A cross sectional study was carried out on Border Security Force (BSF) personnel at Bangalore base camp to assess the physical and mental stress and its relationship with age, duration of service and life satisfaction. A questionnaire study was done on 263 BSF personnel and the data was statistically analysed using student't' test. Physical stress was higher in older age groups ($p < 0.001$) compared to younger age group which increased with number of years of service ($p < 0.001$) and mental stress was high in younger age group ($p=0.008$). Life satisfaction scores were lower in younger age groups compared to older age group. Physical stress increased with age and duration of service in contrast to mental/behavioural stress which was high among the younger group. Life satisfaction score were lower in younger age group.

Key Words

Physical stress, mental stress, BSF personnel, Life satisfaction, age group.

Introduction

Stress and stress related disorders are on the rise. Stress is a highly subjective phenomenon that differs among individuals. Increased stress levels have been reported among security personnel than their civilian counterpart. Though stress during war or counterinsurgency operations is understandable, it is becoming apparent that service life even in the absence of such situations is stressful. Different people respond to stress differently some people blush, some eat more, and while some others grow pale and in the long run fall sick and suffer from different ailments. Stress can manifest as physical or mental consequence. Physical symptoms include headache, heart attack, oral and peptic ulcer, temporomandibular joint problems etc. Whereas mental symptoms include depression, decreased appetite, increased anger, insomnia etc.

Survey on health related behaviour among military personnel showed that both military men and women were nearly twice as likely to report higher levels of stress at work (39%) than their family or personal life (22%). In study on military personnel 26% reported significant work stress, 15% reported that work stress led to emotional distress and 8% claimed that work stress was severe enough to affect their physical health[1]. Another study reported that 60% of the US army had significant work stress and majority blamed the work stress as a significant contributor to the onset of their mental illness[2]. Little autonomy, long working hours, demanding officers, away from family, environmental factors etc contributes to increased job stress among these individuals. Most of these studies have been conducted in west and no study has been reported so far among the Indian armed force. Hence this study was taken up to assess the stress levels and correlate the physical and mental stress with age and duration of service and life satisfaction among BSF personnel at Bangalore Base Camp.

Material and Methods

263 BSF army personnel between the age group of 20-50 years at Yelahanka base camp, Bangalore formed the study group. These personnel were deployed from various states of India for rigorous training sessions for a period of 3 months. A comprehensive proforma representing somatic, emotional, behavioural and cognitive symptoms of stress was used.

Following parameters were assessed

- Personal particulars like age, no. of years of service, marital status, and home town.
- Socio-demographic data like accommodation, diet and leisure activities, work changes and pressures like hectic schedule, demanding or difficult officers, too many responsibilities, powerlessness, inadequate pay, relation with senior officials and peers.
- Self made questionnaire modified form of Stress Response Check List (SRC) by Verma, 1990 was used. It included of physical symptoms of stress (fatigue, headaches, tense neck and jaw, oral ulcers, peptic ulcer) and mental/ emotional symptoms of stress (lack of concentration, depression, sad, insomnia, and increased anger). We utilized 3 point rating scale (mild, moderate and severe). For life satisfaction levels, scale by Ed Diener was employed. Data was analysed by student't' test.

Results

263 male army personnel, between the age group of 20-50 years were divided into two categories based on the age groups as 20-34 years – younger age and 35-50 years – older age. 156 individuals were married. Of the 133 individuals in the older age group of 122 individuals complained of physical stress compared to younger age group. Physical stress was significantly higher among older age group ($p < 0.001$) and increased with age and

Table 1: Showing correlation between physical and mental stress with age.

	AGE	N	MEAN	STA. DEVIATION	MIN	MAX	't' TEST	'p' VALUE
Physical symptoms score	20-34 yrs	130	24.30	6.078	13	43	85.16	<0.001
	35-50 yrs	133	27.06	5.643	14	43		
Mental symptoms score	20-34 yrs	130	47.08	7.474	31	65	11.34	0.008
	35-50 yrs	133	45.92	8.126	26	68		

Table 2: Showing correlation between physical and mental stress with no. of year of Services.

	No. of year Services	N	Mean	Std. Deviation	Minimum	Maximum	't' test	'p' value
Physical Symptoms	1-16 yrs	149	23.82	6.153	13	43	29.21	<0.001
	16-30 yrs	114	25.45	5.438	14	42		
Mental symptoms	1-16 yrs	149	7.89	2.405	3	12	24.77	<0.001
	16-30 yrs	114	6.91	2.633	0	12		

duration of service ($p < 0.001$).

130 individuals in younger age group complained of higher mental stress than older age group ($p= 0.008$) and it decreased with increase in number of year of service ($p < 0.001$). Life satisfaction scores were low among younger group (65.7%) than the older group (34.3%) with significant p value ($p= 0.02$).

Discussion

Job performance is linked with job stress and job satisfaction. This has been documented in a large number of epidemiological studies based mainly on two complementary theoretical concepts, the demand-control model. 3-5 and the effort-reward imbalance model. 6-12 Job stress can lead to various medical ailments both physical and mental. Physical and mental stress related disorders include depression, anxiety, heart attacks, hypertension, stroke, orofacial problems like temporomandibular disorders, apthous ulcer, bruxism, headaches, burning mouth syndrome, xerostomia, tense neck and jaw and body aches etc. Armed forces irrespective of any country are exposed to more physical and mental stress, due to their nature of work and long deployments on border.

In our study high levels of stress was found among the BSF army personals similar to other studies done by Adler A.B et al, Robert M Bray and Capt A. A. Pawar et al on military and naval personnel[13-15].

In a study on 472 military personnel who had not been exposed to any war, 26% reported to be suffering from significant work stress[2]. Nearly one in five blamed work stress for causing significant emotional distress and one in ten reported work stress was severe enough to affect their emotional health. This was independent of the age, sex, education, years of military service and marital status. Probable reasons may be little autonomy, long working hours, away from family, environmental factors etc. Our study has shown that the physical symptoms increased with age which can be attributed to physical weakness, too many responsibilities, and mismatch between expectations and the duration of deployment etc. It was also found that older personnel with longer duration of employment had more stress inspite of good physical exercise, food and becoming more compatible to the organisation. This could be because of age factor, unsatisfaction and a very demanding workload.

In contrast mental/emotional symptoms were more in younger age groups compared to older age group which can be attributed to factors such as long time separation from family, loneliness, less leisure activities, diet factors, etc. Our findings are similar to the study on UK armed forces by Margaret Jones et al[16]. Various studies have reported an association between number of months of deployment and increased physical and mental stress.

A recent study from Sri Lanka reported that 50% of mentally ill persons, suffered from adjustment disorder or a stress reaction. In a three year study by the Royal Navy, the two main causes of stress were balancing work versus home life and discord in working relationships and that good supervisor support was very effective in managing stress[17]. Married people have been found to have better levels of physiological well being as compared to unmarried people who experience loneliness, lower sense of belonging and emotion oriented coping.

Life satisfaction scores were low among younger individuals (65.7%) than the older personnel (34.3%) similar to the findings by Surg Capt AA Pawar et al in their study[15]. Increased mental stress and low life satisfaction scores were found in younger age group compared to older age group which can be attributed to increased energy levels and enthusiasm, but inability to do anything independently, overriding officers, loneliness and low emotional coping.

Increased work stress has been implicated as an important health hazard for military personnel. A healthy lifestyle such as regular exercise, abstaining from smoking and moderate drinking has also been associated in preventing premature death in a forty year follow-up study on naval personnel[18]. Motivation for serving has also been implicated to reduce incidence of future posttraumatic stress disorder[19]. Good working relationship with senior officers, change in work responsibilities, balancing work and personal life, good support system and counselling are very effective in managing stress. Each unit should have a psychiatric permanently and should be shifted to the place of operation during war.

The limitations of this study are it has a small sample size and is confined only to personnel deployed from different states to Bangalore for training. A larger cross sectional study involving different base camps would have greater value.

Conclusion

Job performance is greatly linked with job stress and job satisfaction. Work stress has been implicated as an important health hazard for military personnel. Significantly decreasing stress and increasing job satisfaction helps improve performance among military personnel.

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Comparative Study between Effectiveness of Dance Movement Therapy and Progressive Relaxation Therapy with Music for Stress Management in College Students

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Abstract

Introduction

Stress has been labeled "one of the most common problems that attack all of us". Stress can become either distress or eustress. Distress is the debilitating type of stress most of us think of when we hear the word stress. A particular stressor may cause eustress in one person, while causing distress in another.

Objective

To compare the effectiveness of Dance movement therapy and Progressive Relaxation Therapy with music for stress management in college students for a period of one month.

Methodology

Study was carried out at KLE University's Institute of physiotherapy, Belgaum Subjects participated in the study were 40 samples, were divided randomly into 2 groups of 20 subjects each. Pre and post assessment of stress, using Lakaev academic stress response scale was done.
Group A: Participants received Dance Movement therapy.
Group B: Participants received Progressive relaxation therapy with music.

Outcome Measures

Stress scores were obtained in Lakaev academic stress response scale before and after completion of therapy.
Result: After one month of therapy both the group when compared within the group (pre and post stress scores) showed equal improvement in both the groups independently (p=0.000 in Group A & B) but when post stress scores were compared between the group no statistically significant data was found(p=0.287).

Conclusion

Both the therapies are equally effective in stress reduction.

Key Words

Stress, dance therapy, progressive relaxation therapy, relaxation.

Stress has been labeled "one of the most common problem, that attacks all of us" .Selye (1974) defined stress as the "nonspecific response of the body to any demand placed upon it". According to him it does not matter whether the stressor is positive or negative because things like cold, heat, drugs, hormones, sorrow and joy all produce the same biochemical reaction in the body leads to "a demand for readjustment". He also concluded that stress can become either distress or eustress. When an individual comes across some difficult situation automatically that situation puts that individual into stress which motivates person for an action but if in case that situation does not get solved then it produces a negative reaction in our whole system that leads to the body slowly breaking down. A particular stressor may cause eustress in one person, while causing distress in another[1].

Now a day's young adults consider college time as a golden period of life. This golden period of life requires a student to do lots of adjustments which might be undermined by depression, anxiety, substance abuse and eating disorders. According to a recent UCLA survey of college freshman, college students are feeling more burdened and stressed than fifteen years ago and also reported that thirty-eight percent of college women frequently felt being overwhelmed.

According to the Center for Disease Control and Prevention, 7.8% of men and 12.3% of women ageing between18-24 frequently suffer from mental distress. This psychological problem affects every physiological function of human being right from the nervous system till endocrinal system[2]. Stress appears to be very small problem but has strong roots inside which seizes an individual from giving their best. Now a day's stress is bothering every individual physically as well as mentally. Many therapies such as yoga, meditation, relaxation have been proved to be effective to deal with stress. More recent is Dance movement therapy, which has proved helpful to reduce stress as it involves person's cognition, emotion and feelings for his/her movements. The physical benefits of dance therapy as an exercise are well documented. Experts have shown that physical activity is known to increase special neurotransmitter substances in the brain (endorphins), which create a state of well-being. Total body movement such as dance enhances the functions of other body systems, such as circulatory, respiratory, skeletal, and muscular systems, helping in developing a body image; improving self-concept, self-esteem; reducing stress, anxiety, depression, body tension and increasing communication skills. In order to reduce stress, not only has dance

therapy been proven efficient but also Progressive relaxation therapy (PMR) has shown similar effects and is very easy to incorporate in various populations, research indicates that progressive muscle relaxation is especially effective when paired with music, as music tends to distract an individual from a stress causing situation and thus inducing relaxation[3]. As already known, both the therapies are effective in reducing stress but comparison between the two to find out which one is more effective has never been done. So the aim of this study was to find out the more effective treatment among Dance movement therapy and progressive relaxation therapy with music to reduce stress in college students which can be extrapolated to help every individual to cope with different situations of stress without affecting mental and physical state.

Subjects and Methods

Subjects were recruited from K.LE University's institute of physiotherapy with proper permission. Inclusion criteria included, subjects with age between18-24years, with history of headaches, fatigue, insomnia, restlessness, neck and shoulders tightness, poor concentration, low productivity, negative attitude and scored greater than 50/110 on Lakaev academic stress response scale .Subjects were excluded if they were suffering from any medical condition, were on psychiatry treatment and who were not willing to participate. Consent form was taken in the language known to them; data concerning baseline demographic, clinical characteristics were taken. Outcomes were assessed before and after program implementation. Subjects were blinded regarding their groups.

118 students were screened, out of which 35 did not meet inclusion criteria, 43 participants refused to participate, 40subjects were randomly selected and allocated in two groups by sealed envelope method. Each group consisted 20 subjects and received one of the above mentioned therapies.

Procedure

Subjects were divided into two groups, Group A and Group B, 20 subjects in each group. Group A received Dance movement therapy. The length of the exercises and the rest time was explained before the session. This program was implemented in KLE University's Institute of physiotherapy, it comprised 1-hour session and the whole session was observed by evaluator. It included 5 stages: First stage was Opening circle, subjects described their feelings and energy level; Warm-up section , subjects stood in a circle and did warm-up using different body parts and movements; Structured task section, in this part subjects were asked to mirror each other's movements, create body image sculpture in partners; Creative movement section, subjects did group mirroring, created group sculptures and experienced this feeling; Closing circle, subjects thought about group experience, refocused on oneself with body-oriented exercises such as self-touch, verbal integration. Frequency: 60–90 min/session for 3 days a week for one month[4]. Group B received Progressive relaxation therapy with music, instructions were given along with music. This part of the session lasted for 20 to 22minutes, 8 to 10 minutes of "dead time" encouraged the subject to remain in the chair with minimal or no movements. Sequentially, with all the muscle groups, first subjects were asked to tense a muscle group and were asked to observe what the tense state feels like; then they were instructed to "let go" means were asked to relax tensed muscle. Then they were asked to observe the difference between when the muscle was tensed and when it was not. This self-observation accompanied each maneuver and was repeated several dozen times during the 20-minute procedure. The muscle groups which were employed (with the actual motion) were: palmar (making a fist), hand extensors (extending the wrists), biceps(bending the arms at the elbows),shoulders (shrugging), facial muscles (arching the brows, frowning, shutting the eyes tightly, pressing the tongue against the palate, pursing the lips, opening the mouth wide), neck (moving the head forward and then backward), spinal (arching the back), chest wall(breathing deeply and slowly through the nose), abdominal(drawing in the "stomach"), thighs (straightening the legs from a sitting position), shins (pointing the toes upward), calves (plantar-flexing the feet) and toes (curling the toes)[5]. All these exercises were incorporated with music to achieve a better result.

Statistical Analysis

A statistical analysis was performed using SPSS version. Data was presented as mean & standard deviation. The paired't' test was used to calculate p values for the comparison of means between pre and post treatment of both the groups and p values were highly significant (0.000). Comparison of means was also done between post treatments of both the groups but the p value was not significant (0.287).

Result

This study was to done to find out more effective therapy amongst Dance movement therapy and Progressive relaxation therapy with music in stress management for college students. Age group18-24 participated in which 90% of subjects were females and 10% were males. Pre and post intervention stress score were recorded and statistically compared within group and between groups (table1, fig1& 2). The comparison of stress score pre and post therapy within group for group "A" which received Dance movement therapy (DMT) showed p value 0.000 & group "B" pre and post therapy which received Progressive relaxation therapy (PRT) also showed p value 0.000. Both the values signifies that subjects participated in these two methods gave effective outcomes when compared within the group and results were highly significant (p=0.000).

Post therapy session showed p value of 0.287. This p value does not signify better effectiveness of one therapy over the other (table2, figure3). However it signifies that

Table 1: Comparision of Pre and Post intervention stress score for both groups

Group	Pre treatment stress score	Post treatment stress score	Difference	T value	Degree of freedom	P value
A(n=20)DMT	67.8±12.72	22.1±5.38	45.7±13.91	14.707	19	0.000
B(n=20)PRT+ MUSIC	66.9±13.0	20.3±4.84	46.6±12.21	17.081	19	0.000

Table 2: Comparision of the post therapy stress score between the groups

Group	Post treatment stress score	T value	Degree of freedom	P value
Group A	22.1±5.38	1.080	38	0.287
Group B	20.3±4.84			

both the therapies were equally effective in reduction of stress amongst the college students. Stress scores were not significant in any of the groups (p=.287).

Discussion

This study was focussed on the most common problem which arises amongst college students that is stress. Stress amongst students may develop because of educational pressure, career stress, interpersonal relationships and managing themselves between college and home. Stress is a common ocurrence in today's world and may make the individual mentally bankrupt if not tackled on time.

Research in the United States suggests that the mental health of qualified physicians as well as students is also exposed to certain stressors, leading to stress, during training[6]. A recent report, confirming earlier studies, described particularly high levels of psychiatric distress in medical students in a university in the United States as compared with the general population, with 15-20% of the students meeting criterias for diagnosis of psychiatric illness. Stecker (2004) investigated the mental health and stress needs of 461 graduate students in the fields of physical therapy, pharmacy, dentistry and medicine at a top ranking medical center in the USA which confirmed the same.

This study was aimed to compare two techniques (a) Dance movement therapy and (b) progressive relaxation therapy with music. After analyzing the pre and post data of both the groups, it was seen that both the therapies are effective in stress reduction (fig 1 & 2). In group A,Dance movement therapy was given, which showed reduction in the stress score, which is consistent with study done on the effectiveness of these therapies on various patient populations. Improvements were due to moving as a group which brings people out of isolation, creates a powerful social and emotional bond, and generates the good feelings that comes by being with others. Moving rhythmically eases muscular rigidity, diminishes anxiety, and increases energy. The rhythmic beat, singing and movements are therapeutic tools; through these, sick and depressed people find energy in their minds, bodies and a smile on their faces. They rediscover the feeling of wellness which is their goal. Hope and positive thinking is created which helps people cope with their stressfull situations. Dance movement therapy is being increasingly used to treat many conditions like physical problems such as amputations, traumatic brain injury, stroke, chronic illnesses such as anorexia, bulimia, cancer, Alzheimer's disease, cystic fibrosis, heart disease, diabetes, asthma, AIDS, and arthritis. Some research results have shown that the magnitude of the risk reduction is consistently around 40% for colon cancer. Studies to evaluate effect modification have shown that physical activity may most importantly reduce risk of colon cancer in the presence of high levels of energy intake, a high glycaemic index or large body size[7].

Progressive Relaxation plus music, resulted in the greatest effects on behavioural and self-report measures of relaxation, suggesting that cognitive cues provided by stress management techniques contribute to relaxation[8]. PRT training in cardiac rehabilitation care after discharge improves psychological outcomes of patients, reduces clinical level of anxiety and improves overall wellbeing[9]. PRT also improves the patients self confidence and improve relaxation ability in the patients. Hypertensive patients when introduced with yoga, biofeedback and music therapy, were shown to have improvements in quality of life to a great extent, additionally they also learnt to relax themselves[10]. Intensive supervised practice also improves cardiac events thus helping the patients to

Figure 1: Graphical representation of stress score, pre and post therapy session of Group A (DMT)

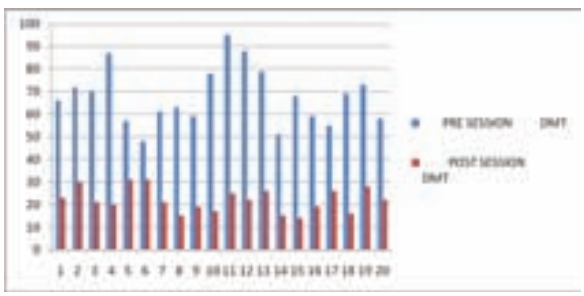


Figure 2: Graphical representation of stress score, pre and post therapy session of Group B (PRT + Music)

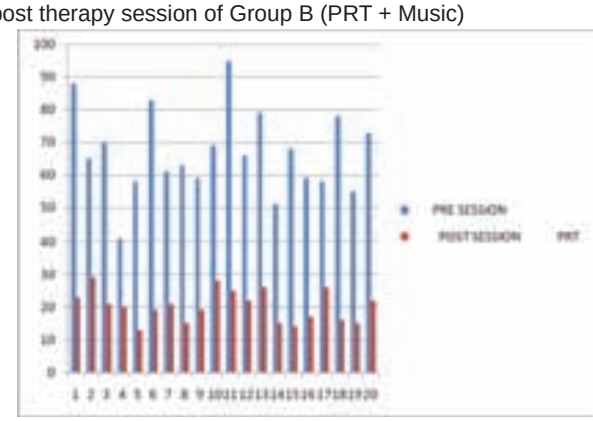
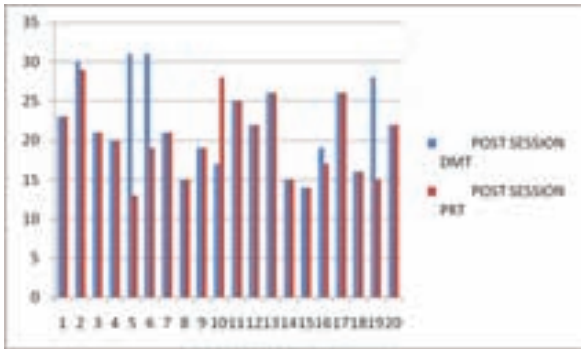


Figure 3: Graphical representation of post therapy stress scores of both groups



recover at a faster rate.

Despite this study being intended to find a better therapy amongst the two nevertheless when data were compared (table 2) no statistical siginificance was found. None of the therapies proved more effective so results indicate that therapy should be chosen on the basis of patients interest and comfort level instead of therapist preference, because this will lead to better compliance and thus better improvement. Furthermore, statistically significant results may or may not be clinically significant. The higher level of psychological morbidity warrants need for interventions like social and psychological support to improve the quality of life of medical students. Student advisors and counselors may train students about stress management. There is also a need to bring about academic changes in quality of teaching and evaluation system. Thus, more research is required, may be with larger sample size, as well as the long term effects of both the therapies needed to be studied.

Conclusion

Various clinical studies with dance movement therapy and progressive relaxation therapy showed that these therapies are very helpful in reducing stress. This study was aimed at studying comparisions to find out which therapy is more effective in reducing stress in college students. The results of the observed evaluation parameters showed significant differences within the group, stress was reduced significantly. Properly applied dance movement therapy and progressive relaxation therapy on college students enabled the sudents to focus on their tensions and relieve them. Results indicate that both the therapies are equally effective in stress reduction and thus will help them to cope up with life challenges

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Effect of Visual and Verbal Cue Training on Gait Parameters in Patients with Parkinson's Disease

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Abstract

Background and Purpose

The use of external cueing techniques to improve Parkinsonian gait has received considerable attention recently. The present study is an initial attempt to compare the training effect of visual and verbal cues and examine the percentage of improvement with that of control group. Purpose is to investigate and compare the efficacy of visual and verbal cue training on parameters of gait in people with Parkinson's disease.

Subject

30 subjects diagnosed as idiopathic Parkinson's disease were recruited in the study.

Method

Groups received training three times per week for three weeks. Subjects walked for total of 20 minutes by repeated 10-m long walk. In group 1, visual cues were provided at 110% of their initial mean step length that was progressed to 120% after 5 days of training. In group 2, verbal cues were provided with instruction to "take long steps". In group 3 subjects were told to practice walking at home.

Results

Within the group there was significant improvement in step length, stride length, speed in Group 1 and 2, but not in cadence. In group 3 there was no significant improvement. Differences of mean show statistically significant improvement in step length and stride length between groups 1 and 3 and groups 2 and 3 but not between groups 1 and 2.

Discussion and Conclusion

The visual and verbal cue training both proved to be effective in improving gait parameters in Parkinson's disease subjects.

Key Words

visual cue, verbal cue, gait and Parkinson's disease

Gait impairments are common in people with Parkinson's disease and are associated with an increased risk of fall and loss of independence[1]. The gait pattern is typically characterized by hesitant, shuffling steps which are short and quick; flexed forward posture with limited natural arm swing; and difficulty initiating and/or altering their gait patterns[2].

Central to these gait problems is the inability to generate proper stride length, which is compensated by an increased gait cadence[1]. Various studies have stated that cadence control remains unaffected and the gait hypokinesia is directly attributed to an inability to generate sufficiently large steps[3-5].

Recent reviews on cueing suggest that it can have an immediate and powerful effect on gait performance in people with Parkinson's disease, indicating improvements in walking speed, step length and step frequency[6,7]. The influence of cueing has mainly been studied in single-session experiments[1,8-10]. Despite the recent interest in the use of such cues, there has been no study specifically investigating the long-term use of visual and verbal cues. The present study is an initial attempt to compare the training effect of visual and verbal cues and examine the percentage of improvement with that of control group.

Method

30 subjects with idiopathic Parkinson's disease were recruited from: Department of Neurology; All India Institute of Medical Sciences. Subjects were selected according to the inclusion and exclusion criteria. The inclusion criteria was diagnosis of idiopathic Parkinson's disease; modified Hoehn and Yahr stageII-IV; walking independently for 12m distance and patient concern for deteriorating walking performance. Exclusion criteria was DBS or other stereotactic neurosurgery; cognitive impairment (MMSE<24); Disorders interfering with participation in cueing training including: visual impairment, hearing impairment, neurological, cardiopulmonary or orthopaedic problem.

After baseline testing, subjects divided into two strata (freezers and non-freezers) and then randomly allocated

Figure 1: Patient performing paper walkway test

Figure 2: Subject receiving Visual cue training

Figure 3: Subject receiving Verbal cue training

into three groups through permuted block randomization. Assessment of gait parameters (step length, stride length, cadence and speed) was done using 10-m paper walkway and the time taken was recorded and number of steps counted.

Procedure

Groups received training three times per week for three weeks. Medical treatment was continued as prescribed by the neurologist. Training and data collection were conducted during the subjects "on phase" approximately 1 hour after medication.

Subjects in group 1 and 2 walked for total of 20minutes by repeated 10-m long walk at their preferred speed, which is defined as that speed at which they walk most comfortably. In group 1 Visual cues was provided throughout the walkway by one meter stripes of 2.5 cm wide tape, applied parallel to each other and perpendicular to the walkway, at a distance of 110% of mean step length calculated from pretest. The distance was increased to 120% of the initial mean step length after 5 days for rest of the days.

In group 2 standard verbal protocol was used. The ends of the walkway were marked with 1 inch wide tape.

In group 3, subjects were given instruction sheet to practice walking for total of 20-minutes at home. They were taught on first day, how to practice walking at home. Subjects in Group 1 were instructed to step over the cues on their walkway. Subjects in Group 2 and 3 were instructed to walk with long steps. Command given was "take long steps" These instructions were given after every 2 walks and when necessary.

Subjects were free to rest at any time they want by sitting on chairs placed at the ends of 10-m walkway. General flexibility and relaxation exercises were given to all patients as home exercises program.

Outcome Measures

Step length (cm), stride length (cm), cadence (no. of steps/min)and speed (cm/sec) were assessed at the beginning (pre-test) and next day after the training was over (post-test).

Data Analysis

Data was analysed using one way ANOVA for between the group analyses. The post hoc test for pair wise group analyses post hoc Schiffe's test was used. For within the group analyses paired t test was used. The α-level was set at 0.05.

Results

The groups were comparable with respect to age, mental status, stage and duration of disease.

Comparison of pre and post training gait performance

Group 1

Results shows statistically significant improvement in step length (p=0.001)(Figure4), stride length (p=0.001) (Figure 5) and gait speed (p=0.022)(Figure6). There was slight non statistical decrease in cadence (p=0.39) (Figure 7).

Group 2

Results shows statistically significant improvement in step length (p=0.003)(Figure4), stride length (p=0.004) (Figure5) and gait speed (p=0.036) (Figure6). There was slight non statistical increase in cadence (p=0.59) (Figure7).

Group 3

Results shows statistically no significant difference in step length (p=0.001)(Figure4) stride length (p=0.153) (Figure 5), gait speed (p =0.357) (Figure 6) and cadence (p=0.76) (Figure7).

Comparison between Group 1, 2 and 3

Table 1: Differences of mean between the three groups

Variable	G1 (N=10)	G2 (N=10)	G3 (N=10)					
	Mean ± SD	Mean±SD	Mean ± SD	F-Value	P Value	G1 Vs G2	G1 Vs G3	G2 Vs G3
Step Length(cm)	11.49 ± 7.46	10.53±8.39	2.13 ± 4.20	5.55	0.010*	0.953 NS	0.019*	0.038*
Stride Length(cm)	20.93 ± 14.15	19.63 ±16.22	3.96 ± 8.04	5.07	0.014*	0.976 NS	0.028*	0.045*
Cadence(Steps/Min)	-6.67±23.22	3.71 ± 20.76	1.97 ±19.88	0.68	0.512 NS	0.561 NS	0.668 NS	0.984 NS
Speed (cm/Sec)	12.56±14.45	19.76 ±25.46	6.63 ±21.60	0.98	0.388 NS	0.748 NS	0.820 NS	0.389 NS

Figure 4: Comparison of Groups for Step Length

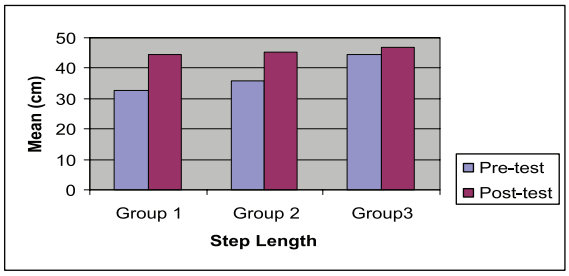


Figure 5: Comparison of Groups for Stride Length

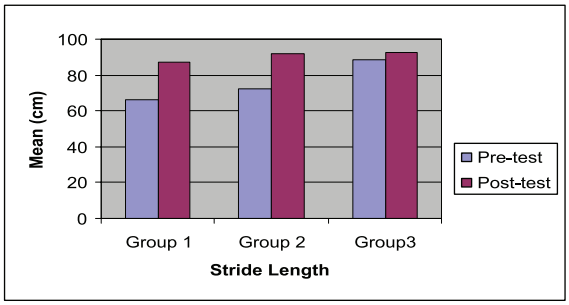


Figure 6: Comparison of Groups for Speed

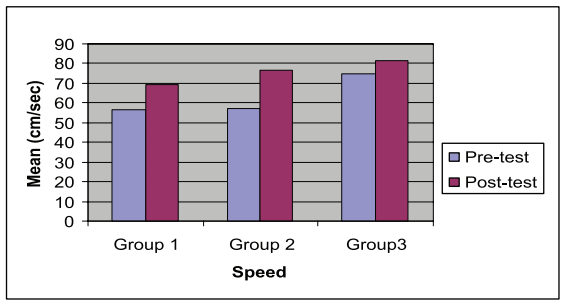
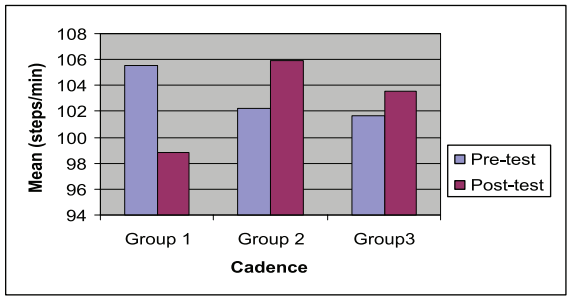


Figure 7: Comparison of Groups for Cadence



Step Length

Result show statistically no significant difference between the three groups pre-training (p=0.105) and post-training (p=0.885)(Figure4). Differences of mean show statistically significant difference between the three groups (p=0.010). The post hoc test show statistically no significant difference between group 1 and 2 (p = 0.953), but show significant difference between group 1 and 3 (p=0.019) and between group 2 and 3 (p=0.038) (Table1, Figure8). The percentage improvement of step length for group 1,2 and 3 is 35.01%, 29.29% and 4.78 % respectively (Figure9).

Stride Length

Results show statistically no significant difference between the three groups pre-training (p=0.148) and post-training (p=0.835)(Figure5). Differences of mean show statistically significant difference between the three groups (p=0.014)(Table1, Figure8). The post hoc test show statistically no significant difference between group 1 and 2 (p=0.976), but show significant difference between group 1 and 3 (p=0.028) and between group 2 and 3 (p=0.045).The percentage improvement of stride length for group 1,2 and 3 is 31.65%, 21.29% and 4.48% respectively (Figure 9).

Speed

Result show statistically no significant difference between the three groups pre-training (p=0.195) and post-training (p=0.600)(Figure6). Differences of mean show statistically no significant difference between the three groups (p=0.388) (Table1, Figure8). The percentage improvement of speed for group 1, 2 and 3 is 22.22%, 34.61%and 8.82 % respectively (Figure9).

Cadence

Result show statistically no significant difference between the three groups pre-training (p=0.927) and post-training (p=0.834)(Figure7). Differences of mean show statistically no significant difference between the three groups (p=0.512)(Table1, Figure8). The percentage change of cadence for group 1, 2 and 3 is -6.31%, 3.63% and 1.95 % respectively (Figure9).

Discussion

From results of the present study we can accept our null hypothesis that there is no difference in the effect of visual and verbal cue training in improving gait performance in Parkinson's disease patients. However, addition of cues along with exercises improves gait performance.

Visual cue significantly improved gait speed by increase in step and stride length but there was slight non-significant reduction in cadence. These results are consistent with findings in previous studies[8,11]. The mechanisms underlying the improvements are not well understood. Praamstra et al.[12] proposed that initiation of movement in Parkinson's disease patients relies on a preliminary visual analysis. Azuley and colleagues[13] hypothesized that visual cues serves as moving targets, activating the cerebellar-visual motor pathway. If this is indeed the case, then it appears from the present experiment that the long term use of visual cues during gait can somehow cause a change in the control of gait from cortical motor pathway to the cerebellar-motor pathway.

Results of Gywn N. Lewis[9] study suggest the ability to utilize visual feedback to regulate movement amplitude, reducing their reliance on kinesthetic feedback.

Azulay et al.[14] suggested that visual cue may draw attention to the stepping process if patients are talked to put their feet on the stripes or motion of floor stripes may enhance the optical flow.

Figure 8: Comparison of differences in mean among three groups

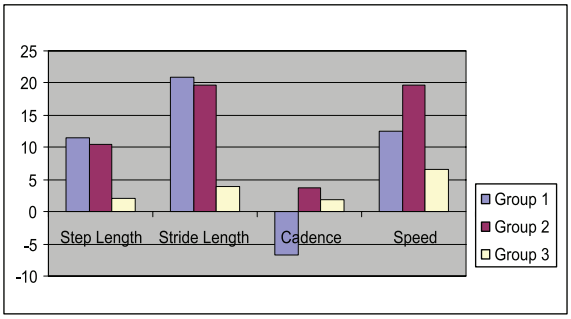
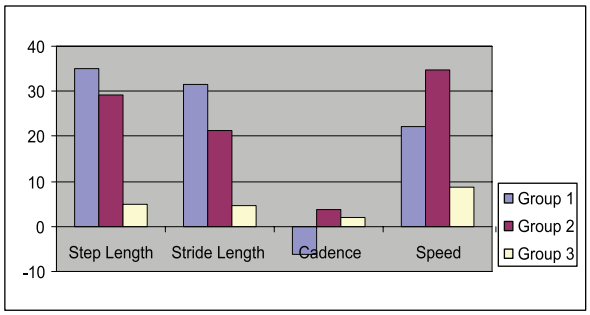


Figure 9: Comaprison of %age change in variables in Group 1, 2 and 3



Verbal cue also significantly improved gait speed (more than visual cue) by increase in step and stride length as well as cadence (slight non-significant increase). Previous studies[15-16] on verbal cues also show improvement in step length, stride length and speed but shows reduction in cadence. However, study by Weiner and coworkers[17] showed that out of three subjects in stride length instruction group, one subject showed no change in cadence and two subjects showed progressive increase in cadence.

Behrman et al[16] reported that use of instructional cues as a cognitive strategy may provide an internal stimulus. This was based on the suggestion by Morris et al.[18] that strategies employing instructional sets and deliberate attention to specific elements of 'normal' walking may bypass basal ganglia circuitry and activate the frontal and prefrontal areas of brain to prepare the motor cortex for locomotion.

In the control group there was very little non-significant improvement in all parameters. This could be accounted to the exercises and walking practice which they were supposed to do and also due to medications.

Between the groups there was no significant difference in any parameters between visual and verbal cue training. This could be due to the fact that they both act through same mechanism of attention. Morris and coworkers1 evaluated the effects of visual cues and attentional cues on micrographia and walking. They found both strategies behaved similarly in terms of carryover effect and deterioration so they concluded that visual cues operate in the same way as attentional strategies.

The percentage changes showed more improvement in step and stride length in visual cue group than in verbal cue group. However the percentage changes showed more improvement in speed in verbal cue group than in visual cue group. This could be accounted to slight non significant increase in cadence. Whereas, in visual cue group the improvement in speed is purely due to increase in step and stride length, as there was slight non significant decrease in cadence.

Gait speed can be increased by increasing cadence or stride length or both19. Quantitative gait analysis of Parkinson's disease patients has shown significant reduction in stride length and gait velocity but non significant decrease in cadence when compared to controls[20-21].

Meg E. Morris et al3 reported that Parkinson's disease patients have the ability to modulate cadence but not the step length and that the gait hypokinesia is due to inability to regulate step length. They also reported[18] that for any given velocity stride length is proportionately shorter and cadence higher in Parkinson's disease subjects compared with the controls.

Our study showed improvement in gait speed with the concomitant increase in step and stride length in both the visual and verbal cue training group and is consistent with the suggestion of Meg E. Morris et al[18] that techniques to normalize cadence would not be effective in normalizing walking speed and strategies that focus Parkinson's disease patients attention on the size of consecutive steps could have the potential to assist Parkinson's disease subjects to achieve more normal step size

Cues are chiefly responsible for the differences detected. However possible influences which could have affected the outcome were the effect of the ingestion of medication, stimulation parameters and the subjects themselves. To overcome these extraneous variables the walkway used in the study was selected to permit the subjects to walk unencumbered and as naturally as possible. It is most unlikely, therefore that this variable could have caused the difference noted. The effect of medication was minimized by timing the treatment and outcome measures within 1 or 2 hours after medication. The stimulation parameters were also remained constant during the course of data collection and hence the chances of it biasing the study are remote.

We can postulate that our patients who practiced cued physiotherapy developed new strategies which allowed a better motor activation and a longer lasting benefit.

Patients can be taught to transfer the concept of the cues into everyday situations When in public for example, the patient can establish their own visual cue or attempt to pay attention to their step size. Verbal training can be used in home setting and in environments where there is limited provision of visual cue.

This study has several limitations. For example effect of cueing was not purely due to cues as medication and general exercises were given. Also we examined, only the immediate effects; no carryover effect of cueing was noted.

Conclusion

The visual and verbal cue training both proved to be effective in improving gait parameters in Parkinson's disease subjects. The cueing must be given to the patient for the improving gait. Type of cueing training given should depend on the patient's condition and choice.

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Effect of Acquire$_C$ on Upper Extremity Function in Children with Cerebral Palsy

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Abstract

Objective

This study describes the use of acquireC in to improve upper extremity function in
children with hemiplegic cerebral palsy.

Method

10 Children with hemiplegic cerebral palsy had been selected by convenient sampling. The participants were assessed two times over a six weeks period using quality of upper extremity skill test (QUEST). Acquire$_C$ included a univalve cast worn on the unaffected arm and approximately 12 hours a day for four hours of Physiotherapy intervention for a period of 6 weeks.

Results

Results shows that there was significant improvement in the upper limb function as the calculated of QUEST variables includes dissociated movement, grasp, weight bearing and protective extension were 7.184 ($P < 0.05$), 11.21($P < 0.05$), 4.04($P < 0.05$) and 2.72 ($P < 0.05$) respectively, was greater than tabulated value (2.262).

Conclusion

It is concluded that there was significant improvement in dissociated movement, grasp, weight bearing and protective extension following acquireC intervention.

Key Words

Cerebral palsy, AcquireC, Hemiparesis, Upper extremity function.

Introduction

Hemiplegic cerebral palsy children often tend not to use the affected extremity, which may further exacerbate the impairments, resulting in a developmentally 'learned non use' of involved upper extremity, termed 'developmental disuse'[1]. Children with hemiplegia due to cerebral palsy have difficulty with the timing and coordination of reaching movements, grasping, movement planning and a deficient capacity to modulate postural adjustments during reaching[1]. The resulting motor failure results in suppression of future attempts to use the more affected limb. At the same time, the individual learn to compensate by using only the uninvolved limb for most purposes. These efforts are at least partially effective and the individual is consequent rewarded by this success. The result is that the individual learns not to try to use the more affected limb, the use of which is then held in powerful inhibition[2]. Unlike adults with hemiplegia, who have had function before the insult to the central nervous system, children with hemiplegia have usually never used their affected upper limb normally. Over time these children learn to disregard the affected arm which has the potential to lead to further impairment including muscle tone, poor motor control and decreased active and passive range of motion of joints of the limb, generalized weakness, and a delay in skeletal maturation[3]. Children possess far better brain re-organisational capabilities after brain lesions than adults. Such plasticity is assumed to be greater in younger children, because the central nervous system is still in the early stages of postnatal development. The neural substrates for hand control, however, continue to develop over the first two decades of life, which suggests the presence of neuroplasticity in older children as well[4]. Paediatric constraint induced movement therapy, now known as Acquirec therapy, consist of 3 major components: (i) Therapy is given many hours a day for many consecutive days to produce changes in motor behaviour and theoretically the brain. (ii)The weaker upper extremity is facilitated and trained in many specific tasks, appropriate to the child's stage of development. (iii) The stronger upper extremity is completely restrained for an extended time. Many of the children participating in paediatric CIMT research to date have been school age. Those studies that have included children ages 0 to 18 months have provided evidence to suggest that even young children can benefit from CIMT[5]. The application of CIMT to paediatric population has prompted recent concerns that children may not be developmentally ready for the intense massed practice and restraint used in CIMT protocol[6,8]. It is thought that the intensive nature of CIMT may cause stress, fatigue and present an excessive burden on the families in terms of time and cost. It has also been suggested that restraint of the unaffected arm poses a safety risk, may cause unnecessary frustration and stress by forcing the child to use the more affected arm and hand because of disuse during periods of development[7,8]. Finally, concerns about paediatric CIMT have been raised by practicing therapists who suggest that 4 to 6 hrs of treatment per day is not supported in current service delivery models and is unrealistic in terms of reimbursement from some payers[8]. So the present study aims to determine the effect of AcquireC in improving the upper extremity

function in children with hemiparetic cerebral palsy in 1 hour treatment duration. Upper extremity function was determined by QUEST which consists of four domains; dissociated movement, grasp, protective extension, and weight bearing[9].

Methods

Subjects

A total of 10 children with cerebral palsy had been selected by convenience sampling method. Their demographic profile and detailed medical history was collected through individual interviewing and from available medical records. They volunteered to take part in the study and met the following inclusion criteria: (i) 3 year to 8 year old. (ii) Both sexes. (iii) Hemiparetic with either left or right side involvement. (iv) MAS with 1 to +1.(v) Child who can understand the command.(vi) Any previous treatment taken are not considered as major contraindication. (vii) There must be 100 wrist extension and 100 metacarpal extension of affected arm. Exclusion criteria were (i) Visual or auditory deficits. (ii) Contractures and deformities of upper limb. (iii) Any disabling condition of upper limb which hinders the functional activity (eg:- shoulder pain , shoulder hand syndrome). (iv) Received botulinum toxin and any previous surgery done with in past 6 months. All participants gave their written informed consent before participation in the study. Before initiation of the study, institutional review board approval was obtained.

Treatment Intervention

Restriction of the unaffected upper extremity kept with the univalve casting and the subjects worn casting approximately 12 hours a day. Patients received treatment intervention of one hour each day, 6 days per week for 6 weeks. Activities given to the affected upper limb were chosen according to the interest of the child, age of the child, individual disability level and were graduated from easy to difficult in the capability level individualized to each child. Shaping & Repetitive Task Practice was employed, duration and number of activities dependent on the attention span of the children. The following movements were emphasized; Shoulder Flexion, Shoulder Abduction, Elbow Extension, Wrist Extension, Pincer grasp. Subject was helped each time whenever they were unable to do or initiate any activity to place them at most stimulating condition to favour an activity. Casting was not removed for any child except for the essential activities like toileting or hand washing during the intervention period. All the patients were reassessed for upper extremity function on the completion of 6 weeks of intervention according to the Quality of Upper Extremity Skill Test (QUEST).

Data Analysis

The paired t- test was used to compare the pre test Vs post test scores of Quality of Upper Extremity Skill Test (QUEST) for upper extremity function in children with hemiparetic cerebral palsy. The significance (Probability-P) was selected as 0.05. The calculated t-value was compared with tabulated t-value (2.262) to find out whether there was any significant difference between pre test and post test values. SPSS 16th version software was used for analysis.

Results

Table 1 shows the analysis of pre versus post test scores of Quality of Upper Extremity Skill Test
(QUEST) following AcquireC therapy.
The calculated t- values at 0.05 level of significance for four components of Quality of Upper Extremity Skill Test (QUEST) was greater than tabulated t-value of 2.262. This shows that there was significant difference between pre versus post test results.

Discussion

The aim of the study was to investigate the effect of acquireC therapy on upper extremity function in children with hemiplegic cerebral palsy. Total 10 patients

Table 1:

Subject	Dissociated movement		Weight bearing		Grasp		Protective extension	
	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test
1	70.31	96.88	77.78	96.3	90	100	91.67	100
2	68.75	79.68	33.33	44.44	54	62	50	88.89
3	59.38	68.75	22.22	37.04	52	62	58.33	58.33
4	57.83	68.75	11.11	33.33	10	20	27.78	33.33
5	46.88	62.5	37.04	51.85	32	36	27.78	30.56
6	53.13	65.63	18.52	29.63	50	62	50	50
7	45.16	53.23	14.82	25.93	10	28	16.67	27.78
8	50	75	14.82	34.04	34	46	33.33	47.22
9	53.49	70.31	37.04	55.56	34	26	66.67	72.22
10	58.07	68.75	11.11	33.33	16	28	16.67	27.78
Mean ±SD	56.30 ±8.41	70.94 ± 11.5	27.77 ±20.3	44.44 ± 20.51	38.20 ±24.5	47 ± 24.7	43.8 ± 24	53.60 ± 26
Paired t-value	7.184		11.21		4.04		2.72	

participated in this study with mean age of 6.5±0.89. Paired t test was performed between pre test and post test values to analyse the effect of acquireC. The analysis of components of Quality of Upper Extremity Skill Test (QUEST) shows that calculated t –value was greater than tabulated t- value of 2.262. This study demonstrated a positive link between acquireC and increased use of affected upper limb in children with hemiparetic cerebral palsy. Even though Casts may cause skin break down, rashes and irritation, limit the ability to use the unaffected hand for protective extension when falling, use of a permanent device such as a cast significantly increases the intensity of constraint[10]. To avoid these issue removable type of cast was made to restraint the affected extremity, and every 2 weeks the cast was changed to avoid sensory integrity. One difference between this investigation and previous studies was that the treatment duration, this difference is clinically feasible for the therapist. This finding also support the use of modified Constraint Induced Movement Therapy for Young Children with Hemiplegic Cerebral Palsy (Naylor et al., 2005)[11]. Another difference between this study and other previous acquireC investigation was a type of restraint used. We used a light weight removable type of cast made with POP material, where as other investigation used water proof casting material (Coban selfadhesive elastic wrap; 3M, St, Paul, MN)[8]. The improvement in upper extremity function with acquireC may be a result of intensive supervised training of affected extremity and making the child concentrate on using their affected extremity for daily activities by restraining the unaffected extremity in cast. Therefore, from the above statistical analysis, the alternate hypothesis has been accepted and null hypothesis is rejected. As the time taken by the subjects to perform an activity was reduced, it is recommended that acquireC is essential for upper limb motor recovery in children with hemiplegic cerebral palsy. Even though this study given positive outcome following acquireC, is having following limitations; (i) Sample size was small. (ii) Right and Left hemiparetic children were considered together. (iii) No follow up was taken. (iv) No exact family / Genetic / Medical history were available. (v) No control group was taken.

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