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Prevalence of Musculoskeletal Disorders and its Influence on Quality of Life in Elderly Females

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Abstract

The study focuses on understanding the Quality of life amongst the elderly female population. The parameters are studied are musculoskeletal disorders (conditions) and its impact on quality of life. The study included willing participants of age 65 and above. Elderly female people unwilling to participate or unable to give interview for various reasons were excluded from the study. The study focused on tertiary hospitals of Miraj, and total 100 subjects were interviewed while OPD visits. The musculoskeletal disorders were evaluated by using Nordic score while Quality of life was assessed by SF-36 questionnaire. The mean value of Nordic questionnaire shows that low back region is more affected as compare to other site of body. Similarly the mean values from SF-36 scores indicates that physical functioning as well as Energy/Fatigue and Bodily pain were more affected in elderly female population. The overall observation of study indicates that increasing age results in poor quality of life. Nordic Questionnaire and SF-36 scores are negatively correlated with respect to the under study population.

Keywords: - SF-36 Questionnaire, Nordic Questionnaire, Elderly female population.

Introduction

Elderly is defined as being 65 years of age or older. The onset of health problems of elderly may occur in early 50s or may be only in 40s. In the 20th century the elderly population has represented the fastest growing segment of total world population. These demographic changes were high-flying in developed countries. In United Kingdom the population of people over 65 years has increased from 5% to 16% in this period. ⁽¹⁾

Population projections suggest that this trend will be continuing in 21st century and elderly will represent 10.8 percent of total world population by 2025. In India over 82 million now, it will cross 177 million by 2025 and 324 million by 2050 which shows almost a two-fold increase in the proportion of elderly people. This is in contrast to America where currently 13% of elderly

population of elderly population will approach 22% by 2030. The startling fact is that the aged population in India is currently the second largest in the world. ⁽¹⁾

In females following the menopause the average women may lose more than 20% of her bone mass by the age of 70 years. 50% of postmenopausal women are seriously at risk of developing clinically significant osteoporosis. It is not only the bone mineral content but also collagen that is lost. There is a greater prevalence of osteoporosis amongst slender women and they are at greater risk for fracture. ⁽²⁾

The WHO definition of Quality of life has a broad meaning it includes physical health, mental health, level of independence, social relationship, personal beliefs and their relationship to salient features in the environment. The elderly people work for certain age limit as per their job, after which they suffer from economic insecurity, loss of power leading to low quality of life. ⁽³⁾

Research has revealed the occurrence of falls is higher among older women, older aged widowed individuals with low education and those who use many

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medications. It is necessary to know the impact problem on the functional ability, in the social life and in the well being of the elderly. Quality of life for an older person has become increasingly important an outcome in public health research.⁽³⁾

There are researches are done in which prevalence rates of musculoskeletal pain were higher for women than for men in the Dutch general population aged 25 to 64 years on the basis of 2 population-based surveys. For musculoskeletal pain in any location, 39% of men and 45% of women reported chronic complaints.⁽³⁾

The goal of the present study is to test the hypothesis that elderly females who develop an musculoskeletal disorder have a significant change in subsequent Quality of life. The nature of musculoskeletal illness, whether it is chronic or acute, and the influence of any co-morbidities are taken into account.

There is strong need to conduct the study to know about musculoskeletal symptoms that affect the Quality of life of elderly female population. The various structured Physiotherapy interventions like pain relief, specific muscle strengthening , aerobic exercises, stretching techniques , group therapy , balance training and cognitive therapy can be introduced to improve the quality of life as a target for the next years⁽³⁾

Material and Method

This is prevalence; a community based cross-sectional study of the elderly female population of tertiary care hospitals in Miraj.

Inclusion Criteria:-

- Population of elderly females of age 65 years and above.
- Elderly females who visits tertiary care hospitals.
- Those who are willing to participate in the study.

Exclusion criteria:-

- Those who were unwilling to participate
- Who refuse to give written consent.

- Who were unable to give interview due to various morbidity conditions.

After getting ethical approval from Institutional Research Committee and Institutional Ethical Committee of College of Physiotherapy, Wanless Hospital, the study was conducted in tertiary care hospitals in Miraj. The whole population was screened for an elderly female population with age 65 years and above. Data collection was done by the direct interview method and total 100 subjects were collected from tertiary care hospitals of Miraj. after taking verbal as well as written consent, clearing the doubts and explaining the benefits of the study to the subject, the subject was personally interviewed on the basis of SF-36 and Nordic Questionnaire. Questions of SF-36 and Nordic Questionnaire were asked in subjects native language i.e-Marathi/Hindi/English.

SF-36:-

- An important instrument for measuring health-related quality of life. Comprises of 8 domains that further included 36 questions.

- The 8 domains are :-

1. physical functioning (PF)
2. Role limitations due to physical problems (RP)
3. Bodily pain (BP)
4. General health (GH)
5. Vitality or energy/ fatigue (VT)
6. Social Functioning (SF)
7. Role-emotional (RE)
8. Mental health/ emotional well being (MH).

- Scores range from 0 – 100

Lower scores = more disability, higher scores = less disability.

- The validity and reliability of health related Quality of Life is 76% and 0.80 respectively.⁽⁴⁾

Nordic Questionnaire:-

- The questionnaire consists of structured

or multiple choice variants and can be used as self-administered questionnaire or in interviews.

- The questionnaire was constructed in which the human body (viewed from back) is divided into 9 anatomical regions.

- Completion is aided by a body map to indicate nine symptoms sites being the neck, shoulder, elbows, wrists/hands, upper back, low back, hips/thighs, knees, and ankle/feet.

- Respondents were asked if they had any musculoskeletal trouble in the last 12 months and have been prevented from normal activities during last 12 months.

The validity and reliability of Nordic Questionnaire is 92% and 0.90 respectively. ⁽⁵⁾

Findings

Nordic questionnaire-

From study it shows that the mean value of Nordic questionnaire shows that out of 9 sites low back region is more affected as compare to other site of body.

The second site which is more affected as compare to other region is knee joint.

SF-36 questionnaire-

The mean values from SF-36 scores indicate that physical functioning as well as Energy/Fatigue and bodily pain were more affected in elderly female population.

Discussion

This study has shown that the most common MSD was low back pain. The impact of low back pain includes reduction or loss of physical function, energy/fatigue, decrease leisure activity and low quality of life. Osteoarthritis of the weight bearing joints was the second most common MSD in this study. Finding has corroborated the reports that osteoarthritis is common in geriatric patients. Although osteoarthritis increases with age, aging is associated with the reduction or cessation of the production of glucosamine, chondroitin and other molecules essential for the formation of proteoglycans (part of connective tissue matrix) and nourishment of

the synovial fluid which interact with collagen fibers to allow resilient compression and reexpansion within the cartilage. The cartilage is hardened, destroyed and forms bone spurs. The end of the bones rubs together with its associated inflammatory reactions. This results in bone deformity and subsequent disability which affects the activities of daily living. Pain at individual joints and overall number of sites of joint pain were associated with poor QoL, this suggests that interventions to reduce the frequency and intensity of pain may be effective in improving QoL at the population level. ⁽⁶⁾

Onset of an MSK disorder reduces QoL. The bodily pain dimension is most affected. People with MSK diseases than in the general population, typically in physical dimensions of SF-36, with greater decrease with the coexistence of more than one MSK disease. SF-36 physical dimension scores were slightly lower than ours. This may well reflect the prevalent cases—that is, established diseases in which the disease impact is more severe than in incident cases—that is, with recent onset or occurrence. ⁽⁷⁾

The worst quality of life patterns were found for LBP and knee pain. Physical dimensions of the SF-36 were more strongly affected by pain than the psychological dimensions. ⁽⁸⁾

Pain in the knee can actually be referred from the hip. Knee pain was of borderline significance in cross-sectional analyses but became significant over time. Diagnosed OA of the back was also an independent correlate of poor QoL (both in cross-sectional and longitudinal analyses). Promotive health services for the elderly at the tertiary care levels. This will help to delay disability associated with MSDs and ensure optimal quality of life of the elder citizens. ⁽⁹⁾

Future longitudinal studies are warranted to characterize the psychosocial and physical risk factors for developing chronic/recurrent MSK pain in elderly female of different ethnicities so that appropriate treatment/education can be provided to mitigate their modifiable risk factors. Studies should also be conducted to determine the optimal interventions for treating MSK pain in elderly female given the complex physical challenges that they face. ⁽¹⁰⁾

Conclusion

This study highlights the burden of musculoskeletal problems and quality of life among elderly female population of tertiary care hospitals of Miraj. It is concluded that there is strong negative correlation exists between independent (Nordic scores) and dependent variable (SF-36 Scores).

This study concludes that the musculoskeletal disorders in elderly female population are highest in low back area as compare to the other sites of body. High score of low back region indicated that age related degenerative changes affect the lower spine more as compare to other body site. The second most affected area of body is the knee.

According to Health related Quality of Life SF-36 questionnaire in elderly female population, the results of domains revealed that physical functioning as well as Energy/Fatigue and Bodily pain were more affected as compare to other domains.

Conflict of Interest: There is no conflict of interest for this study.

Source of Funding: Self (the study was sponsored by author herself).

Ethical Clearance: Ethical clearance obtained from the ethical committee of College of Physiotherapy, Wanless Hospital, Miraj

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Effect of Aerobic Training on Exercise Capacity and Quality of Life in Middle Aged Obese Fishermen: a Comparative Study

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Abstract

Background: Fishermen have risk conditions like obesity due to high amount of food intake and relatively sedentary work type. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health and reduce functional exercise capacity and Quality of life. In this study effort is taken to find optimal physiotherapy intervention for middle aged obese fishermen.

Method: 72 Subjects participated for study. 2 of them did not come for the follow up. Remaining 70 subjects which were screened for 6MWD and SF36 scores and were put in either of the two groups. Group A received Free active exercises and Group B received Aerobic training. Interventions were carried out for a period of 6 weeks (3 times / week). The post treatment improvement was noted with the outcome measures.

Results: The results showed very significant difference between the groups on 6MWD, Group B (experimental) showing better improvement than Group A (Control). ($p=0.0047$). Also extremely significant difference ($p>0.0001$) was noted on all the 8 domains of SF36 within both the groups and no significant difference between the groups post intervention.

Conclusion: We found that Aerobic training showed better effect on exercise capacity in middle aged obese fishermen. And Quality of life improved significantly with Aerobic training and also with Free active exercises.

Keywords: Fishermen, Obesity, Overweight, Aerobic training, Free active exercises, 6MWD, SF36.

Introduction

India is having one of the largest fresh and marine water resources. Thus, a huge chunk of population is involved in fishing.^[1] Fishermen have high risk conditions like obesity due to high amount of fish intake with low priority to other nutrients especially in long voyages.

The prevalence of overweight and obesity was marked first amongst fishermen in 2005 as 76.6% and

30.6% respectively in Denmark population by JAN L. HOEYER and HENRIK L. HANSEN.⁽²⁾ Later on the prevalence was found in Turkish as 26%, Greek as 33% and Spanish as 37% in fishing population according to the systematic review in 2014⁽¹⁶⁾

Then the prevalence of overweight and obesity amongst fishermen was found in India in 2018 which was reported as 42.8% in Tamilnadu, and 13.3% of population were having abdominal obesity.⁽²³⁾

Prevalence of obesity in fishermen was also found as 38.79% in Chennai district in 2018 and 12% in rural coastal areas in south India.⁽²⁴⁾⁽²⁵⁾

One of the possible explanation for obesity in fishermen given by JAN L. HOEYER and HENRIK L. HANSEN was easy access to abundant quantities of

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food, which goes back to the days when fishing was hard work and required high caloric intake. Today most of the work is sedentary. However, the traditions with regard to food have not changed and the risk of an excess intake is likely.⁽⁴⁾ Other explanations were consumption of fish on a daily basis, regular alcohol intake and relatively sedentary lifestyle.⁽²³⁾⁽²⁴⁾⁽²⁵⁾

Overweight and obesity are major risk factors for a number of chronic diseases, including diabetes, cardiovascular diseases and cancer in fishermen. Around 44% of the diabetes, 23% of the ischemic heart disease and 7%-41% of certain cancer burdens are attributable to overweight and obesity.⁽¹⁾ Once considered a problem only in high income countries, 2,3 overweight and obesity are now dramatically on the rise in low- and middle-income countries, particularly in urban settings. In India; Punjab, Kerala, and Delhi are the states with the highest level of overweight and obesity in fishermen but the prevalence is increasing in states of South India.⁽²⁵⁾ Obesity affects the functional status as well.⁽⁴⁾

Materials and Method

This was a Comparative study which was conducted to evaluate effect of Aerobic training amongst middle aged obese fishermen. The subjects who meet the inclusion and exclusion criteria and willing to participate in the study were included. We had approached and assessed 72 subjects as our study population out of which 2 did not come for the follow up. The participants were explained about the study and the evaluation procedure. The informed consent was obtained from the individuals.

Inclusion Criteria were as follows: **1)** Fishing since 5 years **2)** Age group – 25 to 44 years **3)** Overweight and Obesity grade 1 according to Asian grading scale.

Exclusion Criteria were as follows: **1)** Past history of cardiovascular and neurological conditions. **2)** Recent musculoskeletal conditions. **3)** Diabetes mellitus **4)** Hypertension grade 2 or more **5)** Subjects who are on any planned exercise program.

Subjects were assessed for exercise capacity using 6MWD and Quality of life using Short Form 36 Scale

Procedure

The study protocol was presented in front of protocol

and Institutional Ethics Committee of LTMMC, Sion. Middle aged obese fishermen were approached, purpose of the study was explained and written informed consent was taken from those willing to participate. They were then assessed as per inclusion and exclusion criteria and divided into 2 groups.

After the initial assessment, treatment was given 3 times a week for 6 weeks for both the groups.

TREATMENT FOR GROUP A (Free active exercises)

Warm up (5 mins)- stretching, spot marching

Conditioning (20 mins)- Shoulder ROM all movements and Circumduction: 10 reps each, 3 sets

-Elbow ROM : 10 reps each, 3 sets

-Wrist ROM: 10 reps each, 3 sets

-Hip ROM all movements in standing and Circumduction: 10 reps each, 3 sets

-Knee ROM: 10 reps each, 3 sets

-Ankle ROM: 10 reps each, 3 sets

-Trunk Rotations: 10 reps each side, 2 sets

-Trunk Flexion: 10 reps each side, 2 sets

Cool down (5 mins)- ankle toe movements, pursed lip breathing, shavasana

TREATMENT FOR GROUP B (Aerobic training)

PHASE 1 (40-50% THR) for 3 weeks (30 mins session)

Warm up (5 mins)- Stretching, whole body mobility, spot marching

Conditioning (20 mins)- -V marching : 30 reps, 2 sets

-Side walks : 30 reps each side, 2 sets

-Brisk walk forward: 10 mins

-low Jumps : 15 reps, 2 sets

-Jumping Jacks: 10 reps, 2 sets

-Step up and step down:20 reps each,2 sets

Cool down(5 mins)- ankle toe movements,pursed lip breathing,shavasana

PHASE 2(50-60% THR)for 3 weeks(40 mins session)

Warm up(5mins)-Stretching,whole body mobility,spot marching

Conditioning(30 mins)- -V marching :30 reps,4 sets

-Side walks :30 reps each side,4 sets

-Brisk walk forward:15 mins

-low Jumps :15 reps,4 sets

-Jumping Jacks:10 reps,4 sets

-Step up and step down:20 reps each,4 sets

Cool down(5 mins)- ankle toe movements,pursed lip breathing,shavasana

Findings:

· Data was analysed using Graphpad Prism 8.1.2(332).

· All the test were performed considering 95% confidence interval and significance at 0.05.

· The data was initially tested for Normal Distribution using Kolmogorov-Smirnov test for normality.And,the data followed normal distribution pattern.

· Comparison of mean between and within 6MWT(6 minute walk test)groups were analysed using unpaired t test and paired t test respectively for quantitative variables.

· Short Form 36(SF36)scale is ordinal.To compare the difference pre and post SF36 we used Wilcoxon and Mann Whitney test

Results

Table 1:Comparison of values of 6MWD

6MWD (Group)	Pre-treatment		Post-treatment		'p'	
	Mean±SD	Mean±SD	Mean±SD	Median		
A	623.6±68.431	623.6±68.431	646.8±65.420	645	p<0.0001	ES
B	625.86±62.469	625.86±62.469	691.314±61.946	704	p<0.0001	ES
'p'	0.8858		P=0.0047			
	NS		VS			

Table 1 shows a statistically extremely significant improvement within both the groups.And very significant improvement between the groups with p value 0.0047.

II. Short form 36(SF36)

Table 2: Comparison of values of SF36

Domains	Controls(n=35)			Experimentals(n=35)			P value(post-post)
	Pre	Post	P value	pre	post	P value	
Physical functioning	75.514±12.601	84.828±9.835	p<0.0001	75.6±10.293	87.514±6.451	p<0.0001	0.1812
Role-Physical	67.828±9.407	83.457±8.012	p<0.0001	71.857±9.233	86.971±7.857	p<0.0001	0.0701
Bodily Pain	68.558±10.352	84.6±7.109	p<0.0001	71.648±8.203	87.052±6.489	p<0.0001	0.1350
General Health	77.514±10.176	84.714±8.101	p<0.0001	74.228±9.774	86.771±6.486	p<0.0001	0.2450
Vitality	55.485±10.853	66.228±8.465	p<0.0001	55.771±9.935	66.571±10.274	p<0.0001	0.8793
Social Functioning	73.5±7.907	85.028±7.524	p<0.0001	76.657±7.456	86.742±6.938	p<0.0001	0.3969
Role-Emotional	76.857±6.436	81.942±5.765	p<0.0001	78.6±6.165	84.971±6.002	p<0.0001	0.0751
Mental Health	73.914±7.098	86±6.259	p<0.0001	76.2±6.516	87.114±5.487	p<0.0001	0.4439

Table 2 shows a statistically significant improvement within both the groups and no significant improvement between the groups in all the 8 domains of SF36.

Discussion

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health and reduce functional exercise capacity and Quality of life.

⁽¹⁾The prevalence of overweight and obesity amongst fishermen was found in India in 2018 which was reported as 42.8% in Tamilnadu, and 38.79% in Chennai district in 2018 and 12% in rural coastal areas in south india.⁽²⁴⁾

⁽²⁵⁾

Fishermen have risk conditions like obesity due to high amount of food intake and relatively sedentary

work type.⁽²¹⁾⁽³⁾

According to literature, there are very few studies done on the fishermen community especially addressing their exercise capacity and Quality of Life(QOL). There are various studies available showing effectiveness of Aerobic training in Obese subjects on their Exercise capacity and QOL. Hence the objective of this study was to see the effect of Aerobic training on exercise capacity and QOL in middle aged obese fishermen.

In this study 70 subjects were divided into 2 groups viz. Controls and Experimental. Controls were given free

active exercises whereas Experimental group was given Aerobic training. Pre and post outcome measure were taken (6MWD and SF36) before and after 6 weeks.

According to Table 1, Control group showed statistically extremely significant improvement post intervention ($p < 0.0001$) in 6MWD

Fishermen have reduced exercise capacity due to sedentary lifestyle with recent advancement in fishing and no exercise routine in their daily schedule in particular.⁽³⁾ In our study we gave ROM exercises along with sideward, forward and backward walks in our control group. These showed the effect on 6MWD due to following possible mechanisms.

- There was increase in muscle power and endurance due to increased tension created in muscles especially in Lower limb muscles due to resistance offered by the body weight on them. The tension also increased in large muscles while doing ROM exercises due to mechanical leverage provided by a long and heavy limb.⁽²¹⁾

- One of the other reason is also an increase in the number of capillaries surrounding each muscle fiber post free active exercises. This effect is similar to the study in 2003 by Rico Sanj et al where they found that With long periods of exercise training, the number of capillaries may increase by more than 15%⁽⁹⁾. Having more capillaries allows for greater exchange of gases, heat, nutrients, and metabolic by-products between the blood and contracting muscle fibers.⁽¹¹⁾

- Free active exercises also increased venous return to the heart which results in increase in the cardiac output.⁽²⁰⁾

In the present study for 6MWD, Experimental group showed statistically extremely significant improvement post intervention. $p < 0.0001$

Improvement of 6MWD in obese fishermen after Aerobic training can be explained by following reasons

- Better cardiac adaptation: increased left ventricular size thus increased filling and stroke volume thereby increasing blood supply to exercising muscles and fulfilling increased oxygen demand⁽¹⁸⁾.

- Decrease lactic acid production, as studies have

shown that in trained state one can exercise at a higher percentage of one's VO₂max before lactate begins to accumulate in the blood and reduction in metabolic cost for exercise⁽¹⁹⁾.

- increase in capillary density resulting in increased blood supply, oxygen and nutrients to the exercising muscles as stated by W kenny, Jack Wilmore et al in 2011 in their publication of 'Physiology of sport and exercise', edition 5⁽¹¹⁾

- Increase in lower limb type I fibers cross sectional area and transition from type II to type I fibers⁽¹⁰⁾. The similar effect was seen by Wilson JM et al in 2012 after giving endurance training in athletes.

- changes in the mitochondrial function that improves the muscle fibers capacity to produce ATP. Studies have also shown that aerobic training increases the number and size of mitochondria which helps in generating more ATP.⁽⁹⁾

Intergroup analysis showed very significant difference between Controls and Experimentals ($p = 0.0047$). Hence Experimental group showed better effect on 6MWD post interventionally.

This may be because of the following reasons

- Free active exercise are lesser intensity exercises as compared to exercises we gave in Aerobic training.⁽¹⁹⁾

- Free active exercises are localized to individual joints and specific group of muscles associated with that joint, whereas Aerobic exercises are the rhythmic movements involving upper extremity, lower extremity and trunk all together simultaneously,

- Aerobic training was given at a target heart rate and at a specific intensity.

- Aerobic training was also progressed in intensity and duration after 3 weeks of intervention whereas free active exercises were carried out at same intensity throughout the 6 weeks of intervention.

Control group showed extremely significant difference post interventionally in all 8 domains of SF36. ($p < 0.0001$) in all the domains.

This might be explained by the following reasons

- Relaxation: Rhythmic swinging movements in ROM exercises assist the relaxation of muscles due to alternating and reciprocal contraction and relaxation of the opposite muscle groups. This might relieve pain due to spasms in the muscles. Hence we got the significant difference in our Bodily pain Domain post intervention.

(20)

- Mobility: Improvement in joint mobility and flexibility of muscles hence preventing adapting shortening in these sedentary individuals.

- Neuromuscular co-ordination: The co-ordination was improved due to repetition of exercises. The achievement of Co-ordinated and efficient movement assures the patient of his ability to maintain subjective control of his body, giving him confidence to attempt other and new activities.

- Perceived improvement of energy levels: which showed difference in the Vitality Domain which assesses the energy and fatigue levels subjectively.

- Increased Social interaction amongst fishermen and instructor improved the social functioning domain.

- Subjective feeling of well being: which must have improved due to regular participation in exercises and positive social relationships. Positive social relationships have previously been linked with various indicators of well being.

- Reduce stress and anxiety: due to increases in circulating β -endorphin levels and thereby increasing mental health.

Experimental group showed extremely significant difference post interventionally in all domains of SF36 post interventionally. $P < 0.0001$ in all the domains. The possible reasons attributed for this are as follows

- Increase in peripheral muscle strength which improved the scoring of Domains like Physical functioning and also Role physical because of increase in ability to do ADL with less difficulty. In a meta analysis in 2009 by Chiung-Ju Liu et al, 121 randomised controlled trials (6700 participants) showed that improvement in muscle strength improves the performance of simple activities such as walking, climbing steps, or standing up from a chair more quickly. Similar effect was found in

our study as our physical functioning domain assesses the activities like walking, climbing flight of stairs, lifting etc

- Increase in the production of ATP due to improvement in the mitochondrial activity and increase in the number and size of mitochondria. Hence greater energy levels for doing physical activities and hence improvement in the vitality domain.

- Reduction of Fatigue: Due to delayed lactic acid production in blood. Hence better Physical Functioning.

- Release of endorphins hence Increase in the arousal, and euphoria and reduction in perception of pain and therefore improvement in the Bodily Pain domain as said by Berger and Owen in 1992 and 1998.

- Anish Eric J et al in 2005 conveyed various effects of exercise on CNS like Improvement in stress adaptations due to adrenal gland activity, Improvements in the mood and emotion due to release of serotonin and Improvements in motivational levels due to increased Dopamine levels which improved mental health domain score.

- Increase in social interaction, similar to the effect seen by Reis H in 2000, which improved social functioning domain.

Inter group statistical analysis revealed no significant difference between the groups post intervention for SF36 score.

This might be because of the following reasons.

- Both groups were given exercise in group, hence they had equal opportunities to socially interact amongst each other and instructor.

- Both groups had subjective perception of well being after 6 weeks of exercise

- Improvement in motivation levels in both the groups post exercises

- Also habitual participation of exercise increases the self esteem which was seen in both the groups.

Conclusion

We found that Aerobic training has better effect than free active exercises on exercise capacity and have similar effect on Quality of life in middle aged obese fishermen.

Source of Funding: Self

Conflict of Interest: There is no conflict of interest.

Ethical Clearance: Ethical clearance was taken from institutional ethical committee of LTMMC.

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Effect of Aerobic Training and Mindfulness Therapy on Smartphone Addicted Young Individuals

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Abstract

A comparative study on effect of Aerobic training and Mindfulness therapy on Smartphone addicted young individuals.

Objective: To compare effect of aerobic training and mindfulness therapy on smartphone addicted young individuals according to Smartphone Addiction Scale (SAS).

Methodology: A simple random sampling of 30 smartphone addicted young individuals between age group of 18-25 years and were screened according to inclusion and exclusion criteria. They were divided into two groups: Group A (Aerobic training) and Group B (Mindfulness therapy). The rate of addiction in young individuals was assessed using the Smartphone Addiction Scale. The entire study was explained to the individuals and written informed consent was obtained. Aerobic training was performed 4days/week for 6 weeks and mindfulness therapy was performed 2days/week for 6 weeks. The Smartphone Addiction Scale score was taken before and after the intervention and results were analyzed.

Outcome measure: Smartphone Addiction Scale (SAS) was used for the purpose of measuring the rate of addiction.

Result: The comparison of pre to post intervention score of group A was statistically not significant ($p=1.05$) and also the comparison of group B was statistically not significant ($p=3.86$)

Conclusion: The present study compares the effects of both aerobic training and mindfulness therapy on rate of addiction and it concludes that both these interventions are similarly effective in reducing the addiction to smartphone when assessed in terms of Smartphone Addiction Scale (SAS). There is no significant difference in improvement with respect to aerobic training and mindfulness therapy according to the Smartphone Addiction Scale (SAS).

Keywords: Aerobic training, Mindfulness therapy, Smartphone addict young individuals, Smartphone Addict Scale (SAS).

Introduction

Addiction is a process where behavior can function both, to produce pleasure and to provide an escape from internal discomfort¹. It not only refers to drug or substance abuse, but also refers to gambling, internet, games, and even smartphones². Addictive behaviors of the young individuals are particularly the cause for significant negative outcomes, as they may develop those addictions as long-lasting habits and have harmful effects on individuals' physical health, social

relationships and financial status³.

Smartphones are popular devices which are capable of processing more information than other phones; these smartphones include many features such as gaming, access to the Internet and social network sites, messaging, videos, multimedia, and navigation, in addition to their use for communication⁴. Symptoms of smartphone addiction can be characterized by presence of tolerance, salience, mood changes, and dependence on smartphones¹. College students/young individuals

see smartphones as an essential part of their daily life and critical in maintaining social relationships and conducting the more ordinary need of everyday life⁸. As there is seen significant increase in the level of addictions mostly, in younger generations, making it an area of concern.

The rate of smartphone addiction in young individuals can be measured using various scale such as, Smartphone Addiction Scale (SAS), Smartphone Addiction Scale-Short Version (SAS-VS), Smartphone Addiction Proneness Scale (SAPS). These scales have various components on the basis of which the rate of addiction is decided. Smartphone Addiction Scale (SAS) has a set of 33 questions which are further rated from 0-6 (strongly disagreed-strongly agreed) higher the score of the scale more is the rate of addiction. The Cronbach's alpha for the total scale was 0.967¹⁷.

According to a literature review, common treatment options for behavioural addiction include cognitive-behavioural therapy (CBT), motivational intervention, and mindfulness behavioural cognitive treatment (MBCT), which can be conducted individually or in group¹⁰. Through mindfulness techniques, individuals learn to increase their perceptual distance from mental urges and are mainly beneficial for those with symptoms of depression and other mental disorders^{10,11}.

There are some evidences available regarding the effectiveness of merely aerobic training as secondary prevention for helping with addiction¹⁴. Aerobic training can be defined as any physical training that depends primarily on the aerobic energy-generating process, on the condition that it is of sufficient intensity to maintain or improve physical fitness¹⁴. As aerobic training could also seek mental changes through feeling of confidence, satisfaction, and new feeling of happiness⁵. Acute bouts of exercise have been related with enhanced cognitive functioning¹⁶, positive effects of physical activity have also been described for persons with mental disorders, such as depression¹⁵. The electrophysiological mechanisms of aerobic training are associated with the positive effects of exercise on cognitive performance in young individuals, and whether or not the effects of acute exercise are any different for higher fit and lower fit adolescents¹⁶. Exercise rehabilitation can employ the first goal for recuperating their physical health on the

surface⁵. Exercise programs across several weeks have also been shown to improve cognitive functioning in children and adolescents¹⁶.

In the current study we hypothesized that aerobic training and mindfulness therapy both are effective but we thought of assessing the comparison between the effect of aerobic training and mindfulness therapy on the young individuals addicted to smartphone. Also, considering the multiple potential effects of aerobic training we hypothesized to assess the effect on the addiction of smartphone in young individuals.

Method

This was a single center, simple randomized (18-25years of age, with balanced randomization [1:1]), single-blind, parallel-group study conducted in the Dr. A.P.J. Abdul Kalam College of Physiotherapy Loni Bk.

Eligible participants were all young individuals aged between 18 to 25 addicted to smartphone who met the eligibility criteria of SAS score >90 for intervention of aerobic training and mindfulness therapy. Exclusion criteria included individuals who were not sedentary or had any orthopedic or cardio-respiratory condition.

The study took place at Dr. A.P.J Abdul Kalam College of Physiotherapy, Loni bk. India from September 2019 to December 2020.

For interventions, the individuals were divided into two groups, with the help of permutations and combinations.

Group A: The individuals received the intervention for 4days/week for 6 weeks. Each session included 5min. of warm-up, 20 min. of treadmill walking at moderate intensity i.e.(40-60%HRR) which was calculated using the Karvonen's formula and 5 min. of cool down phase.

Group B: The individuals received mindfulness therapy for 2days/week for 6 weeks. The individuals were made to perform various mindfulness exercises which included: Mindfulness breathing where the individuals had to concentrate on the breathing cycles and hold it for at least 6sec each. Individuals attained a comfortable position sitting/supine and after that the individuals were made to perform the breath cycles for a minute without having any other thoughts in their mind. Mindfulness

observation, here the individuals were made to observe a particular natural object for the environment without any previous perception to that object. The individuals had to observe the object as if that individual was observing it for the first time, without any previous perception or thought to that object. Mindfulness listening, here the individuals had to listen to the music without relating the music to any composer or any other thoughts related to that music/song, the individuals were supposed to listen to the music and have a non-judgmental thought toward the music which is being played. Mindfulness awareness, here the individuals had to feel any action which he/she did in their everyday life and to relate that activity with the importance of that activity in our everyday life. While performing the activity the individuals had to focus at every stage of the action/ every phase and step of the action because of which the action can be taken place. Mindful appreciation, here the individuals had to select any 5 objects or activities from our daily living which are important but go unnoticed by us and appreciate them. The individuals were supposed to appreciate all the 5 objects which were listed.

The outcome measure for this study was Smartphone Addiction Scale (SAS) to assess the rate of addiction in the young individuals. Pre and post assessment were done of all individuals using this scale.

Randomization sequence was created using Microsoft Excel 2010 statistical software and was stratified by a statistician with a 1:1 allocation using random block sizes of 4.

“Participants were randomly assigned using simple randomization procedures computerized random numbers were allocated to 1 of 2 treatment groups.”

Whereas young individuals allocated to the intervention group were aware of the allocated arm, primary investigator and data analysts were kept blinded to the allocation.

The outcome measure was in terms of smartphone addiction during the 6 weeks of the study in the intention to reduce the rate of smartphone addiction in young individuals. The pre to post intervention was analysed using the paired T-test and the difference between group A and group B was done using the unpaired t-test.

Questionnaire of Smartphone Addiction Scale (SAS) filled by the participants were coded into a unique number for the blinding of assessor and analyst for the reference of pre ad post scoring of participants.

30 young individuals were assessed according to the eligibility out of which all 30 went under randomization as they were all addicted when assessed according to smartphone addiction scale. 15 were assigned under aerobic training and 15 were assigned under mindfulness therapy group. Out of which all 15 from aerobic group and 15 from mindfulness therapy group were regular at follow-up. At the end of the interventions all 30 individuals were included in the analysis.

On the basis of aerobic training and mindfulness therapy being effective for treatment of addiction we prespecified our interventions as aerobic training and mindfulness therapy being effective in reducing the Smartphone Addiction in young individuals. We also prespecified Smartphone Addiction Scale as an outcome measure for this study. For the analyses of the treatments T-test was used which designated to be not significant as $p > 0.05$. The subgroup analyses were done using the paired T-test.

The intervention was implemented for both sexes and age group between 19-22 were included, the results indicate that smartphone addicted sedentary young individuals would benefit the present intervention for reducing the rate of addiction. By including the sedentary individuals, a broad range of rate of addiction was obtained for the study.

Baseline data

	Group A	Group B
AGE	19	20.6
HIEGHT	159.93	156.93
WEIGHT	66.6	58.46
BMI	25.92	23.72

Discussion

Physical activity has shown to reduce symptoms of depression and increase cognitive functions in other groups associated with cognitive dysfunction¹⁵. The primary finding from the present study was that both aerobic training and mindfulness therapy showed significant results in pre to post intervention improvement according to Smartphone Addiction Scale (SAS). There was a difference between the results of aerobic training and mindfulness therapy but it was not statistically significant.

It was observed that aerobic training was more enjoyable than mindfulness therapy so the adherence was better in the aerobic group.

Another finding of this study was that sedentary smartphone addicted young individuals in aerobic training group produced almost equal improvements in reduction of addiction in terms of Smartphone Addicted Scale (SAS) but, there was a lesser reduction in Smartphone Addicted Scale (SAS) score as compared to mindfulness therapy group. Since, both the groups participated in these trainings for the same period but the aerobic training group included exercises which included the young individual's attention physically, also the individuals in the aerobic group enjoyed the activity more as compared to the individuals in the mindfulness group. Therefore, the individuals in the aerobic group showed comparatively a little more decrease in SAS score as compared to the individuals in mindfulness group, though it was not statically significant.

Young individuals had no injury during the training program under aerobic group and no young individuals had complaint of muscle soreness except for initial 1 week of training program. The adherence to mindfulness training was lesser as compared to aerobic training. The young individuals in aerobic training completed the intervention for 6 weeks, 4days/week and mindfulness therapy for 6 weeks, 2days/week.

Mindfulness therapy is proven to be effective in young individuals as they learn to increase their perceptual distance from mental urges and is mainly beneficial in those with symptoms of depression and other mental disorders^{10,11}, whereas in aerobic training acute bouts of exercise have been related over enhanced cognitive

functioning¹⁶, positive effects of physical activity have also been described for persons with mental disorders, such as depression, anxiety¹⁵. Mindfulness therapy is almost effective but has no statistical difference.

These observations conclude that aerobic training is effective and valid and can be used to design a regular non-pharmacological program for sedentary individuals addicted to smartphones. Since cardiovascular endurance and muscular fitness are very important fitness components related to health, and aerobic exercises are related to cardio-vascular endurance and muscular fitness, therefore along with reducing the rate of addiction it is also helpful in improving the individual's fitness. However aerobic training is more enjoyable and hence adherence is better as compared to mindfulness. Moderate-to-high intensity activity helps counteract and deal with different chronic conditions and, considering the effects of moderate intensity exercises for treating cardiovascular conditions, obesity, type 2 diabetes, and a few malignancies^{18,19} it can be a useful adjunct reducing the rate of smartphone addiction.

The trail is registered at Pravara Institute of Medical Sciences, number PIMS/DR.APJAKCOPT/IEC/2019/454.

The study resulted with the comparison between the difference of pre-post intervention scores of Group A and Group B for: Smartphone Addict Scale (SAS) was found to be statistically not significant using the unpaired t test in which p value was 0.483 ($p > 0.05$) and t value was -0.711 with 27 degrees of freedom.

Comparison between group A (Aerobic training) and group B (Mindfulness therapy)

	P value	Mean of difference between group A and B
Group A	1.05	48.13
Group B	1.08	41.6

Ethical Clearance- Taken from institutional ethical committee of Dr. A.P.J Abdul Kalam College of Physiotherapy (PIMS/DR.APJAKCOPT/IEC/2019/454)

Source of Funding- None

Conflict of Interest - None declared

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Effectiveness of Kaltenborn Mobilization Technique Versus Mulligan's MWM in Patients with Adhesive Capsulitis of Shoulder

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Abstract

Background and Objectives: Adhesive capsulitis(AC) is a condition commonly affecting the shoulder with 2% prevalence, causing insidious pain and restriction of active as well as passive gleno-humeral movement. This study compares the effectiveness of Kaltenborn mobilization versus Mulligan's MWM technique for AC of the shoulder.

Method: 56 participants were randomly allocated in Group M and Group K for the shoulder. SPADI and shoulder ROM were used as outcome measures. These were recorded at baseline and at the end of 2 weeks post treatment.

Results: Statistically significant ($p<0.05$) improvements were found in Group K with respect to SPADI scores, while the same was observed in ROM although not statistically significant.

Conclusion: Pain and disability along with ROM improved in both groups.

Keywords: Adhesive capsulitis, Mulligan, MWM, Kaltenborn, SPADI.

Introduction

Adhesive Capsulitis (AC) is a condition characterized by significant restriction of active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder¹. The Kaltenborn method places an emphasis on translatory linear joint , the convex-concave rule, 3-dimensional pre-positioning for the joint movement, protecting adjacent joints during procedures, self treatment and ergonomic principles applied to protect the therapist².Mulligan's MWM is used in the management of musculoskeletal pain and passively involves the application of a sustained glide to a joint while a concurrent movement is actively

performed by the patient.³ This study compares the efficacy of Kaltenborn method with movement (MWM) techniques in the management of AC of the shoulder.

Objective of the Study

Effectiveness of Kaltenborn mobilization versus Mulligan's MWM in AC of shoulder for 2 weeks on pain, ROM & functional impairment.

Material and Method

Ethical clearance was obtained from S.D.M. College of Medical Science and Hospital, Dharwad. Subject's affected shoulder was evaluated & allocated into Group K or M.

Treatment given for 3 sessions/ week for 2 weeks. The outcome were: shoulder ROM Pain,Disability Index (SPADI) at baseline & post 2 weeks of intervention.

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Inclusion criteria:

Subjects diagnosed & referred by an Orthopedician with primary AC of shoulder, having shoulder ROM limitation of 25% or more compared to the non-involved shoulder, 40 - 70 years of either.

Exclusion criteria:

Musculoskeletal pathology in upper limb other than AC, recent rotator cuff injuries, Neurological conditions affecting the shoulder, Physiotherapy treatment/on corticosteroid injections for the affected shoulder.

Study design, duration A Prospective Randomized Study, 1 year.

Sample size: 28 subjects were allocated randomly in each group.

Procedure:

All the subjects with AC were screened for inclusion & exclusion criteria after which written consent was taken. Demographic data & baseline data was recorded.

Intervention**GROUP K:**Shoulder Traction Technique (restricted flexion):

Grade II/III traction was sustained for 30 seconds; repeated 20 times with a gap of 10 seconds.

Shoulder Caudal Glide (restricted Abduction):

Grade II/III distraction with caudal glide was given & sustained for 30 seconds; repeated 20 times with gap of 10 seconds.

Shoulder Ventral Glide (for restricted external rotation):

Grade II/III ventral glide was performed with shoulder in end ROM in extension & external rotation sustained for 30 seconds; repeated 20 times with gap of 10 seconds.



(1)

Kaltenborn Mobilization (1) Ventral glide

Shoulder Dorsal Glide (for restricted internal rotation):

Grade II/III dorsal gliding movement to the joint was given & sustained for 30 seconds; repeated 20 times with a gap of 10 seconds².

GROUP M:

To improve shoulder abduction, flexion & rotations were performed on the involved shoulder as described by Mulligan³. 3 sets of painless glides of 10 repetitions were given, with 1 minute rest between sets.

Subjects were asked not to perform home exercises to exclude the influence of adherence to the exercise protocol.⁴



(2)

Mulligan Mobilization :(2) Shoulder abduction

Result

Table 1: Depicts distribution of study subjects by gender, age, duration.

DATA	GROUP M	GROUP K
Gender	Male=19(67.86%)	Male=14(50.00%)
Age(mean±SD)	Female=9(32.14%)	Female=14(50.00%)
Duration	3.29±2.22	3.73±2.07
Affected side shoulder	Left= 17(60.71%)	Left=20(71.43%)
	Right=11(39.29%)	Right=08(28.57%)

Table 2: Depicts pre and post scores of Group M

DATA	GROUP M		
	pre test ;mean ± SD	post test; mean ± SD	mean change; mean± SD
% of pain score	59.00± 8.17	36.93± 5.88	22.07± 4.66
% of disability scores	48.39± 12.18	27.95± 9.50	29.86± 2.27
% of SPADI scores	53.9± 3.49	32.07± 0.90	21.84± 8.26
Flexion ROM scores	104.8 ±22.05	126.61± 14.97	21.79 ±12.26
Abduction scores	86.6± 15.52	1.43± 8.35	24.82± 4.94
Internal rotation scores	37.14 ±20.34	5.6 ±14.91	4.46± 11.41
External rotation scores	30.61± 14.87	50.54± 2.62	14.42 ±9.14

Table 3: Depicts pre and post scores of Group K

DATA	GROUP K		
	pre test; mean SD	post test; mean SD	mean change; mean SD
% of pain score	66.50± 12.93	34.94± 11.38	31.56 ±12.56
% of disability scores	55.97± 13.69	26.11 ± 9.27	29.86 ± 2.27
% of SPADI scores	58.70 ±11.04	30.42 ± 0.11	28.29 ±11.06
Flexion ROM scores	93.36±26.05	25.00± 2.52	28.68 ± 7.23
Abduction scores	8.96± 20.70	107.14± 18.53	25.18 ±18.08
Internal rotation scores	32.32± 14.69	49.46 ± 4.42	17.14 ±8.44
External rotation scores	37.68 ± 22.01	50.54 21.62±	12.86± 11.74

Table 4: Intergroup Comparison using Independent t-test

DATA	PRE-TEST		POST-TEST	
	Group M	Group K	Group M	Group K
% of pain score	59.00± 8.17	66.50±12.93	36.93± 15.88	34.94± 11.38
% of disability scores	48.39± 12.18	55.97±13.69	27.95± 9.50	26.11 ± 9.27
% of SPADI scores	53.91± 13.49	58.70±11.04	32.07± 10.90	30.42 ± 10.11
Flexion ROM scores	104.8 ±22.05	93.36±26.05	126.61± 14.97	125.00±21.52
Abduction scores	86.61± 15.52	81.96±20.70	111.43 ±18.35	107.14±18.53
Internal rotation scores	37.14 ±20.34	32.32±14.69	51.61 ± 14.91	49.46 ± 14.42
External rotation scores	30.61± 14.87	37.68±22.01	44.82 ± 14.43	50.54 ± 21.62
Mean	60.06286	60.91857	61.63	60.51571
SD	24.70953	20.38827	37.23256	36.4445

There was no significant difference between Group M & Group K ($t=0.05$, $p=47$) post intervention, despite Group M (61.63 ± 37.2) attaining higher scores than Group K (60.5 ± 36.4).

Discussion

The results indicate that Kaltenborn mobilization when administered for 6 sessions over a period of 2 weeks was effective in improving ROM deficits which are commonly found in patients with AC. Although the higher number of male subjects with AC compared to female subjects is in contrast to general notion that there exists a higher prevalence of AC in female population, our study result is consistent with findings of Balci N et al.⁵

Study suggests AC is common in people aged 51 years & above in agreement with previous studies which have found AC to be uncommon before 40 years of age while its incidence increases until 60 years, peaks at 56 & then plateaus.^{6,7} In the present study, age distribution showed no statistical difference in groups, depicting homogeneity of subjects.

A majority of the subjects who reported pain and movement restriction were in 1st or 2nd phase of AC. Homogeneity of duration of symptoms was observed, with similar findings by Rauoof MA et al.⁸

Comparing the 2 groups, a greater number of subjects affected with AC have left shoulder affected more than right. A study noted that non-dominant shoulder is more frequently affected.⁶

On analysis, both groups showed significant reduction of pain (<0.05), while comparison of pain scores between groups following 2 weeks of intervention, showed Group K with significantly higher improvement (10.05%). The effect size of the post treatment scores (between both groups) for pain in present study was found to be 0.0718 & for SPADI was found to be 1.62. For Cohen's d , effect size of 0.2 - 0.3 might be smaller, around 0.5 medium effect and 0.8 to infinity, a large effect.⁹

Joint motion maintains extensibility & tensile strength of joint & surrounding structures which reduces pain. Joint mobilization restores joint mobility & facilitate proper biomechanics of involved tissues. There are two rationales proposed for joint mobilization - neurophysiologic & biomechanical. The former is based on stimulation of peripheral mechanoreceptors & inhibition of nociceptors. Evidence suggests that stimulation of peripheral mechanoreceptors blocks transmission of pain to central nervous system.¹⁰ Traction often relieves pain¹¹ & this has been part of the mobilization techniques used in Group K, presumably leading to higher improvement seen in this group. Stimulation of mechanoreceptors by distraction & small-amplitude oscillatory movements may also inhibit transmission of painful stimuli at spinal cord or brain stem levels.^{12,13}

Disability scores also improved significantly ($p < 0.05$) in both groups individually & comparison between groups showed Group K with significantly higher improvement in scores with $p < 0.05$, leading us to assume that it may have been brought about by reduction in pain & improvement in ROM, facilitating subjects to perform their ADL with better ease in agreement with Shaffer et al.¹⁴

Small-amplitude distraction or gliding movements of joint are utilized to cause synovial fluid motion, responsible for nutrition to avascular portions of the articular cartilage & intra-articular fibrocartilage which helps sustain nutrient exchange & consequently prevent painful and degenerating effects of stasis when a joint is painful & cannot move through ROM.¹⁵

The same was also reflected in the Total SPADI scores, showing significant change in the pain & disability (Total) scores ($p < 0.05$) between both groups, but Group K showed 7.67% better results than Group M.

Improved flexion scores in both groups were seen on comparing pre & post-treatment values. Group K showed higher improvement than Group M. Grade III traction mobilization at the point of restriction increases joint mobility mainly in the pre-positioned direction.¹¹ This maneuver was used in treating the restriction in flexion for subjects in Group K of our study.

Backing up this theory is, a cadaver study done to analyze humeral head displacement while performing an axial distraction mobilization of GH joint, which stated that end range distraction may be more effective in gaining mobility of GH joint.¹⁶ Manske R C et al¹⁷ observed that lengthening of the posterior shoulder structures by posterior shoulder joint mobilization techniques permits humeral head to glide in appropriate direction, thus allowing normal GH arthro-kinematics. A study by Ludewig P M & Cook T M¹⁸ also found that forward translation of humeral head limits shoulder movement along with causing pain. The MWM technique applied in our study in Group M utilized a posterior directed glide, which hence leads us to speculate whether this led to increasing the flexion ROM in the said Group.

In present study, shoulder abduction ROM also improved, where higher improvement was seen in Group K. Our abduction procedure in Group K involved using a caudal glide applied at the end of available range for treating restricted shoulder abduction.

Hsu et al¹⁶ showed that a caudal glide was more efficient in improving abduction ROM & applying glide at resting position of the GH joint is not effective in improving abduction range, hence suggesting otherwise. Hypomobility of a joint of reversible nature can be treated with progressively vigorous joint-play stretching techniques to extend hypomobile capsular & ligamentous connective tissue. Sustained or oscillatory stretch forces are used to mechanically lengthen shortened tissue.¹⁹

Group M also showed improvement in abduction from baseline to 2 weeks of intervention. Application of MWM has been indicated for treatment of AC wherein painful movement is repeated by patient while the therapist continues to sustain appropriate accessory glide. Additional gains are believed to occur with repetition of same during treatment session mainly involving 3 sets of 10 repetition.²⁰

Group K showed 14.10% higher improvement in internal rotation scores compared to Group M & same trend was observed in terms of external rotation scores with an improvement of 12.3% in Group K.

Asymmetrical tightening of shoulder capsule during humeral rotation results in translation of humeral head in direction opposite to capsular tightening. Hence, when

the arm is rotated internally, posterior capsule becomes tight & pushes humeral head anteriorly, resulting in anterior translation according to capsular constraint mechanism, which may be responsible for causing positional fault in GH joint. Hence longer posterior capsule will lead to a greater ROM in internal rotation.²¹ Thus application of dorsal glide might have stretched the posterior capsule & increased internal rotation in Group K which is reflected in the pre-intervention to post-intervention values, substantiated by the study done by Ticker et al who reported the presence of thickened posterior capsules in those patients diagnosed with limited internal rotation.²² Results of this study are consistent with previous studies demonstrating that end-range mobilization technique appear to generate positive outcomes in improving abduction & rotational joint range.^{23,24}

According to Kaltenborn, stretching of shortened connective tissues increases & maintains mobility, delays progressive stiffness & loss of ROM in chronic musculoskeletal disorders including AC.¹⁹ A fibrous contracture of rotator interval & coraco-humeral ligament is said to cause frozen shoulder²⁵ which might have led to the higher improvements seen in Group K, indicating that correction of positional fault alone may not be effective in treating shoulder AC. Treatment goals may include restoration of normal capsular tissue length by mobilizing in the direction of anterior-inferior GH ligaments.²⁶

All the shoulder ROMs documented in our study showed a large effect size of >0.8 , which concludes that Kaltenborn mobilization technique showed greater clinical benefit in improving ROM than MWM technique.

We may conclude that although correction of positional fault showed improvements in pain, disability and ROM of the shoulder, application of traction and capsular stretching demonstrated a greater clinical effectiveness in relieving pain & disability & in improving ROM in individuals with AC of shoulder.

Conclusion

Experimental trial provided evidence to support use of physiotherapy intervention in the form of Kaltenborn mobilization technique & Mulligan's MWM in reducing

pain & improving disability & ROM over a period of 2 weeks. Group K was more effective in improving shoulder ROM, reducing pain & disability.

Thus, Kaltenborn mobilization technique could be used effectively in the treatment by way of reducing pain, disability & improving ROM.

Conflict of Interest: None

Source of Funding: Self

Limitations of the study:

1. Lack of subject blinding process due to experimental conditions for each subject & primary outcome being subjective measurement.

2. Small sample size

3. Gender wise analysis was not performed

Further scope of study:

1. Studies with larger sample size

2. Longer duration of follow up, can be extended by comparing these treatment interventions with true control group.

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Prevalence of Chronic Obstructive Pulmonary Disease in Cotton Mill Industries Workers of the Miraj Taluka

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Abstract

Background: Chronic obstructive pulmonary disease is a preventable and treatable disease state characterised by progressive airflow limitation that is not fully reversible. It includes two main conditions-1. Emphysema 2. Chronic bronchitis. These are associated with fixed airway obstruction. Patients with COPD complaints of breathlessness, chest tightness, generalized weakness, fever & cough (with expectorations).

Materials & Methodology: Both male and female workers from cotton mill industries of Miraj Taluka who were aged between 35-45 were included in this study. Data was collected using COPD Assessment test (CAT) and PEFr.

Results: There were 54.17% workers who had a no obstruction with low impact of disease, 30% workers showed mild obstruction with moderate impact of disease, 15.83% workers showed moderate obstruction and high impact of COPD, and there were no workers who had severe obstruction of the airways. p value=0.1437

Conclusion: This study concluded that cotton mill industries of Miraj taluka showed that there were 54.17% of workers with no obstruction of airways. There were prevalence of mild obstruction of COPD in 30% of workers, moderate obstruction of COPD in the 15.83% of workers, also there were no workers with severe obstruction of COPD.

Keywords: COPD, Cotton mill workers, Miraj Taluka, COPD Assessment test (CAT) score, PEFr.

Introduction

Chronic obstructive pulmonary disease is a preventable and treatable disease state characterised by progressive airflow limitation that is not fully reversible¹. Chronic obstructive pulmonary disease is the fourth leading cause of death worldwide². Prevalence of this disease in India lies between 6.6 to 7.7%³.

It includes two main conditions-1. Emphysema 2. Chronic bronchitis. These are associated with fixed airway obstruction. Long term occupational exposure to the organic cotton dust may lead to obstructive lung disease⁴. Bacterial endotoxins present in the cotton dust may be a major causative agent contributing to the airway inflammation and obstruction⁵. This endotoxin comes from the cell wall of Gram negative bacteria that grows on cotton. This particle causes alveolar injury results in

local inflammatory reaction in the form of macrophages and B & T lymphocytes. Activated macrophages causes recruitment of neutrophils & also produces cytokines. These neutrophils causes liberation of protease & oxidants which injures type 1 pneumocytes. Cytokines leads to proliferation of type 2 pneumocytes. The result is inflammatory destruction of pulmonary parenchyma followed by fibrosis. Widespread destruction of alveolar capillary wall resulting in end stage lung⁴⁻⁷. Thereafter patient starts complaining of breathlessness, chest tightness, generalized weakness, fever & cough (with expectorations). A very common effects of the exposure are clinical symptoms of bronchoconstriction & declined expiratory flow⁸. Generalized weakness limits the patient's activities at work place and even the activities of daily living. The exposure length & type of work influences the respiratory morbidity among the workers.

This leads to the chronic illness and absenteeism at work place.

Materials and Method

An approval for the study was obtained from the institutional ethical committee. An observational study was conducted in the cotton mill industries workers of Miraj Taluka. Sample was achieved by simple random sampling method. A total of n=120 subject were included in study. All the subjects were screened for inclusion criteria i.e. Both males and females of age 35-45 years. Subjects excluded were those having neurological, musculoskeletal or cardiac disease, tuberculosis and uncooperative subjects. Subjects were briefed about the nature of the study. The demographic data including age, gender and occupation of the subject was collected through data sheet. Subjects were given written consent prior to the study. Data was collected using COPD Assessment test (CAT) and PEF. R.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE ASSESSMENT TEST (CAT)⁹: Correlation coefficient between SGRQ and CAT, $r=0.8$. this includes total 8 items scoring 40. Out of 40, the score is interpreted as 0-10 low (mild), 11-20 as moderate, 21-30 as high and 31-40 as very high impact of chronic obstructive pulmonary disease on the health of the workers.

PEAK EXPIRATORY FLOW METER¹⁰⁻¹²: Forced expiratory volume through the peak flow meter, indicating 300-201 L/min as mild obstruction, 200-101 L/min as moderate obstruction, whereas less than 100 L/min as severe obstruction of the airways.

Findings

Data Analysis was performed with SPSS version 20.0. Chi square test for independence was done to check the association between, gender, peak flow rate and CAT score.

Table 1: Gender distribution of the Cotton Mill Industries Workers

Gender	Frequency	Percentage
Females	37	30.8
Males	83	69.2
Total	120	100

Table 1 shows that there were 37(30.8%) female subjects and 83(69.2%) male subjects in cotton mill industries workers.

Table 2: Age group wise distribution of the Cotton Mill Industries Workers

Age groups	Frequency	Percentage
35-40 years	82	68.3
41-45 years	38	31.7
Total	120	100

There were 82(68.3%) subjects between 35-40 years and 38(31.7%) subjects between 41-45 years of age in the cotton mill industries shown in table 2.

Table 3: CAT score and PEF. R wise distribution of the Cotton Mill Industries Workers

CAT Score and PEF. R	Frequency	Percentage
No obstruction	65	54.16%
Mild	36	30%
Moderate	19	15.83%
Severe	0	0%
Total	120	100%

According to CAT score and PEF. R, 65(54.16%) workers had no obstruction, 36(30%) had mild obstruction, 19(15.83%) had moderate obstruction, there were no workers with severe obstruction.

Table 4: Association between gender, peak expiratory flow rate and CAT score of the Cotton Mill Industries Workers.

Gender	Peak expiratory flow rate and COPD assessment test score								Chi square statistic	p value
	Normal		Mild obstruction		Moderate obstruction		Total			
	F	%	F	%	F	%	F	%		
Females	17	14.16	16	13.33	5	4	37	30.83	3.881	0.1437
Males	48	40	20	16.66	14	11.66	83	69.17		
Total	65	54.16	36	30	19	15.83	120	100.00		

Chi square test for independence was done to check association between gender, peak expiratory flow rate and CAT score of the cotton mill industries workers of Miraj taluka. P value=0.1437.

Table 5: Descriptive statistics of the age, PEFR, CAT score of Cotton Mill Industries Workers Miraj Taluka

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Age	120	35	45	39.34	3.25
PEFR (L/min)	120	120	380	285.23	67.81
CAT Score	120	5	19	11.96	5.39

Table 5 showing that the minimum age was 35years and maximum was 45years, minimum PEFR was 120L/min and maximum PEFR was 380L/min, minimum CAT score was 5 whereas maximum score was 19. The mean age of workers was 39.34 years with 3.25 std deviation, mean PEFR was 285.23 and standard deviation was 67.81, mean CAT score was 11.96 and standard deviation was 5.39.

Discussion

The purpose of this study was to find out the prevalence of chronic obstructive pulmonary disease in the cotton mill industries workers of Miraj Taluka. Endotoxin is the disease leading source that grows in cotton⁵. It causes pathophysiological changes that leads to the prolonged illness in the workers hence, this was done to analyze the number of subjects suffering from chronic obstructive pulmonary disease in the cotton mill

industries.

In our study, we included both male and female workers. Out of 120 workers, we found that female workers were 37 (30.8%) whereas, the frequency of the male workers was higher than the female workers i.e. 83 (69.2%). There were 82 (68.3%) who were having their age between 35-40 & 38 (31.7%) were having age between the range of 41-45. We used the PEFR and COPD assessment test score as outcome measures. According to the PEFR and CAT score, 65 (54.17%) workers had a no obstruction with low impact of disease, in which there were 48 (40%) male workers and 17 (14.16%) female workers. 36 (30%) workers showed mild obstruction with moderate impact of disease which was distributed as 20 (16.66%) male and 16 (13.33%) female workers, remaining 19 (15.83%) workers showed moderate obstruction and high impact of COPD, which was included 14 (11.66%) male workers and 5 (4%) female workers. There were no workers who had severe obstruction of the airways. P value = 0.1437. This study has also found that the mean age of workers was 39.34 years, mean PEFR was 285.23 and mean CAT score was 11.96.

Important strengths of this study include subjective assessment was done using COPD assessment test which is having $r=0.8$ correlation coefficient with SGRQ. This questionnaire was administered by trained personnel in the native language of participants. We were able to find age as well as gender related differences as we have included both male and female workers in this study.

There are few limitations that should be considered for this study. We were able to include the workers from only two industries of Miraj taluka. Possible overlapping of the diagnosis such as byssinosis, asthma, other lung diseases and COPD may have affected the outcomes of this study. We were not able to take in any long term changes that are affecting the respiratory health of these cotton mill workers as this was a cross-sectional study.

A study conducted by Shi J showed that endotoxin exposure was significantly associated with chronic bronchitis and byssinosis¹³. A report by DC Christiani has proved that the cotton dust is strongly associated with chronic airflow limitations seen in COPD¹⁴. An analysis of pulmonary functions and respiratory symptoms by Bharat D concluded that there is significant decrease

in spirometric parameters and increase in respiratory symptoms in the cotton mill workers of the Ahmedabad city in India¹⁵. Similarly a statistical study done by Pandey S. has estimated that there was significantly low PEFR (Lit/min) in cotton spinning smoking workers as compared to normal healthy individuals¹⁶. An exposure assessment done for the prevalence of lung related disease in cotton operatives (ginners) by H. Chaudhry postulated that the prevalence of chronic bronchitis and chronic obstructive pulmonary disease were 42% & 6% respectively among the exposed vs (0%) unexposed¹⁷.

Conclusion

This study concluded that cotton mill industries of Miraj taluka showed that there were 54.17% of workers with no obstruction of airways. There was prevalence of mild obstruction of COPD in 30% of workers, moderate obstruction of COPD in the 15.83% of workers, also there were no workers with severe obstruction of COPD, hence the experimental hypothesis of prevalence of COPD in the cotton mill industries workers of Miraj taluka has proved. To protect the cotton mill industries workers from the cotton dust exposure that leading to the COPD, the personal protective equipments should be provided to the workers as well as curative and preventive measures need to be undertaken.

Conflict of Interest: None.

Source of Funding: Self.

Ethical Clearance: The ethical clearance was obtained from the Institutional Ethical Committee of College of Physiotherapy, Wanless Hospital, Miraj Medical Centre, Miraj

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Feasibility of using Treatment based Classification System to Plan Management of Patients with Low Back Pain

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Abstract

Background: Low back pain (LBP) is an extremely common symptom and most troublesome of complaints in the general population. Pain can vary from a dull constant ache to a sudden sharp feeling. At any point in time 80% of general population will experience some type of low back pain¹. Treatment efficacy for the increasing prevalence of this back pain is a great challenge for both health care providers and individuals coping with this problem³.

In order to select an effective and efficient treatment in daily clinical practice, low back pain patients should be classified by symptoms during testing and physical examination. One of the main classification systems which focus individual clinical presentation is treatment based classification system. Treatment based classification system will also have impact on clinical decision-making in the management of low back pain³.

Objectives: To educate all therapist working with patients with back pain to categorize each patients using treatment based classification system.

To establish the consistency and accuracy of therapists in using treatment based classification system for patients with LBP.

To analyze therapists opinion of the feasibility of treatment based classification system to plan the management of LBP.

Study design: Observational study

Method: A total of 46 patients were recruited in this observational study. Each patients was assessed and allocated to treatment based classification system. Visual analogue scale and Patient-Specific Functional Scale for first and last day of the treatment was taken and number of session also documented by the trained therapist.

Results: Results were analysed by the questions obtained from the five therapists. All five agreed for the accuracy in categorization and time, 60% agreed for the consistency in usage and goal setting and only 40% agreement for the usefulness. The total feasibility level was 75%.

Conclusion: The study concludes that using TBC system to plan management for low back pain is feasible in terms of categorization, accuracy and time but not cost effectiveness.

Key words: Low Back pain; PT Management and Low Back Pain; Treatment Based Classification System with Booleans AND, OR, IN.

Introduction

Low back pain is a very common symptom and most troublesome of complaints in the general population. Pain can vary from a dull constant ache to a sudden sharp feeling. At any point in time 80% of general population will experience some type of low back pain¹.

Low back pain may be classified by duration as an acute pain lasting less than 6 weeks, sub-chronic is 6 to 12 weeks, or chronic is more than 12 weeks¹. Some of the main causes of low back pain are hypothesized to include muscle strain, tendonitis, mechanical low back pain, herniated disc, and facet dysfunction¹.

In the majority of cases of low back pain, the principles of management depend on careful assessment and then appropriate treatment. The important aspects of LBP assessment may include measurement of pain severity using Visual Analogue Scale (VAS), measurement of range of motion, sensory and motor assessment, and functional disability profile using Patient-specific functional scale (PSFS)². The specific categorization of the patients by symptoms is not been followed in treatment approaches and hence the effect of these treatments cannot be generalised³.

One explanation for the inability to identify effective interventions for acute low back pain, is the lack of success in clinical settings to defining subgroups of low back pain patients who were most likely to respond to a specific treatment categories. Because of difficulty in the grouping low back pain patients on the basis of pathoanatomic mechanisms, classification system has been made based on clinical examination findings. Treatment based classification system is one main approach used in treating LBP patients.³

This system is based on the information from the clinical examination and by patients self-reports on pain severity scale and functional disability scale. There by patients can be grouped into one of four treatment categories such as Stabilization category, Passive mobilization and manipulation category, Specific exercise category, Sustained positions or traction category to have an effective clinical decision making.³

In Indian physiotherapy clinics, an organized evaluation and management for low back pain is still challenging because of adherence to traditional

management patterns. It has been postulated that treatment based classification system is a comprehensive system considering various clinical presentation of the patients with LBP. However, feasibility of this system must be evaluated before implementation. If the study results show that TBC is feasible and acceptable, it can be recommended as a routine method of plan of management for LBP.

The aim of this study was to explore the feasibility of using treatment based classification system to plan management of patients with low back pain.

The objectives were to educate all therapists working with patients with back pain to categorize each patients using treatment based classification system. To establish the consistency and accuracy of therapists by using treatment based classification system on patients with LBP. To analyze therapists opinion of the feasibility of treatment based classification system to plan the management of LBP.

Methodology

Research Design: An observational cross sectional design

Source of data: JSS physiotherapy department, Mysore

formed the cohort from which participants were selected.

Sampling method: All patients who fulfilled criteria during the duration of the study period (4 months) were recruited (Complete enumeration of available samples).

Duration of study: 4 months.

PARTICIPANTS CHARACTERISTICS: The following criteria of inclusion and exclusion were considered to recruit participants specify phase a, b, c

Ø Inclusion criteria of physiotherapists:

Practicing therapist with minimum BPT qualification.

Ø Inclusion criteria of patients:

Both men and women aged 18-40 years who had low back pain with or without radiating

Patients who had a current episode of mechanical LBP with less than 3 weeks.

Men and women who were able to understand and follow the procedure

Ø Exclusion Criteria:

Patients who had recent musculoskeletal injury other than low back pain.

Patients with a history of recent surgery or surgical management for low back pain

Pregnancy related back pain

Cognitive impairment.

Severe cardiac deficit which doesn't allow them to lie on prone.

Outcome measures:

q Patient specific functional scale

q Visual Analogue Scale

Procedure

This is a three phase study

Phase A: Review of medical records

Objective: To observe the VAS, PSFS and number of sessions from the medical records of last 6 months of patients with low back pain in JSS hospital.

Permission was taken from JSS College of physiotherapy and ethical approval for the study was obtained from JSS medical institution of Ethical committee.

Based on the inclusion and exclusion criteria, patients who had undergone treatment for low back pain in the previous six months were identified from department register.

VAS, PSFS and number of sessions of these patients were documented.

Phase B: Reliability of treatment based classification system

Objective: To find out reliability of treatment based

classification system.

This phase was to find out reliability of TBC system in order to ensure the internal agreement of categorization among therapists. Five sessions of training on TBC system was given to 5 therapists on various low back pain patients until they were familiar with the technique. Thereafter, reliability of TBC was established by observing the specific allocation of five patients into the subgroups of TBC system.

Phase C: Feasibility of using treatment based classification system.

Objective: To find out the feasibility of using treatment based classification system.

Participants were selected on the basis of inclusion and exclusion criteria. Procedure was explained and written informed consent form had taken from the participants. Based on the inclusion and exclusion criteria, a therapist trained in phase B, categorized and treated the patients with low back pain according to treatment based classification system. VAS and PSFS for first and last day of the treatment was taken and total number of session was documented.

After observational analysis the comparative analysis was done on phase A and phase C by using ICC (Intraclass Correlation Coefficient) Feasibility questioner was given to the trained therapists to evaluate their opinion of the feasibility of using TBC system.

Data Analysis

Data analysis and result generation was done using SPSS version 22.0. A 'p' value of ≤ 0.5 was considered as significant. Comparison between pre and post test of VAS and PSFS was analyzed using paired t test.

Results

Phase A

A total of 71 patients were selected, men (n=35) women (n=36) details were obtained from department register. Out of 71 records, only 10 records included VAS and PSFS with only pre values. Total number of sessions was calculated for obtained patients in order to find out the cost effectiveness.

Phase B

This was carried out by observing the specificity of allocation by five therapists. A 100% reliability match was obtained by all therapists.

Phase C

A total of 46 patients, men (n=24) women (n=22) were included in the study

Profile of patients under various categories**Table 1: Comparison between before and after treatment values of visual analogue scale**

Groups	N	VAS	Mean (cm)	SD	T	Sig.(2-tailed)
Specific exercise	21	Pre	7	2	20.996	.000
		Post	4	2		
Traction	15	Pre	6	2	14.554	.000
		Post	4	2		
Stabilization exercise	10	Pre	6	2	8.573	.000
		Post	3	2		

Table 2: Comparison between before and after treatment values of patient specific functional scale

Groups	N	PSFS	Mean (cm)	SD	T	Sig.(2-tailed)
Specific exercise	21	Pre	4	1	-17.81	.000
		Post	6	1		
Traction	15	Pre	5	2	-5.12	.000
		Post	7	2		
Stabilization exercise	10	Pre	4	1	-2.29	.047
		Post	6	2		

Cost effectiveness:

To find out the Cost effectiveness of TBC, average number of sessions was compared between routine physiotherapy care and TBC (Table 5).

Table 3: Documentation of number of sessions to determine cost effectiveness

Routine physiotherapy care		Treatment based classification system		
Mean (no of days)	Std. Deviation	Groups	Mean (days)	Std.Deviation (days)
4	3	Specific exercise	7	2
		Traction	6	3
		Stabilization exercise	5	2

Number of sessions was statistically analysed by mean and standard deviation to determine cost effectiveness

Result shows routine physiotherapy had minimum number of sessions (4±3) when compare with treatment based classification system.

Feasibility Questionnaire:

Table 4: Percentage of therapist agreement for the feasibility in using treatment based classification system

Categorization	Percentage of therapists agreement
1) Accuracy in categorization	100
2) Consistency in usage and goal setting	60
3) Requirement of time	100
4) Usefulness	40

Questions analyzed through percentage

Results were analyzed by the questions obtained from the five therapists. All five agreed for the accuracy in categorization and time, 60% agreed for the consistency in usage and goal setting and only 40% agreement for the usefulness. The total feasibility level was 75% including a combination of opinion, cost effectiveness and reliability

Discussion

The study design will not permit any conclusions in regarding the effectiveness of any treatments used.

Results however, support the further need for the efforts to determine the best methods for matching specific interventions to patients with particular clinical presentations. There are many guidelines for non-surgical for management of low back pain are available in current clinical setups. It is important to have accurate, feasible and reliable results for any newly introduced system. Observed data on routine physiotherapy care concluded that there was no established systems were used in any of the treatment plan and it was an experienced based treatment rather than structure based protocol.

Our study gives an insight that, even though there are lot of advanced treatments and scientific technology has been developed, still documentation in physiotherapy was lagging and the management protocols were generalized instead of condition or cause specific. Out of 71 records, 48 records did not have details of outcome measures and 13 records were found with inadequate assessment. These findings were strongly recommending that there should be a need of newly established condition specific categorization system in management of LBP.

In order to find out the agreement between the therapists the reliability of TBC system was assessed in phase B. This is supported by the study done by Fritz et al on evaluation of a classification approach for low back pain. The study suggests that before implementing any therapeutic techniques, the agreement among the therapists has to be measured⁽³⁾. To find out the feasibility of TBC system the patients is placed into four classification groups, each with its own treatment approach.

Patients exhibiting the centralization phenomenon during lumbar flexion or extension range of motion testing are treated with the specific exercises group that promote symptoms of centralization. Numerous findings from patients clinical examination reportedly is associated with clinical instability are treated using stabilization exercise group. Finally, patients who do not demonstrate centralization phenomenon can be treated with spinal traction.

The most common combination of subgroups for which the criteria were met was manipulation + specific exercise (n=6)⁽⁵⁾. The complexity of the symptoms and clinical presentation might be the major factor that would have been attributed for this phenomenon. This is supported by the study done by Stanton et. al, on evaluation of a treatment-based classification algorithm for low back pain. The findings shows that 25% of the participants did not fell into any of the subgroup and the most common combination of subgroups was manipulation and specific exercise^(6, 5).

VAS and PSFS for first and last day of the treatment was taken and number of session also documented by the trained therapist. Paired T-test was done for documented VAS and PSFS to find out the significant difference and the results shows that data is statistically significant

(.000) between pre and post values of VAS and PSFS. This might be because of increased number of sessions, proper initial evaluation and findings in TBC group than traditional group. It was observed that the number of sessions patients came for physiotherapy was more in using classification system compare to usual care. Because initial treatment sessions were not based on patients symptoms in usual care.

Hence, TBCS used in the study was not cost-effective in compared with usual physical therapy care. However this cannot be considered as a drawback of TBC as the aim of all system of treatment is to get a satisfactory outcome irrespective of number of session or the cost of it. Apeldoorn et al also observed that mean total societal costs for the classification- based group were more than the routine physical therapy care group.

After the observational analysis, Feasibility questioner was given to five trained therapist to find out the feasibility of using treatment based classification system. Among five trained therapist, 100% agreement for easily categorizing the patients and time necessary to use treatment based classification system, 60% agreement for feasibility in usage and goal setting and only 40% agreement for feasibility in accuracy and useful than traditional evaluation method and goal setting.

Overall findings of this study suggest that the classification system is feasible to use for patients with low back pain. But may not be a cost-effective in comparison with usual physiotherapy care.

Strength:

Ø Therapists were blinded to find out the reliability of TBC system by asking the therapists to write the allocated patients name with group of exercise and drop inside the box kept in treatment room.

Ø Training of therapist on TBC was given to ensure consistency in agreement

Ø Continues monitoring and observation during allocation and during treatment

Limitation:

Limitation of this study was relatively small sample size. And a large number of patients who were screened

did not meet the participant's criteria. The large number of patients excluded emphasizes that the classification system was designed to apply to non-elderly patients with acute low back pain. No certified manual therapists in the group.

Clinical Implication:

When using the treatment based classification system the finding shows that many patients meet the criteria for more than one subgroup or did not clearly fit in any subgroup, a therapist may begin with the treatment subgroup indicated by the classification system and should monitor the patient's response to the treatment. Careful monitoring of a patients response to treatment may be particularly important for those patients who do not clearly fit a subgroup.

5.4. Research Implications:

Future research could investigate whether clinical outcomes would be improved by application of the classification system to patients and applying a different strategy to improve patients with an unclear classification based system.

Conclusion

The study concludes that using TBC system to plan management for low back pain is feasible in terms of categorization, accuracy and time but not cost effectiveness.

Conflict of Interest: None

Source of Funding: None

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Comparative Study on Effect of Insulin and Oral Hypoglycemic Drugs on Quality of Life among Type 2 Diabetics Using Modified Diabetes Quality of Life Questionnaire (MDQOL-17)

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Abstract

Diabetes mellitus is defined as a group of metabolic diseases characterized by hyperglycemia, due to defective insulin secretion, action or both. Type 2 diabetics can be treated by using oral hypoglycemic drugs or insulin or both. Type 2 diabetics who do not respond to the treatment of oral hypoglycemic drugs or maybe insulin resistant over a period of time require supplemental insulin for adequate glycemic control. The reality is that diabetes influences patient's lives. The mere presence of diabetes deteriorates a person's quality of life. When diabetes co exists with other chronic illnesses, the effect is even worse. **Aim and Objective of the Study** - To compare quality of life in diabetics on insulin and oral hypoglycemic drugs. The objectives being assessing and comparing quality of life in Diabetics on insulin and oral hypoglycemic drugs using MDQol-17 on the components like Physical functioning, Role limitations due to physical health, Role limitations due to emotional health, Energy fatigue, Emotional well-being, Social functioning, and General health. **Study design and methodology** -Total of 124 subjects were included in the study. Of this, 62 were on insulin (Group A) and 62 were on oral hypoglycemic drugs (Group B).Outcome measure used was Modified Diabetes Quality of life questionnaire-17. **Results and analysis** - The data was collected and analyzed using statistical test – Unpaired t test for the comparison between two independent groups. The QOL score for insulin and OHD group was 60.96(±1.8) and 71.32(±1.5) respectively which was significant. With the $p < 0.05$. The difference in the domains of Role limitations due to physical health, role limitations due to emotional health, social functioning and general health was statistically significant on comparing between the two groups. **Conclusion** - There is significant difference in the Quality of life of Diabetic patients who are on insulin and those on oral hypoglycemic drugs.

Key words – Diabetes mellitus, Modified Diabetes Quality of Life questionnaire.

Introduction

Diabetes mellitus is defined as a group of metabolic diseases characterized by hyperglycemia, due to defective insulin secretion, action or both.

As per the etiological classification of Diabetes mellitus, it is divided into 2 types. 1.Type 1 diabetes (IDDM) Beta-cell destruction, usually leading to

absolute insulin deficiency^[1] 2.Type 2 diabetes (NIDDM) may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance^[1]

Type 2 Diabetes is a growing challenge in India with estimated 8.7% diabetic population in the age group of 20 and 70 years. The rising prevalence of diabetes and other non-communicable diseases is driven by a combination of factors - rapid urbanization, sedentary lifestyles, unhealthy diets, tobacco use, and increasing life expectancy.^[1]

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Obesity and overweight are the most important risk factors responsible for diabetes. Much of the diabetes burden can be prevented or delayed by behavioral changes favoring a healthy diet and regular physical activity.

Type 2 diabetics can be treated by using oral hypoglycemic drugs or insulin or both. Type 2 diabetics who failed to be adequately controlled with diet and exercise need to be put on oral hypoglycemic agents for tight metabolic control.

The Oral Hypoglycemic agents which stimulate beta cells to secrete insulin are Sulphonylureas, the one which works by suppressing hepatic glucose production is Metformin, the ones which enhances insulin sensitivity in peripheral tissue are Thiazolidinediones and the drugs which interfere with absorption of glucose from gut are Alpha glucosidase inhibitors.

Type 2 diabetics who do not respond to the treatment of oral hypoglycemic drugs or maybe insulin resistant over a period of time require supplemental insulin for adequate glyceemic control.

It is well established that the prevalence of diabetes has increased in the developed and developing countries during the last four decades. That is a result of abundance of food, the consequent change of our dietary habits and the lack of exercise. According to International diabetes Federation, now a days, one every 11 adults has diabetes (415 million worldwide).^[7]

Progression of diabetes, and especially poor glyceemic control, leads to numerous potentially life threatening complications. Almost half of the adults with chronic kidney disease are derived from diabetic population. Likewise, 9.8% of diabetics have experienced heart attack, 9.1% suffer from coronary artery disease (CAD), 7.9% have congestive heart failure, 6.6% have stroke while more than a quarter of them 27.8% have foot problems and last but not the least 18.9% have eye damage. All these complications along with the metabolic deterioration demand a large amount of patient's every day energy, planning and thought, which leads to a situation called "diabetes overwhelms"^[7]

The reality is that diabetes influences patient's lives. The mere presence of diabetes deteriorates a person's quality of life. When diabetes co exists with other chronic illnesses, the effect is even worse.

The aim of this study is to compare quality of life in diabetics on insulin and oral hypoglycemic drugs.

The objectives being assessing and comparing quality of life in Diabetics on insulin and oral hypoglycemic drugs using MDQol-17 which includes the following components :

- 1) Physical functioning
- 2) Role limitations due to physical health
- 3) Role limitations due to emotional health
- 4) Energy fatigue
- 5) Emotional well being
- 6) Social functioning
- 7) General health

Null hypothesis of the study was that there would be no difference in quality of life in diabetics on insulin and diabetics on oral hypoglycemic drugs and the experimental being there would be a difference in quality of life in diabetics on insulin and diabetics on oral hypoglycemic drugs

Materials and Methodology

It was a cross sectional comparative study. The inclusion criteria were Type 2 Diabetics between the age group of 30 to 65 years on insulin and or hypoglycemic drugs. The exclusion criteria were all those with Type 1 Diabetics, Individuals with endocrine disorders (except Metabolic Syndrome) or cs with any serious illness or complications. Individuals with other severe musculoskeletal aches and pains or neurological conditions were also excluded from the study.

Total of 124 subjects were included in the study. Of this, 62 were on insulin (Group A) and 62 were on oral hypoglycemic drugs (Group B).

Outcome measure used was Modified Diabetes Quality of life questionnaire-17. It consists of 17 questions that comprise seven domains, which include

physical functioning, role limitation due to physical health problems, role limitations due to personal or emotional problems, emotional well being, social functioning, energy/fatigue and general health perceptions.

TABLE I - MDQoL-17 Domains and item numbers

Domains	Number of Items	Item Numbers
Physical functioning	3	4,5,6
Role limitations due to physical health	1	7
Role limitations due to emotional	2	11,12
Energy Fatigue	1	17
Emotional well being	3	8,9,10
Social functioning	4	13,14,15,16
General Health	3	1,2,3

TABLE 2 -Grading for questionnaire:

TABLE 2 -Grading for questionnaire:

Response category and scores of MDQoL-17	
Item Number	Response category and Scores
1,2,7,13	1→100,2→75,3→50,4→25,5→0
3	1→0,2→25,3→50,4→75,5→100
4,5,6	1→0,2→50,3→100
8,9,10,11,12,14,15,16	1→0,2→20,3→40,4→60,5→80,6→100
17	1→100,2→80,3→60,4→40,5→20,6→0

The subjects were interviewed for demographic data which included their name, gender, age, co morbidities, duration of diabetes, medications and insulin units consumed. The subjects were asked to fill the appropriate score for each question. All the contents were scored so that a high score depicts a more favorable health state.

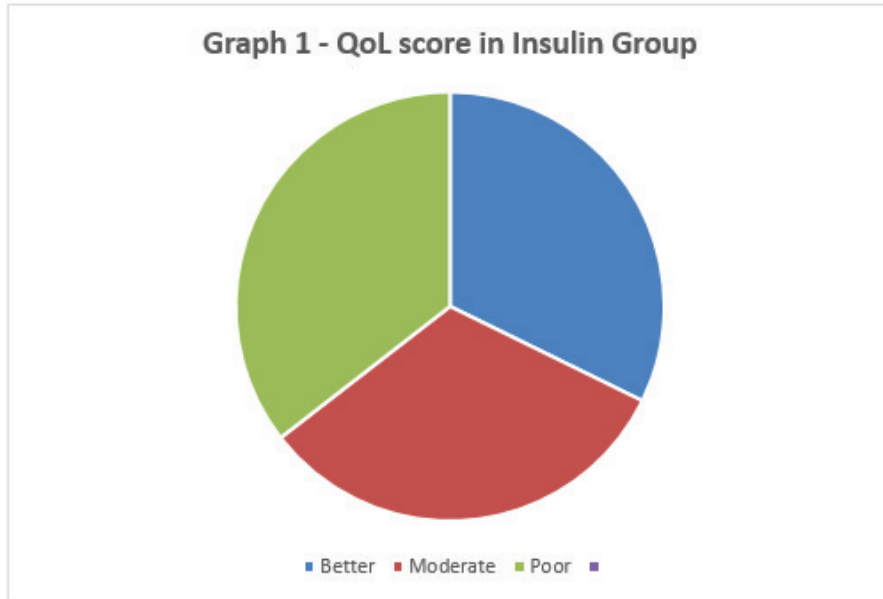
The possible scores were 0-100, 0 being the minimum and 100 being the maximum score. Scores represented the percentage of total possible scores achieved.

The Quality of Life (QoL) score of MDQoL-17 was expressed as a percentage of total QoL score for ease of comparison and analysis. The patients with a QoL score

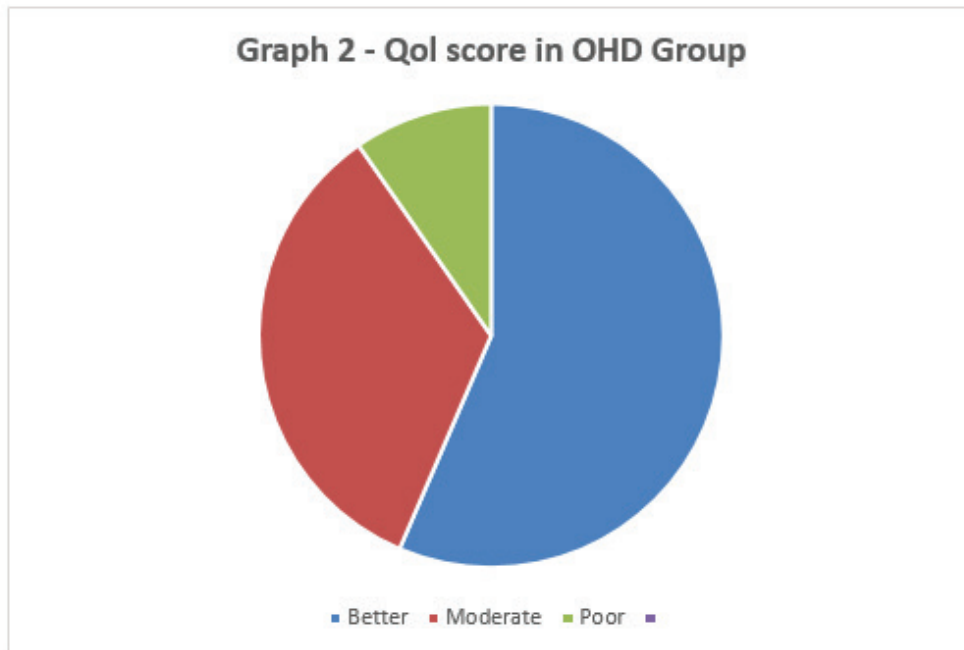
of more than 70 represented better QoL, those with a QoL score of 50-70 represented moderate QoL and those with less than 50 represented poor QoL.

Moreover, every component of the questionnaire was compared in the two groups.

STATISTICAL ANALYSIS AND RESULTS



The data was collected and analyzed using statistical test – Unpaired t test for the comparison between two independent groups.



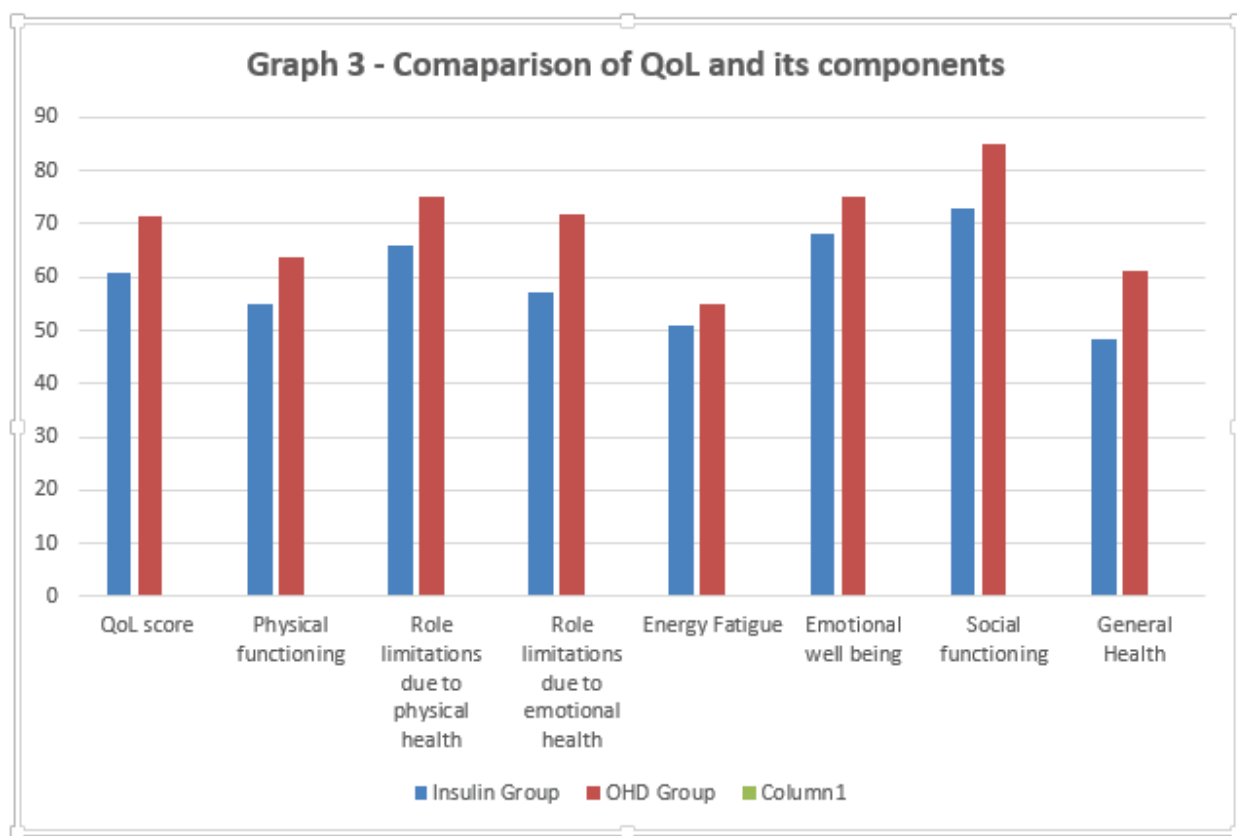


Table 3 - Comparison of QoL and individual components of QoL

	Insulin	OHD	P value	Interpretation
QOL score	60.96(±1.8)	71.32(±1.5)	0.00046	p<0.05, Significant
Physical functioning	55(±3.1)	63.71(±3.1)	0.069	Not significant
Role limited due to physical health	66(±3.2)	75(±2.1)	0.024	p<0.05, Significant
Role limited due to emotional health	57(±2.7)	72(±2.3)	0.00063	p<0.05, Significant
Energy fatigue	51(±2.4)	55(±2.3)	0.164	Not significant
Emotional well being	68(±2.6)	75.02(±2.1)	0.056	Not significant
Social functioning	73(±1.8)	85(±1.5)	0.000074	p<0.05, Significant
General health	48.3(±2.2)	61.12(±1.8)	0.001097	p<0.05, Significant

Discussion

In the present study, diabetic subjects on insulin (Group A) and diabetic subjects on oral hypoglycemic drugs (Group B) were included to observe the difference in Quality of life and its components using MDQoL-17. Age and gender were matched. Group A consisted of 62 patients, including 48% of women and 52% of men with the mean age 57.85 years (36-65 years) as seen from graph 1. Group B - n=62; 66% of women and 34% of men; with mean age 55.25 years (36-65 years) as seen in graph 2. There was no significant difference in mean age and gender between two groups.

As in graph 3, patients in group A had a longer disease duration time, 24% of respondents suffered from diabetes for 1 to 5 years, 34% between 5 to 10 years, and 42% for more than 10 years. In the group B, 58% of respondents were in the first five years of disease duration, 24% between 5 to 10 years; 18% for more than 10 years as shown in graph 4.

In Group A, 32% subjects had a better Quality of Life score i.e. more than 70%; 32% subjects had a moderate Quality of Life score i.e. between 50% to 70% and 35% subjects had a poor Quality of Life score i.e. less than 50%. In Group B, 56%, 34% and 10% of subjects had better, moderate and poor Quality of Life score respectively.

The overall Quality of Life of patients in Group A was less as compared to Group B because majority of patients on insulin had diabetes for a longer duration (graph 5 ,6). There is a strong association between Diabetes Mellitus and Cardiomyopathy that parallels with the duration and severity of hyperglycemia. Coexistence of Cardiovascular Diseases leads to significant increase in the clinical complications and thus to a substantial reduction in Quality of Life of patients.^[9]

The difference in physical functioning component was not significant in two groups ($p=0.069$). But the role limitations due to physical functioning was significantly different, being more affected in Group A than Group B ($p=0.024$). This is because of the fact that the work life of Group A patients was adversely affected due to co morbidities as well as other factors like pain of insulin injections, urgency to take insulin injections in time, frequent change of sites as well as embarrassment of

taking it in public.^[2]

The role limitations due to emotional health were significantly more in Group A with p value being 0.000631. The diabetics on oral medications do not have an anxiety regarding self injections which are to be taken by the insulin patients so also the complicated regimens of insulin dosages and timing of injecting insulin adds on to the stress and hence emotional well being of the patients.^[9] The fact that presence of more co morbidities as seen in insulin subjects as chronic diabetics use insulin makes them lose confidence in their abilities.

There was no significant difference in energy fatigue component between two groups ($p= 0.167383$) as well as emotional well being ($p= 0.56022$).

The social functioning was significantly reduced in Group A than Group B ($p=0.000074$) this is due to multiple factors like travelling being a hindrance for patients on insulin, insulin injectables which are more expensive than oral drugs hence adding onto an economic burden and reducing expenses on social functions.

General health of the patients in Group A was affected than those in Group B (0.001097) because of the presence of more co morbidities. Insulin leads to improvement in glycemic control and well being in patients receiving long term insulin therapy, but hypoglycemia related to the Type 2 Diabetes insulin treatment has a significant negative impact on health related Quality of Life and productivity of these patients.^[9]

Thus, it can be concluded that presence of Diabetes Mellitus overall reduces the Quality of life of patients in all aspects like physical, emotional, social as well as general health; the affection being more in insulin group than in OHD group.

Limitations of the study was that the subjects were chosen from the hospital as well as from the community settings due to which Quality of life scores can differ. Also HbA1c could not be assessed for all the patients to know their latest glucose levels. Further it can be suggested that the Quality of Life can be compared separately for the patients with co morbidities and those without co morbidities.

The clinical implication of this study is that once we know how much physical functioning is affected at the same time what physical limitations the patient has due to Diabetes. This study will be helpful in the context of physiotherapy for designing exercise protocols for the affected domain, thus setting up individualized exercise protocols. Thus, finding a trend of which component is affected more in which group of diabetics and setting up exercise protocols for two separate groups is the significance for doing this study.

Conflict of Interest- There are no conflict of interests in the study.

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Effect of I-balance Training on Balance Performances among Elderly with Diabetic Peripheral Neuropathy: A Case Study

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Abstract

Falls is a major concern for elderly with diabetes peripheral neuropathy (DPN). Declines in sensory function caused by neuropathy may lead to increased risk of falls among elderly and associated with poor balance performances. Walking and turning requires integrated multiple system that includes sensorimotor, functional, and attention functions. However, any alteration in this system will impaired the gait parameters. An elderly need a cost-effective training to restore their upper and lower extremities strength and balance performances in order to reduce the risk of falling. This case illustrate the effectiveness of I-balance training for elderly who experienced DPN with fear of falling.

Key words: Balance training, diabetic peripheral neuropathy, elderly

Introduction

Globally, there was about 136 millions of diabetes mellitus cases that involved an elderly more than 65 years old¹. Surprisingly, this number keep on increasing and become one of the burden to the society. Those elderly who suffered from DM also had serious and significant complications such as diabetic peripheral neuropathy (DPN) due to their long term diabetes²⁻⁴. Nerve damage and apoptosis will be occurred due to glucose toxicity is a common cause of peripheral neuropathy⁴⁻⁶. Therefore, elderly who suffered from DPN may complaints of numbness and pain over their lower extremities⁵⁻⁶.

Decline in this somatosensory function caused body inefficiently detect changes in balance performances among elderly, will predisposing them to high risk of falls⁵⁻⁶. Alteration in static and dynamic balance instability cause by impaired in joint sense of hip and ankle also became a major limitation for an elderly to maintain their

balance performance, especially during daily activities⁷⁻⁹. A well-balanced in sensorimotor, functional, and attention functions during walking performance is needed for an elderly. Therefore, for rehabilitation purpose, those elderly needs a comprehensive balance training that includes dual task, attractive and mimic their functional activities.

The following case study demonstrates the effectiveness of I-balance training on balance performance among elderly with diabetic peripheral neuropathy.

Case Presentation

AF is a 67 years old man who had been diagnosed as diabetic peripheral neuropathy (DPN) and been refereed to physiotherapy. He complained of tingling sensation over his bilateral foot, since two months ago. His tingling sensation was aggravated during prolong walking and standing. Recently, the tingling sensation over bilateral foot getting worse and became constant. He also complained that sometimes he might off balance. Due to that, he had experienced a few incidence of fall. He also had underlying disease of hypertension,

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dyslipidemia and diabetes mellitus more than 5 years and under follow up with the doctor. He is a retired teacher, currently stayed in double-storey house with his wife, three son and one daughter. He loved travelling for vacation. Previous morbidity, he able to walk independently without any limitation or walking aids. He understand that the tingling sensation over his foot is due to his diabetic problem. He hope that he can able to walk as usual as before.

Physical examination

AF is a mesomorph-sized man came to the physiotherapy department by using walking stick accompany by his wife with slow gait. Based on his facial expression he look tired and sweaty as he claimed that he need to walk from car park to physiotherapy department approximately around 2 km and he stop a few times because his foot getting numbness.

On local observation, there is no swelling and no redness noted over bilateral foot. On palpation, there is no increase in temperature and tenderness. AF had sensation impairment based on vibration perception test at great tone using 128-Hz tuning fork done to him by qualified medical officer. He had decreased vibration perception over his great toe. There is no limited ankle range of motion based on measurement by goniometer. Unfortunately based on muscle length test, noted that AF has minimal muscle tightness over bilateral calf. Based on special test Tinel's sign performed to him, there is no nerve entrapment involvement in his case. On clearing test over proximal joint, which is knee and hip, there is

no abnormal finding detected.

As this patient complaints he might off balance sometimes during prolong walking and standing, the Berg Balance Scale (BBS) had been used as outcome measure to evaluate balance in his first, second and third physiotherapy sessions. BBS is a performance based measure which consists of 14 items that included sitting balance, standing balance, step up on a stool, tandem step, standing on one leg any many more that are valid and practical for elderly¹⁰. Total score for BBS is 56. The scores 41-56 means independent, 21-40 means walking with assistance and 0-20 means wheelchair bound ¹⁰. On first session's total score for AF is 40/56.

The second outcome measure for this patient is Timed Up and Go (TUG) test. This TUG test is used to assess mobility and predict risk of fall in elderly ¹¹. This test was carried out by patient sit on the chair, get up, walk for 3 meters and return back to the chair. Time taken by patient to complete this test was recorded. On first sessions total time taken for AF to complete this test is 18 seconds. This indicate that AF has high risk of fall.

The third outcome measure for this patient is 5-times sit to stand test. This test is used to measure lower limb strength ¹². First, patient need to sit on the chair, stand up and sit down for 5 repetitions. For the first session, AF scored 15.5 seconds. This indicate that AF had poor strength for his lower extremities. Refer Table 1.0 for summary of the findings.

Table 1.0 Summary of Findings Derived from AF's Physical Examination.

Assesment Variables (OM)	First session	Second session	Third session
Range of motion 13	Both ankle active full range of motion	SAP	SAP
Muscle length Test 14	Bilateral calf muscle tightness	-	-
Special Test			
Tinel's Sign Test 15	NAD	-	-
Sensation Test			

Cont... Table 1.0 Summary of Findings Derived from AF's Physical Examination.

128-Hz tuning fork (Confirmed by medical doctor)	Impaired	-	-
Balance and Mobility Performances			
Berg Balance Scale 10	40	47	50
TUG Test 11	18 secs	14.3 secs	11.5 secs
Lower Extremities Strength			
5-times sit to stand test 12	15.5 secs	13 secs	11.5 secs

* Note: Same as previous = SAP; NAD = No abnormality detected

Assessment Findings

The analysis of this patient problems were discussed according to International Classification of Functioning, Disability and Health (ICF)¹⁶. The impairments were (i) bilateral calf muscle tightness, (ii) impaired sensation and balance of bilateral foot, and (iii) reduced lower limb strengths. This may leads to difficulties to prolong standing and walking. Thus, resulted in interferes with his participation restriction, which is difficult for travel. His short term goals are to improve flexibility of calf muscle within 3 weeks, improve strength of lower limb within 6 weeks and improve balance performance within 7 weeks. His long term goal is to regain optimum functional activity.

Discussion

Stretching training

During the first session of physiotherapy, there was bilateral calf muscle tightness had been noted on AF. Therefore, AF had been prescribed a calf stretching exercise in his first session of physiotherapy. Stretching exercise helps in improving extensibilities of soft tissues¹⁷.

Strengthening training

AF lower limb strength had been assessed using Five Times Sit to Stand Test (FTSS). Unable to complete the test less than 12 seconds is associated with increased risk of fall and weakness of lower extremities¹⁸⁻¹⁹. During first session of physiotherapy, AF take 15.5 seconds to complete his FTSS. This indicate that AF had reduced

strength of lower limb. Thus, AF had been prescribed with sit to stand exercise as a strengthening exercise, for 15 repetitions, 3sets, 3 times per week. Strengthening exercise helps in improving muscle mass and increased in muscle strengthening²⁰.

Balance training

Balance and mobility performance for AF was assessed using Berg Balance Scale and Timed Up and Go (TUG) test. This test is used to evaluate balance and predict risk of fall. Balance is defined as the ability to remain or return the body's centre of gravity within the base of support²¹. Balance is a complex skill that requires the integration of multiple sensorimotor and cognitive processes. Most of elderly with DPN commonly had a muscle loss and osteoporosis. Thus, the balance training must be in simple and safe, easy to follow and low to moderate intensity. This is to avoid harmful and trauma to the elderly during exercise.

Lower resistance and low intensity exercise with involvement of all major muscle is a form of exercise recommended for elderly with DPN. In order to improve motivation for elderly to engage in exercise, the exercise program must be interesting and cost-effective. Collective form of exercise, exercise along with music and home based exercise found to increase adherence of elderly²²⁻²³. Moreover, involving dual tasks in balance training found to improved balance performance²⁴. Therefore, the 'I-balance' training for AF seems to provide superior effects for improving overall strength and balance performance, and increase quality of life.

I-balance training module comprises of two phases. For beginning phase (i) Forward tandem walk, (ii) Reversed walking, (iii) Sideway walking and (iv)

3-meters turning walk, and (v) Clock reach. While for advance phase, (i) Forward tandem walk with head movement, (ii) Reversed tandem walk with counting backwards, (iii) Sideway walking with holding a glass of water, (iv) 3-meters turning walk with holding a glass of water and (v) Clock reach add on 1 pound weight cuff at wrist.

Conclusion

The 'I-balance' training programme found to be effective training in enhancing balance performances among elderly with DPN. This training programme involved dual and cognitive task training, turning mechanism and mimic daily functional activity. This I-balance may be incorporate with other strength and flexibility training act as multi-components in designing an exercise for elderly.

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Source of Funding: Self

Ethical Clearance: Taken from the Faculty of Health Sciences.

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Effect of Neuromuscular Electrical Stimulation Integrated with Closed Kinetic Chain Exercises on Strength of Quadriceps Muscle

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Abstract

Background & Objective: Electrical stimulation has been well studied in strengthening of weak muscles. Incorporating high-intensity NMES into rehabilitation program for muscle strengthening is an effective option available for restoring quadriceps strength. The clinical use of CKC has significantly increased during the past two decades as these exercises concentrates on a co-contraction of the quadriceps, hamstrings, hip flexors, soleus, and gastrocnemius muscles and are labeled as being “sport specific movements. Literature available till date has been largely inconsistent whether combining NMES with either of strength training will produce better results. Therefore, in present study we propose to integrate NMES and CKC exercises protocols in improving strength of Quadriceps Femoris.

Method: Thirty Healthy subjects were recruited, group A(n=10) combination technique, group B(n=10) NMES, group C(n=10), CKC group: were given training for 3 days/ week for 4 weeks.

Result and Conclusion: maximum improvement resulted in Group C, followed by Group A and minimum improvement in Group B.

Key words: Neuromuscular electrical stimulation, Closed kinetic exercise, Maximum isometric voluntary contraction, Quadriceps

Introduction

The quadriceps is the main muscle group that control knee movement and stability. Training the quadriceps muscle is an integral part of most sports strength programs. It is important to keep the quadriceps strong to allow for highest level of flexibility, as well as to prevent injury.¹

The key to protect the knee from pain or injury is the effective strengthening of quadriceps.⁶ Several

rationales for CKC exercises have been presented. CKC exercises are more “functional” as it stimulates the role of lower limb muscles in daily activities, differs in proprioceptive feedback, produce less shear force between the Tibiofemoral joint.^{2,9} Thus, biomechanically CKC exercise places less strain on Patellofemoral joint.⁸

NMES has a potential to override muscle activation deficits resulting from impairment in central nervous system processing. In addition, NMES activates a greater proportion of type II (fast twitch) muscle fibers when compared to volitional training exercise at a comparable intensity. Type II Fibers are essential for higher levels of force production and their activation may translate to improved functional performance.⁷ In present study we propose to integrate NMES with closed kinetic chain exercises in improving strength of Quadriceps Femoris.

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Clinically, this study will help in successful integration of NMES as an adjunct with the sports specific activities to improve the complex dynamic movements and thus improve functional abilities of athletes.

Method

Subjects

In group A 5 physically active male & 5 female subjects (age = 23.7 ± 1.1 ; height = 5.26 ± 0.24) In group B 5 physically active male & 5 female subjects (age = 23.8 ± 1.2 ; height = 5.55 ± 0.33) In group C 4 physically active male & 6 female subjects (age = 22.8 ± 1.1 ; height = 5.33 ± 0.24) were recruited according to following inclusion & exclusion criteria. Inclusion criteria, Healthy young men and women, of 20-30 yrs of age, who had not participated in any other form of systematic physical training for at least 4 weeks prior to the beginning of the study. Subjects were excluded if they had Significant knee injury, Participated in any other form of systematic physical training for at least 4 weeks of starting of the study. Contraindication to use of NMES, Any neurological symptoms and Hypersensitive skin. Subjects were selected randomly and divided in to 3 groups, Group A, Group B and Group C using lottery allocation system. Subjects were stratified by sex and randomly assigned to either a group A, group B, or group C. All subjects were assigned a number. The numbers were written on a small piece of paper and then placed into 2 separate boxes. The boxes contained the numbers representing female and male subjects, respectively. Numbers were drawn and returned to the boxes until all subjects were assigned to a group. All the males ($n=14$) were randomly assigned to the groups first, and then the females ($n=16$) were assigned to the groups. This method assured a random drawing and that the number of male subjects in each group was approximately equal. Group A individuals were given NMES and CKC exercise, Individuals in Group B were given NMES and Group C individuals were given CKC exercises only.

MVIC measurements

A strain gauge (gold tech) was used with quadriceps table. The subject was positioned on quadriceps table with knee flexion of 60 degrees. The trunk was in upright position and the subject was asked to hold the arms across the chest to prevent unwanted movements.

The strain gage was connected to the distal part of test leg by a non stretchable strap. The subject was asked to push the knee strap by knee extension till 60° . The subject was asked to produce maximal isometric voluntary contraction force (MVICF). Verbal cues like "more" and "more" was told so that subject applies maximal contraction. The measurements were repeated 3 times with a 1 minute rest and the maximum value was recorded as the MVICF. Then the mean of the 3 values of MVIC was taken as the MVICF value.

Electrical stimulation training protocol

The subjects in group 1 & 2 received 3 electrical stimulation sessions per week. The purpose made electrical stimulator was used to deliver 10 trains of electrical stimulation over a period of 10 minutes to each subject. The electrical stimulation was on 10 seconds and off 50 seconds of each minute and had a frequency of 50 bursts per second with a carrier frequency of 5000 Hz. The electrical stimulation consisted of a sinusoidal waveform that was interrupted every 10 milliseconds. Each sine wave in the train had a cycle duration of 200 microseconds. Two surface electrodes were positioned on the anterior surface of the right thigh. The proximal electrode was positioned transversely 15 cm distal to the right anterior superior iliac spine and over a point where the rectus femoris and vastus lateralis come together. The distal electrode was placed longitudinally on the muscle belly of the vastus medialis with the distal end 4 cm proximal to the superior pole of the patella.¹⁵ Following an initial session to familiarize subjects with NMES, each subject completed 10 isometric quadriceps contractions produced by electrical stimulation in an attempt to produce an isometric force at or above 60% of the MVIC.

Result

The Mean & SD characteristics of subjects in all 3 groups were calculated for age, height, and weight using ANOVA.(Table 1)

Between groups data analysis

The between group comparison showed that there is significant improvement between groups after 4 weeks of training. ($F= 4.844$, $p\text{-value}= 0.016$)

Table 1. Comparison of demographic data of all

3 groups

Variables	Group 1 Mean ± SD	Group 2 Mean ± SD	Group 3 Mean ± SD	ANOVA	
Age	23.7±1.1	23.8±1.2	22.8±1.1	F= 2.2	p= 0.13
Height	5.26±0.24	5.55±0.33	5.33±0.24	F=2.93	p=0.07
Weight	58.3±7.24	58.6±8.0	51±6.87	F= 3.39	p=0.04

The analysis revealed that both types of training i.e. NMES and CKC, influenced isometric strength of quadriceps

during study period. One – way ANOVA followed by Bonferroni’s correction for multiple comparisons was applied to data collected. There was significant effect when compared between the group 2 and group 3. Post hoc analysis showed that groups improved with training i.e. from pre to post1 to post2 to post3 and to post4. Result demonstrated that maximum improvement resulted in Group C after 4 weeks of training i.e only Closed Kinetic exercises, followed by Group A i.e. combined effect and minimum improvement in Group B i.e only NMES.

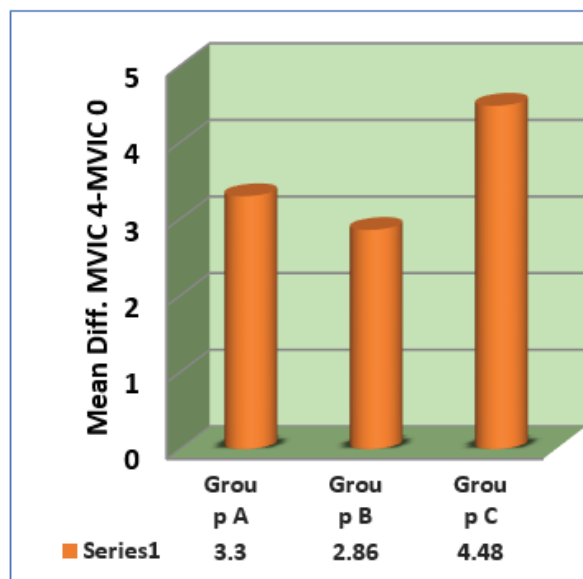
Within group analysis

In within group analysis repeated measures ANOVA followed by Bonferroni’s correction for multiple comparison was used. ANOVA shows that there was statistically significant improvement within all the 3 groups.

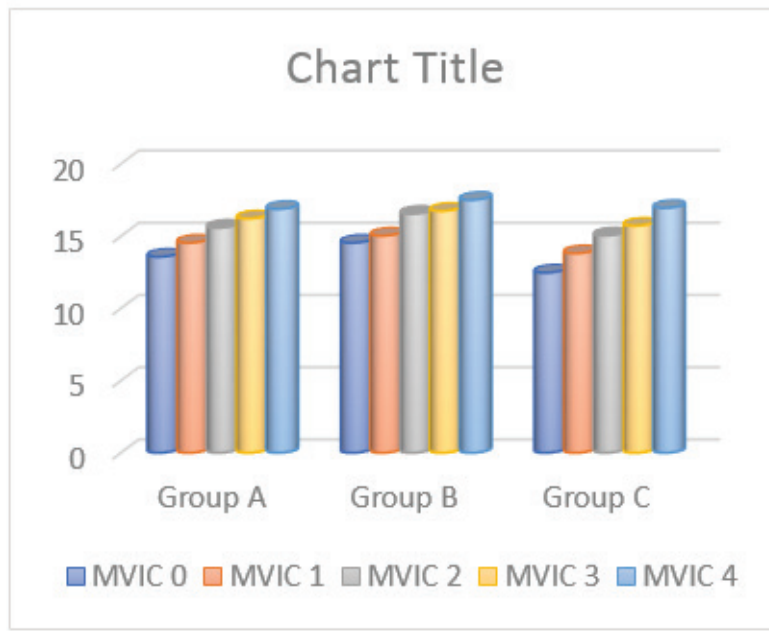
Discussion

The results of studies using NMES have been reported widely in the scientific literature. NMES has been shown to increase strength in healthy subjects ^{3,4,11,12,14,18}. NMES in combination with voluntary exercise has also been shown significantly effective in increasing strength in healthy subjects.¹³ and in those recovering from reconstructive surgery.^{16,19,20} There are many possible reasons why there were less strength

gains with NMES when compared with exercises alone. First explanation is that the results of previous studies mentioned could not be applied to healthy subjects as they were conducted on patients or impaired muscles. Another potential explanation for the lack of strength gains with NMES is the difference in skeletal muscle activation when achieved voluntarily versus involuntarily.



Graph 1 : Between groups comparisons of change in isometric strength of Quadriceps after training



Graph 2: Comparison of mean values for MVIC0, MVIC1, MVIC2, MVIC3, MVIC4 in all 3 Groups

Table 2 : Between groups comparisons of change in isometric strength of Quadriceps after training.

% change (MVIC4-MVIC0)	Group 1 Mean ± SD	Group 2 Mean ± SD	Group 3 Mean ± SD	ANOVA	
				F value	p- value
	3.30±1.20	2.86±1.16	4.48±1.23	4.84	0.016

With voluntary exercise muscles are recruited in an asynchronous fashion thus a greater number of fibers are involved in the training and fatigue is reduced. Whereas when training with NMES the same lower threshold fibers are recruited again and again so that fewer fibers are trained and fatigue is increased.¹⁷ The fatigue then results in less force later in the set thus a lower training stimulus, which was the case in the present study.¹⁰ Another reason if the intensity of electrical stimulation is not sufficiently high, then the CKC ex training is more efficient than Combined Technique to restore muscle strength.⁵

There is a consensus that the force increases induced by NMES are similar to, but not greater than, those induced by voluntary training. The rationale for the complementarity between NMES and voluntary

exercise is that in voluntary contractions motor units are recruited in order, from smaller fatigue resistant (type I) units to larger quickly fatiguable (type II) units, whereas in NMES the sequence appears to be reversed. As a training modality NMES is, in nonextreme situations such as muscle denervation, not a substitute for, but a complement of, voluntary exercise of disused and healthy muscles.⁸⁵ While associating NMES and exercise it therefore seems theoretically possible to completely or partially cumulate the physiological adaptations induced by each mode of muscle action performed separately.²¹ This reason may explain the results of our study that superimposition of two types of contraction induced greater neuromuscular adaptations than NMES practiced alone.

Maximum strength gains were seen in only exercise group i.e CKC exercise which was carried out using the DAPRE protocol. However, the muscular strength produced by CKC is superior to that produced by NMES. Two reasons can explain this phenomenon. First, with NMES, the maximum tolerated intensity supported by subjects is generally lower than that induced by a voluntary contraction because the electrical current unrelentingly generates noxious effects that limit the optimal spatial recruitment of the MUs. Secondly, NMES only stimulates the muscle on which the electrodes are placed. CKC movement implies activation from several synergic and stabilizer muscles, which are not stimulated by NMES. Hence, NMES does not facilitate intermuscular coordination and thus it does not induce great muscle strength in a mono- or poly- articular movement. With CKC, the strength gains are specific to the muscle action (e.g. isometric vs dynamic), velocity, joint position and movement patterns used in training. The strength gains induced by Combined Technique are thought to be less specific than those induced by CKC.²¹

Result for strength gains within group subjects demonstrated a significant improvement. Strength gains achieved during the 4 weeks probably represented an increase in neural adaptation. Moritani and DeVries reported that neural factors (increased motor unit recruitment) were responsible for initial strength gains and that muscle hypertrophy became more dominant after the first 3-5 weeks of training. Direct comparison of this study with others is not possible because of the paucity of CKC training studies.²² But in group B i.e. only NMES group there is reduction in strength gain results after 2nd week. This result may indicate short term effects of NMES on strength gains in healthy muscles. There is lack of evidences which proves minimum time duration for maintenance of strengthening effects of NMES on healthy muscles.

Limitation of the study were:

- As only healthy young adults were taken, generalization of our results on subjects of knee pathology are not possible
- Study was conducted only on dominant extremity.
- Study was conducted on sedentary subjects.

- Only isometric strength was measured.

Scope & suggestions for further research

- In future similar work can be done by taking more number of male subjects to compare the effects in male and female subjects.
- Strength training for other muscles of body can be done.
- Non dominant leg can be used or both legs strength training can be done.
- Since the study was done on a limited age group 20-30 yrs, it is advisable that similar work can be done including older or younger to included age group to allow for better generalization of the results.

Future Research

Since the present work examined the effects of 4 weeks of stimulation, it can be said that effects were mainly due to neuromuscular adaptations, In future researchers can undertake a study to examine the effects of a longer (> 4 wks) NMES program; to check for any hypertrophy caused by currents and for how long these effects are sustained i.e. the effects of detraining after cessation of current therapy.

Clinical Relevance

Clearly based on current evidence, it can be concluded that for healthy subjects and post – immobilization patients, NMES is likely to be more appropriate as an adjunct to rather than a replacement of volitional (quadriceps) strength training. For patients wearing casts, applying NMES via holes in the cast may be valuable to decrease the loss of strength.

Conclusion

The results of present study show that there is a significant improvement in strength gain by quadriceps muscles after 4 weeks training program of NMES using 5 KHz carrier frequency. But it is also seen that combining NMES with CKC ex's is much more beneficial to improve strength rather than giving NMES alone.

So, it may be concluded from present study that NMES may act as an adjunct therapy and not a replacement therapy for strength training and the better

mode for strength training remains CKC exercises or resistance training.

Ethical Clearance- Taken from...consent form's duly filled by volunteer's and by college committee

Source of Funding- Self

Conflict of Interest - NIL

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Physical Activity and Cognition: A Narrative Review

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Abstract

Introduction. Cognitive rehabilitation programs have traditionally focused on mental strategies targeting executive-functions, memory, and language. However, researchers are increasingly exploiting avenues to enhance benefits of cognitive training to facilitate neuroplasticity through integrative therapies. **Purpose.** The aim of this paper is to provide an overview of the evidence that supports addition of physical activity into traditional cognitive rehabilitation, creating a more integrated treatment approach. Specifically, the evidence focuses on increased levels of Brain-Derived neurotrophic factor (BDNF), a specific growth factor in neuroplasticity, following physical activity. **Method.** This narrative review chose a representative sample of the evidence that informs cognitive gains as a result of physical activity, with an emphasis on BDNF. A comprehensive review of the literature was conducted across PubMed, Cinahl, and PsycInfo, and a representative sample of the evidence was selected that informs the effects of physical activity on cognition, as well as the relationship with BDNF. **Conclusion.** The review supports the addition of physical activity into cognitive rehabilitation programs to enhanced cognition in clinical populations. However, more evidence is needed to support the duration and type of activity that would produce the most benefit.

Key words: BDNF, Brain injury, Cognition, Cognitive rehabilitation, Physical activity

Introduction

Genetic composition, environment, lifestyle factors including nutrition, physical activity, and comorbid diseases are just a few of the aspects that play a role in cognitive health.¹ Cognitive rehabilitation programs have traditionally focused on mental strategies targeting executive functions, memory, and language. However, researchers are increasingly exploiting avenues to enhance benefits of cognitive training to facilitate neuroplasticity through integrative therapies that further enhance cognition. Neuroplasticity refers to the neuron's ability to change, restructure, or create synaptic pathways when confronted with a new or changing environment such as an injury to the brain.² One such approach, to promote neuroplasticity, is the addition of physical activity to existing cognitive training paradigms.

Recent research has supported the positive effects of physical activity on cognition.³⁻⁷ Specifically, research is highlighting the association between physical activity and cognition by identifying the role of a specific growth factor, Brain-Derived Neurotrophic Factor (BDNF) that promotes neuroplasticity and structural changes in the brain following exercise. In other words, this approach of adding physical exercise/ activity to cognitive training proposes that motor and cognitive plasticity could work hand-in-hand during rehabilitation.

Physical activity is yet to be incorporated as a standard treatment strategy in cognitive rehabilitation. This integrative approach of incorporating physical exercise in cognitive remediation is highly relevant to therapists, specifically those working in neurorehabilitation. This knowledge could greatly impact therapy interventions and functional outcomes for individuals recovering from a brain injury. This narrative review highlights benefits of physical activity on cognition and suggests possible treatment guidelines that could be implemented in cognitive rehabilitation. Specifically, the review highlights the role of BDNF-levels post-exercise/activity

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and its effect on cognition. The review summarizes selected literature that supports addition of physical activity into cognitive rehabilitation, creating a more integrated approach.

Brain-derived Neurotrophic Factor (BDNF)

Discovered in 1982, BDNF is a nerve growth factor protein.⁸ The term “neurotrophic” means that the BDNF protein stimulates or promotes growth in nerve cells.⁸ Because of its known ability to influence the growth and survival of neuronal cells, BDNF has been widely studied in the neuroscience field to gain a better understanding of the depth of influence.

Initial studies demonstrated BDNF as a key mediator in affecting pathways that enhanced neural plasticity and synaptic transmission.⁹⁻¹¹ BDNF is identified as a primary modulator important for synaptic transmission. Researchers discovered that an increase in the BDNF levels in the brain can activate molecular pathways important for neurogenesis, specifically in the hippocampus, which is responsible for learning and memory.¹²⁻¹³ The key for improving BDNF levels is to increase blood flow, which has been linked to aerobic exercise and physical activity.

Methods

The narrative review of literature chose a representative sample of the evidence that informs cognitive gains as a result of physical exercise/activity, with an emphasis on BDNF. The review of the literature was conducted in a search including PubMed, Cinahl, and PsycInfo. Search terms included (cognition) AND (physical activity OR physical exercise) AND (brain-derived neurotrophic factor OR BDNF). Inclusion criteria included sources were written in English and was within the last 20 years (1998-2018). Exclusion criteria included pediatric and adolescent populations.

Effect of Physical Activity on BDNF Levels

Results from healthy control studies demonstrate benefits of physical activity in improving BDNF levels. Tang,¹⁴ found short-term increases in BDNF levels lasting 25-50 minutes following exercise. Szuhany,

Bugatti, and Otto⁷ suggests that every session of exercise results in a ‘dose’ of BDNF activity, which can be increased in magnitude with each successive session of exercise. That is, regular physical exercise has a cumulative effect on BDNF, resulting in long-term benefits.

The key ingredient to stimulating the growth of BDNF is increasing blood flow, which can be achieved by participation in any kind of aerobic activity. Recreational and social activities of billiards, bowling, arts and crafts, and cooking are found to be as effective as treadmills and bicycles in increasing BDNF levels, and lead to improvements in memory and executive functioning, both in short-term and long-term.¹⁵

Research has found limited influence of strength training in increasing BDNF levels, memory, or overall cognition.¹⁶⁻¹⁸ Further research to determine specific parameters of activity, including type and duration, and cognitive outcome measures are still required. This additional research may refine exercise paradigms to the optimal length and intensity to result in increased BDNF levels.¹⁹⁻²⁰

Effect of Increased BDNF Levels on Cognition

Increased levels of BDNF due to physical activity have been shown to improve cognition. Erikson²¹ discovered that an aerobic exercise program increased BDNF levels and also reversed the age-related hippocampal volume loss as well as improved memory function in healthy older adults. This supports other research illustrating that exercise can have positive effects on the hippocampal region of the brain, an area vulnerable to both age-related decline and dementia. Additional research has demonstrated effects of physical activity on increased BDNF levels in the entorhinal cortex and memory function,²² improved executive functioning in older adults.^{5,23} The global cognitive gains experienced from exercise have also been found in populations with multiple sclerosis, panic disorder, and survivors of stroke.^{15, 24-25} We propose the following visual schematic (Figure 1) to illustrate the impact of physical activity on cognition.

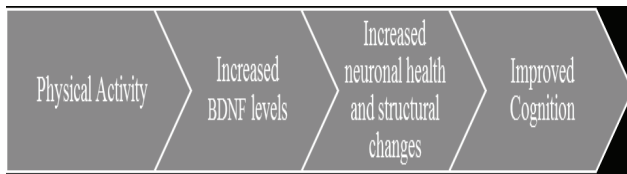


Figure 1: Effects of Physical Activity on Cognition

A positive correlation was found between BDNF levels and cognition in older adults with a mild cognitive impairment.²⁶ The results indicated increased cognitive performance in visual learning, speed of processing, and working memory, particularly in the groups with the combined cognitive and aerobic training.²⁷ Physical activity was also found to be successful in improving cognition and ADLs in individuals with dementia.²⁸ In this systematic review, researchers found that the addition of general exercise into older adult's routines may slow the advance of cognitive decline and in turn, reduce the dependence with ADLs.

Effect of Increased BDNF Levels on Psychological Health

The BDNF pathway is one of several known pathways associated with depression and cognitive impairments in older adults.²⁹ Decreased BDNF levels are associated with deficits in functioning as noted in individuals with depression, schizophrenia, cognitive impairments, and panic disorder.^{25, 27} Significant gains were reported following four weeks of integrative therapies (i.e., cognitive plus aerobic training) versus exclusively cognitive training in adults with psychiatric illness (e.g. schizophrenia, major depressive disorder).²⁷ Older adults with lower BDNF levels are at an increased risk for depression.⁶ A recent study on neuronal function including cognition and mood, examined individuals with depression and utilized the international American College of Sports Medicine standard of 150 minutes per week of moderate to vigorous exercise. This resulted in improved neural efficiency due to increased cardiovascular fitness, positively affecting aspects of cognition and associative memory. This neurocognitive increase was associated with an increase in Add Major Depressive Disorder (MDD) BDNF levels.³⁰ In a recent study, individuals with MDD are shown to have lower levels of BDNF as compared to healthy adults. The researchers found that when individuals with MDD were treated with a combination of SSRIs and physical

activity, BDNF serum levels increased nearly to those of the healthy population.³¹ Research is continually showing the benefits of increased BDNF levels associated with physical activity in the MDD population.

Discussion

Residual cognitive, psychological, and physical impairments are often attributed to discouraging functional outcome in chronic stages of recovery post brain injury.³² Therefore, researchers and clinicians are beginning to recognize the benefits of integrative approaches to mitigate chronic long-term functional challenges. That is, physical exercise such as aerobics and other fitness regimens are integrated into cognitive training programs. These integrative approaches have demonstrated gains in both preservation (in healthy adults) and enhancement (in adults with brain injuries) of cognitive and psychological function.³³⁻³⁵ This review highlights the therapeutic interplay between cognition and physical activity. We propose integration of physical activity as a critical component in cognitive rehabilitation approaches in clinical populations (Figure 2).

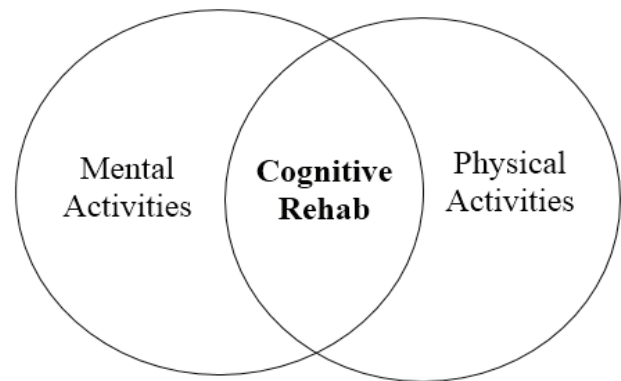


Figure 2: Proposed components of Cognitive Rehabilitation

Integrating physical activity and exercise into the traditional cognitive rehabilitation training is a way to further benefit outcomes for multiple clinical populations. As the research has shown, benefits from increased BDNF levels following physical activity have been present in many populations including stroke, MS, MDD, schizophrenia, and panic disorder. In sum, evidence from both healthy adults and clinical populations show promise in cognitive gains following physical exercise/activity.

Limitations and Future directions

The narrative review is a broad overview of a specific topic of interest, with no predefined protocol. Therefore, the selection of articles is selective to summarize the benefits of physical exercise on cognition. The results may be biased as we did not systematically examine all evidence that critically analyses the benefits of physical exercise on cognition. Further research is needed to precisely understand the dosage and frequency of physical exercise that can cause positive long term changes in cognition. Furthermore, the gains of physical exercise on cognition in different clinical populations needs to be discerned.

Clinical Implications

Physical activity/ exercise could increase production of BDNF levels, which has been linked to cognitive benefits. Although more research is needed to determine specific exercise/activity modalities and parameters to accompany cognitive programs; the evidence present has significant implications for practitioners.

What can the addition of physical activity in cognitive rehabilitation programs look like to a practitioner? Based on the literature reviewed, the following are intervention strategies that supplement cognitive training with physical activity. Have a client walk or jog for 10 minutes prior to cognitive activities, alternate between physical activity and cognitive tasks, or combine cognitive tasks with physical activity rather than performing tasks on a tabletop. For instance, training in problem solving strategies could incorporate walking during a scavenger-hunt versus doing a paper-pencil worksheet. Engaging clients in functional tasks increases activity naturally, and physical activity can be easily added into programs through treadmills, standard walking, ellipticals, or bikes to name a few modalities. Adding physical activity is a simple way to build on the benefits of cognitive retraining, these strategies require little more than creativity added into therapy sessions.

Additional research is needed to lend knowledge to practitioners about specific boundaries for inclusion of physical exercise/activity in cognitive rehabilitation programs. At this time, the evidence summarized in this paper identifies generalized exercise as a course for increasing BDNF levels to facilitate cognitive gains.

Conclusion

Integrating physical exercise to enhance cognition is a feasible, cost effective and potentially valid treatment paradigm in cognitive rehabilitation. This review provides evidence of the benefits of physical activity on cognition and supports the initiative to incorporate physical exercise/activity into cognitive training. Further research on duration and types of exercise/activity is warranted to provide clinicians with evidence-based protocol for implementing physical activity in cognitive rehabilitation.

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The Efficacy of Eccentric Training Versus Concentric Training Along With Therapeutic Ultrasound Therapy for Pain and Functioning in Subjects with Lateral Epicondylitis

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Abstract

Background: Lateral Epicondylitis is a disabling musculoskeletal condition leading to pain and/or tenderness around the elbow. A common presentation may show pain and tenderness over the lateral epicondyle of the humerus, the radial head, the fascia, between the origins of extensor muscles as well as radiating into the forearm.

Materials & Methodology: Patients with Lateral Epicondylitis (n=20) were included in this study and patients with fracture of upper limb, radiculopathies, undergoing steroid therapy, rheumatoid arthritis were excluded from the study. A comparative study was done where two groups were made, Group A (n=10) received Eccentric exercise along with Ultrasound Therapy and Group B (n=10) received Concentric exercise along with Ultrasound Therapy. Treatment was given for 3 times a week for 3 weeks. Pain was assessed using Numerical Pain Rating Scale and functional disability was assessed using Patient Rated Tennis Elbow Evaluation.

Results: Group A showed significant decrease in pain and functioning as compared to Group B. Mean pre NPRS of eccentric subjects was 6.70 which was significantly higher than mean post NPRS 6.30 (p<0.001). Mean pre NPRS of concentric subjects was 6.30 which was significantly higher than mean post NPRS 2.60 (p<0.001). Mean pre PRTEE of eccentric subjects was 53.90 which was significantly higher than mean post PRTEE 12.85 (p<0.001). Mean pre PRTEE of concentric subjects was 55.45 which was significantly higher than mean post PRTEE 23.50 (p<0.001)

Conclusion: The study concluded that Eccentric exercise along with Ultrasound Therapy is more effective than Concentric exercise along with Ultrasound Therapy.

Keywords: Lateral Epicondylitis, Eccentric Exercise, Concentric Exercise.

Introduction

Lateral Epicondylitis is a disabling musculoskeletal condition leading to pain and/or tenderness around the elbow.¹ It is a degenerative or failed healing tendon response characterised by the increased presence of fibroblasts, vascular hyperplasia, and disorganised collagen in the origin of the extensor carpi radialis brevis (ECRB). It occurs due to work or sport related pain disorder usually caused by excessive quick, monotonous, repetitive eccentric contractions and gripping activities of the wrist. The patient mainly complains of pain and decreased function, both of which may affect activities of

daily living.² The estimated annual incidence in general population is 1-3%.³ It is clinically diagnosed by pain over the lateral epicondyle of humerus, resistive wrist extension and middle finger extension. If left untreated it may lead to chronic pain syndrome, sensitivity and pain in lateral epicondyle.² A common presentation may show pain and tenderness over the lateral epicondyle of the humerus, the radial head, the fascia, between the origins of extensor muscles as well as radiating into the forearm. Many people complain of weak and painful grasp, eventually shaking hands along with which turning a door handle, picking up a milk carton or carrying a briefcase may cause severe pain around the

lateral epicondyle.⁴

The main goals of treating Lateral Epicondylitis are to reduce pain, recovery time and overload over the arm along with improvement in function. Physiotherapy is a conservative treatment that is usually used for treating patients with Lateral Epicondylitis. Conservative treatment involve orthotics, cryotherapy, extracorporeal shock wave therapy (ESWT), ultrasound(US), laser, acupuncture, massage, manipulation-mobilization, therapeutic exercises, and pharmacological treatment.⁵

Materials and Method

An approval for the study was obtained from the Institutional Ethical Committee. A randomized Control trail was conducted in subjects with Lateral Epicondylitis in Physiotherapy OPD of Tertiary Care Hospitals of Miraj. Sample was achieved by simple random sampling method. A total of n=20 subjects were selected. All the subjects were screened for inclusion criteria i.e. Both males and females of age 25-50 years, Subjects with positive Cozen's test and Mill's test, willingness of subjects. Subjects excluded were those having recent fractures of upper limb, subjects undergoing steroid therapy, rheumatoid arthritis, history of neurological deficit and unwilling subjects. Subjects were divided into two groups with: Group A=10 subjects Group B=10 subjects. Subjects were briefed about the nature of the study and intervention. The demographic data including age, height, gender, weight, side affected, duration of symptoms was collected through data sheet. Subjects were given written consent prior to the intervention. Group A subjects were treated with Therapeutic Ultrasound Therapy and Eccentric exercise and Group B was treated with Therapeutic Ultrasound Therapy and Concentric exercise. The data was collected pre-treatment and post-treatment using Numerical Pain Rating Scale(NPRS)⁶ and Patient Rated Tennis Elbow Evaluation Questionnaire(PRTEEQ)⁷.

NUMERICAL PAIN RATING SCALE: Pain intensity is measured on a 11-point pain intensity numerical rating scale, where 0=no pain and 10=worst possible pain.10 Reliability=0.94⁶.

PATIENT RATED TENNIS ELBOW EVALUATION QUESTIONNAIRE: It is a 15-item self-reported questionnaire to measure perceived pain

and disability in people with tennis elbow. It has three subscales: pain, usual activities and specific activities. Each of the items of the PRTEE is scored on a 0–10 scale, where 0 is 'no pain' or 'no difficulty' and 10 is 'worst ever' or 'unable to do. Reliability and internal consistency were excellent (PRTEE pain subscale, 0.94; PRTEE specific activities subscale, 0.93; PRTEE usual activities, 0.85).⁷

ULTRASOUND THERAPY: The patient was positioned in sitting position with pillow placed under the arm. The area to be examined was exposed and cleaned. The ultrasound probe was placed over the point of maximal tenderness in the region of the lateral epicondyle⁸. Treatment duration was 6 minute.⁸ A coupling gel was applied to the probe and patients were given the device 3 times a week over a 3-week period.⁸ Parameters: Mode= Pulsed output, Frequency= 1 MHz, Intensity= 0.8-1.5 watt/cm², Duration= 6 minutes.

ECCENTRIC EXERCISE: It was performed on a bed with the elbow supported on the plinth in full extension, forearm in pronation, wrist in extended position (as high as possible), and the hand hanging over the edge of the bed². In this position, subjects flexed their wrist slowly until full flexion is achieved, and then return to the starting position². Subjects were instructed to continue with the exercise even if they experience mild pain². However, they were instructed to stop the exercise if the pain becomes disabling². They performed three sets of 10 repetitions at each treatment session, with at least a 1 min rest interval between each set². When subjects were able to perform the eccentric exercises without experiencing any minor pain or discomfort, the load was increased using free weights or therabands.².

CONCENTRIC EXERCISE: Sit on a chair next to a table that has an edge or an overhang. Bend the elbow to 90°; palm should be facing the floor. Slowly lower the weight, then slowly raise it toward the ceiling.⁹ In this position, subjects extended their wrist until full extension is achieved, and then return to the starting position. Subjects were instructed to continue with the exercise even if they experience mild pain. However, they were instructed to stop the exercise if the pain becomes disabling. They performed three sets of 10 repetitions at each treatment session, with at least a 1 min rest interval between each set. When subjects were able to perform

the concentric exercises without experiencing any minor pain or discomfort, the load was increased using free weights or therabands.

Findings

The subjects were divided into two groups i.e. Group A (n=10) and Group B (n=10). Table 1 show that, there were 7(70%) female subjects and 3(30%) male

subjects with lateral epicondylitis receiving eccentric exercise along with ultrasound therapy. Data analysis was performed with SPSS version 20.0. The level of significance for Numerical Pain Rating Scale and Patient Rated Tennis Elbow Evaluation Questionnaire was calculated by applying an unpaired t-test. And there were 5(50%) female subjects and 5(50%) male subjects with lateral epicondylitis receiving concentric exercise along with ultrasound therapy.

Table 1: Gender Distribution of subjects with lateral epicondylitis receiving eccentric and concentric exercise along with ultrasound therapy

Gender	Eccentric		Concentric		Total	
	Frequency	%	Frequency	%	Frequency	%
Females	7	70	5	50	12	60
Males	3	30	5	50	8	40
Total	10	100	10	100	20	100

After the application of the unpaired t-test the outcome exhibited a significant ($p=0.01$) reduction in pain and in Eccentric exercise with Ultrasound therapy (Group A) as compared to Concentric exercise with Ultrasound therapy (Group B). And there was a high significance ($p<0.01$) reduction in functional disability in Eccentric exercise with Ultrasound therapy (Group A) as compared to Concentric exercise with Ultrasound therapy (Group B). Table 2

Table 2: Descriptive statistics of subjects with lateral epicondylitis receiving eccentric or concentric exercise along with ultrasound therapy on pain using Numerical Pain Rating Scale (NPRS) and on functioning using Patient Rated Tennis Elbow Evaluation Questionnaire (PRTEE) and its comparison using unpaired t test.

Group Statistics	Group	N	Mean	Std. Deviation	Unpaired t statistic	p value
Pre NPRS	Eccentric	10	6.70	1.25	0.65	0.53
	Concentric	10	6.30	1.49		
Post NPRS	Eccentric	10	1.60	0.97	2.89	0.01
	Concentric	10	2.60	0.52		
Pre PRTEE	Eccentric	10	53.90	11.80	0.29	0.77
	Concentric	10	55.45	11.96		
Post PRTEE	Eccentric	10	12.85	7.82	3.54	<0.01
	Concentric	10	23.50	5.44		

Mean pre NPRS of eccentric subjects was 6.70 and mean pre NPRS of concentric subjects was 6.30. Mean post NPRS of eccentric subjects was 1.60 which was significantly lower than mean post NPRS of concentric subjects was 2.60 ($p=0.01$). Pain on wrist extension was reduced post-treatment in both the groups but significantly reduced in Group A i.e. Eccentric exercise along with Ultrasound Therapy. Mean pre PRTEE of eccentric subjects was 53.90 and mean pre PRTEE of concentric subjects was 55.45. Mean post PRTEE of eccentric subjects was 12.85 which was significantly lower than mean post PRTEE of concentric subjects was 23.50 ($p<0.01$). Therefore, functioning was improved

post-treatment in both the groups but significantly improved in Group A i.e. Eccentric exercise along with Ultrasound Therapy performing eccentric exercise along with ultrasound therapy.

Table 3: Descriptive statistics of subjects with lateral epicondylitis receiving eccentric or concentric exercise along with ultrasound therapy on pain using Numerical Pain Rating Scale (NPRS) and on functioning using Patient Rated Tennis Elbow Evaluation Questionnaire (PRTEE) and its comparison using paired t test.

Group Statistics	Group	N	Mean	Std. Deviation	Paired t statistic	p value
Pre NPRS	Eccentric	10	6.70	1.25	10.58	<0.001
Post NPRS	Eccentric	10	1.60	0.97		
Pre NPRS	Concentric	10	6.30	1.49	41.05	<0.001
Post NPRS	Concentric	10	2.60	0.52		
Pre PRTEE	Eccentric	10	53.90	11.80	8.75	<0.001
Post PRTEE	Eccentric	10	12.85	7.82		
Pre PRTEE	Concentric	10	55.45	11.96	9.28	<0.001
Post PRTEE	Concentric	10	23.50	5.44		

Paired t test was done to compare between subjects with lateral epicondylitis receiving eccentric and concentric exercise along with ultrasound therapy.

It was found that Mean pre NPRS of eccentric subjects was 6.70 which was significantly higher than mean post NPRS 6.30 ($p<0.001$). Mean pre NPRS of concentric subjects was 6.30 which was significantly higher than mean post NPRS 2.60 ($p<0.001$). Mean pre PRTEE of eccentric subjects was 53.90 which was significantly higher than mean post PRTEE 12.85 ($p<0.001$). Mean pre PRTEE of concentric subjects was 55.45 which was significantly higher than mean post PRTEE 23.50 ($p<0.001$).

Discussion

Our study showed that Eccentric exercise along with Therapeutic Ultrasound Therapy (Group A) and Concentric exercise along with Therapeutic Ultrasound Therapy (Group B) both were effective for pain relief and functioning associated with Lateral Epicondylitis. But improvement with Eccentric exercise along with Therapeutic Ultrasound Therapy was much greater as compared to Concentric exercise along with Therapeutic Ultrasound Therapy. This study confirmed that Eccentric exercise along with Therapeutic Ultrasound Therapy is

capable of producing hypoalgesic effect by the end of 3rd week. There was significant improvement ($p < 0.01$) in the Eccentric group as compared to Concentric group. Improvement in NPRS and PRTEE in both the groups were observed.

The rationale for the protocol of this regimen is that stressing the attachment of the ECRB through progressive eccentric and concentric resistance exercises results in the formation of a dense collagenous scar in the area of attachment; thus, pain is eliminated. This idea is supported by the work of Curwin and Stanish,⁹ who wrote that the tension created through eccentric contractions allows the formation of new fibrous tissue at the musculotendinous unit, making it more resistant to damage. Effects of eccentric training on tendonitis include “lengthening” of the muscle-tendon unit, which might result in less strain during elbow joint motion, or “loading” of the muscle-tendon unit, which might increase the tensile strength of the tendon and cause hypertrophy of the muscle belly. Both eccentric and concentric contractions increase muscle strength, but the former improve muscle strength more than the latter. Curwin and Stanish postulated that only eccentric contractions sufficiently produces the tension necessary for forming fibrous tissue at the musculotendinous structure, allowing adaptation to increased tension. These powerful contractions often result in soreness and potential damage to the muscle itself. On the basis of these findings, Walmsley et al stated that the addition of concentric contractions decreases muscle tension during the training regimen, thus minimizing muscle soreness and damage.⁹

In the previously published RCT, the effectiveness of home exercise programme was compared with ultrasound. Pienimaki et al found that the home exercise programme was more effective treatment than ultrasound at the end of the treatment. However, their treatment protocol was totally different to that employed in the present report and research should continue to investigate the long-term effects of their treatment methods.²

There are many different approaches to the treatment of chronic lateral epicondylitis, such as phonophoresis or iontophoresis, corticosteroid injections, extracorporeal shockwave therapy, topical nitric oxide, and bracing.

These are commonly provided independently or as part of standard physical therapy. With respect to eccentric training for chronic lateral epicondylitis, Croisier et al⁸ compared isokinetic eccentric wrist extensor training to standard physical therapy. Pain reduction, disability questionnaire scores, and muscle strength were significantly better in the eccentric group. The effects of eccentric training on pain scores were very similar to the present study. Interestingly, the control groups in both studies also showed similar changes in pain. Different disability questionnaires were used, and those results are not directly comparable. Additionally, Croisier et al chose not to measure wrist extension strength pre-treatment and only compared groups post-treatment, at which point the eccentric group were 1-10% stronger on the involved side while the standard treatment group were 28-38% weaker on the involved side.³

Conclusion

In this study there was significant difference between Eccentric exercise and Concentric exercise along with Therapeutic Ultrasound Therapy protocol in treating Lateral Epicondylitis. Eccentric exercise along with Therapeutic Ultrasound Therapy was more beneficial than the Concentric exercise along with Therapeutic Ultrasound Therapy in eliminating pain and improving function.

The Eccentric and concentric exercise we describe is inexpensive, effective and convenient. Patients must have tolerance for pain. Also, the patient must be provided with detailed instruction sheet to enable them to safely perform the exercises at home. Limitation being that Group B i.e. Concentric exercise along with Therapeutic Ultrasound Therapy had exactly 50% female subjects and 50% male subjects but Group A had 70% female subjects and 30% male subjects. Therefore, the study is bias as the Eccentric group did have equal number of males and females as the Concentric group. Further, research might be carried out on the long-term effect of the exercises with a large population.

Conflict of Interest: None.

Source of Funding: Self.

Ethical Clearance: The ethical clearance was obtained from The Institutional Ethical Committee of

College of Physiotherapy, Wanless Hospital, Miraj Medical Centre, Miraj

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Correlation between the Hand Grip Strength and the Shoulder Rotator Cuff Function

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Abstract

Aim of the Study: To know if there is correlation between handgrip strength and shoulder rotator cuff function.

Materials and Method: total of 60 healthy, male volunteers with no history of shoulder, upper limb or neck injury comprised the study group. The mean (SD) age was 20 ± 0.64 years (range 20 years to 25 years). Grip strength (measured with hand grip dynamometer) and lateral rotator strength (measured with Manual Muscle Testing) was measured at neutral, 90° abduction, and 90° abduction with 90° external rotation.

Results: The correlation test revealed that there is significant correlation between handgrip strength and lateral rotator cuff function in neutral and 90° abduction and lateral rotation. While it showed negative correlation between in 90° abduction position.

Conclusion: This cross-sectional study concluded that there is positive correlation between neutral and 90° abduction and negative correlation in 90° abduction position.

Keywords: hand grip, lateral rotator strength, rotator cuff, shoulder, hydraulic hand held dynamometer

Introduction

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. ⁽¹⁾ Shoulder pain could occur due to many factors including psychosocial work environment and physical load. That might cause inability to work, loss of productivity, and inability to carry out household activities which can be a considerable burden to the patient as well as to society. ⁽²⁾ Optimal rotator cuff function requires strong healthy rotator cuff muscles, tendons and bony attachments, normal capsular laxity, an even curve of the coraco-

acromial arch, a thin synovial bursa and coordinated co-contraction of the cuff muscles acting in force couples ⁽³⁾ In addition to the obvious biomechanical factors of arm posture and hand load, gripping and cognitive effort have also been shown to increase shoulder load and the risk of injury. ⁽⁴⁾ The rotator cuff muscles function dynamically as secondary stabilizers by contracting in a coordinated and synergistic way to hold the humeral head throughout abduction. Internal rotation strength is primarily the result of the subscapularis, pectoralis major, latissimus dorsi, and teres major; the contribution of each of these is dependent upon shoulder position. ⁽⁵⁾ Due to repetitive micro trauma and eccentric overload, resulting in muscle-tendon injury. Subtle instabilities of the gleno-humeral joint may cause impingement within the sub-acromial space. ⁽⁶⁾ Due to the repetitive micro trauma to the articular site of the rotator cuff might cause the tendon to become compressed between the superior posterior glenoid rim and humeral head. ⁽²⁾ Disruption of this complex mechanism predisposes to a cycle of movement impairment and tissue pathology, leading

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to anterosuperior migration of the humeral head and subsequent impingement of the sub acromial structures under the coracoacromial arch.⁽³⁾ It has been estimated that rotator cuff problems, including impingement and associated rotator cuff tendonitis and bursitis, account for nearly one-third of physician visits for shoulder pain complaints. If not alleviated, impingement can progress to tears of the rotator cuff tendons.⁽⁷⁾ Manual muscle testing was developed by Lovett and described by Wright⁷ in 1912. This technique has been revised, advanced, and promoted, resulting in several methods from which to choose.⁽⁸⁾

Manual Muscle Testing is an attempt to assess the maximum force a muscle is capable of generating maximum force generated depend greatly on the function and the size of the muscle. The force produced by the muscle can be classified according to the grades given in the Kendall and Kendall muscle testing and function.⁽⁹⁾ The MMT would be used to assess the strength of glenohumeral rotation in different patient and different shoulder position. Measurement of the handgrip strength is used during rehabilitation to compare the normal values or to compare the dominant with non-dominant limb.⁽¹⁰⁾ Hand muscle activity, mainly gripping, is an essential part of kinesiology many work- and sport-related activities which can contribute to upper limb disorders. Stabilization of the glenohumeral joint by the Supraspinatus and Infraspinatus rotator cuff muscles is an essential for hand grip activity.⁽¹¹⁾ while changes in arm posture, hand loading and shoulder angular velocity have all been shown to affect shoulder muscle activity, they have done so under constrained conditions.⁽¹²⁾ The hand has to be able to undertake extremely fine and sensitive movements and must also be able to perform tasks which require considerable force. The ability to grip and manipulate an object may be one of the most important functions of the hand, and any deterioration in this ability can impair activities of daily living.⁽¹³⁾ Hand grip strength measurement is useful in the assessment of individuals who suffering from impairments in daily life tasks, measurement of the integrity of upper extremity function, and effectiveness of hand rehabilitation procedures.⁽¹⁴⁾ The hand grip strength can be measure by the dynamometer. The person has to squeeze the hand around the dynamometer and the static force is measured. The force is usually measured in kilogram and

pound. The grip strength can be measured quantitatively using a hand dynamometer and that would provide objective index of the functional integrity of hand as well as the upper extremity.⁽¹⁵⁾ The comparison between the hand dynamometer and isokinetic dynamometer is moderate and hand dynamometer is inexpensive. Hence it is preferred.⁽¹⁶⁾ The handgrip strength can be checked with the hydraulic dynamometer the reliability values of test-retest ($0.58 \leq ICC \leq 0.97$) and inter-rater ($0.60 \leq ICC \leq 0.98$).⁽¹⁸⁾ Manual muscle testing is a clinically useful tool for checking manual muscle testing.⁽¹⁹⁾ Previous study claim strong correlation between grip strength and lateral rotator strength at all position for both left and right hands. That study show that grip strength can be reliably used to assess the function of the lateral rotators of the shoulder in normal individuals.⁽¹⁰⁾ Population studies have reported that in musculoskeletal pain, shoulder pain is the most frequently reported pain. Shoulder pain is often presented together with other pain symptoms and is considered to have multifactorial causes and symptoms.⁽¹⁹⁾ Where most common shoulder disorder is shoulder impingement in primary care.⁽²⁰⁾ And it is seen in several studies that after the sub acromial impingement there would be presence of weakness or suboptimal recruitment of rotator cuff muscles.^{(21), (22)} Shu-Wen Wu et al. found that the grip strength depends upon the factors like gender, age, palm length, grip position, and grip span. The grip strength can be used to recognize the overall strength of the upper limb.⁽⁸⁾

Methodology

Materials and Method :SOURCE OF POPULATION- The volunteer were taken from Uka Tarsadia University. **Study Design-** This is a cross-sectional study. **Sample Size-60.** **Study Population-** 50 male volunteer participated in the study. **Material Used-** Pen ,Consent Form ,Plinth ,Hydraulic hand held dynamometer (SH5001) (reliability- 0.99)⁽¹⁷⁾ , chair. **Inclusion Criteria-** Gender- male, Healthy male ,Age- 20-25year, Manual Muscle Testing- grade 4 and 5. **Exclusion Criteria-**Manual Muscle Testing- Grade- 1, 2 and 3 History of shoulder pathology History of wrist pathology History of elbow pathology **Outcome Measure-** The grip strength would be measured using hydraulic hand held dynamometer (SH5001) (reliability- 0.99)⁽¹⁷⁾

And the rotator cuff strength would be measured using manual muscle testing. **PROCEDURE-** The present study was initiated once the clearance obtained from the institutional committee of ethics of the Shrimad Rajchandra of physiotherapy, where in a total of 50 subject who were found satisfying all the inclusion criteria were included. Detailed information of the procedure was given to the each subject and as a formality towards the willingness to be a part of the study they were told to sign a written consent. After taking a written consent all the patient were asked to rest on plinth or chair. All test were performed in a well-ventilated room. Then the assessment of rotator cuff strength was started firstly, Assessment of rotator cuff strength: Lateral rotation would be tested by a manual muscle testing (MMT). **SHOULDER EXTERNAL ROTATION:** Position of the patient: patient should lie in side line. With the arm supported on the trunk and elbow flexed. A towel should be placed between the arm and the trunk. Position of therapist: standing at the back of therapist at the level of waist. One hand is used to give resistance over the forearm, as near the wrist as possible. Another hand supporting the elbow to provide the counter pressure at the end range. Test- patient moves forearm upward through the range of external rotation. Instruction to patient- "raises your arm. Hold it. Don't let me push it down." Therapist may need to demonstrate the desired motion. Position of the patient: prone with the head turned to the test side. Shoulder abducted to 90. With the arm fully supported on the table; forearm hanging vertically over the edge of the table. Place a folded towel under the arm at edge of the table. Position of the therapist: Standing at the test side at the level of the patient waist. One hand is used to give resistance over the forearm, as near the wrist as possible. The other hand support the elbow to provide the counter pressure at the end of the range. Test- patient moves forearm upward through the range of external rotation. Instruction to patient- "raises your arm to the level of the table. Hold it. Don't let me push it down." Therapist may need to demonstrate the desired motion. Assessment of the hand grip: The grip strength was measured by using hand held dynamometer (SH5001 (0.99) ⁽¹⁰⁾. The participants were asked to complete 5 second of maximum contraction in three position: Neutral, 90* abduction and external rotation. The wrist was kept in neutral and elbow at 90* flexion in all the position. The participants were sitting

on the chair comfortably with arm supported on the chair. Each arm would be tested three times in each arm position and verbal encouragement. An average would be taken of these three scores. 1 minute rest time would be given to recover from each contraction.

Data Analysis and Result

Statistical Analysis

Table:1: Demographic data of Volunteers (n=60)

	MEAN±SD
AGE	20 ± 0.64

1 Shows descriptive statistic of age for all volunteers

Table : 2 Pearson correlation of neutral, 90 degree abduction and external rotation

	Neutral	90 degree abduction	External Rotation
R Square	0.01997	0.031618	0.088925
P value	0.01*	0.05**	0.02*
r value	0.14	0.17	0.29
DF	59	59	59

Table :2: above table shows descriptive result for clinical measure of handgrip strength and manual muscle testing

*Correlation is significant and is less than 0.05

**Correlation is not significant

There is an positive correlation between handgrip strength and lateral rotator cuff function in neutral. ($P < 0.05$). There is an negative correlation between handgrip strength and lateral rotator cuff function in 90° abduction position. ($P = 0.05$). And positive correlation between handgrip strength and lateral rotator cuff function in 90° abduction and external rotation position. ($P < 0.05$).

Discussions

Hydraulic Hand Held Dynamometer and Manual Muscle Testing were used. And the correlation between the outcomes were analyzed by using Pearson

coefficient. Data were normally distributed parametric test were used. And correlation between outcomes were analyzed by using Pearson coefficient that is shown in table.2. Previous studies found that and have published data of grip strength values between the sexes show that males have higher peak strength. The peak strength occurs in the fourth decade in both sexes and undergoes a similar gradual decline. ⁽²³⁾ Several studies have shown a positive correlation between hand gripping activity and rotator cuff muscle activity in line with the findings of the present study. ⁽²⁴⁻²⁶⁾

Kwasniewski compared bilateral rotator cuff strength in patients with a unilateral hand or wrist disorder using a hand held dynamometer and found that a there is statistically significant decrease in increased external rotation strength. Kwasniewski also stated that it was unclear if there was a causal relationship. ⁽²⁷⁾ Similarly, There was alterations in muscle activity patterns have been documented in the presence of shoulder dysfunction with the activity of some shoulder muscles increasing, whereas others decrease when gripping is added to shoulder movements. ^(4, 25) The strong positive correlation found between the two variables in the present study in both hands is in agreement with the findings of Mandalidis and O'Brien ⁽¹⁶⁾ who investigated the relationship between isometric grip strength and isokinetic strength of the shoulder stabilizers. This relate with the concept of shoulder stabilizer activity increasing during handgrip actions shown in previous studies. ^(12, 25) Sporrang et al. ²⁸ found that the electromyography activity of rotator cuff musculature increased significantly during isometric handgrip tasks, particularly in positions of shoulder flexion/abduction, and that biceps brachia activity also increased during handgrip. It has been suggested that this may cause changes in activity of the shoulder muscles and potentially changes in 'internal loading' of the shoulder. ⁽¹²⁾, Walaa and Walaa ⁽¹⁴⁾ also found that hand grip strength correlated with body position.

Limitations: The discrepancy of the result of this study might be caused due to 4 and 5 grade were taken due to which there might be variation. And also due to limited population exposure.

Conclusion

The study showed a positive correlation of handgrip

and lateral rotator cuff function in the neutral and 90° abduction with external rotation position. But failed to show positive correlation in 90° abduction position.

Conflict of Interest – No.

Source of Funding- Self

Ethical Clearance – Obtained by The Institutional Committee of Ethics of The Shrimad Rajchandra College of Physiotherapy.

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Comparative Study Between Muscle Energy Technique Versus Therapeutic Taping on Pain and Disability in Patients with Patellofemoral Arthritis

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Abstract

Background: The patellofemoral joint (PFJ) is one compartment of the knee that is usually affected by OA and is a source of symptoms. Within the PFJ, the lateral compartment is more frequently affected by the OA process than the medial. Patellofemoral joint osteoarthritis (OA) is common and leads to pain and disability. The evidence that an increased (or decreased) Q-angle actually has an effect on the position of the patella. McConnell Taping is believed to relieve pain by improving alignment of the patellofemoral joint and/or unloading inflamed soft tissues. Muscle Energy Technique is a form a manual therapy which uses a muscle's own energy in the form of gentle isometric contractions to relax the muscles via autogenic or reciprocal inhibition, and lengthen the muscle.

Aim & Objective: To compare the effectiveness of muscle energy technique versus therapeutic taping on pain, disability and range of motion in patients with patellofemoral arthritis.

Method: 40 participants were allocated to the muscle energy technique (n=20) and therapeutic taping group (n=20). Both group received SWD and conventional exercise for 3 weeks. Outcome included pain (VAS), disability (WOMAC) and range of motion (ROM).

Result: While applying Wilcoxon Signed Rank Test within the group, in Group A (Muscle energy technique) and Group B (therapeutic taping). Both group showing significant improvement in post intervention ($P < 0.05$). While applying Mann Whitney U test in-between groups Group A versus Group B there is no statistical difference in-between groups ($P > 0.05$).

Conclusion: The study shows that both the Technique Muscle Energy Technique and Therapeutic Taping were individually effective in improving the pain, disability and range of motion. While comparing both the technique there is no significant difference present in between the groups.

Keywords: Muscle Energy Technique, Therapeutic Taping, Patellofemoral Osteoarthritis

Introduction

Patellofemoral arthritis is defined as the loss of articular cartilage on one or both surfaces of the patella and in the trochlear groove, or either. The greatest prevalence of chondral wear is on the lateral patellar facet. The presence of lateral facet arthritis is not necessarily caused by Malalignment, but it does suggest that the lateral patellar facet becomes overloaded more commonly than the central or medial aspect of the patella. This suggests that there is some degree of tilt

or Malalignment of force in the etiology of lateral facet arthritis. This suggests that patellofemoral Malalignment can and often does lead to some presentations of patellofemoral arthritis ^[1]. Quadriceps weakness plays an important role in the pathogenesis of knee OA and appears to be more important in the progression of (PFJ) disease than tibiofemoral (TFJ) disease ^[2]. The evidence that an increased (or decreased) Q-angle actually has an effect on the position of the patella and/or the thickness of the knee cartilages is limited ^[3]. McConnell taping is proposed to achieve its effect by both mechanical

and functional mechanisms. Mechanically, the ROM at the joint is reduced by taping and the force required to displace the joint is increased. Functionally, taping can cause reflex stimulation of skin encourage learning process due to skin drag, enhance proprioception and alter underlying muscle contraction. Knee taping is believed to relieve pain by improving alignment of the patellofemoral joint and/or unloading inflamed soft tissues [4]. Muscle Energy Technique (MET) is a form a manual therapy which uses a muscle's own energy in the form of gentle isometric contractions to relax the muscles via autogenic or reciprocal inhibition. Post Isometric Relaxation (PIR) is the effect of the decrease in muscle tone in a single or group of muscles, after a brief period of submaximal isometric contraction of the same muscle. It's a naturally occurring preventive mechanism to prevent rupture or further injury to the muscle and thus have a lengthening effect due to sudden relaxation of the muscle under stretch [5].

Materials and Method

In these experimental study a total 40 subjects were included by screening according to inclusion and exclusion criteria after obtaining the informed consent from the subjects. This study was approved by the Institutional Ethical Committee (IEC) and written consent was taken from every subject. Study duration was 3 weeks. Subjects were divided in 2 groups.

Inclusion Criteria:

- Age in between 45 to 65.
- Both in male and female.
- Anterior and retro patellar knee pain.
- Peripatellar tenderness.
- Pain on gridding of patella.
- Crepitation on knee motion, Pain on compression of patella, Limitation of Patellar mobility.
- Clarke's sign positive.
- Patellar grind test positive.
- Mild to moderate degenerative changes on

X-ray in the patellofemoral joint.

- Patients having pain on stair activities, kneeling, squatting, rising from

Sitting to standing.

Exclusion Criteria:

- History of skin allergy.
- Patellar dislocation.
- Patellar fracture.
- Recent any knee injection (in period of 3 month).
- History of knee and hip surgery.
- Severe osteoarthritis.
- Symptoms or signs suggestive of another cause of knee pain.
- Underlying Systemic arthritic condition.
- Unilateral tibio-femoral osteoarthritis.

Procedure

A total number of 40 patients were selected for study. Each patient was screened initially by using a simple selection Performa relevant to the inclusion and exclusion criteria. Then the selected patients who were willing to participate were divided into two groups of 20 patients in each group. Each patient of the study was treated for conventional exercise for 3 weeks, 4 days per week, 1 day per session. In Group A, conventional exercises were followed by muscle energy technique of quadriceps, hamstring, and calf muscle with isometric for 7-10 second hold followed by stretching 30 second for 3-4 repetition, 4days/week for 3weeks [5]. In group B conventional exercises were followed by therapeutic taping (McConnell taping) of medial shift with medial glide, taping is given alternate day for 4 days per week for 3 weeks [6].

Group A

® QUADRICEP MUSCLE [7]:

Patient Position: prone position, cushion place under the abdomen to prevent Lordosis. Therapist Position:

beside the patient, therapist one hand over pelvis for stabilization and one hand over ankle. Procedure: Ask the patient to deep breathe and hold isometric for 7-10 second, and followed by exhalation therapist stretch the muscle for 30 second, repeated these technique for 3-4 time.

® HAMSTRING MUSCLE^[5]:

Patient Position: supine laying Therapist Position: therapist stand beside the patient towards affected side. Therapist one hand over the ankle and another hand over the thigh Procedure: patient knee and hip is flexed. Ask patient to breath and hold the hamstring isometric for

7-10 sec and followed by exhalation therapist stretch the muscle 30 second. Repeated these technique for 3-4 time.

® CALF MUSCLE^[5]:

Patient Position: supine laying Therapist Position: therapist stand beside the patient towards affected side. Therapist one hand over calcaneum and foot supported at therapist forearm and therapist another hand above the knee joint Procedure: Ask patient to breath and hold the calf isometric for 7-10 sec and followed by exhalation therapist stretch the muscle 30 second. Repeated these technique for 3-4 time.



FIGURE 1 CALF MUSCLE ENERGY TECHNIQUE

GROUP B

® Medial Shift With Medial Glide^[6]:

Subjects laid supine with their knees extended and the quadriceps relaxed. Skin was shaved prior to tape application. Two tape were taken; one is adhesive tape of 2 inch width (adhesive, non-elastic) and another is leucopore for under wrap. At first, the under wrap was applied by leucopore anteriorly from lateral femoral condyle to just posterior to medial femoral condyle to

cover the patella completely. Over the under wrap, rigid adhesive tape was applied on the patella in the direction of medial glide with medial shift. Medial glide technique: One end of the tape was secured to the lateral patellar border and the patella was glided medially by the use of the thumb while maintaining tension of the tape. It was applied up to medial border of medial hamstring tendon as in figure.



FIGURE 2 MEDIAL TAPING OF PATELLA

Both the group received conventional exercises like static quadriceps exercise, straight leg raise, hip abduction, high sitting knee extension and hip flexion and last degree knee extension followed by short wave diathermy.

OUTCOME MEASURE

® Visual analogue scale: The Visual Analogue Scale (VAS) consist of a straight line with the endpoint defining limits such as ‘no pain at all’ and ‘pain as bad as it could be’. The patient is asked to mark his pain level on the line between the two endpoints. The distance between ‘no pain at all’ and the mark then defines the

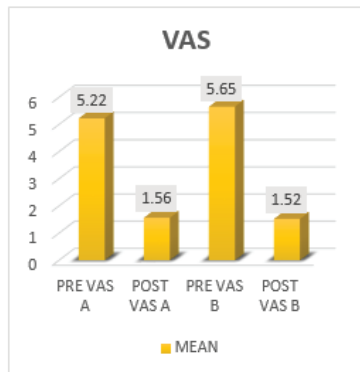


FIGURE 3 SHOWS MEAN AND SD FOR VAS IN WITHIN GROUPS

subject’s pain [8].

® WOMAC: The WOMAC is a self-report disease-specific multidimensional questionnaire assessing pain (5 questions), stiffness (2 questions), and physical functional disability (17 questions) of hip and knee OA. The subscale of pain carries 20 points, stiffness 8 points, and physical functional disability 68 points where 96 points represent an overall score of WOMAC, which indicates the worst possible score. Each of the 24 questions was rated 0–4 Likert scale where 0=none, 1=mild, 2=moderate, 3=severe, 4=extreme. The scores for each

Sub scale are summed up, with a possible score range of 0-20 for Pain, 0-8 for

Stiffness, and 0-68 for Physical Function [9].

® Range of motion: Patient’s position and procedure: prone position, fulcrum is placed over the lateral epicondyle, fixed arm placed over the parallel to shaft of femur and movable arm placed over the parallel to fibula. Knee flexion range: 0-135° Knee extension range: 0-15°

Statistical Analysis

Test used to compare within group A and group B Wilcoxon signed rank test. Test used to compare between the groups A and B Mann Whitney U test is applied. While applying within group A and B for VAS the P<0.001 it’s indicate that it’s effective. While applying within group A and B for WOMAC the P<0.001 it’s indicate that it’s effective. While applying within group A and B for ROM the P<0.001 it’s indicate that it’s effective.

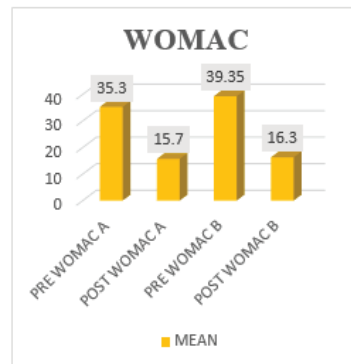


FIGURE 4 SHOWS MEAN AND SD FOR WOMAC IN WITHIN GROUPS

By Analysing The Data For MANN WHITNEY U TEST The Calculation Between GROUP A And GROUP B For VISUAL ANALOGUE SCALE 'Z' Value Is -1.232 And 'P' Value Is .218 Which Shows That 'P' Is >0.05. It Means There Is No Significant Difference Present Between the groups.

By Analysing The Data Mean Difference For MANN WHITNEY U TEST The Calculation Between

GROUP A And GROUP B For WESTERN ONTARIO & MACMASTER UNIVERSITIES OSTEOARTHRITIS INDEX (WOMAC) 'Z' Value Is -1.492 And P Value Is .136 Which Shows That 'P' Is >0.05. It Means That There Is No Significant Difference Present Between the groups.

TABLE 1 SHOWS THE INTERGROUP COMPARISON OF VAS BETWEEN GROUPS

GROUPS (VAS)	DIFFERENCE OF MEAN±SD	Z VALUE	P VALUE
MUSCLE ENERGY TECHNIQUE (A)	3.68±0.99	-1.232	.218
THERAPEUTIC TAPING (B)	4.15±1.11		

TABLE 2 SHOWS THE INTERGROUP COMPARISON OF WOMAC BETWEEN GROUPS

GROUPS(WOM-AC)	DIFFERENCE OF MEAN±SD	Z VALUE	P VALUE
MUSCLE ENERGY TECHNIQUE (A)	19.6±4.4	-1.492	.136
THERAPEUTIC TAPING (B)	23.05±6.58		

By Analysing The Data Mean Difference For RANGE OF MOTION FLEXION The Calculation Between GROUP A And GROUP B For RANGE OF MOTION 'Z' Value Is -.592 And P Value Is .554 Which Shows That 'P' Is >0.05. It Means That There Is No Significant Difference Present Between the groups

Discussion

Lateral facet arthritis can be caused by Malalignment or tilt, arthritis can naturally be associated with Malalignment or tilt^[10]. In patellofemoral Malalignment there is weakness present in quadriceps muscle because of lateral shifting of patella there is weakness of VMO

present in Quadriceps muscle. VMO and VLO force affect the alignment of patella. Applying medial taping to the knee joint, one end secured to lateral patellar border and applying stretch and glide and another end is secured to medial hamstring tendon. After applying the tape the pain is reduced and Malalignment is corrected. Taping can cause the reflex stimulation of skin and taping encourage skin drag and improve the proprioception. Medial taping corrected the tracking of patella and allowed V.M.O. to be strengthened in a position of normal length and tension. Taping caused neural inhibition and relieved pressure on lateral facet of patellofemoral joint and thus helped in reducing anterior knee pain. The soft tissue

relaxation, pain relief, improved tracking of patella and hence efficient contraction of V.M.O. might have helped to improve the extension lag. The relief of symptoms in such cases might be maintained by concurrent exercises to strengthen the V.M.O. to permanently realign the patella²⁹. The result shows that after applying the taping on patella it improves pain and functional disability and range of motion^[11]. Arnab Chandra¹, K. S. Sharad, Anwer Shahnawaz, Siddhartha Shankar Sikdar in November 2012 concluded Application of taping can be considered beneficial for pain relief and functional ability improvement in subjects with patellofemoral joint osteoarthritis. Post isometric relaxation technique is applied to reduce muscle spasm and improve range of motion and it's reduce the pain. MET involving isometric contraction of muscles stimulate the proprioceptors of muscle fibres which might produce pain relief via pain gate control theory, Immediately following an isometric contraction, a muscle in hypertonic state could be lengthen passively to a new resting length^[12]. Muscle energy technique is improve the strength of muscle and it's improve the flexibility of muscle. The use of muscle energy technique improves both strength and endurance by increasing the flexibility of the muscles surrounding the joint. It is also Beneficial in reducing localised swelling and increasing the restricted range of motion^[7]. SUSHMITA SINGH* 2017 concluded post isometric technique is effective to reduce the pain and improve the stability and range of motion in knee osteoarthritis.

Conclusion and Clinical Implication

According to the statistical analysis the study shows that both the Techniques GROUP A (Muscle Energy Technique) and GROUP B (Therapeutic Taping) were individually effective in improving the pain, disability and range of motion. While comparing both the techniques, there is no significant difference present in between the groups. Clinically Therapeutic Taping group is more effective than Muscle Energy Technique group.

Limitation of Study were Sample size is small, Men and women are not equally distributed, there is no control Group, There was not long term follow up of the patients. **Recommendation for Future Study** are Future studies should be done on effectiveness of other techniques and modalities, The same study can be done

with longer follow up, Study can be done with large sample size, Only unilateral patellofemoral arthritis patients were taken in study so to study on bilateral involvement of patellofemoral arthritis should be carried out.

Conflict of Interest: None

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Effect of 8 Weeks Interval Aerobic Exercise Program on Lipid Profile of Type 2 Diabetes Patients

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Abstract

Background: Lipid abnormalities are prevalent conditions in diabetic patients and predispose to atherogenic cerebrovascular accidents thus necessitating development of rehabilitative intervention.

Objectives: To determine the effects of 8-weeks interval aerobic exercise on lipid profiles of type 2 diabetes mellitus patients (T₂DM).

Subject and Method: All the subjects were allocated into groups using mixed sampling methods, and were on prescribed oral hypoglycemics and diabetes exchange diet. In addition, the intervention group received interval aerobic exercise intervention performed at sub-maximal intensity for 48minutes per session three times per week for period of eight weeks. Hypothesis was tested using independent t-test, ANOVA and ANCOVA and data analysed with Statistical Package for Social Sciences version 21 and alpha set at 0.05.

Results: A total of 40 (20 male and 20 females) T₂DM patients, with mean age and body mass index of 56±8years and 26±4Kg/m² respectively participated in the study. Over 87% of the participants had at least one form of lipid abnormality. At baseline, both groups were comparable in all the variables except age (P<0.05), triacylglycerol (P<0.05), and very low density lipoprotein (P<0.05). Post-treatment analysis revealed significant differences in TG (P<0.05), and high density lipoprotein (P<0.05) between exerciser and control group, following single (30minutes) exercise bout. At the end of 8weeks, no significant difference in lipid profiles was recorded between exercisers and the control group (P>0.05).

Conclusion: Interval aerobic exercise does not optimize reduction in lipid profiles in T2DM patients with fairly controlled blood sugar.

Keywords: Diabetes, lipid abnormality, dyslipidemia, exercise, physical activity

Background

Type 2 diabetes mellitus (T₂DM) remains a leading cause of death, with slightly less than 5% of all death attributed to it worldwide¹. Dyslipidemia is a prevalent

biochemical abnormality associated with lethal effect of glucose on beta cells of the islet of Langerhans^{2, 3}. Insulin resistance or deficiency affects key enzymes and pathways in lipid metabolism^{3, 4}. Lipid abnormalities comprise a triad of raised triglycerides cholesterol (TG-C), reduced high density lipoprotein cholesterol (HDL-C) and raised density lipoprotein cholesterol (LDL-C)⁵. They occur as responses to impaired insulin sensitivity leading to hepatic glucose production, with enhanced synthesis of triglycerides from non-esterified **fatty acids** and glycerol. Dyslipidemia is associated

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with myocardial infarction, ischemic heart disease, ischemic stroke and coronary heart disease as well as peripheral arterial disease⁵. In Nigeria as much as 70% of people with type 2 diabetes mellitus presents with at least one lipid abnormality⁶. Hence, there is the need for potent interventional options for the management of dyslipidemia in T2DM patients.

Exercise has been known to cause breakdown of fat molecules through beta oxidation, in healthy individuals, and regular exercise is currently one of the lifestyle modifications recommended for people living with diabetes⁷. It delays impaired glucose metabolism and desensitization of insulin receptors⁸. Particularly, aerobic exercise has been proved to attenuate diabetes-related inflammation thus enhancing endothelial function, insulin sensitivity and attenuating hyperglycaemia⁹. There is no doubt that aerobic exercise is of important benefit in management of T2DM. However, given that chronic hyperglycaemia affects key enzymes involved in lipid metabolism, the effect of exercise on dyslipidemia holds itself as subject of investigation. Studies have shown that aerobic exercise reduces lipid profiles of people living with T2DM¹¹. There is however paucity of evidence on the effect of interval aerobic exercise on lipid profile in T2DM patients. Interval aerobic exercise is a single combination of aerobic and resistance exercises performed at a high intensity. It works on the aerobic and anaerobic system, which produces lactic acid and may hinder exercise-induced lipolysis¹². This study was designed to answer the research question: what value does short-term interval aerobic exercise protocol add to the successful management of T2DM patients.

Materials and Method

Subjects

The subjects comprised T₂DM patients, who were attending Endocrinology and Diabetes Clinic of University of Nigeria Teaching Hospital (UNTH), Enugu, and who later were referred to the Physiotherapy Department of the same institution where the study took place. Informed consents were obtained in conformity with the ethical approval obtained from the Health Research and Ethics Committee of the UNTH, Enugu.

Research Design

This is an interventional study with a mixed

allocation design. Initially, allocation was random but later we resorted to allocation by convenience as patients turn out became low.

Sample Size

The sample size was determined using Cohen's power table as follows: effect size ($\sigma=0.5$), at degree of freedom of 1 and power ($1-\beta$) of 0.8, minimum sample size of 36 subjects was obtained¹³.

Inclusion Criteria

Subjects were recruited based on the following inclusion criteria: being medically and mentally stable, being on oral hypoglycaemic medications and diet.

Exclusion Criteria

Subjects who were pregnant, hypertensive (>140/90mmHg) on antidepressant, had chest pain or insufficient aerobic capacity following exercise testing were excluded from the study.

Procedures

Initially, subjects were randomly allocated to either of the two groups upon presentation, by asking each subject to pick a number from a box which contained numbers allocated to the two groups (A and B). When a participant picked a number, there was no replacement of such number. However, at a point, the researchers resorted to allocation by convenience due to low participants turn-out. Subjects were advised to abstain from other forms of physical activity during the course of the study. Cardiovascular and anthropometric indices were measured at baseline. The lipid profile and HbA1c measurements were done in the morning hour between (between 8am and 10am) using standard laboratory procedures¹⁴. Reassessments of outcome variables were done immediately after the first exercise bout and at the end of 8weeks.

The Intervention

Before the intervention, exercise stress test was done to determine subjects' aerobic capacities following the Young Men Christian Association sub-maximal cycle ergometry test protocol^{15,16}. The intervention constituted cycle ergometer at a moderate intensity of between 50-60% of subjects' HR-max which was estimated from age

of subject subtracted from 220, at a work/rest ratio of 1:1. The subjects pedalled at a slow speed and zero resistance for 5 minutes as warm up exercise. The workload was 100 Kg.m.min⁻¹, which was increased at a pedal speed of 50rpm to obtain a HR max of 60%. The training session was concluded with a cool-down exercise which was slow speed pedalled at zero resistance for 5 minutes. The exercise duration was five 6-minutes (30 min) work interspaced with 6 minute rest. At the rest intervals, subjects pedalled at zero resistance. The workload that gave the HR max was noted and recorded for subsequent training sessions. The trainings were done in the morning hours between 8:00am and 11:00am.

Data Analysis

Data was analyzed using the statistical package for Social Sciences (SPSS) version 21, with α set at 0.05. Mann-Whitney U test, Friedman's test and Wilcoxon test were used to test for the effect on the exercise on lipid profiles.

Findings

A total of 40 sex matched T2DM patients participated in this study. At baseline, significant difference in age between experimental and control group ($P < 0.05$). The baseline anthropometric and cardiovascular indices were comparable between the groups ($P > 0.05$). Pre-exercise comparison of lipid profiles between the groups reveals significant differences in TG ($P < 0.05$) (Table 1).

Table 1: Baseline anthropometric indices, cardiovascular characteristics, baseline lipid

Profiles and HbA1c of the subjects

Variable	Mean Rank Experimental	Control	Mann-Whitney U test	P-value
Age (years)	16.65	24.35	123.00*	0.037
Weight (Kg)	21.78	19.23	174.50	0.488
Height (meters)	20.18	20.83	193.50	0.860
Body Mass Index (kg/m ²)	21.73	19.28	175.50	0.512
SBP (mmHg)	18.30	22.70	156.00	0.242
DBP (mmHg)	22.23	18.78	165.50	0.355
Pulse rate /min	21.98	19.03	170.50	0.429
TC (mg/dL)	19.63	21.38	182.50	0.640
TG (mg/dL)	25.63	15.38	97.50*	0.005
HDL (mg/dL)	18.23	22.78	154.50	0.221
LDL (mg/dL)	18.35	22.65	157.00	0.253
VLDL (mg/dL)	25.28	15.73	104.50*	0.009
HbA1c (mmol/L)	20.60	20.40	198.00	0.957

Over 87% of the participants had at least one form of lipid abnormality. Three forms of lipid abnormalities were identified in this study namely reduced HDL-C (42.5%), raised TG (40%) and raised LDL (15%) (Table 2).

Table 2: Frequency of Lipid Abnormalities and Glycaemic Status of the Participants

Lipid profile	Frequency	Percent
TC		
Normal	40	100
Abnormally h	-	-
TG		
Normal	16	60
Abnormal	24	40
HDL		
Normal	33	57.5
Abnormally low	17	42.5
LDL		
Normal	34	85
Abnormal	6	15
VLDL		
Normal	38	95
Abnormal	2	5
Glycaemic status		
Poorly controlled	12	30
Fairly controlled	28	70
Dyslipidemia status		
None	5	12.5
One form of lipid abnormality	15	37.5
Two forms of lipid abnormality	13	32.5
Three forms of lipid abnormality	7	17.5

Results show significant differences in immediate post-exercise HDL ($P < 0.05$). There was no statistically significant reduction in TC ($P > 0.05$), TG ($P > 0.05$) and LDL ($P > 0.05$) following acute exercise bout ($P > 0.05$). At the end of 8 weeks, results show significant differences in TG ($P < 0.05$) and VLDL ($P < 0.05$) between exercisers and control group ($P > 0.05$) (Table 3).

Table 3: Between group comparison of post-treatment lipid profile of the participants

Variable	Mean Rank Experimental	Control	Mann-Whitney U test	P-value
TCii (mg/dL)	18.98	22.03	169.50	0.414
TCiii (mg/dL)	20.35	20.65	197.00	0.947
TGii (mg/dL)	21.63	19.38	177.50	0.547
TGiii (mg/dL)	24.58	16.43	118.50	0.026*
HDLii (mg/dL)	16.75	24.25	125.00	0.043*
HDLiii (mg/dL)	21.83	19.18	173.50	0.478
LDLii (mg/dL)	22.73	18.28	155.50	0.231
LDLiii (mg/dL)	16.93	24.08	128.50	0.052
VLDLii (mg/dL)	21.85	19.15	173.00	0.478
VLDLiii (mg/dL)	25.03	15.98	109.50	0.013*

*: significant at $\alpha=0.05$; i: pre-exercise value; ii: value after first exercise bout; iii: value obtained at the end of 8weeks of exercise;

There was no significant change in lipid profiles with timing of exercise within exercise group ($P>0.05$). However, significant changes in TC, TG and HDL with

timing of exercise were found ($P<0.05$). Wilcoxon post-hoc test revealed that the significant changes in TC, TG and HDL within the control group occurred between the post-30minutes and 8-weeks value for TC ($P<0.05$) and HDL ($P<0.05$).

Table 4: Within-group comparison of post-treatment lipid profile of the participants using Friedman's test

Variable	Experimental Mean Rank X2 P	Control Mean Rank X2 P
TCi	2.00 1.60 0.449	2.00 6.40 0.041*
TCii (mg/dL)	2.20	2.40
TCiii (mg/dL)	1.80	1.60
TGi	1.95 1.696 0.428	1.55 10.56 0.005*
TGii (mg/dL)	1.83	2.55
TGiii (mg/dL)	2.23	1.90
HDLi	1.85 0.900 0.638	1.55 10.30 0.006*
HDLii (mg/dL)	2.00	2.55
HDLiii (mg/dL)	2.15	1.90
LDLi (mg/dL)	1.98 1.527 0.392	2.20 2.10 0.350
LDLii	2.23	1.75
LDLiii (mg/dL)	1.80	2.05
VLDLi	1.95 3.169 0.205	1.65 5.778 0.056
VLDLii (mg/dL)	1.75	2.25
VLDLiii(mg/dL)	2.28	2.10

*: significant at $\alpha=0.05$; i: pre-exercise value; ii: value after first exercise bout; iii: value obtained at the end of 8weeks of exercise;

Table 5: Post-hoc comparison of within group post-treatment lipid profile of the participants using Wilcoxon signed ranks test

Variable	Control Z-value P
TCi TCii	-1.906 0.057
TCi TCiii	-1.420 0.155
TCii TCiii	-2.542 0.011*
TGi TGii	-2.654 0.008*
TGi TGiii	-2.131 0.033*
TGii TGiii	-1.723 0.085
HDLi HDLii	-3.180 0.001*
HDLi HDLiii	-0.673 0.501
HDLii HDLiii	-1.987 0.047*

*: significant at $\alpha=0.05$; i: pre-exercise value;

ii: value after first exercise bout;

iii: value obtained at the end of 8weeks of exercise;

Discussion

In this study, prevalence of lipid abnormality was as high as 87.5%. This is consistent with the finding obtained by Jisieike-Onuigbo et al.¹⁷ and Ogbera et al.¹⁸ in which prevalence between 87-90.7% was recorded. Dyslipidemia is a metabolic disorder commonly found in people living diabetes mellitus. It usually results from damage to some key enzymes involved in lipid metabolism, and it is frequently accompanied by the risk of cardiovascular atherosclerosis¹⁹. This is validated by the evidence that insulin modulates production of apolipoprotein in the liver as well regulates activity of lipoprotein lipase and cholesterol ester transport protein, which induces dyslipidemia in persons living with diabetes mellitus. Similarly, deficiency of insulin hinders the enzymatic activities of hepatic lipase and paths to production of active lipoprotein lipase²⁰, thus increasing the risk of hepatosteatosis and cardiovascular events.

Surprisingly, result showed that the control group recorded greater reduction in TG and VLDL and greater

increase in HDL. First, this suggest that a combination of hypoglycaemic diet and interval aerobic exercise is not superior to hypoglycaemic diet alone in regulation of lipid profiles in a T2DM patients population with fairly controlled blood glucose. By implication, our study found that interval aerobic exercise did not reduce or improve lipid profiles, and this reveals the weakness of interval aerobic exercise in management of dyslipidemia in T2DM patients. Recall that interval aerobic exercise is single combination of intense aerobic and anaerobic exercises with interspaced periods of rest. It works on aerobic and anaerobic systems. The anaerobic component results in production of lactic acid, which has been shown to suppress lipid metabolism through stimulation of GPR81, an orphan G-protein-coupled receptor which is highly expressed in fat cells¹². Aerobic power generated from aerobic exercise is most efficient source of energy for lipid catabolism²¹. Similarly, fat oxidation is lower in high-intensity exercise than in moderate-intensity exercise, because of decreased fatty acid delivery to exercising muscles following lactate production²¹. Given that previous studies reported positive findings regarding the combination of exercise and dieting in regulation of lipid profiles, in people with diabetes, it is safer to posit that intensity of exercise intervention was not adequate enough to stimulate cardiopulmonary mechanism for beta oxidation of fat molecules¹². This is inconsistent with finding that 8week anaerobic resistance exercise improved HDL-C, although the change in HDL was not accounted for by alterations in VO₂max, muscle mass or percent fat²². The major deficiency in our study is the inadequate exercise intensity and long period of rest in between exercise bouts. A major limitation in this study was mixture of random and convenience sampling techniques.

Conclusion

The exercise protocol adopted in this study proved to be counter-productive. There is need for development of interval aerobic exercise protocol for mitigating lipid abnormality in T2DM patients.

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Competing Interest: Nil

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Relationship between Oxygen Saturation and Academic Performance in School Going Children: A Cross-Sectional Study

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Abstract

Background: Slow learners are those students who learn more slowly than other children of the same age group, yet they do not have a disability requiring special education. Oxygen administration enhances memory formation which is an integral part of learning and academic performance in children. So oxygen saturation can play an important role in learning.

Objective: To determine the correlation between oxygen saturation and academic performance in school going children.

Method: Schools were selected for the study and respective teachers for the class 5th to 8th were approached and the study was explained with its rationale. 60 students were selected from which they were divided into slow learners and good learners by the teachers based on their academic performance. The oxygen saturation of these students was noted during their free hours using a pulse oximeter and was recorded. The scores were put forth for statistical analysis.

Results: The results of the study revealed that, there is a significant correlation between oxygen saturation and academic performance in school going children.

Conclusion: The study concluded that the oxygen saturation showed significant correlation with the academic performance in school going children.

Key Words: *Slow learners, Good learners, Oxygen saturation, and Academic performance*

Introduction

Slow learners are those students with below average cognitive abilities who cannot be termed as disabled. These children usually struggle to cope up with the usual academic demands of a regular classroom¹. They learn more slowly compared to their peers, but they do not have any disability requiring special education. A slow learner is a child who has a below average intelligence

and whose thinking skills that have developed more slowly than a normal child of his/her age. The basic developmental stages (communication styles, memory skills, social interaction etc) will be the same for the child as for the other children, but the child will do so at a slower rate².

Slow learners have an IQ of around 76-89 and constitute about 8 percent of the total school population. The handicaps of those children who are blind, deaf, or physically handicapped are obvious to the observer but the handicaps of the slow learners are not always so obvious and their handicap is related to their power of thinking and ability to learn³.

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Slow learning in a child can be due to various reasons. Firstly, it can be seen in those students who are facing certain socio-cultural problems, frustrating past language classroom experiences, inadequate use of strategies, or lack of interest. Secondly, in those students who are already diagnosed as learning-disabled by specialists⁴.

Pulse oximeter is a device that is generally used for monitoring oxygenation especially in a critical care setting. Use of pulse oximeter leads to a quicker treatment of hypoxemia. Using spectrophotometric methodology, pulse oximetry measures oxygen saturation by illuminating the skin and measuring changes in light absorption of oxygenated and deoxygenated blood using two light wavelengths ie. 660nm (red) and 940nm (infrared). Conventional pulse oximeter uses transmission sensors in which the light emitter and detector are on the opposing surfaces of the tissue bed. These sensors are suitable for use on the finger, toe, or earlobe⁵.

Hypothesis of the study states that there will be a significant correlation between oxygen saturation and academic performance in normal school going children. Research by Michael S Urschitz in the year 2005 stated that, there is a significant correlation between nocturnal oxygen saturation and academic performance in Mathematics in a community sample of children⁶. But there are no studies showing a significant correlation between oxygen saturation and academic performance in school going children during the day hours. Also, research works by Moss MC and Scholey shows that academic performance depends upon the amount of oxygen utilised during learning⁷. So this study is been taken up to evaluate the relationship between oxygen saturation and academic performance in a group of school going children.

Methodology

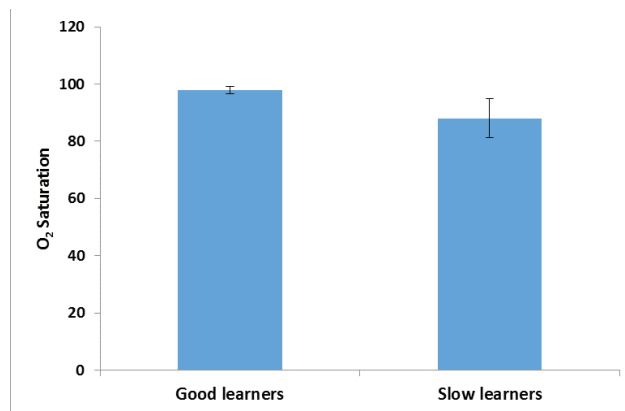
The data required for the study was included from a nearby school in Mangalore. 60 students were included based on their academic performance and were divided as good learners and slow learners by the teachers. Children of the age group 10-13 were included in the study. Children having any systemic illness like fever and those who are associated with any cardio-respiratory conditions were excluded from the study.

The oxygen saturation of these students was measured using pulse oximeter. It was done during the day time in the afternoon session during their free hours. Students were neither studying nor involved in any activities. Students were asked to wash their hands thoroughly before the oxygen saturation was noted. This was done to reduce the transmission of micro-organisms which can vary the readings. They were asked to sit in a chair with back support. The probe of the pulse oximeter was placed on the index finger of the students for one minute. The oxygen saturation values were noted and recorded.

Statistical Analysis and Results

Age and gender does not differ significantly between good learners and slow learners (P>0.05).

Mean Oxygen saturation is higher in good learners compared to slow learners and it differs significantly (P=0.001)



		Oxygen Saturation
AGE(YRS)	Pearson Correlation	0.016
	P	0.903
N		60

There is mild positive correlation between age and oxygen saturation (r=0.016) overall in all students but it is not statistically significant (P=0.903)

Correlations- good learners

		OXYGEN SATURATION
AGE(YRS)	Pearson Correlation	0.039
	P	0.839
	N	30

There is mild positive correlation between age and oxygen saturation ($r=0.039$) in good learners but it is not statistically significant ($P=0.839$)

Correlations- slow learners

		OXYGEN SATURATION
AGE(YRS)	Pearson Correlation	-0.133
	P	0.482
	N	30

There is mild negative correlation between age and oxygen saturation ($r=-0.133$) in slow learners but it is not statistically significant ($P=0.482$).

Discussion

Present study mainly aimed to find out the relationship between oxygen saturation and academic performance in normal school going children, who were divided into slow learners and good learners by their teachers based on their academic achievement. Burt (1937) pointed out that the term 'backward' or 'slow learners' is reserved for those children who are unable to cope up with their work, which is normally expected of their age group. Jenson(1980) states that students with I.Q 80-90 who are said to be dull normal, are generally slower to catch on to whatever is being taught to them.³

Research works by Moss M C and Scholey shows that oxygen inhalation enhances memory and since memory is an integral part of academic performance, they concluded that oxygen administration enhances academic performance⁷. Studies also showed that there is significant correlation between nocturnal oxygen saturation and academic performance⁶. But there are

no studies showing the correlation between oxygen saturation during the day hours and the academic performance in school going children.

The result of the present study shows that the oxygen saturation was less in slow learners compared to the good learners. In the present study, measurement of oxygen saturation was taken for a short duration. Future research can be done observing the oxygen saturation during a prolonged period during the school hours to find the difference among the children.

Conclusion

The study concluded that the level of oxygen saturation showed significant relationship with the academic performance in school going children. Slow learners whose academic performance was affected had a low level of oxygen saturation.

Limitations

- The sample size taken was very small. It could have been done on a larger population for better confirmation of the result.

- The sampling was done from a small geographical area, so the results cannot be generalised.

- The time taken for the study was very less. The measurement time of oxygen saturation could have been more prolonged for better validation of results.

Conflict of Interest: None

Source of Funding: Nil

No ethical Clearance taken as there was no interventions given during the study.

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A Comparative Study on Effectiveness of Paraffin Wax Bath Versus Ultrasound in Plantar Fasciitis

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Abstract

Plantar fasciitis is the most common cause of inferior heel pain in adults. Amongst various options available for the treatment of planter fasciitis, purpose of this study was to compare effectiveness of two different electrotherapy modalities, Paraffin wax bath and Ultrasound, in the treatment of plantar fasciitis and to know which modality is better in relieving pain and improve function in patients with plantar fasciitis. Study included 30 (Thirty) subjects with plantar fasciitis who fulfill inclusion and exclusion criteria. The subjects were divided into 2 groups: group A who were given Paraffin wax bath along with conventional exercises and group B who were given Ultrasound along with conventional exercises. The subjects were treated for a period of 10 days. Pain was assessed by Visual Analogue Scale, Pressure Pain Threshold assessed by Pressure Algometer and functional disability by Foot Functional Index. In this study we found that there is no statistical significant difference between these two modalities in relieving pain and alleviate disability. it can be concluded that both Paraffin wax bath and Ultrasound are equally effective in plantar fasciitis.

Key Words : *Paraffin wax bath, Ultrasound, Plantar fasciitis.*

Introduction

Plantar fasciitis (PF) is a degenerative syndrome of the plantar fascia resulting from repeated trauma at its origin on the calcaneus.¹ PF is reported to be the most common cause of inferior heel pain in adults. The word “fasciitis” assumes inflammation is an inherent component of this condition. However, recent research suggests that some presentations of PF manifest non-inflammatory, degenerative processes and should more aptly be termed “plantar fasciosis”.^{2,3} Some of the factors frequently believed to precipitate plantar fasciitis include aberrant foot biomechanics and/or foot types, improper footwear, and obesity.⁵

The classic presentation of plantar fasciitis is pain on the sole of foot at the inferior region of the heel.

Patient reports the pain to be particularly bad with the first step taken on rising in the morning or after an extended refrain from weight bearing activity. After few steps and through the course of the day, the heel pain diminishes, but returns if intense or prolonged weight bearing activity is undertaken. Initial reports of heel pain may be diffuse or migratory; with time it usually focuses around the area of the medial calcaneal tuberosity. Generally, pain is most significant when weight bearing activities are involved.⁴

A variety of treatment options are available for the treatment of planter fasciitis.⁷ The most prudent approach to therapy is to employ conservative treatments first. One important question that needs to be answered is, “Which particular forms of conservative treatment are most effective in treating plantar fasciitis?”

Controversy always exists when deciding any electrotherapy modality for the treatment of plantar fasciitis. Purpose of this study was to compare effectiveness of two different electrotherapy modalities, Paraffin wax bath and Ultrasound, in the treatment of

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plantar fasciitis and to know which modality is better in relieving pain and improve function in patients with plantar fasciitis.

Research Method

The study was carried out in patients referred to Physiotherapy department of Civil Hospital, Ahmedabad for treatment of plantar fasciitis. It was an interventional study. Consent to carry out the study was granted by the Institutional ethical clearance committee. Both male and female (30 subjects) individuals suffering with heel pain and clinically diagnosed plantar fasciitis since 6 weeks referred to physiotherapy department and willing to take treatment for 10 successive days, were enrolled for that study.

Inclusion Criteria

Subjects were selected for the study if they fulfilled the following criteria:

- a. Clinically diagnosed cases of plantar fasciitis not less than 6 weeks.
- b. Those who were willing to precipitate in the study and willing to take treatment for 10 successive days.
- c. Heel pain felt maximally over plantar aspect of heel
- d. Pain in the heel on the first step in the morning
- e. No history of rest pain in heel

Exclusion Criteria

- a. Subjects with clinical disorder where therapeutic ultrasound is contraindicated such as infective conditions of foot, tumor, calcaneal fracture, metal implant around ankle.
- b. Subjects with clinical disorder where paraffin wax bath is contraindicated such as cuts & open wound,

impaired skin sensation, some dermatological conditions such as eczema and dermatitis, circulatory dysfunction such as varicose veins & deep vein thrombosis, tumour.

- c. Subjects with referred pain due to sciatica and other neurological disorders.
- d. Arthritis
- e. Corticosteroids injection in heel preceding 3 months

Subjects selected for the study were divided into two groups: Group A and Group B. The whole procedure of the study was explained to all the subjects. A written informed consent of all the subjects was taken prior to the study. All the subjects were evaluated for duration of symptoms, previous surgery, medications, history, chief complains, active and passive ROM and palpation of heel. Pre-participation Visual Analogue Scale (VAS)^{11,14}, Foot Functional Index (FFI)¹⁶ and Pain Pressure Threshold (PPT) by pressure algometer^{12,13,17} were taken for all subjects.

Clinical Intervention:

Group A:

The subjects in Group A were given Paraffin wax bath and Conventional physiotherapy exercises.

Group B:

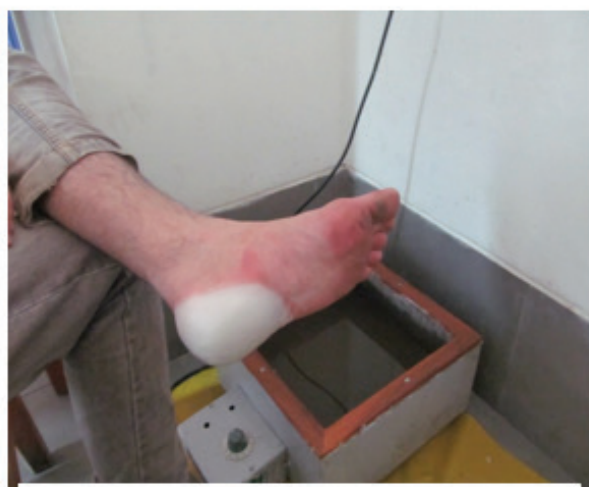
The subjects in Group B were given Ultrasound and Conventional physiotherapy exercises.

Paraffin Wax Bath For Group A: ¹⁰

Patient position was sitting. Paraffin wax bath was given by dip and wrap method. The part was immersed in for a second or so in the wax, withdrawn and allowed to cool for 2 to 3 s and then reimmersed. The procedure was repeated for 8 times. The foot then was covered in Macintosh. Wax was removed after 15 minutes.



Picture 1: Dipping of heel in PWB



Picture 2: 8 layers of wax

ULTRASOUND FOR GROUP B: ¹⁸

Patient position was prone. Ultrasound was given with the output of 1 watt/cm² for 5 minutes using pulse mode 1:4 ratio with frequency of 1 MHz for 10 days.



Picture 3: Ultrasound to heel

Conventional Physiotherapy Exercises for Both Group -A & Group -B:

It consists of the following:

1. TA stretching: ^{4,8}

Active Achilles tendon stretching in standing by leaning against the wall, holding each stretch for 20 seconds and repeating 5 times each session.

2. Plantar fascia stretching with tennis ball: ^{4,18}

Subjects sitting on the chair rolling foot on the tennis ball for 5 minutes.

3. Active ankle exercises: ⁶

Active ankle exercises – dorsiflexion, plantarflexion, inversion and eversion in supine lying position 10 times.

4. Exercise for intrinsic muscles strengthening: ^{4,6}

- 1) Towel curl up-

For towel curl ups participants sat with foot flat on the end of towel placed on a smooth surface, small weight is kept at the other end of towel. Keeping the heel on the floor, the towel was pulled towards the body by curling the towel with the toes for 10 minutes.

- 2) Toes curl up with marbles-

Patient in sitting position ask patient to pick up marble from the floor, put it in the bucket.

Subjects in both groups were advised to wear soft heel sleepers. Outcome was assessed, at the end of 10th day of intervention, based on pain on VAS, Foot Function Index and Pain Pressure Threshold.

Data Analysis and Results

Data was analysed using statistical software SPSS 16.0. Before applying statistical tests, data was screened for normal distribution. All the outcome measures were

analysed at baseline and after 10 days of treatment using appropriate statistical test. Level of significance was kept at 95%. Changes in outcome measures were analysed within group as well as between groups.

Gender distribution of the 30 subjects participated in the study: The group in which the subjects were given Paraffin wax bath along with conventional exercises (Group A) had 11 females and 4 males and the group in which the subjects were given Ultrasound along with conventional exercises (Group B), had 10 females and 5 males.

Statistics of age distribution of the 30 subjects: Among the 30 subjects, the mean age of 15 subjects in Group A was 40.13 year with a standard deviation (SD) of 11.96 and the mean age of 15 subjects in Group B was 42.80 year with a standard deviation of 10.29. No age difference was seen across the groups.

The group statistics of Body Mass Index (BMI) among 30 subjects: The mean BMI of 15 patients in Group A was 25.54 kg/m² with standard deviation

4.28. In the Group B, the mean BMI was 25.08 kg/m² with standard deviation 2.98. No difference is seen in between groups.

To analyse the difference in the VAS score after 10 days of intervention in both the groups, **Wilcoxon Signed Rank Test** was used. For both the groups A and B, p values were 0.001 showing **highly significant** difference in VAS score as compared to baseline.(Table 1)

To analyse the difference in the FFI score after 10 days of intervention in both the groups, **Wilcoxon Signed Rank Test** was used. For both the groups A and B, p values were 0.001 showing **highly significant** difference in FFI score as compared to baseline.(Table 1)

To analyse the difference in the PPT (Newton) after 10 days of intervention in both the groups, **Wilcoxon Signed Rank Test** was used. For both the groups A and B, p values were <0.001 showing **highly significant** difference in PPT as compared to baseline.(Table 1)

TABLE 1: COMPARISON OF VAS SCORE, FFI SCORE AND PPT VALUE WITHIN GROUP A & B

Group	Pre Treatment			Post Treatment			T value	p value
	Mean	Median	+SD	Mean	Median	+SD		
Group A VAS	6.92	7.30	3.05	3.31	3.10	2.06	0	0.001
Group B VAS	7.12	7.50	1.74	3.66	3.80	1.78	0	0.001
Group A FFI	45.02	51.12	14.29	22.31	26.48	10.60	0	0.001
Group B FFI	43.86	44.12	10.71	21.72	22.35	8.86	0	0.001
Group A PPT	30.67	23.00	20.00	69.35	61.50	26.57	-120	<0.001
Group B PPT	33.35	27.10	24.18	74.87	63.20	23..93	-120	<0.001

The difference between VAS score between two groups was analysed by using **Mann Whitney ‘U’ Test**. U=94, p=0.442, showing **no significant** difference in group A compared to group B. (Table 2)

The difference between FFI score between two groups was analysed by using **Mann Whitney ‘U’ Test**. U=103, p=0.693, showing **no significant** difference in group A compared to group B. (Table 2)

The difference between PPT value between two groups was analysed by using **Mann Whitney ‘U’ Test**. $U=91$, $p=0.372$, showing **no significant** difference in group A compared to group B. (Table 2)

TABLE 2: POST TREATMENT VAS SCORE, FFI SCORE AND PPT VALUE BETWEEN GROUP A & B

		Group A	Group B	U value	p value
VAS score	Mean	3.31	3.66	94	0.442
	Median	3.10	3.80		
	± SD	2.06	1.78		
FFI Score	Mean	22.31	21.72	103	0.693
	Median	26.48	22.35		
	± SD	10.60	8.86		
PPT Value	Mean	69.35	74.87	91	0.372
	Median	61.50	63.20		
	± SD	26.57	23.93		

Discussion

Plantar fasciitis is one of the conditions, which can be treated by a wide variety of physiotherapy methods. It is still difficult to formulate all proof guidelines for the management of plantar fasciitis. Various methods of treatment exist with own claims of success without any attempts of comparing the maximal effective methods. The objective of this study was to compare the effectiveness between paraffin wax bath and ultrasound in treatment of plantar fasciitis.

30 subjects who fulfilled inclusion criteria were taken for the study. They were divided into two groups, group A and group B, each consist of 15 participants. Treatment with paraffin wax bath along with conventional physiotherapy exercises was given to group A and ultrasound along with conventional physiotherapy exercises was given to group B.

In both group A and group B significant improvement in pain (VAS), physical function (FFI) and pain threshold (PPT) was seen after 10 days of intervention.

The main finding of the study is that there is no significant difference in VAS ($p>0.05$), FFI ($p>0.05$) and PPT ($p>0.05$) between the groups. Both groups were receiving common conventional physiotherapy exercises. Electrotherapy modality was different in both groups, paraffin wax bath was given to group A and ultrasound was given to group B. From the above findings we can say that paraffin wax bath and ultrasound both are equally effective in relieving pain and improving function.

For therapeutic ultrasound the dosage used in this study was chosen from evidence available. Pulsed ultrasound was used as it is preferred for soft tissue repair as affirmed by Young SR et al¹⁹ and 1 MHz was chosen as it is capable of reaching to deeper layer. Pain relief could have occurred due to the non-thermal effects of pulsed ultrasound in the form of stimulation of histamine release from mast cells and factors from macrophages that accelerated the normal resolution of inflammation as suggested by Young and Dyson.¹⁹

According to a study performed by Hana Hronkova in 2000²⁰ in which the group which received ultrasound for plantar fasciitis showed significant reduction in pain. In contrast, study done by Crawford F, et al in 1996⁹ therapeutic ultrasound was given to patients with heel pain and found no evidence to support the effectiveness of therapeutic ultrasound.

The results are contradictory to a review carried out by Robertson and Baker of 35 randomized controlled trials looking at evidence of the biophysical effects of ultrasound out of which only 2 trials were found to be more effective than placebo ultrasound and ten of the 35 trials studied were judged to be robust.¹⁵

Effects of paraffin wax bath are directly due to superficial heat production and the consequent stimulation of the sensory nerve fibres. Activation of sensory (A-β) fibres has a gating or partial blocking effect on transmission of C (pain) fibre signals. Warmth is thus associated with a sedatory, i.e. pain relieving effect.¹⁰

Superficial heating will also trigger reflex vasodilation and so produce a greater blood flow through the dermis. Blood flowing through the dermis is warmed and carries heat into the deeper tissues on its return from capillaries to venules and veins. The increased blood flow may have an effect on the resolution of some chronic conditions as it will increase the flow of metabolites to and from cells and so could accelerate the rate of healing.¹⁰

To best of our knowledge no previous studies has been done on comparison of PWB and US in plantar fasciitis.

Conclusion

On the basis of present study, it can be concluded that both Paraffin wax bath and Ultrasound are equally effective in plantar fasciitis. There is no statistical significant difference between these two modalities in relieving pain and alleviate disability in patients with plantar fasciitis. So either of the modality can be prescribed in patients with plantar fasciitis.

Ethical Clearance: Ethical clearance was taken from Institutional ethical clearance committee of Government Physiotherapy College, Civil Hospital,

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Conflict of Interest : Nil

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Electrical Stimulation Versus Voluntary Exercise on the Navicular Height, Calcaneal Pitch Angle, and Cross-Sectional Area in Healthy Subjects: A Single-Blinded Randomized Controlled Trial

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Abstract

The important function of the intrinsic foot muscles is the dynamic stabilization of the medial longitudinal arch (MLA). Several studies have reported that implementing short foot exercise (SFE) and electrical stimulation (ES) amid the intrinsic foot muscles may increase MLA height. Hence, the aim of this study was to compare the effects of ES versus SFE on navicular drop (ND), calcaneal pitch angle (CPA), and cross-sectional area (CSA) of the abductor hallucis (AbdH) muscle. 20 healthy female subjects were randomly assigned to undergo ES (n=10) or SFE (n=10). SFE performed 30 repetitions whereas 20 min per day for ES, 3 days/week, for 4 weeks. ND, CPA, and the CSA of the AbdH muscle were assessed before and after intervention. The results showed that ES group significantly decreased in ND after training ($p < 0.05$) without significant differences between groups. The CPA is a little change in both groups (SFE = 0.4° and ES = 2.4° ; $p > 0.05$). The CSA of the AbdH muscle in both groups was increased (ES = 10.93 mm^2 and SFE = 7.44 mm^2 ; $p < 0.05$) with no significant difference between ES and SFE. These results demonstrated that ES and SFE alone could improve intrinsic foot muscle size. Nevertheless, ES tended to increase MLA more than SFE alone. Hence, ES can be considered as an alternative treatment to increase MLA and intrinsic foot muscle size.

Keywords: electrical stimulation, voluntary exercise, cross-sectional area, navicular height

Introduction

The foot is an importantly complex structure which serves as the propulsive organ and supporting pedestal during weight bearing throughout locomotion¹. Foot function efficiency depends on the integrity of the medial longitudinal arch (MLA)². The MLA is the primary structure responsible for stability and resiliency

of the foot load³. The most significant arch static contributors are the plantar fascia, the long and short plantar ligaments, and the spring ligament. Whereas, the intrinsic and extrinsic foot muscles play a role in dynamic contributors. However, recent evidence has suggested that the intrinsic foot muscles (IFM) play a crucial role in supporting MLA⁴⁻⁵.

Previous studies have confirmed the function of the IFM. A study by Fiolkowski et al.⁶ and Headlee et al.⁷ demonstrated the tibial nerve inhibition amid the IFM in addition to exercise until IFM fatigue increased significantly enough to render a navicular drop (ND). Moreover, previous studies demonstrated that muscle strength had significant correlation with cross-sectional area (CSA)⁸. IFM weakness and atrophy commonly result in several conditions such as plantar fasciitis⁹,

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hallux valgus, and pes planus¹⁰. Pes planus is associated with heel eversion and forefoot abduction. In the long term, these changes may be a cause of overuse injuries¹¹, and disability¹². Therefore, the rehabilitation and prevention of these problems are resultant of necessarily reinforcing IFM strength aimed at improving MLA by increasing CPA.

Several studies have reported the beneficial effects of IFM training, especially short foot exercise (SFE) on ND⁹ and the CSA of the abductor hallucis muscle (AbdH)¹¹. Jung et al.¹³ reported that SFE can improve IFM activity and prevent the fall of MLA.

Today, electrical stimulation (ES) is an alternative method for the rehabilitation of a paralyzed muscle as well as strength promotion¹⁴ because this treatment has the ability to isolate contraction of the desired muscle group¹⁵. A study by Fourchet et al.¹⁶ found that neuromuscular electrical stimulation of the abductor hallucis (AbdH) muscle decreased ND post training. Moreover, ES significantly increased CSA of the vastus lateralis, vastus medialis, and vastus intermedius muscles post training¹⁷.

Conversely, some evidence suggests that combined ES in addition to exercise training is more effective for strengthening the muscles than exercise alone¹⁸⁻²⁰. Nevertheless, the short-term effect of ES as an intrinsic foot strengthening exercise method has to date not been discussed. Therefore, the purpose of this study was to compare the effects of ES versus SFE alone on ND, calcaneal pitch angle (CPA), and CSA of the AbdH muscle.

Materials and Method

Design and setting

A Single-blinded randomized controlled trial was used in this study. Subjects were recruited from Chonburi province, Thailand. This present study was approved by the Khon Kaen University Ethics Committee in Human Research (TCTR20180511002). All subjects were randomly assigned to undergo combined ES group or SFE. Numbered lots (1, SFE; 2, ES) were placed in sealed opaque envelopes by physiotherapist 1. The subjects were then allocated for intervention by physiotherapist 2.

Participants

Twenty healthy females between 18-40 years of age volunteered to participate. All subjects reported no contraindication of ES, and no lower extremity orthopedic or neurologic disorders history within the previous 6 months.

Outcome measures

The measurements of outcome in this study were assessed at the site of the dominant foot prior to and 4 weeks succeeding training intervention by the same investigators.

Navicular drop

The differences in distances between navicular tuberosity and the floor while sitting and standing are defined as the ND. Subjects sat on a chair with the hips, knees, and ankles at a 90°. Each subject was marked for their navicular tuberosity using a permanent marker. The investigator measured navicular tuberosity height utilizing a digital vernier caliper (CD-20AX, Mitutoyo, Kawasaki, Japan). Then, subjects were instructed to stand with their weight equally distributed between legs. The knees were extended and feet relaxed. Navicular tuberosity height was then remeasured. The test was performed three times with the mean value of three measurements calculated. Consequently, ND was calculated by subtracting navicular height standing from the sitting measurement.

Calcaneal pitch angle

Participants stood on the platform with equal weight on both legs, with knees extended and feet relaxed, while radiological technicians placed the radiographic film between their feet. Calcaneal pitch angle (CPA) is defined as a line drawn extending from inferior portion of the calcaneocuboid joint to the inferior border of the calcaneus, a second line extending from the inferior aspect of the medial sesamoid bone to the inferior border²¹. All films were read and calculated by a radiologist.

Cross-sectional area of abductor hallucis

An ultrasound machine (M5 series, Shenzhen Mindray Bio-Medical, China) with 7.5 MHz linear array probe was applied to render an image of the AbdH

muscle. Subjects lie down in the supine position with a 15° knee flexion with the ankle in the neutral position. An ultrasound probe with a sufficient amount of gel was placed perpendicularly to the AbdH muscle. The anterior margin of the ultrasound probe should be positioned 1cm posteriorly to the navicular tuberosity with minimal pressure. CSA mean was calculated from three separate images using software Image J V.1.52b (NIH, Bethesda, MD, USA). The CSA measures the desired area by tracing the muscle border²².

Procedure

ES training was performed using an electrical stimulator (Endomed 482, Enraf-Nonius Co., Netherlands) with two electrodes. The passive electrode was placed behind the head of the first metatarsal bone in sitting position. Meanwhile, the active electrode was placed over the AbdH motor point. Each individual was trained at 85 Hz, 5 seconds pulse duration, and 6 seconds pause duration for 20 minutes each session, once daily covering 3 sessions weekly for 4 weeks. Intensity was adjusted to each subject's maximum tolerance without pain.

Subjects in SFE group performed in the sitting position. Subjects were asked to place their feet on

the ground. Then, they attempted to pull the head of metatarsal bones toward the heel without flexing the toes, nor lifting the forefoot and heel from the ground. Exercise training was performed for 30 repetitions/day, 3 days/week, for 4 weeks. Each repetition required a contraction of 5 seconds. Throughout the 4 weeks, subjects were not allowed to participate in any other exercise.

Statistical Analysis

All data were analyzed using SPSS version 19. All data are presented as mean \pm standard deviation. The student t-test was implemented to compare demographic characteristics. Changes to ND, CPA, and CSA. in the AbdH muscle between groups at baseline and 4 weeks post-intervention were compared utilizing the independent student t-test. A p-value of less than 0.05 was considered statistically significant.

Results

Demographic Characteristics

Subjects' demographic and clinical characteristics are shown in Table 1 with no differences between groups.

Table 1 The baseline outcome measures in each group

Characteristic	ES (n=10)	SFE (n=10)
Age (years)	20.60 \pm 0.89	20.40 \pm 0.55
Height (cm)	158.40 \pm 7.30	158.20 \pm 6.42
Weight (kg)	50.40 \pm 6.89	53.50 \pm 4.72
BMI (kg/m ²)	19.80 \pm 1.56	21.59 \pm 1.13
PCA (degree)	18.70 \pm 1.89	20.40 \pm 2.76
ND (mm)	6.28 \pm 1.50	7.47 \pm 2.31
CSA (mm ²)	191.25 \pm 35.43	190.24 \pm 25.33

ES, Electrical stimulation; SFE, Short foot exercise; BMI, Body mass index; PCA, Calcaneal pitch angle; ND, Navicular drop; CSA, Cross-sectional area

Navicular drop, calcaneal pitch angle, and cross-sectional area

After 4 weeks, there is a little change in CPA in both groups (SFE = 0.4° and ES = 2.4°) with no significant change of the CPA between groups (Figure 1A). The results showed a significant decrease in ND in ES amid

the SFE group subsequent to training, whereas the SFE group did not reach significance. However, there were no significant differences between groups (Figure 1B). The CSA of the AbdH muscle in both groups was increased (ES = 10.93 mm² and SFE = 7.44 mm²; $p < 0.05$) without significant differences between groups (Figure 1C).

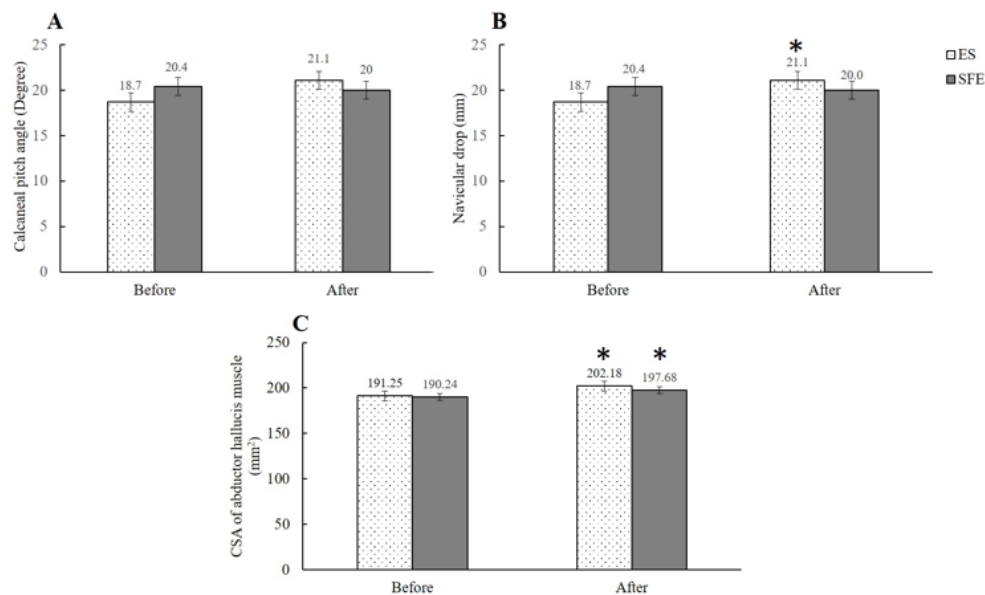


Figure 1. Effects of ES and SFE on CPA (A), ND (B) and CSA (C). Measurements were made before and after 4 wks intervention. Data are given as mean and SD (N = 20). *Significant difference from baseline testing ($p < 0.05$).

Discussion

The purpose of the current study was to compare the effects ES versus SFE on ND, CPA, and CSA amid the AbdH muscle. Hence, our results demonstrated that 4 weeks of ES tend to increase MLA height, CPA, and CSA more than SFE. More recently, a study conducted by Kaur et al.²² showed the use of ES in flexible flatfoot significantly decreased ND after 3 weeks. This is consistent with a study by Fourchet et al.¹⁷ which revealed that stimulation of the AbdH muscles in young adults significantly caused ND to decrease after 3 weeks of training.

The possible mechanism was the ES involved in the reverse motor unit recruitment in the muscles. Large fibers have a lower threshold for stimulation, thus they are recruited preferentially, resulting in a greater potential for force production²³. Therefore, ES

can facilitate muscle strength to gain more rapidly than exercise alone²⁴. Moreover, a possible mechanism that used to describe a changed of the height of navicular in this result was “the closed kinetic chain”. Changes in calcaneal position (i.e. CPA) affect the navicular via subtalar joint motion²⁵.

Moreover, the results in this study incorporated measured muscle size measurement which is considered to be one of the preminent determinants of muscle strength¹⁰. A previous study reported that the cases of IFM weakness presented a significant reduction in CSA^{10,26}. Recent studies on the uses of SFE or ES to treat flatfoot suggest that both methods tend to improve plantar intrinsic foot strength²⁷.

In a similar way, the results of this study support a previous finding in that ES and SFE tends to increase

muscle size. CSA was significantly increased after 4 weeks of intervention. Whereas, the previous study demonstrated that CSA may increase after 5-12 weeks of strength training²⁸. Gondin et al.¹⁷ found the CSA of the quadriceps muscles increased after 8 weeks of ES. Jung et al.¹¹ demonstrated that AbDH muscle CSA significantly increased after 8 weeks of SFE.

The finding in terms of increased the AbDH muscle CSA may be described by the proper strength training intensity and duration. An increase in muscle size using NMES and exercise alone rendered the enlargement of muscle fibers due to the resistance training mechanism²⁹.

This study has some limitations. Firstly, the sample size was small. Secondly, the young subjects cannot be generalized to fit the general population. Lastly, we selected subjects without muscle weakness. In the future, the study will be conducted among atrophy condition and long term study.

In conclusion, these results demonstrate that ES and SFE alone, can improve intrinsic foot muscle size. An increase in AbDH muscle size is one factor relating to IFM strength. Hence, ES tended to increase MLA and CPA over SFE alone. Consequently, ES may be recommended as an alternative treatment to increase MLA.

Conflict of Interest: The authors declare that they have no conflict of interest.

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Informed consent: Informed consent was obtained from all individual participants included in the study.

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Effectiveness of Neuromuscular and Functional Task Training in Subjects with Osteoarthritis of Knee: A Comparative Study

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Abstract

Background and Objective: Knee Osteoarthritis is the most prevalent and leading cause of pain and disability which is leading to functional limitation and reduced quality of life. The rate of prevalence in India it is 22-39%. Evidence suggests that Neuromuscular and Functional Task Training may be the best way to treat knee Osteoarthritis. Hence from the above literature, both the interventions are effective in improving strength and function in subjects with Knee Osteoarthritis and literature is limited on their comparison.

Method: 150 subjects who were clinically diagnosed of Osteoarthritis of knee were assessed and only 68 were recruited who are willing to be in the study and they were randomly allocated into two groups. In Group I (n=34) subjects were received neuromuscular training, where in Group II (n=34) subjects were received functional task training for 8 weeks. The outcomes of this intervention were knee pain and function using disability index (KOOS) and DYNAMOMETER for limb strength (knee flexors and extensors).

Results: Statistical analysis of the data revealed that in between group comparison showed there is a STATASTICAL significant difference in KOOS and Knee Flexors and Extensors strength

Conclusion: In the present study Neuromuscular training is more effective in improving strength and function when compared with Functional Task Training. Thus we can conclude that Neuromuscular Training is a suitable adjunct to physiotherapy rehabilitation in subjects with knee Osteoarthritis

Key words: Knee Osteoarthritis, strength, KOOS, ADL, QOL, Neuromuscular Training, Functional Task Training.

Introduction

Knee Osteoarthritis is a degenerative joint disease, which alters the structure of the cartilage¹. Knee is the most commonly affected joint by Osteoarthritis². Knee

Osteoarthritis is the most prevalent and leading cause of pain and disability in most countries worldwide. The prevalence increases with age and affects generally women than men. Worldwide prevalence of knee Osteoarthritis is 3.3% and in India it is 22-39%. In Andhrapradesh knee Osteoarthritis is 68%^{3,4}

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The etiologies of Osteoarthritis are to be multifactorial which includes genetic, environmental, metabolic and biomechanical. Osteoarthritis is classified into primary and secondary. The cause of primary Osteoarthritis is idiopathic and the cause of secondary Osteoarthritis is any underlying primary disease of joint which leads to degeneration⁵.

In Osteoarthritis the pathophysiology of articular cartilage is played by cell or extra cellular matrix (ECM) interactions which are mediated by cell surface integrins.. In Osteoarthritis abnormal integrin expression alters cell or ECM signaling and modifies chondrocyte synthesis, imbalance of destructive cytokines over regulatory factors. IL-1, TNF- alpha and other procatabolic cytokines activate the enzymatic degradation of cartilage matrix ⁶

Pain is the dominant symptom of Osteoarthritis which affects crucial functional activities like walking and other associated symptoms are stiffness and muscle weakness which reduces function ⁷. Quadriceps inhibition is an impairment of central nervous system results in decreased strength and proprioceptive acuity. Defect in proprioception results in reduced dynamic stability of knee and progressive functional limitation ^{8,9}

Diagnosis of Osteoarthritis is made with reasonably based on history and clinical examination. X-ray may confirm the diagnosis. Kellegran and lawrence grading system was used commonly for grading knee Osteoarthritis^{10,11} and other investigations used for detecting Osteoarthritis are serological tests, ESR, serum uric acid and arthroscopy. ¹²

Most of the Osteoarthritis knee subjects are treated conservatively with pharmacological (Analgesics, non steroidal antiinflammatory drugs, glucosamine and intraarticular hyaluronate injections) ^{13,14}. Physiotherapy management reduces pain by the use of electromodalities such as TENS, ultrasound, diathermy, cryotherapy ^{15,16}. Exercises improves function and reduce pain are range of motion exercises, strengthening exercises, stretching of hamstrings, aerobic exercises, agility and perturbation training, retrowalking and Aquatic exercises ¹⁷.

Recent trends shows that exercise therapy includes Neuromuscular Training ²¹ and Functional Task Training ²² has been proved effectively in reducing symptoms of Osteoarthritis Knee.

Material and Method

Inclusion criteria: subjects with age 35 – 60 years of both men and women, Able to walk 100 feet without assistive device, Able to ascend and descend stair, Mild to moderate knee OA grade 2, 3 kellegran and lawrence

scale, Not taking anti inflammatory medication, Unilateral involvement of Osteoarthritis knee

Exclusion criteria: Knee surgeries or intraarticular corticosteroid injections, Traumatic injury to the knee joint, Neurological disease Inability to rise from and return to a chair without assistance, currently participating in any exercise programme, Uncontrolled cardio pulmonary conditions

Outcome measures: Hand Held Dynamometer (HHD) ¹⁸ used to measure muscle strength at baseline, posttest (end of 8 weeks). **KOOS Questionnaire** ¹⁹ used to measure the functional ability and Quality of life at baseline and posttest.

The study was a pretest – posttest prospective cohort study, the subjects are grouped based on sample of convenience and are allocated in Neuromuscular group (n=34) and Functional Task Training group (n=34). Baseline measurements for both groups were taken in the 1st day, after completion of 8 weeks. A brief explanation was also given about the nature and duration of the study and then informed consent was taken. Initial assessment like age, gender, occupation, address, side affected was also taken

Group- I: NEUROMUSCULAR TRAINING

Subjects in group-I received neuromuscular training. This training consists of three parts 1) warming up – cycling for 10 minutes 2) circuit program consists four exercise circles 3) cooling down part for 10 minutes. Training session was given 3 times per week for 8 weeks and it lasts for 60 minutes ²¹

Part 2: Circuit program

Four exercise circles are in circuit program, Each exercise is performed by the subject's is 10-15 repetitions, 2-3 sets, with rest, corresponding to one set, between each set and exercise. Three levels of difficulty are given for each exercise that allows for progression.. The exercises are performed with both the affected and the non affected leg, although focus is on the affected leg ²¹.

Exercise circle 1: Core stability/postural function

This circle includes exercises with focus on core stability and postural function.

Exercises

A. Pelvic-lift with flexed knees and short lever arm, putting load on both legs .

B. Sit-ups with flexed knees, both legs on ball, arms along the sides (short lever arm)

Exercise circle 2: Postural orientation

This circle includes exercises with emphasis on an appropriate position of the joints in relation to each other i.e., with the hip, knee and foot joints well aligned

A. Slide-exercise forward-backward: Standing, weight-bearing on one leg, other leg on sliding surface. Slide backwards – forwards with “sliding leg”, while flexing – extending the knee of the weight-bearing leg and keeping an appropriate position of the joints in relation to each other.

B. Slide-exercise sideways: Standing, weight-bearing on one leg, other leg on sliding surface. Slide sideways with sliding leg, while flexing – extending the knee of the weight-bearing leg and keeping an appropriate position of the joints in relation to each other..

Exercise circle 3: Lower extremity muscle strength

This circle includes exercises in open and closed kinetic chains to improve strength of hip and knee muscles.

Exercises

A. Hip abductors/hip adductors: Standing on one leg, rubber band other leg. Pull rubber band out (hip abductors) and in (hip adductors). Make sure there is tension in the rubber band also in resting position. Focus is on the hip abductors of the standing leg, keeping an appropriate position of the joints in the lower extremity in relation to each other and in relation to the trunk, i.e., without lateral displacement of the hip-pelvis region.

B. Knee Extensors/knee Flexors: Sitting position. Rubber band around one foot. Pull rubber band forward (knee Extensors) and backwards (knee Flexors). Make sure there is tension in the rubber band also in resting position.

Exercise circle 4: Functional exercises

This circle includes exercises resembling activities of daily life.

Exercises

A. Chair stands: Start in a seated position, feet parallel, putting load on both legs, slight hand support for balance

B. Stair climbing: Step-up and step-down on low step-board, with or without slight hand support for balance.

Part.3. Cooling down: It consists of walking exercises forward and backwards, about 10 meters in each direction, in front of mirror , mobility exercises for the lower extremities and stretching exercises for the lower extremity muscles for a total of about 10 minutes.

GROUP-II: FUNCTIONAL TASK TRAINING

Subjects In Functional Task Training received five exercises. The subjects were asked to do each exercise for one minute, 3 times per week for 8 weeks. All exercises were supervised by the physiotherapist. Progressions included by increasing the time to perform the activity²²

Exercises:

1. Sit to stand in a chair Subject is able to perform this exercise by sit to stand from a chair under supervision of physiotherapist. **2. Standing star exercise:** Subject performs this exercise in standing position with affected knee placed forward followed by sideward and backward which is in the form of star. **3. Walking up and down a ramp:** Subject perform this exercise on a ramp by walking up and down under supervision of physiotherapist. **4. Ascending and descending stairs:** Subject perform this exercise in stairs by ascending and descending under supervision of physiotherapist **5.Walking indoors:** Subject walk indoors under the supervision of physiotherapist

Findings

Statistical Analysis

All statistical analysis was done by using SPSS software version 20.0 and Microsoft excel-200.

Descriptive data was presented in the form of mean standard deviation and mean difference percentages.

Between the groups: Independent student “t” test was performed to assess the statistical significant difference in mean value between the groups for dynamometer and KOOS score

Within the groups: Paired Student “t” test was performed to assess the statistical difference with in the groups for knee Flexors and knee Extensors and KOOS score (Pain, Symptoms, ADL and QOL) from pretest and post test values.

For all statistical analysis, $p < 0.05$ was considered as statistically significant.

Results

Table 1: Comparison of Post Mean scores in strength and function between the groups

			Mean	Std.Deviation	p- value	Inference
STRENGTH	Knee flexors	Group-I	14.75	2.19	0.0041	Significant
		Group –II	13.23	1.69		
	Knee extensors	Group-I	15.89	2.07	0.0001	Significant
		Group –II	14.2	1.58		
FUNCTION	KOOS Pain	Group-I	46.79	14.30	0.0409	Significant
		Group –II	40.66	11.68		
	KOOS Symptoms	Group-I	55.86	12.19	0.018	Significant
		Group –II	46.76	17.42		
	KOOS ADL	Group-I	50.58	10.84	0.037	Significant
		Group –II	44.16	11.43		
	KOOS QOL	Group-I	44.41	11.02	0.0014	Significant
		Group –II	35.16	9.23		

The above Table shows improvement in Post Mean Group-I and Post mean of Group-II. There is a significant difference between the Groups

Discussion

Aim of the study was to evaluate the effectiveness of Neuromuscular (Group-I) and Functional Task Training (Group-II) on strength and function in subjects with knee Osteoarthritis

In this study subjects were assessed for knee Osteoarthritis underwent either Neuromuscular or

Functional Task exercises which are performed for 8weeks, the parameters usually assessed before and after exercise training are knee pain, strength, and function. The following outcome measures named as DYNAMOMETER, and KOOS. These measures are used for quantifying the intensity of strength, pain and function in subjects with Knee Osteoarthritis. There is statistically significance difference between two groups

in improving strength and function in subjects with Osteoarthritis Knee

In this study, the result in Neuromuscular Training is primarily based on sensorimotor system. sensorymotor dysfunction may play a role in development and progression of degenerative knee disease. The aim of the Neuromuscular Training method is to improve sensorymotor system and achieve functional stability ²⁴.

Eva Ageberg et al ²⁵ conducted a study on effects of Neuromuscular Training on patient reported outcomes and physical function in severe primary hip or knee Osteoarthritis and find that Neuromuscular Training with progression and with individualized approach had showed improvement in patient reported outcomes and also physical function in old patients with primary hip or knee Osteoarthritis

Functional Task exercises enhance muscle strength, function and reducing pain in subjects with Knee Osteoarthritis. It is due to complex neural activation and vast muscle mass using multiple joint exercises, neural adaptations and then muscle strength. Similar findings are seen by Paul et al in his study the closed chain exercises (squat) which gives high stability by co contraction of quadriceps and hamstrings provide minimal stress on knee joint in functional range, it is effective and safe exercise method

Similar results are also seen in the study conducted by kk singh et al ²⁶, the effects of Functional Task Training (FTT) versus Progressive Resistance exercises on Osteoarthritis knee and find that FTT is effective in improving balance, functional mobility and reducing pain in Osteoarthritis of knee

Osteoarthritis knee affects the hamstring muscle more than the quadriceps muscle. The ratio of quadriceps to hamstrings muscles strength is important for stability of the knee for protecting from exercise stress. In conclusion, subjects who have knee Osteoarthritis need to improve muscle power, proprioception. We think that designing appropriate exercise programs create effective result ²⁷.

Conclusion

The present study concluded that eight weeks of Interventions of Neuromuscular and Functional Task

Training were shown statistically significant in improving strength and function. However Neuromuscular is more effective in improving strength and function when compared with Functional Task Training. Thus we can conclude that Neuromuscular Training is a suitable adjunct to physiotherapy rehabilitation in subjects with knee Osteoarthritis

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: The ethical clearance of this study protocol was approved by the Ethical Committee of GSL Medical College; the participants were requested to provide their consent to participation in the study.

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Practicing the Leisure Sports Activities and their Relation to Alleviating the Examination Anxiety among the Students of Al-Balqa Applied University

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Abstract

Background and Objective: This study aimed to identify the practice of the leisure sports activities and their relationship in reducing the examination anxiety among the students of Al-Balqa Applied University.

Subjects and Method: The study adopted the descriptive, analytical method. The study sample consisted of (200) male and female students at Al-Balqa Applied University who were randomly selected from the study population. To achieve the objectives of the study, the researcher prepared a questionnaire as a study tool for gathering information from the members of the study sample. Statistically analysis have used to verifying the validity and reliability of the study tool and to get the results.

Results: After verifying the validity and reliability of the study tool, the researcher concluded that there is a high degree in practicing the leisure sports activities and their relationship to alleviating the examination anxiety among the students of Al-Balqa Applied University and that there are statistically significant differences at sig. ($\alpha \geq 0.05$) among the viewpoints of the members of the study sample on reducing the examination anxiety among the students of Al-Balqa Applied University in favor of the practitioner of sports activities.

Conclusion: According to the results, the researcher in the study recommended the need to work on paying attention to the leisure activities and work on their development and activation among the university students in order to relieve the pressures of the exam for them and working on holding free training programs for students on the leisure activities and their types, and showing their importance in the students' university life in order to relieve the exams' pressure and to achieve a psychological well-being.

Key words: Exercise- Leisure sports- Examination anxiety- psychological.

Introduction

Studying at university is considered one of the most important stages through which man passes; it is one of the main pillars in the progress and development of societies, as universities are educational institutions containing an important segment of society that cannot be underestimated, namely the students. Through students, the development and advancement of the members of the society lie in them in all the fields of life.

One of the most prominent of these areas at the university level is the leisure sports activities, which play an important role in raising the efficiency of the

performance of the university student mentally and physically through the students' practice of some leisure sports activities.

Furthermore, the sports activity in its modern sense is considered an important dimension of education and a strong element in the process of preparing the student's personality alongside the curricula¹. One of the most important problems that the leisure sports activities can alleviate is the anxiety from which many members of the society suffer from in their daily lives in general.

Psychologists and sports psychologists have agreed that play is the basic building block of this phenomenon;

therefore, it had a great importance in the social life. It is now known as the leisure sports activities which contribute to the development of the cognitive and educational skills, values, and trends among persons practicing their activities².

The leisure sports activities are one of the most prominent and important means of physical and psychological recreation that help people achieve a balanced life, especially when sports activity becomes a leisure activity invested by the student at all times³. According to Scully et al., the sports and leisure activities have a positive role in achieving psychological well-being, physical health, reducing anxiety and stress, and improving the mood⁴.

The phenomenon of anxiety is one of the general phenomena that characterize the current era. The degree and severity of anxiety vary from person to person. Examination anxiety, as a topic, is tackled by many modern educational studies and researches. It is defined as a psychological status or an emotional phenomenon affecting the student before and during the test; it arises from his fear of failure or his fear of not getting results that satisfy him and others. This case affects the student's mental processes such as concentration, attention, remembrance, and thinking⁵.

As a result of linking tests to important decisions in the lives of individuals such as admission to universities, they are considered as a source of anxiety for students. This will negatively affect the student's performance, which may be a cause of failure or lower percentages than he expects or than what should be achieved. This deepens the hatred of tests that causes some individuals to face the neurotic anxiety of examinations⁶.

There are many definitions for the leisure sports activities see Al-Anzi⁷, Al-Fayiz⁸, Barwais et al.⁹. Taqi Al-Din defines the leisure sports activities as the games or sports that are exercised in leisure and free of intense competition. In other words, they mean the sports outside the regulatory activity, which is a leisure physical activity for pleasure and happiness at its fullest¹⁰.

According to the viewpoints of many researchers, the leisure sports activities are divided into the four major groups¹¹: Games and competitions with simple organization, individual games or sports, couple sports

and team games.

Many researchers have defined the examination anxiety, Saihi one of them. Saihi defined the examination anxiety as "a state of the student's feeling of tension and discomfort as a result of disorder in the cognitive and emotional aspects. It is accompanied by certain physiological and psychological symptoms that may appear on him. They may feel them when facing the examination situations or remembering them, or when their experiences are invoked in testing situations"¹². Another definition by Al-Khazi. He defined the examination anxiety as a psychological state of discomfort and stress felt by the university student before and during the test; it affects his or her performance and the requirements of the normal education¹³.

Several studies exist for understanding the relation between the leisure sports activities and the examination anxiety, such as Türkmen & Balci study¹⁴, Zobairy et al., study¹⁵ and Bouzidi study¹⁶.

Study Methodology and Procedures

Study methodology: The study adopted the survey descriptive approach due to its suitability to its nature.

Study population: The study population consisted of all the students of Al-Balqa Applied University in all the governorates of the Hashemite Kingdom of Jordan.

Study Sample: The sample of the study consisted of (200) students from Al-Balqa Applied University. Table 1 shows the distribution of the sample members according to the personal variables.

Table 1: Distribution of the members of the sample according to the personal variable (n = 200)

Level	Frequency	Percentage
Practitioner of Leisure sports activities	110	55.0
Non- Practitioner of Leisure sports activities	90	45.0
Total	200	100.0

Study tool: For the purpose of achieving the study objectives and answer its questions, the researcher adopted the questionnaire as a means of collecting information from the study sample members. Here are the procedures of preparing for the study tool.

Preparing the study tool: After reference to theoretical literature and the previous studies, the researcher prepared the study tool, the questionnaire, which consisted of two parts: the first included the personal information of the members of the study sample and the second included (25) items that measure the extent of practicing the leisure sports activities and their relations with alleviating the anxiety among the students of Al-Balqa Applied University.

Validity of the study tool: To confirm the validity of the study tool, it was presented to (6) experts with experience for the purpose of identifying an appropriate degree for the language formulation, the item’s extent of belonging to the field in addition to deletion, addition and modifications necessary. In accordance to the consensus of the majority of experts, the appropriate adjustments were conducted to the questionnaires.

Reliability of the study tool: To verify the reliability of the study tool, the reliability coefficient (Cronbach’s alpha) for the study tool as a whole was extracted. Table 2 shows that clearly.

Table 2: Reliability coefficients (Cronbach’s alpha) for the Study Tool as a Whole

Tool as a whole	(Cronbach’s alpha) coefficient
	0.81

Table 2 shows that the values of the Cronbach’s alpha coefficients for the study areas ranged (0.72-0.84) and that the Cronbach’s alpha coefficient for the tool as a whole was (0.81), which is considered high for the application purposes. Most studies indicated that the degree of accepting the reliability factor was (0.70).

Scale Correction: The questionnaire consisted of (20) items. The researcher used the fifth Lickert scale for measuring the viewpoints of the members of the study sample as follows: very high (5), high (4), moderate (3), low (2), very low (1). This was done through placing a

(√) signal before the answer that reflect their approval degree. The following classification was adopted to indicate the means as follows:

- Less than 2.33 low.
- From 2.34-3.66 moderate.
- From 3.67 to 5.00 high.

Statistical Treatment: To answer the questions of the study, the following statistical treatments were used throughout the SPSS:

- Frequencies and percentages of the personal variables of the members of the study sample.
- Internal consistency coefficient (Cronbach’s alpha) for the study tool.
- Means and standard deviations for the answers of the members of the study sample.
- Results of applying the Independent Samples T-Test on the study tool.

Results and Discussion

This section includes the presentation of the results of the study which aimed at identifying the extent of practicing the leisure sports activities and their relationship in alleviating the anxiety of examinations among the students of Al-Balqa Applied University through the study questions. Here are the results:

First: The results of the first question: What is the degree of the extent of practicing the leisure sports activities and their relation with alleviating the examination anxiety among the students of Al-Balqa Applied University?

To answer this question, means and standard deviations of the answers of the members of the study sample for the study tool were extracted. Table 3 explains this.

The data collected by questionnaire shows that the means of the respondents’ answers to the items of the study tool ranged from (3.59 to 4.01). Item (1) which stated “practicing the leisure sports activities contributes to providing me with confidence and satisfaction while answering the exam questions” came in the first rank by

a mean of (4.01) and a high evaluation degree. However, in the final rank, came item (7), which is “Practicing the Leisure sports activities contribute to alleviate my feelings of panic and fear before and during the test” with the mean of (3.59) and a high evaluation degree. The researcher attributes this result to the students’ awareness of the importance of practicing the leisure sports activities and their role in filling their free time positively, and because of their psychological, mental and social benefits, which help them achieve a sense of confidence and satisfaction during answering the questions of the exam. Furthermore, practicing the sports activities also reduces the feeling of panic, fear and extreme confusion among the university students before and during the exam. Also, practicing the sports activities works to guide the university students towards living in a high spirit of sportsmanship that help them expel the negative energy left by the process of preparing for the exam and its accompanying anxiety.

There is no doubt that the practice of leisure sports activities reduces the level of anxiety of the exam, where the anxiety of university students causes an overall tension that affects the student as well as the mental processes of attention, thinking, concentration and remembering, which is one of the most important requirements for passing the exam. Such state of tension therefore negatively affects the achievement of university students.

The practice of leisure sports activities also helps the university students to improve their academic level, and reduces anxiety, which is one of the psychological phenomena that clearly affect the students’ personality.

The anxiety of the exam is reflected in students’ performance and level of educational and cognitive achievement at university, which has the greatest impact on the future of the university student.

Second: Results related to the second question: Are there statistically significant differences at sig. ($\alpha \leq 0.05$) for the degree of practicing the leisure sports activities and their relation in alleviating the examination anxiety among the students of Al-Balqa Applied University due to the practitioner of leisure sports activities and non-practitioner of leisure sports activities?

To validate this hypothesis, the Independent Samples T-Test was applied on the study tool according to the variable (practitioner of sports activities). Table 3 illustrates this.

Table 3: Results of applying the Independent Samples T-Test to the study tool according to the variable of practitioners of sports activities

Level	Mean	SD	T	SS
Practitioner of Leisure sports activities	4.04	0.57	5.71	0.00
Non-practitioner of Leisure sports activities	3.59	0.54		

Where: SD (Standard Deviation), SS (Statistical Significance)

Table 3 shows statistically significant differences at sig. ($\alpha \geq 0.05$) between the opinions of the sample members about the study tool according to the variable of the practitioner of leisure sports activities where the value of (T) was (5.71), which is a statistically significant value in favor of the practitioner of leisure sports activities with a mean of (4.04). However, the mean for the Non-practitioner of leisure sports activities was (3.59) which is attributed to the fact that the university students who practice the leisure sports activities before the exams get better results in the exam. This was proved through applying some mental tests on them and their results were better than the students who did not practice the leisure sports activities before the exam. The researcher also noted that practicing the leisure sports activities clearly increased the concentration of students in their studies. Also it reduced the anxiety of the exam for students, achieved success and led to getting rid of leisure time and a sense of psychological comfort as well as physical and mental health.

Conclusion

Leisure sports activities with all their kinds and names are not only leisure activities, but also educational, mental, social, physical and purposeful activities that cannot be achieved without proper and careful planning of these activities, and the provision of physical and technical facilities and appropriate conditions for the implementation of these activities. Based on the results,

the study recommended:

1. The need for paying attention to leisure activities and working on developing them among the university students in order to relieve their pressures of the exam.

2. Working on holding free training programs for students in particular whose topic are the leisure activities and their types, and showing their importance in the life of university students in order to relieve the pressure of examinations, and to achieve the psychological well-being.

3. The need for working on conducting further studies examining the leisure sports activities and their relationship to certain variables, such as self-efficiency, methods of entertainment, achievement, and emotional intelligence. The study also recommended conducting further studies on the psychological well-being of students and their relationship to certain variables such as happiness, optimism, social intelligence, and emotional intelligence.

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Comparative Effect of Burst Transcutaneous Electrical Nerve Stimulation (Tens) Versus Interferential Therapy (Ift) Along With Exercise In Reducing Pain and Functional Impairment in Subjects with Knee Osteoarthritis

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Abstract

Background: Osteoarthritis is a condition characterized by progressive loss of articular cartilage within a joint resulting in a pain. Osteoarthritis is more commonly seen in weight bearing joints i.e. knee joint. Radiologically and pathologically changes of osteoarthritis are seen in age of above 65 years. Because the knee joint is weight bearing and contributes to ambulation, patients usually experience functional limitations in activities of daily living.

Materials & Methodology: Patients with knee Osteoarthritis (n=20) were included in this study and patients with traumatic injury to knee, or any recent surgical intervention performed at knee and Neurological illness were excluded from the study. A comparative study was done where two groups were made, Group A (n=10) received burst transcutaneous electrical nerve stimulation along with exercises and Group B (n=10) received interferential therapy along with exercise. Treatment was given for 5 times a week for 2 weeks. Pain was assessed using Visual Analogue Scale and functional disability was assessed using Western Ontario and McMaster Universities Osteoarthritis Index.

Results: Group B showed significant decrease in pain and functioning as compared to Group A. Mean pre VAS of Burst TENS subjects was 5.90 which was significantly higher than mean post VAS 4.00 (P=0.06). Mean pre VAS of IFT subjects was 6.50 which was significantly higher than mean post VAS 2.90 (p<0.001). Mean pre WOMAC of Burst TENS subjects was 64.90 which was significantly higher than mean post WOMAC 45.60 (p<0.01). Mean pre WOMAC of IFT subjects was 67.50 which was significantly higher than mean post WOMAC 20.70 (p<0.01).

Conclusion: The study concluded that Interferential Therapy along with Exercises is more effective than Burst Transcutaneous Electrical Nerve Stimulation along with Exercise.

Keywords: IFT, TENS, VAS, WOMAC Index, Exercise, OA Knee.

Introduction

Osteoarthritis is defined as a condition characterized by progressive loss of articular cartilage within a joint resulting in a pain. Osteoarthritis is more commonly seen in weight bearing joints i.e. knee joint.¹ The common causes of Osteoarthritis are age more than 40 years, female, hereditary condition, previous joint injury, obesity, disease of joint, poor posture, occupational stress and strain.¹ The WHO Scientific Group on Rheumatic

Disease estimates that 10% of the world's population who are 60 years or older have significant clinical problems that can be attributed to OA.² since incidence and prevalence increase with age, longer life expectancy will result in an increase of Osteoarthritis in the future.^{3,4} Knee Osteoarthritis is associated with a variety of pathophysiologic deficits, including joint instability, reduced joint range of motion (ROM), and disuse atrophy of the quadriceps muscle.^{5,6} Radiographical and

pathological changes of OA are present in most persons over the age of 65 years. Because the knee joint is weight bearing and contributes to ambulation, patients usually experience functional limitations in activities of daily living.⁷ Electrotherapeutical modalities of rehabilitation are important resources in the treatment of musculoskeletal pain.⁸ IFT and TENS are forms of electrical current that are primarily used for pain relief.⁹ Although the evidence for other modalities is lacking, there is strong evidence for the benefits of exercise in relieving pain and improving functional status. Huang et al reported significant improvements in pain, reduced disability and improved walking speed in OA patients after a muscle-strengthening exercise programme.¹⁰

The purpose of this study was to evaluate the effects of IFT and TENS, when used in conjunction with exercise, on pain and function in patients with knee OA. We specifically combined an exercise programme with these two modalities to maximise any effect on patient pain and function.

Materials and Method

An approval for the study was obtained from the Institutional Ethical Committee. A randomized Control trial was conducted in subjects with Knee Osteoarthritis in Physiotherapy OPD of Tertiary Care Hospitals of Miraj. Sample was achieved by Purposive Random Sampling method. A total of n=20 subjects were selected. All the subjects were screened for inclusion criteria i.e. Both males and females of age 45-70 years, Subjects with Both Unilateral and Bilateral knee Osteoarthritis, subjects were taken from confirmed diagnosis knee OA, Willingness of subjects. Subjects excluded were those having Traumatic injury to knee, recent surgical intervention performed at knee, history of neurological deficit and unwilling subjects. Subjects were divided into two groups with: Group A=10 subjects Group B=10 subjects. Subjects were briefed about the nature of the study and intervention. The demographic data including age, height, gender, weight, side affected, duration of symptoms was collected through data sheet. Subjects were given written consent prior to the intervention. Group A subjects were treated with Burst Transcutaneous Electrical Nerve Stimulation along with Exercise and Group B was treated with Interferential Therapy along with Exercise. The data was collected

pre-treatment and post-treatment using and using visual analogue scale and Western Ontario and McMaster University Osteoarthritis Index (WOMAC).

Visual Analogue Scale- It is usually presented as a 100 mm horizontal line on which the patients pain intensity is represented where 0=no pain and 10=worst possible pain.¹¹ Reliability=0.72.

Western Ontario McMaster And Universities Osteoarthritis Index- Subjects rated the 24 questions (5 relating to pain, 2 to stiffness and 17 to function) on a five-point scale: 0 = none, 1 = slight, 2 = moderate, 3 = severe and 4 = extreme¹². Reliability=0.61 to 0.71.¹²

Group A = Burst Transcutaneous Electrical Nerve Stimulation-

Before starting the treatment therapist explain the subjects about the modality. The area to be examined was exposed and cleaned.

Position- supine/ sitting

Electrodes Placement- Four TENS pad electrodes will be placed around the affected knee joint for 10 sessions, 5 times a week for 2 weeks.

Parameters- Mode=Burst, Frequency= 40-150Hz, duration= 10-20 minutes, TENS output intensity was increased until the a strong, tolerable, stroking sensation, preferably producing visible phasic muscle contraction, was achieved.¹³

Group B = Interferential Therapy-

Before starting the treatment therapist explain the subjects about the modality. The area to be examined was exposed and cleaned.

Position- supine/sitting position.

Electrodes Placement- Four interferential pad electrodes will be placed around the affected knee joint for 10 sessions, 5 times a week for 2 weeks. The patient was explained that he/she will feel a tingling sensation which could not be unpleasant.

Parameters- Frequency=4000Hz, base=90Hz, sweep= 40Hz, Beat frequency =90-130Hz, quadripolar, duration=10-20minutes, IFT output intensity was increased until the “normal” tingling was encountered

by the patient.¹⁴

Dynamic Resisted Exercises-

Manual Resisted Active Isokinetic Knee Exercises¹

Patient position- sitting position with full knee flexion

Procedure- instruct subject to extend the knee while the therapist applied the resistance while performing the movement, and then return to the starting position.

Duration- They performed 3 sets of 10 repetitions at each treatment session, with at least a 1 min rest interval between each set.¹

Progression- weight cuffs

Mecahnical Resisted Exercise-

Using Quadriceps Table –

Procedure- It was performed on quadriceps table with your lower legs behind the padded lever. Hold on to the table or provided handles with your hands to keep the upper body in correct position. Strengthen by extending the knee in a controlled manner. Initially with 0.5 kg weight. Duration: They performed 3 sets of 10 repetitions at each treatment session, with at least a 1 min rest interval between each set

Progression- Progressed the weight up to 1kg to 3kg.

Using Therabands¹⁵ –

Patient position- sitting with full knee flexion

Procedure- Tie your resistance band into a loop. Place the looped resistance band around the leg of a chair. Sit on the chair and put your leg into the loop with the band just above your ankle. Straighten knee to about 2/3 straight.

Duration- They performed 3 sets of 10 repetitions at each treatment session, with at least a 1 min rest interval between each set.

Progression- Use appropriate level of resistance band – red through to black or ankle cuff weight.¹⁵

Findings

The subjects were divided into two groups i.e. Group A (n=10) and Group B (n=10). Table and fig 1 shows that, there were 6(60%) female subjects and 4(40%) male subjects with knee osteoarthritis receiving burst transcutaneous electrical nerve stimulation along with exercise. And there were 7(70%) female subjects and 3(30%) male subjects with knee osteoarthritis receiving Interferential therapy along with exercise.

Table1: Gender Distribution of subjects with knee osteoarthritis receiving TENS and IFT along with exercise

Gender	TENS		IFT		Total	
	Frequency	%	Frequency	%	Frequency	%
Females	6	60	7	70	13	65
Males	4	40	3	30	7	35
Total	10	100	10	100	20	100

After the application of the unpaired t-test the outcome exhibited a significant ($p=0.06$) reduction in pain in Interferential therapy along with exercise (Group B) as compared to burst transcutaneous electrical nerve

stimulation along with exercise. And there was a high significance ($p<0.01$) reduction in functional disability in Interferential therapy along with exercise (Group B) as compared to burst transcutaneous electrical nerve stimulation along with exercise (Group A). Table 2

Table 2: Descriptive statistics of subjects with knee osteoarthritis receiving TENS or IFT along with exercise on pain using visual analogue scale (VAS) and on functioning using Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and its comparison using unpaired t test.

Group Statistics	Group	N	Mean	Std. Deviation	Unpaired t statistic	p value
VAS Pre	TENS	10	5.90	1.20	1.29	0.21
	IFT	10	6.50	0.85		
VAS Post	TENS	10	4.00	1.49	2.09	0.06
	IFT	10	2.90	0.74		
WS Pre	TENS	10	64.90	13.38	0.50	0.63
	IFT	10	67.50	9.63		
WS Post	TENS	10	45.60	14.12	4.29	<0.01
	IFT	10	20.70	11.70		

Mean pre VAS score of burst transcutaneous electrical nerve stimulation subjects was 5.90 and mean pre VAS score of interferential therapy subjects was 6.50. Mean post VAS score of subjects was 4.00 and mean post VAS score of Interferential therapy subjects was 2.90 ($p=0.06$). Pain was reduced post-treatment in both groups but significantly reduced in Group B i.e. Interferential therapy along with exercise. Mean pre

WSS score of burst transcutaneous electrical nerve stimulation subjects was 64.90 and mean pre WSS score of IFT subjects was 67.50. Mean post WS score of TENS subjects was 45.60 was significantly higher than mean post WS score of Interferential therapy subjects was 20.70 ($p<0.01$). Therefore, functioning was improved post-treatment in both the groups but significantly improved in Group B i.e. Interferential therapy along with exercise.

Table 3: Descriptive statistics of subjects with knee osteoarthritis receiving TENS or IFT along with exercise on pain using visual analogue scale (VAS) and on functioning using Western Ontario and McMaster universities Osteoarthritis Index (WOMAC) and its comparison using paired t test.

Group Statistics	Group	N	Mean	Std. Deviation	Paired t statistic	p value
VAS Pre	TENS	10	5.90	1.20	6.04	<0.001
VAS Post	TENS	10	4.00	1.49		
VAS Pre	IFT	10	6.50	0.85	16.28	<0.001
VAS Post	IFT	10	2.90	0.74		
WSS Pre	TENS	10	64.90	13.38	6.03	<0.001
WSS Post	TENS	10	45.60	14.12		
WSS Pre	IFT	10	67.50	9.63	14.13	<0.001
WSS Post	IFT	10	20.70	11.70		

Paired t test was done to compare between subjects with knee osteoarthritis receiving Burst transcutaneous electrical nerve stimulation with exercise and Interferential therapy along with exercise. It was found that Mean pre VAS of burst TENS subjects was 5.90 which was significantly higher than Mean post VAS 4.00 ($p < 0.001$). Mean pre VAS of IFT subjects was 6.50 which was significantly higher than Mean post VAS 2.90 ($p < 0.001$). Mean pre WSS of Burst TENS subjects was 64.90 which was significantly higher than Mean post WSS 45.60 ($p < 0.001$). Mean pre WSS of subjects was 67.50 which was significantly higher than Mean post WSS 20.70 ($p < 0.001$).

Discussion

Osteoarthritis (OA) is one of the most important causes of chronic pain in the general population. Treatment of pain in patients with osteoarthritis is mainly with analgesic medications that can cause serious adverse events in long-term use. To avoid the adverse effects from these drugs other modalities have been introduced and their effectiveness has been demonstrated.¹⁶ The present study demonstrated that Burst Transcutaneous Electrical Nerve Stimulation along with exercises (Group A) and Interferential Therapy along with exercise (Group B) both were effective for pain relief and functioning associated with Knee Osteoarthritis. But improvement with Interferential Therapy along with exercise was much greater as compared to Burst Transcutaneous Electrical Nerve Stimulation along with exercises for all treatment groups. There was significant improvement ($p < 0.01$) in the IFT group as compared to Burst TENS group.

Some Previous study concludes that IFT show better effect when it compare with TENS and exercise programme alone. Improvement in VAS and WOMAC in both the groups were observed.¹⁶ Previous study i.e. Topp et al found that dynamic or isometric resistance exercises produced pain relief that was significantly better in patients with knee OA. And also Bischoff and Roos recommend that strengthening exercises is to improve pain and function in patients with OA.¹⁷

Some other authors suggested like Kreindler and colleagues, using control, "traditional quadri- ceps and hamstring strengthening exercise," and isotonic treatment groups for comparison, also demonstrated

isokinetic exercise to increase strength, which was better maintained with a follow-up home exercise program.¹⁸ Several investigators²⁰, I have reported declines in the sensorimotor function of the quadriceps (proprioception) among knee OA patients. This decline may be a primary factor contributing to the development and progression of knee OA.¹⁹ Thus, regular resistance training may lower the impact and impulsive loads through the knee joint not by only increasing the strength of the muscle surrounding the knee joint but also by increasing sensitivity and coordination of the proprioceptors within the quadriceps muscle.²⁰

IFT is a popular treatment for pain and dysfunction associated with musculoskeletal conditions. Interferential electrotherapy with amplitude modulated at low frequencies reaches deep muscles and nerves, stimulates voluntary muscles, promotes an increase in peripheral blood flow, accelerates bone healing, and reduces pain.²¹

Conclusion

This study concludes that Burst transcutaneous electrical nerve stimulation and Interferential therapy along with exercise were effective in reducing VAS and WOMAC score treating in Knee Osteoarthritis. After comparison it showed that Interferential therapy along with exercise was statistically more effective for pain relief stiffness and physical function than Burst transcutaneous electrical nerve stimulation with Exercise

This strengthening exercise program includes exercises that have been shown to be beneficial for people with knee osteoarthritis. Limitation being that this study were not screened by using any sort of osteoarthritis grading. Also, there were not equal number of subjects. i.e. equal number of males and females in Group A or Group B. Therefore, the study is bias as the both group does not have equal number of males and females. Further, research might be carried out on the long-term effect of the exercises with a large population.

Conflict of Interest: None.

Source of Funding: Self.

Ethical Clearance: Ethical clearance obtained from the ethical committee of College of Physiotherapy, Wanless Hospital, Miraj

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Fatigue in Multiple Sclerosis: Its Relation to Disability and Functional Independence

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Abstract

Background: Fatigue is a common and disabling symptom in Multiple Sclerosis (MS), but it was overlooked for a long time probably. Fatigue has a significant effect on the mental health and general health status. It is not only the most frequently reported symptom in MS but also a limiting factor which can interfere with physical ability and functional independence. Thus, aim of this study was to find out the relation of fatigue to disability and functional independence, as it can help all the rehabilitation team to emphasize on the importance of fatigue and its effect on disability and functional independence when assessing subjects of MS and planning treatment guidelines for them. **Materials and Methods:** The participants in this study were 30 MS subjects. These subjects were assessed for fatigue by using Modified fatigue impact scale (MFIS), disability by expanded disability status scale (EDSS) and functional independence by functional independence measure scale (FIM) and a correlation was done between them. **Result:** The Spearman's correlation test indicates that fatigue has a moderate positive correlation with disability which was assessed by EDSS ($r = 0.4$) and statistically showed moderate significance ($p < 0.05$). Fatigue has moderate negative correlation with functional independence ($r = -0.50$) and statistically showed strong significance ($p < 0.01$). Also, disability has a very large negative correlation ($r = -0.852$) with functional independence and statistically showed strong significance ($p < 0.001$). This study accepted the experimental hypothesis stating that there was a significant relation of fatigue to disability and functional independence in subjects with MS. **Conclusion:** Study concludes that fatigue is a common symptom affecting majority of patients with MS. It was found that fatigue had a positive correlation with disability but when functional independence was considered there existed a negative correlation in fatigue and functional independence.

Keywords: Multiple sclerosis, fatigue, disability, functional independence

Introduction

Multiple sclerosis (MS) referred by the British as disseminated sclerosis and by the French as scleroses en Plaques, is among the most vulnerable of neurological diseases and one of the most important by virtue of its frequency, chronicity and tendency to attack young adults. It is referred as the "The Great Crippler of young." MS is a chronic, often disabling, demyelinating diseases of the central nervous system (CNS). MS

primarily affects adults between the ages of 20 and 40 years, and is more common in women than in men with a ratio of 2:1.⁽¹⁾

The estimated number of people with MS in India is 50,000.⁽²⁾ An International survey of Neurologist (Lubin and Rein Gold 1996) defined four main variants of this disease Relapsing / Remitting MS (RRMS), Secondary Progressive MS (SPMS), Progressive relapsing MS (PRMS) and Primary progressive MS (PPMS)⁽³⁾ The etiology of MS is thought to involve interplay between genetic and environmental factors resulting in an immunologically mediated inflammatory response with the CNS.⁽⁴⁾ Signs and symptoms of MS vary considerably depending on the location of specific

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lesions. Early symptoms often include minor visual disturbances, paresthesias, incontinence, weakness and fatigability.

Fatigue is a very prevalent and severe problem in MS.⁽⁵⁾ It is reported to be the first and most troubling symptom. Upto 80% of subjects with MS complain of fatigue.^(6,7) Fatigue in MS is described as nerve fibre fatigue which results when body requires more energy for nerve impulses to travel along demyelinated fibres. Normally, conduction through myelinated pathways in the CNS is saltatory and axons transmit fast trains of impulses. In MS, demyelinated axons cannot transmit fast trains of impulses and this explains the symptom fatigue.⁽⁸⁾ Fatigue in MS is classified as follows; Primary fatigue: Short-circuiting fatigue occurs in specific muscle groups and Secondary fatigue: Sleep disturbances which are due to muscle spasm, pain, and urinary urgency at night, depression or anxiety⁽⁹⁾.

Fatigue has a significant effect on mental health and general health status of MS. It has been found that the cortical atrophy in MS is related to disability.⁽¹⁰⁾ Considering all these factors leading to fatigue which further reduces the quality of life and also makes them more dependent, thereby increasing their disability. In MS, subjects experience restriction in mobility and everyday functional activities for which a wide range of factors are responsible like physical, psychological, environmental, and economic issues. Though it has been found that fatigue in MS has significant relation with disability.⁽¹²⁾ and few studies show that fatigue is not related to disability status.

As there is few literature which shows the effect of fatigue on disability but there is no studies which shows relation of fatigue to functional independence. Thus, the need exist to find out the exact relationship of fatigue to disability and functional independence in subjects with MS, as it can help all the rehabilitation team to emphasize on the importance of fatigue and planning treatment guidelines for them.

Materials & Methodology

Study design was observational. Study was conducted between November 2006 and September 2007 in a Tertiary Care Hospitals in Bangalore, India.

Study design was observational study design. Sampling method was Convenient sampling .Inclusion criteria was subjects diagnosed with MS by the Neurologist. Both Males and females with a age group of 20 to 40yrs was included. Subjects with one relapse and progressive condition who could carry out at least one ADL and with complaint of fatigue were included in the study. Subjects with other neurological disorder, musculoskeletal disability, unstable cardiac condition and bedridden patients were excluded from the study.. Outcome measures were Modified fatigue impact scale (MFIS) Expanded disability status scale (EDSS) and Functional independence measure scale (FIMS).

Procedure:

After obtaining clearance from the ethical committee, subjects were selected based on the inclusion and exclusion criteria by convenient sampling method. An informed consent was obtained from the patient. A detailed history of illness was taken from them and their neurological status was examined. The subjects were assessed for fatigue using MFIS, disability by EDSS, and functional activities by FIM, and above mentioned scales are reliable and valid.⁽⁹⁾

The subjects were asked questions from MFIS and made to select the appropriate options given for each of, the questions asked in the questionnaire by marking (√) or encircling on any of the four options. The four options, in each questions were explained to the subjects before they were asked to mark the appropriate option. If the patients were unable to write, they were allowed to be assisted by their relatives. EDSS scale was used to assess the disability status of the patient. The scoring was done according to the number of the systems involved which includes pyramidal system, brainstem system, sensory system, bowel and bladder, and higher mental functions.

Lastly, the subjects were assessed for activities of daily living by FIM scale. The subjects were made to perform certain activities of day to day routine and their capability was scored.

Result

TABLE 1: CORRELATION BETWEEN MFIS AND EDSS

	EDSS
MFIS correlation coefficient	r =0.400
Sig. (2-tailed)	0.029*
Physical correlation coefficient	r =0.530
Sig. (2-tailed)	0.003**
Cognitive correlation coefficient	r =0.161
Sig. (2-tailed)	0.397
Psychosocial correlation coefficient	r =0.215
Sig. (2-tailed)	0.254

Correlation between MFIS and EDSS in MS subjects using Spearman Rank correlation test, p value obtained was 0.0297, which is statistically significant

TABLE 02: CORRELATION BETWEEN MFIS AND FIM

	FIM
MFIS correlation coefficient	r = -0.500
Sig. (2-tailed)	0.005**
Physical correlation coefficient	r = -0.582
Sig. (2-tailed)	0.001**
Cognitive correlation coefficient	r = -0.316
Sig. (2-tailed)	0.088
Psychosocial correlation coefficient	r = -0.268
Sig. (2-tailed)	0.152

Correlation between MFIS and FIM in MS subjects using Spearman Rank correlation test, p value obtained was 0.005, which is statistically significant

TABLE 03: CORRELATION BETWEEN EDSS AND FIM

	FIM
EDSS Correlation coefficient	r = -0.852
Sig. (2-tailed)	0.0001**

Correlation between EDSS and FIM in MS subjects using Spearman Rank correlation test, p value obtained was <0.0001, which is statistically significant

Discussion

This study is intended to find out the relation of fatigue to disability and functional independence in subjects with MS. Fatigue assessed by MFIS has a moderate positive correlation with disability assessed by EDSS (r = 0.4) with a moderate statistical significance (p< 0.05). To find out which component of fatigue is responsible for increasing disability, the physical, cognitive and psychosocial component of MFIS was analyzed. The results shows that physical fatigue (r = 0.530) has a large positive correlation with disability and statistically shows strong significance (p<0.01). Cognitive (r = 0.07) shows a Trivial positive correlation with disability and is not statistically significant (p>0.05), psychosocial (r =0.215) shows a small positive correlation with disability but is not statistically significant. (p>0.05) (Table no. 01) Thus, as fatigue level increases; disability level increases. It was also seen that fatigue has a negative correlation with Functional Independence (r = - 0.50) with a p value obtained was <0.0001.

To find out which component of fatigue is responsible for decreasing functional independence, the physical, cognitive and psychosocial of MFIS was analyzed separately. The results shows that physical component has a large negative correlation with functional independence (r = - 0.582) and statistically shows strong significance (p<0.01) Cognitive component shows a moderate negative correlation with functional independence (r = - 0.31) and is not statistically significance (p>0.05). Psychosocial component shows a small negative correlation with functional independence (r= - 0.26) but is not statistically significant. (p>0.05) (Table no. 02) Thus, as fatigue level increases; functional

independence decreases.

John Walton 10th edition (1993) who states that MS is due to demyelination of the neurons as the demyelination proceeds, it causes slow conduction across the neurons thus increasing the energy consumption of the muscle to do an activity leading to early fatigue. In addition to this, in MS the dopamine level decreases leading to slowness of movement and lack of co-ordination leading to disability.⁽⁴⁾

Similarly, Pittion-Vouyovitch et al. (2006) did a study to demonstrate the relationship of fatigue (FIS) to disability (EDSS), depression (BDI) and quality of life (SF-36) and concluded fatigue had a positive correlation with depression and quality of life. But physical and psychosocial component of fatigue showed positive Correlation ($r = 0.44$ and $r = 0.21$), with EDSS, but no correlation was between cognitive fatigue and EDSS.⁽¹³⁾ Also, fatigue assessed by FIS has a moderate negative correlation with functional independence ($r = -0.50$) and statistically shows strong significance ($p < 0.01$). Thus, as fatigue increases; functional independence decreases.⁽¹⁴⁾

The above finding is also observed by Freeman JA. 2001, in a study on mobility and functional independence in MS and concluded that persons with multiple sclerosis commonly experience restrictions in mobility and everyday functional activities. A wide range of factors including physical, psychological, environmental and economic issues may contribute to these difficulties. Hence an effective management of these complex problems requires assessment and intervention from a variety of different perspectives by using a coordinated, goal-oriented, multi-disciplinary management approach.⁽¹⁶⁾ Also, disability (EDSS) has a very large negative correlation ($r = -0.852$) with functional independence (FIM) and statistically shows strong significance ($p < 0.001$).⁽¹⁵⁾ The limitation of study was smaller sample size and Uthoff's phenomenon was not considered in the study.

Recommendations

Ø The Present study can be done with larger sample sizes

Ø Further study can be done to know the type of MS influencing on fatigue and disability

Conflict of Interest- None

Conclusion

This study concludes that fatigue is a common symptom affecting majority of patients with MS. out of 3 components of fatigue – physical and psychosocial fatigue had more impact on MS subjects as compared to cognitive fatigue. It was found that fatigue had a positive correlation with disability but when functional independence was considered there existed a negative correlation in fatigue and functional independence. It is important for all the rehabilitation team to emphasize on the importance of fatigue and its effect on disability and functional independence when assessing subjects of MS and planning treatment guidelines for them.

Source of Funding- Self

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A Study of Kinesiophobia in Elderly with and without Pain

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Abstract

Aim: Kinesiophobia is defined as an excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or reinjury.^[1] The current study aims to compare kinesiophobia in the elderly population with and without pain.

Methodology: Kinesiophobia (using The Tampa Scale for Kinesiophobia) and pain (using the Extended Nordic Musculoskeletal Questionnaire) was assessed in 30 elderly individuals with pain and 30 elderly individuals without pain.

Results: The kinesiophobia scores were higher in elderly individuals with pain compared to elderly individuals without pain. In terms of pain, the lower back and knees were the most commonly affected body regions.

Conclusion: The study concluded that the subjects showed a high level of kinesiophobia (mean=37.71, median=37). Elderly subjects with pain experienced higher kinesiophobia than elderly without pain.

Key Words: *The Tampa Scale for Kinesiophobia, Extended Nordic Musculoskeletal Questionnaire, Kinesiophobia.*

Introduction

According to Population Census 2011 there are nearly 104 million elderly persons (aged 60 years or above) in India; 53 million females and 51 million males. A report released by the United Nations Population Fund and HelpAge India suggests that the number of elderly persons is expected to grow to 173 million by 2026. As an individual ages, physiological changes in various systems occur. Osteoporosis is frequently seen due to a decline in bone mass and the lean body mass declines due to atrophy of muscle cells. Degenerative changes occur in many joints, affecting the peripheral and axial skeleton.^[2] These degenerative changes may cause severe pain and inhibit an elderly individual's locomotion. Hence aging may lead to limitations in

functional abilities and in activities of daily living.^[3]

Statistics show that pain is a critical public health problem affecting 37-41% people worldwide. The persistence of pain can lead to changes in behaviour for both physical and psychological reasons.^[4] Pain has shown to have several negative effects like reduced participation in social and recreational activities, reduced social support, unemployment and disability.^[5]

One of the factors associated with the presence of pain is self-limitation/fear of activities which are perceived to cause or aggravate pain. In 1983, Lethem, Slade, Troup and Bentley introduced a concept known as the fear avoidance model. The model attempts to explain how and why some individuals develop a more significant psychological overlay than others do.^[1] When faced with fear, confrontation and avoidance are the two coping mechanisms available. Confrontation leads to a reduction of fear over time, while avoidance leads to an increase of fear. Avoidance has two components-

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cognitive avoidance which is avoidance of pain and behavioral avoidance which is avoidance of painful activities. Long term avoidance of physical activity impairs activities of daily living, leading to onset, maintenance and progression of disability.^[5] Studies show a positive association between pain-related fear and disability which indicates that reductions in pain-related fear may improve pain-related disability outcomes.

Kinesiophobia, is defined as an excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or reinjury.^[1]

Kinesiophobia causes disability, disuse and depression.^[6] It is a vicious cycle of increased fear of pain, more pain and disability. Kinesiophobia levels are negatively associated with health related QOL.^[7] Higher degree of kinesiophobia leads to greater limitation in performing ADLs implying the need for institutionalizing the elderly.^[3]

The Tampa scale for kinesiophobia (TSK) was developed to measure fear of movement/ (re)injury in chronic pain patients.^[8] A valid and reliable psychometric measure, it has a high degree of internal consistency.

The relationship between kinesiophobia and pain has been studied in several populations .^[4,7,9] but there has been very little research directed at the elderly.^[3,6] A literature review has further revealed that there is a lack of uniformity with respect to the association between pain and kinesiophobia.^[3,6]

The current study therefore aims to compare kinesiophobia in the elderly population with and without pain.

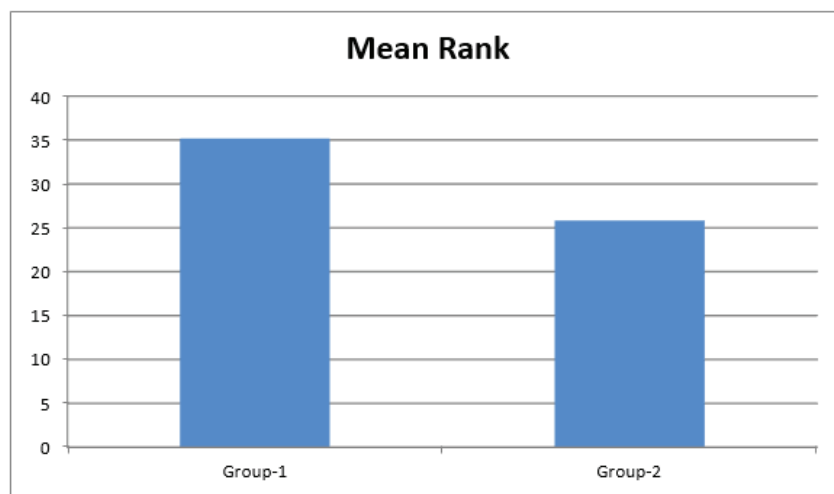
MATERIALS AND METHOD:

The study was approved by the Institutional Ethics and Research Committee at D.Y. Patil University. A community based cross-sectional survey was conducted on 30 elderly individuals experiencing pain since 3 years and 30 elderly individuals without pain since 3 years. The participants were assured that the information regarding their identification obtained during the study would be kept strictly confidential. The demographic details including name, age, gender, dominance etc were obtained. The Extended Nordic Musculoskeletal Questionnaire was administered to quantify the musculoskeletal pain and activity limitations in 9 body regions. Kinesiophobia was assessed by administering The Tampa Scale for Kinesiophobia, with higher scores indicating higher levels of fear of movement-related pain. The obtained data was statistically analysed and results were obtained

Data Presentation and Analysis

1) Comparison of TSK Scores between Group 1 and Group 2

Mann-Whitney U test was used to compare the significance of difference between two groups along with Independent t-test.



Graph 1 - Mann-Whitney U test results:

Group 1- 30 individuals with pain

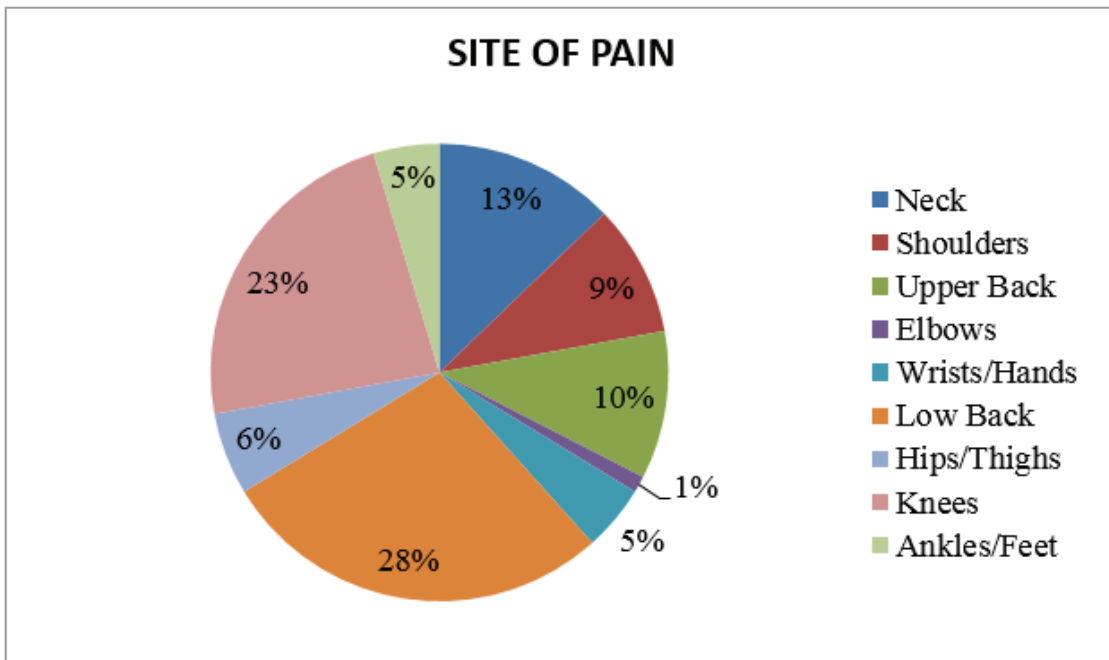
Group 2- 30 individuals without pain

As seen in the above graph, the scores in Group 1 are higher than Group 2.

Table 1 - Mann-Whitney U Test result:

	Value
Mann-Whitney U	309.500
Wilcoxon W	774.500
Z	-2.090
p-value	.037

Interpretation: Since p-value for the M-W U test is less than that of 0.05, it indicates significance of difference between the average TSK scores of Group-1 and Group-2.



GRAPH 2: INVOLVEMENT OF SITE OF PAIN

INFERENCE: The commonest site of pain was the low back (28%) and knee (23%)

Discussion

A study was conducted to compare kinesiophobia in elderly individuals with and without pain

The first objective of the study was to assess kinesiophobia in elderly with and without pain using Tampa Scale for Kinesiophobia (TSK). In a subject size of 60 elderly individuals above the age of 60, our study

shows the TSK median score to be 37, which indicates that the subjects have high kinesiophobia.^[10]

Our study shows the mean score to be 37.71. A study conducted by Larsson C et al ^[6] shows the mean score to be 22.8, which indicates significantly lower levels of kinesiophobia as compared to our population. The differences in results could be due to difference in

the population characteristics. The mean population age was high for the study conducted by Larsson C et al (mean age=74.8 years) as compared to our study (mean age= 68.8). Secondly the above study was conducted in a larger Swedish population (n=433) while ours was conducted on the Indian elderly (n=60).

Our study is in agreement with Milenković M. et al whose research indicates that kinesiophobia occurred in a considerable number of participants (more than a half) in a sample of elder institutionalized population with chronic pain.^[3] Researches conducted by Crombez G et al,^[11] Vlaeyen JW et al^[12] and Roelofs J et al^[13] state that kinesiophobia is not only an essential factor resulting in the avoidance of movement, but also the factor leading to disability even more than the pain itself.

Fear is defined as an unpleasant feeling that arises as a normal response to realistic danger. Being a basic emotion, fear appears as a reaction to a specific, identifiable, and imminent threat (e.g. a fall).^[14] Kinesiophobia can be acquired through two forms: a direct aversive experience (e.g. pain or trauma) or social learning (observation and instruction)^[15] Kinesiophobia is an important factor influencing ADL and, consequently, the extent of the assistance needed for the performance of ADL. Evidence suggests that lower degree of independence of participants in performing ADL corresponds to higher degree of fear of movement.^[3]

The second objective was to assess pain in elderly using Extended Nordic Musculoskeletal Questionnaire (ENMQ). Our study showed that 28% subjects suffered from low back pain followed by 23% complaining of knee pain. 97% subjects had experienced pain in the previous 12 months and 100% had experienced pain in the previous month with 83% subjects experiencing pain the day the survey was taken.

Cross-sectional epidemiological studies have shown that the overall prevalence of pain increases with advancing age.^[16,17,18,19] The prevalence of articular joint pain more than doubles in adults over 65 years old compared to young adults.^[20] Gerontologists state that pathological load is an essential factor contributing to increased pain complaint with advancing age.^[21]

The third objective of the study was to compare kinesiophobia in elderly with pain (Group 1) and

without pain (Group 2). Using a Mann-Whitney U test, the difference between the two groups was found to be statistically significant (p-value = 0.037) , with the elderly subjects with pain experiencing higher kinesiophobia than elderly without pain.

Several studies have found that individuals with chronic musculoskeletal pain caused by degenerative changes can have fear of movement.^[22,23,24,25] Data from 118 studies included in a systematic review showed strong evidence of an association between a greater degree of kinesiophobia and greater levels of pain intensity and disability; and moderate evidence for an association between greater levels of kinesiophobia and lower quality of life.^[7] First, kinesiophobia alters how people move, possibly with the initial goal to avoid pain. It causes changes in the motor behaviour which affects the performance of actions related to the management and control of pain and pain-related disability.^[26] Second, the processing of pain in people with chronic musculoskeletal pain (CMP) is related to how kinesiophobia is perceived.^[27] A person in pain will refuse to perform certain activities because she/he anticipates that these activities will increase the pain and suffering.^[23] People with pain avoid activities which are assumed to provoke a real or potential injury/re-injury, which leads to further physical inactivity.^[25] This fear to carry out certain movements creates a negative vicious cycle wherein they show greater levels of pain, disability, emotional distress and as a result, poor quality of life. The fear-avoidance model of chronic pain states that pain-related fear contributes to greater disability among persons with pain.^[5] Hence people with pain show higher levels of kinesiophobia.^[28] Our results support this statement.

According to a study conducted by Bunzli et al, people who score highly on the TSK believe that painful activity will result in damage; and that painful activity will increase suffering and/or functional loss.^[29] The relation between poor health and kinesiophobia is self explanatory because pain itself is regarded as a health factor.^[30]

Conclusion

Based on the results of our study, the following conclusions can be drawn:

1) The subjects showed a high level of kinesiophobia and pain.

2) Elderly subjects with pain experienced higher kinesiophobia than elderly without pain.

Conflict of Interest: The authors report no conflict of interest in this work.

Source of Funding: No funding was required for the present study.

Ethical Clearance: The study was approved by Institutional Ethical Committee of D.Y.Patil School of Physiotherapy.

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Impact on National and International Global events : The Novel Corona Virus

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Abstract

After Motivated by rapid outbreak of Corona Virus (COVID-19) in Wuhan china, it is a situation of concern for us to keep away gatherings, Community relations, occasions, and social functions. The world health organization has set forth Covid-19 as a widespread pandemic. The prototype is expressed on the basis of cases described from the globe. In order to safeguard people's life steps like social distancing is the key factor. The outcome about moreover show that supported gathering confinements humbly influence the scourge direction and chances of higher diminishment of transmission within community. The affect of those major and minor occasions cancellation moreover lead to misfortunate in trade, economy, excitement and many more.

Keywords:- COVID- 19, corona virus, national and international events, Impact, SARS, economy.

Introduction

At the Start of December 2019, China closely observed serial of pneumonia alike symptoms in patients in the city of Wuhan, of Hubei region. The pathogen causing pneumonia like symptoms among affected individuals was termed as corona virus, COVID-19 and SARS-CoV-2.¹ Novel Corona virus associated disease is now called as COVID-19. With lapse of time 80,151² patients have been found and diagnosed in China till 3 March 2020. (COVID-19) become pandemic in both national as well as pan Chinese spaces. This current emerged COVID-19 has augmented global awareness that will have both immediate and long-term affects⁴.

This outbreak has caused a pandemic of respiratory disease rapidly for which no vaccines and other targeted remedies are available^{4,5}. This outspread is clearly through person to person especially close face-to-face social contact, mainly in small enclosed spaces, and transmission from failed infection prevention and control measures in health facilities in family clusters worldwide. As experience in Wuhan which shows the rapid and massive transmission in a short period of time. This is directly related to mortality⁶. As the current situation is unprecedented, and developing rapidly the

current aim of the government is to achieve the flatten epidemic curve so that transmission is slowed, and to obstruct transmission where ever is possible⁶. These cases initially started in China then worldwide spread through travelers from China and people who have had contact with travelers from China.

Apart from its ill effect on humans, the novel strain of corona virus (COVID-19) has significantly slowed down the economy, social gatherings, cancellations of events and lot many more not only in China but also the worldwide. Many Upcoming major and minor events could also be canceled because of the global prevalence of COVID-19.

To curb its further effect and spread, government has decided to lock down the movement of people and market throughout. Commercial and social activities became negligible, with schools, restaurants, other entertainment spots and sports activities closed.⁶ The country has come up with the efforts to contain the virus by amending travel restrictions, closing schools, restaurants and bars and canceling entertainment events across the country⁷. Canceling events that are likely to draw crowds is an example of **social distancing**. Social distancing is intentionally increasing the space between

one another to avoid spreading the illness. Settle yourself at least six feet away from other people lessens your chances of getting COVID-19⁸.

Methods and Materials

A scoping review was conducted following the cancellation of national and international events. In this scoping review, various researches articles and news published were analyzed and discussed to better understand the epidemiology, and impact and control of this virus. All the findings and statements in this review concerning the impact are based on published information as mentioned in the references.

Impact of cancellations of major global events

Various global events which include business, sports, entertainment, fashion, cultural, conference, education, marriage etc are done to enhance the Economy of country, Promote business and sales, Growth of connections, Enhancing Cultural Diversity, Discover New opportunities, Gain new ideas and inspirations , Learning new skills and techniques, Enhancing communication tools, reward achievements and recognize success etc. Sports have always been a crucial part of the people's entertainment. People are passionate about sports in India and globe. Sudden Marriage cancellation is also creating a mental and economic loss to the family

List and Impact of major global business events

1) Google canceled its annual news conference which is to be held in California. This Google News Initiative summit, aims to support "quality of journalism" and meet their business needs and industry challenges.

2) The 90th Geneva International Auto Show - has been canceled organiser Palexpo said it'll lead to a loss of over 250 million Swiss francs (or \$257 million) worth of business.

3) Facebook F8 developer conference- this event shares its vision for future with global developer from worldwide every year.

4) The global telecom industry's biggest event, Mobile World Congress was Scheduled between February 24 to 27, 2020, at Barcelona was canceled which will lead to delay in upgradation of technology.

5) One of the biggest theme parks "Disney in Hong Kong, Shanghai, Tokyo- was closed till March 15 and now extended this estimated the loss of worth \$200 million due to closure.

6) Milan Furniture Fair - the largest furniture fair in the world, has been postponed until June which lead to massive loss.

7) Other events that have also been canceled include Cherry Blossom Festival, Beijing and Shanghai fashion weeks, Paris and Milan fashion weeks and Chinese Grand Prix.

List and Impact of sports events

Sports are always an important part of development and growth of society worldwide. It improves physical and mental health, skills, leadership, community health and productivity, reduces medical expenses, imbibes discipline in character, enhances social cohesion and confidence. People and sportsmen worldwide wait every year for some major sport events such as Olympics, common wealth games, IPL, ICC, etc. Globally people attend the program and events. Cancellation of these events not only break the heart of public but also sportsman in regards with their talent, skill, growth, opportunity and Carrier.

Organizing committee has to face monetary loss. Following are the list of some events which are postponed or canceled:-

1) Olympic game has been postponed to 2021 which was to be held in Japan- affects to sportsman and organizers both. We cannot deny from the fact that Olympics costs a great deal to host, an estimation of around £15 billion.

2) Indian Premier League 2020 have been canceled of this could have cost lost of BCCI Rs 3,869.5 crore.

3) The **National Hockey League**

4) The **French Open**, has been postponed until Sept. 20.

5) **League Soccer** suspended its season for at least 30 days,

6) The **N.C.A.A.** canceled the men's and women's

Division basketball tournaments,

7) The Boston marathon

8) Masters golf tournament

9) Indian Woman's Hockey Tour of China: tour has been canceled

10) The **BNP Paribas Open**, a major tennis tournament that was scheduled to take place in Indian Wells, Calif, beginning this week, was canceled after local health officials declared a public health emergency in the Coachella Valley

11) 2020 Paris Half Marathon: The Paris half-marathon has been canceled.

List and Impact of Cultural events

1) London's West End **theater closed**

2) The **Metropolitan Museum of Art** and the **Museum of Modern Art** announced that they would temporarily close.

3) The **Met Gala** postponed

4) The **Louvre Museum** in Paris closed.

5) The **Cannes Film Festival**, scheduled for May, was postponed.

6) **Cherry Blossom Festival**.

7) The **Tribeca Film Festival**, which was scheduled to run from April 15-26, has been postponed.

8) The **John F. Kennedy Center in Washington for the Performance of Arts** canceled all their public events, and performances.

9) The Walt Disney World Resort in Orlando is closed.

10) The Tucson Festival of Books, which is the biggest festival was also canceled.

Conclusion

The present study and from above discussed points we conclude that the Novel corona virus affects not only the Physical health but mental health also. Important sectors like business, sports, tourism, entertainment,

culture, hospitality and trade are facing the primary brunt. Lock down, social distancing and activity curbs imposed by the governments across the globe is important to control the massive spread but it is causing a major impact on economy and development of the country.

Ethical Clearance - from ethical committee of Galgotias university

Conflict of Interests - Nil

Source of Fundings - No

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A Study to Compare Immediate Effect of Suboccipital Muscle Inhibition Technique and Muscle Energy Technique on Hamstring Flexibility in Healthy Collegiate Subjects – An Interventional Study

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Abstract

INTRODUCTION: Hamstring is one of the commonest muscles that often get tight. The suboccipital muscle inhibition (SMI) technique is a manual technique that aims to relax the tension in the suboccipital muscles by decreasing the myofascial restriction in the suboccipital region. Muscle energy technique (MET) is a procedure that involves voluntary contraction of a patient's muscle in a precisely controlled direction, at varying levels of intensity and against a distinctly executed therapist applied counterforce. **AIM:** Aim of the study is to compare immediate effect of suboccipital muscle inhibition technique and muscle energy technique on hamstring flexibility in healthy collegiate subjects. **METHOD:** Total 40 subjects with hamstring tightness (both male and female) (age:18-26 years) were selected for study. Group A: Suboccipital muscle inhibition(SMI) technique. Group B: Muscle energy technique(MET) **OUTCOME MEASURE:** Active knee extension test(AKET). **RESULTS:** Results have shown significant difference between pre & post measurements in both the groups and no significant difference was found between the groups. **CONCLUSION:** Suboccipital muscle inhibition technique (SMI) and Muscle Energy Technique (MET) are equally effective in improving hamstring flexibility in healthy collegiate subjects.

Key Words: *Suboccipital muscle inhibition technique, Muscle energy technique, Active knee extension test, Popliteal angle, Hamstring flexibility*

Introduction

Flexibility has been defined as the ability of a muscle to lengthen allows one joint or more than one joint in a series to move through a range of motion.¹ Flexibility is an important component of physical conditioning program used as an adjunct to muscle strength and endurance training.¹ Flexibility allows the tissue to accommodate more easily to stress, to dissipate shock impact and improve efficiency and effectiveness of movement that helps in minimizing or preventing injury.¹

Hamstring is one of the commonest muscles that often get tight.² Such damage mainly occurs in multi-joint muscles which have large functional excursion and a high percentage of fast twitch muscle fibers, and the hamstring muscle has been reported to be the multi-joint muscle which is most frequently damaged in the human body.^{1,3}

Sitting for longer duration hours may be a contributing factor for reduced hamstring flexibility.⁴ The prolonged sitting hours required in most of the jobs, and educational setups can affect flexibility of soft tissues, especially two joint muscles.^{5,6}

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Hamstring tightness is not only a causative factor for reduced range of motion but it can also lead to various other musculoskeletal⁶

Clinically, hamstring muscle length is not measured directly but instead, it is represented indirectly by angular measurements of unilateral hip flexion with the knee extended. Methods to assess hamstring flexibility include the Straight-Leg Raising (SLR) test, Sit and Reach (SR) test and Active Knee Extension (AKE) test.^{7,8} The SLR test specificity has been questioned, as it is also widely used as a neurological test.

Even though hamstring flexibility assessment is easy using the Sit and Reach (SR) test, the validity of this test is considered poor. Among them AKE with plantar flexion is the gold standard measure for hamstring muscle length having excellent interrater and intrarater reliability (0.99) for assessing hamstring flexibility in healthy adults.^{7,8}

The suboccipital muscle inhibition technique relaxes the tension in the muscles located between the axis and occiput, which regulates the upper cervical vertebra. The main functions of these muscles is to regulate body posture and rotation of the head.⁴

The suboccipital muscle inhibition (SMI) technique is a manual technique that aims to relax the tension in the suboccipital muscles by decreasing the myofascial restriction in the suboccipital region.⁹

When the tone of suboccipital muscles falls, it has been reported that the tone of knee flexors such as the hamstrings also decreases due to relaxation of the myofascia.¹⁰ This is because the hamstrings and suboccipital muscles are connected by one neural system, which passes through the dura mater. Myers called this the superficial back line.^{11,12,13}

Muscle energy technique (MET) is a manual technique developed by osteopaths and is now used in many different manual therapy professions.^{14,15}

Muscle energy technique (MET) is a procedure that involves voluntary contraction of a patient's muscle in a precisely controlled direction, at varying levels of intensity and against a distinctly executed therapist applied counterforce.^{16,17}

The systematic protocol for MET involves identifying a restrictive barrier within the normal range of joint motion, which is then followed by an isometric

contraction of the agonist muscle. Subsequently, a passive stretch is applied to the muscle for a short period. This form of MET is also known as isometric CR or post-isometric relaxation (Chaitow, 2006a; Ward, 2003).¹⁸

There are many studies in literature which shows muscle energy technique and suboccipital muscle inhibition technique both are effective in improving hamstring flexibility, but no studies has compared both the techniques yet. So purpose of this study is to compare the effect of both the techniques in improving hamstring flexibility.

Aim of the Study

Aim of the study is to compare immediate effect of suboccipital muscle inhibition technique and muscle energy technique on hamstring flexibility in healthy collegiate subjects.

Objectives of the Study

- To evaluate immediate effect of suboccipital muscle inhibition technique on hamstring flexibility in healthy collegiate subjects.
- To evaluate immediate effect of muscle energy technique on hamstring flexibility in healthy collegiate subjects.
- To compare immediate effect of suboccipital muscle inhibition technique and muscle energy technique on hamstring flexibility in healthy collegiate subjects.

Hypothesis:

Null Hypothesis: There is no statistical significant difference between immediate effect of suboccipital muscle inhibition technique on hamstring flexibility in healthy collegiate subjects.

Alternative Hypothesis: There is statistical significant difference between immediate effect of suboccipital muscle inhibition technique on hamstring flexibility in healthy collegiate subjects.

Methodology

Study design: An Interventional study

Sampling technique: Convenient sampling for

selection of subjects and group allotment was done by simple random sampling

Study setting: Shree K. K. Sheth Physiotherapy college rajkot.

Sample size: 40 subjects (Group A – 20 subjects & Group B – 20 subjects)

Study population: subjects with hamstring tightness.

Study duration: One time study

Method of data collection:

40 subjects with hamstring tightness were selected for the study that fulfilled the inclusion and exclusion criteria. The details and purpose of the study were explained to all subjects and written consent was taken from them.

Selection Criteria

Inclusion criteria:

- Normal healthy individuals having hamstring tightness with Active knee extension (Popliteal angle) $<125^{\circ}$.²
- Age group between 18 to 26 year.²
- Gender : both male and female.²
- Subjects who are willing to participate in the study.

Exclusion criteria:

- Individuals with history of neck trauma [whiplash injury].²
- Individuals with herniated disc, lumbar protrusion, cervical ligament instability.²
- Individuals with vertebrobasilar artery syndrome.²
- History of trauma or fracture of affected lower limb.
- Non consent subject

PROCEDURE:

Outcome measure: Active knee extension test (AKET)¹⁷ was noted as an outcome measure at the beginning of the treatment session (pre-intervention) and immediately after treatment (post-intervention)

Active Knee extension test:

Active knee extension was measured with goniometer while the subject was in supine lying with hip stabilized at 90 degrees flexion. The goniometer was placed in such a way that non movable arm was aligned along the femoral shaft pointing greater trochanter and the movable arm along tibial shaft pointing the lateral malleolus with lateral knee joint-line as a fulcrum. The participants were asked to extend the testing knee actively as much as possible. Then the knee flexion angle (popliteal angle) was measured using goniometer. Three readings were taken for active knee extension of which average was calculated.



Fig 1: Active knee extension test

Group A (Suboccipital muscle inhibition technique²):

The Subject was in supine lying position. The therapist was standing head of the table and places the palms of hands under the subject's head. Pads of therapist's fingers on the projection of the posterior arch of the atlas which is palpated between the external occipital protuberance and spinous process of axis vertebra. The therapist has placed middle and ring fingers

of both hands the space between the occipital condyles and the spinal process of the second cervical vertebra. Then, with the metacarpophalangeal joints in 90° flexion, therapist rested the base of the skull on hands. Pressure was exerted upward and toward the therapist. The pressure was maintained for 2 minutes until tissue relaxation had been achieved. During the SMI technique, the subject is asked to keep his eyes closed to avoid eye movements affecting the sub-occipital muscle tone. The procedure was repeated 3 times with 20 seconds rest in between repetitions. Post treatment assessment was done with Active knee extension (Popliteal angle) test.



Fig 2: Suboccipital muscle inhibition technique

Group B (Muscle energy technique⁵):

Muscle energy technique was applied using postisometric relaxation technique. The Subject was in supine lying position. The therapist was standing at the side of the table on the side to be treated. The therapist stretched the hamstring muscle by passively flexing the hip with knee fully extended, allowing no hip rotation. The affected leg was rested on the therapist right shoulder. The hamstring muscle was stretched until the subject first reports a mild stretch sensation; this position was held for 7 sec. The participant was then instructed to isometrically contract the hamstring muscle for 3 sec by attempting to push the affected leg down towards the

table against the resistance of the therapist with 20% effort. Following this, the participant was asked to relax for 5 sec. The therapist then passively stretched the muscle until a mild stretch sensation is reported. This stretch was held for 7sec. This sequence was repeated 3 times with each sequence separated from each by a 20 second interval. Post treatment assessment was done with Active knee extension (Popliteal angle) test.



Fig 3: Muscle energy technique

Results

Statistical software:

All statistical analysis was done by SPSS statistics version 20.0 for windows software. Microsoft excel and word were used to generate graphs and tables.

Statistical test:

Means was calculated as a measure of central tendency for popliteal angle and Standard Deviation (SD) was calculated as a measure of dispersion. Pretreatment and post treatment data were analyzed by Wilcoxon signed rank test and comparison between two groups was analyzed by Mann-Whitney U test (Wilcoxon sum rank test).

Level of significance (p value) was set to 0.05.

Table 1: Mean and SD of pre and post treatment popliteal angle of Group A and Group B

		GROUP A		GROUP B	
		Mean	SD	Mean	SD
Popliteal Angle	Pre treatment	110.25	7.691	111.75	7.122
	Post treatment	128.75	3.932	128.75	3.932

Table 2: Pre treatment and post treatment comparison of Group A and Group B and Between Group comparison of Group A and Group B

	Group A		Group B		Between group comparison for Group A and Group B	
	P value	Result	P value	Result	P value	Result
Popliteal angle	<0.05	Significant	<0.05	Significant	>0.05	Non- Significant

Discussion

In present study, when the values of pretreatment and post treatment were analysed, it was statistically significant in both the groups. When comparison was done between them, both the groups were equally effective in improving hamstring flexibility.

The suboccipital muscles are the “proprioceptor monitors” that contribute significantly to regulation of head posture, and they have the most muscle spindles in the human body.^{10,19} Among them, in particular, the rectus capitis posterior minor muscle, which has 36 muscle spindles per gram, is known to contribute greatly to regulation of posture and the degree of tension.¹⁰ The SMI techniques could increase the flexibility of the hamstring may be because the superficial back line was relaxed through relaxation of the suboccipital muscles.¹⁰ Studies done on effect of SMI on hamstring flexibility resulted in improving flexibility due to the connection to dura mater, postural control, myofascial chain connection and was proved by Dr Rasika Panse⁴ in which also supports the results of this study.

Treating the hamstring in patients with acute lower back pain for increasing hamstring length such as local site stretching techniques may cause aggravation of the local inflammatory response and may cause further muscle spasm and guarding.² So in such cases indirect technique can be used to improve hamstring flexibility

MET is claimed to be effective for a variety of purposes, including lengthening a shortened or contracted muscle, strengthening muscles, as a lymphatic or venous pump to aid the drainage of fluid or blood, and increasing the range of motion (ROM) of a restricted joint.²⁰ MET is said to inhibit motor activity via the Golgi tendon organs or the muscle spindles. Postisometric relaxation technique is effective for reduction of the tone of the muscles. The latency period of approximately 7-10 s that is present after the isometric phase. During this period, the movement toward the new position of a joint or muscle can be easier (due to the reduction in tone)¹⁶

Roshan Adkitte¹⁶ et al, concluded Muscle energy technique has been shown to be an effective technique in increasing the flexibility of hamstring muscle

Dr. Ujwal L, Yeole⁵ concluded that Muscle Energy Technique is more effective than Neural Tissue Mobilization for improving hamstring flexibility in young adults.

Limitations

- Unequal ratio of male and female in study population.

- Blinding was not done in the study

Further Recommendations

- Study could be done with large sample size.

- Treatment can be given for longer duration with follow up.

Clinical Implication

Both the techniques are equally effective in improving hamstring flexibility in healthy collegiate subjects. So, sub occipital muscle inhibition technique can be used when hamstring is injured or when there is severe pain and cannot directly work on hamstring.

Conclusion

Suboccipital muscle inhibition technique (SMI) and Muscle Energy Technique (MET) are equally effective in improving hamstring flexibility in healthy collegiate subjects.

Conflict of Interest: None

Source of Funding: None

Ethical Clearance: Taken from ethical committee, Shree K. K. Sheth physiotherapy college Rajkot

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Treatment of Pronated Foot - A Review

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Abstract

Foot Pronation, also called as “eversion” is a normal and necessary component of the gait cycle. However, abnormal pronation occurs when foot pronates, when actually it shouldn't. It occurs during the half of the stance phase. The foot rolls inward when one lands their foot on surface while walking and running. The complementing structures of the ankle or foot complex permits both stability and mobility depending on conditions acting on it. This article presents an overview on current knowledge on pronated foot and focuses on biomechanics, etiology, diagnosis and treatment strategies, conservative treatment.

Keywords- pronated foot, physical therapy, supination, pronation, eversion.

Biomechanics of the Pronated Foot

The major joint taking part in pronation of the foot is subtalar joint and calcaneonavicular joint. So, if these structures are weak the pronation takes place. If the pronation force of the foot continued distally throughout, the lateral border of the foot would tend to lift from the ground, diminishing the stability of the base of the support, resulting in unequal weight bearing, and imposing stress at multiple joints. This undesirable effect of weight bearing subtalar joint pronation may be avoided if the fore foot remains flat on the ground. This can occur if the transverse tarsal joint is mobile and can effectively absorb the hindfoot pronation. When the talus and calcaneus moves on an essentially fixed naviculocuboid unit, there is a relative supination of the bony segments distal to the transverse tarsal joint, with the result that the forefoot remains relatively flat on the ground. The transverse tarsal joint maintains normal weight bearing forces on the forefoot while allowing the hindfoot to absorb the rotation of the lower limb. In a bilateral standing position on level ground, both the subtalar joint and transverse tarsal joints pronates slightly, to allow the foot to absorb the body's weight. As a result of the pronation there will be a slight medial rotary force on the leg. ⁽¹⁾

Types of Pronation

Neutral Pronation:

- ‘Eversion’, is natural in the body's regular movement
- In neutral pronation the weight distributes fairly among all of the toes with a slight emphasis on the big toe and second toes which are better adapted to handle more of the load.
- Any deviations from normal pronation may cause injuries. One injury that is commonly rooted in foot pronation problems is shin splints.
- weight of the foot is distributed in the middle of the shoe
- If soles of your shoes become worn from the outer heel towards the big toe, you are likely to have a neutral stride.
- Lessens the probability of injuries due to running.
- How your Foot Contacts the Ground: foot lands on outside of the heel, then rolls inward (pronates) to absorb shock and support body weight.
- Push Off: even distribution from the front of the foot.

- Injuries: less likely due to effective shock absorption, but neutral runners are not immune to injury.
- Foot Type: normal-size arches

Over Pronation

- Pushes off almost completely from the big toe and second toe.
- This results into shock from the foot's impact doesn't spread evenly throughout the foot and the ankle has trouble stabilizing the rest of the body.
- In addition to this, an unnatural angle formed between the foot and the ankle causes the foot splays out abnormally.
- Overpronation occurs when the weight of the foot is distributed in the inside (medial side) of the foot.
- Overpronators usually have a low arch and they are likely to suffer from achilles tendon problems. Overpronators should consider using shoes with maximum support.
- How Your Foot Contacts the Ground: foot lands on outside of heel, then rolls inward (pronates) excessively, transferring weight to inner edge instead of ball of the foot
- Push Off: big toe and second toe does majority of the work
- Injuries: shin splints, plantar fasciitis, bunions, heel spurs
- Foot Type: low arches or flat feet^(2,3)

Supination

- Supination (underpronation) targets the weight to the outside of the foot.
- Supinators have high arches and they are likely to suffer from stress fractures as the impact to the body is increased.
- Supinators should use a neutral shoe with plenty of cushioning.
- **How Your Foot Contacts the Ground:** outer side of the heel hits the ground at an increased angle

with little or no normal pronation, causing a large transmission of shock through the lower leg.

- **Push Off:** pressure on smaller toes on outside of foot.
- **Injuries:** plantar fasciitis, shin splints, ankle strain.
- **Foot type:** high arches.

Etiology of Overpronation

- Leg length discrepancy:- As leg length discrepancy increases, the total loading increases. Forefoot loading increased, hindfoot loading remained the same. The contact phase of gait decreased in the shortened length, the midstance phase remained the same, the propulsion phase increased from 44% to 50%. There is compensatory knee bend and foot pronation of the longer leg. Leg length discrepancy has significant effects on the foot.
- Ligament laxity:-when the ligament on the medial side of the foot is lax, and ligaments on the lateral side is stronger; and when the body's weight falls on the ankle, the subtalar joint moves towards medial side and forms calcaneo valgus angle more than 180° leading to pronation of the foot.
- Muscular weakness or tightness in gastrocnemius and soleus:- If the muscle is weak the stability of the joint is compromised, thus pronation of the foot. But when the muscle is tight there is no proper contraction and relaxation of the muscle which will hamper the stability of the joint and will lead to pronation of the foot. Gastrocnemius and soleus are the major muscle which goes and gets attach to the calcaneal bone, therefore responsible for the stability of the ankle joints as a whole along with the other small muscles, tendon and ligament.
- Tibia vara >10 degree:-

Genu vara (*a medial angulation of the distal tibial in relation to the thigh*). The gait cycle moves center of weight and its effect on the foot. At heel strike, the foot encounters the ground in very slight supination. This triggers an immediate shift toward pronation, absorbing

shock and adjusting for uneven terrain. As weight transfers from hindfoot to midfoot, the foot moves into pronation. At mid-stance, the foot is in slight pronation and continues in that direction. In rolling through to toe-off, the ankle transfers weight to the forefoot, with the foot leaving the ground again in supination.

- Flatfoot:-

The arches of the foot are responsible for the equal weight distribution throughout foot. When there is loss of medial longitudinal arch is called flat foot and affects the balance and weight distribution causing the foot to pronate and roll inward. Decrease in the arch height causes instability of the subtalar joint and thus affects ankle and knee joint and so on.

- Improper shoe:-

Shoes like high heels, shoes without medial arch or too much arched, pointed shoes, loafers where when the leg is lifted most of the work is done by the forefoot straining the muscles. When the shoes is tight the foot doesn't get enough space to move and thus affects the overall function of the foot. Likewise, when the shoe is loose, there is excess work of the muscles of the foot since they have to over work to lift up the loose shoe hanging on the foot. Shoes without frictionless soles will tend to slip on the surface and when the person wears such shoes and walk they have to work excessively to compromise the slippery surface in order to prevent themselves from falling. Therefore, it is important to wear a shoe of proper material and size with all the support needed from the shoes itself.

According to the study the people who have spent most of their lives barefoot had significantly wider feet, and more evenly distributed pressure on their when they walked, than those who habitually wore shoes. The barefoot walking enables the foot to achieve its biologically normal shape and function. Many shoes are designed with bullet shaped toebox, or tapering of the width of the shoe towards the toes and prevent the toes from spreading apart.

- Arch height:-The higher the arch height, lower is the chance of foot pronation. The arch is totally responsible for the proper weight distribution of the foot. When the arch is proper it distributes the weight to the

lateral and medial side of the foot equally and prevents the foot from pronation^(4,5)

Diagnostic Criteria Test for pronation type and arch height

- Examine your old running shoes for signs of wear and to see which type of footprint you leave behind.

- To determine type of arch, step out of the shower and examine your foot print.

- A medium arch (neutral) leaves a distinctive curve alongside the foot.

- A flat arch (over pronation) leaves a flat foot print with very little curve.

- A high arch (supination) leaves a sharp curve with a very thin line going towards the toes.

- Shoes worn from the middle indicate that your pronation is neutral.

- Shoes worn from the inside indicate that you over pronate.

- Shoes worn from the outside indicate that you are a supinator.

- Foot pronation index developed by Tony Redmond.

Method: patient should stand in their relaxed stance position with double limb support. The patient should be instructed to stand still, with their arms by the side and looking straight ahead. It may be helpful to ask the patient to take several steps, marching on the spot, and prior to settling into a comfortable stance position. During the assessment, it is important to ensure that the patient does not swivel to try to see what is happening for themselves, as this will significantly affect the foot posture. The patient will need to stand still for approximately two minutes in total in order for the assessment to be conducted. The assessor needs to be able to move around the patient during the assessment and to have uninterrupted access to the posterior aspect of the leg and foot. If an observation cannot be made (e.g. because of soft tissue swelling) simply miss it out and indicate on the datasheet that the item was not scored. If there is genuine doubt

about how high or low to score an item always use the more conservative score. Features commensurate with an approximately neutral foot posture are graded as zero, while pronated postures are given a positive value, and supinated features as negative value. When the scores are combined, the aggregate value gives an estimate of the overall foot posture. high positive aggregate values indicate a pronated posture, significantly negative aggregate values indicate a supinated overall foot posture, while for a neutral foot the final FPI aggregate score should lie somewhere around zero^(6,7,8)

Prevention and Treatment

Self Care and Exercises:

1. Self-massage to the soles of your feet, roll a golf or other small ball under them.

2. For a relaxing foot soak, add Epsom salts to a basin of warm water and soak your feet and ankles for at least ten minutes. You can also add a few drops of essential oils.

3. Ice Technique: Use ice to reduce inflammation, pain and spasms to the involved area apply to the involved area for at least 15-30 minutes/session. If you are sensitive to putting the pack directly to your skin, cover the pack with a thin towel to protect the skin. If the area is bony, you may want to cool it down slowly to improve the tolerance. Apply the ice in 15-second increments, on/off until the skin surface cools enough to leave the ice on. You can apply the ice on/off throughout the day in 15-30 minute increments. Ice packs are excellent for use on swollen, tight, muscle spasm, trigger points or areas that are burning or very sore and achy.

4. Task interruption/rotation at work regularly.

5. Ergonomic changes

6. Barefoot walking and running⁽⁸⁾

Conservatives Method

1. ORTHOTICS, BRACES and SPLINTS: - Orthotics in a shoe for over pronation helps carry out daily activities and avoid other treatment options

that could be potentially costly and time consuming. Orthotics (also known as orthotic insoles, shoe inserts, or orthoses) are devices placed inside the shoes with the purpose of restoring our natural foot function. This is necessary when the natural biomechanical balance of our lower body has been disrupted by overpronation. Many common complaints such as heel pain, knee pain and lower back pain are caused by poor foot biomechanics. Orthotic insoles correct over-pronation and realign the foot and ankle bones to their neutral position, restoring natural foot function. In turn, this will help alleviate problems not only in the feet, but also in other parts of the body, such as the knees, hips, and lower back.

2. SHOE TYPE

- Motion control shoe
- Anti slip shoe
- Stability shoes

3. EXTRA CUSHIONING THE SHOE For flat foot or under pronation.

4. TAPING “LOWDYE taping technique” procedure studied in University of Queensland. Effective for both movement and standing.

5. SHOE-LACING patterns

6. Pronation decreases with higher number of eyelets in the shoe used for lacing and Shoe are tied as tight as possible.

7. BAREFOOT RUNNING

> Decreases pronation on the foot’s impact with the ground.

> Acc. to the researchers in the Swissfederal institute of technology “the least

amount of pronation takes place when running barefoot^(10,11)

Medical Intervention:

• Your doctor may have prescribed pain medication and anti-inflammatory for your condition. If you have other medical problems, discuss these

medications with your doctor before taking them.

Surgical Correction:

- Surgery can sometimes help cure and prevent over pronation if you suffer from inherited or acquired *pes planus* deformity. Surgery typically involves stabilizing the bones to improve the foot's support and function.

Physiotherapy Management:

- a. Curl Your Foot to Grasp and Pull the Towel exercises 5 to 10 times atleast. Now push the towel forward by curling and uncurling your toes. Again, keep your heels on the floor so it isn't your ankle or heel doing any of the work.

- b. Calf stretching

- c. Plantar fascia stretching.

- d. Strengthening exercises for the foot with resistance band in all direction i.e.; plantar flexion, dorsi flexion, eversion and inversion.

- e. Toe standing

- f. One leg standing balance exercises

- g. Toe exercises.

- h. Equilibrium board balance exercises to increase the stability of the ankle.

- i. **Lift the Arches:** Keep your toes relaxed, don't scrunch them up, and initiate a bit of a sliding motion pulling the ball of your foot and heel toward each other.

- o Trigger point release: A constant amount of pressure on the trigger point is believed to relieve the pain.

- o Dry needling technique

- o Faradic foot bath

- o Interferential therapy

- o Ultrasound therapy

- o Paraffin Wax bath^(12,13)

Ethical Clearance- the institutional ethics committee has given permission to initiate the research project.

Source of Funding- Self.

Conflict of Interest- Nil

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Work Place Ergonomics- A Review

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Abstract

Ergonomics is the study of the interaction between people and machines and the factors that affect the interaction. Its purpose is to improve the performance of systems by improving human machine interaction. This can be done by ‘designing-in’ a better interface or by ‘designing-out’ factors in the work environment, in the task or in the organization of work that degrade human-machine performance. Systems can be improved by • Designing the user-interface to make it more compatible with the task and the user. This makes it easier to use and more resistant to errors that people are known to make. • Changing the work environment to make it safer and more appropriate for the task. • Changing the task to make it more compatible with user characteristics. • Changing the way work is organized to accommodate people’s psychological and social needs. This article presents an overview on current knowledge on work place ergonomics.

Keywords- *Ergonomics, Work Place, Job Stress, Work Site Analysis.*

Introduction

The word ergonomics comes from two Greek words: ergon means work and nomos meaning laws. Ergonomics covers all aspect of a job; from the physical stresses it places on joints, muscle, nerves, tendons, bones and the like, to environmental factors which can affect hearing vision, and general comfort and health. If work is performed in awkward posture or with excessive effort, fatigue and discomfort may result. Job are made up of tasks. Tasks are the things employees must do to accomplish their jobs. Some jobs may contain only a single task, but many jobs are made up of multiple tasks⁽¹⁾

Contributing factors- the contributing factors both employers and employees should be aware of include: work environment, awkward postures, visual effort, repetitive motions, forceful exertion, pressure points and vibration.⁽²⁾

Ergonomics job analysis methods- there are many types of ergonomics job analysis methods. This method consists of various techniques for taking for taking a systematic look at jobs and work tasks. They help decide which jobs and specific tasks may contribute to problems. Some methods are relatively simple, and other requires detailed analysis and sophisticated equipment. Checklists are generally a simpler, less

comprehensive type of ergonomics job analysis method. More comprehensive method breaks job down into specific movements (eg- reach, grasp, and place) or use other complicated techniques. Ergonomics job-analysis methods also vary according to what types of work activities they address. Some focus on workstation design. Other are more specific to certain types of work (eg- manual material handling) or focus on the work environment (eg- lightning, cold exposure)^(3,4,5)

Work site analysis- hazard prevention and control, Engineering control, Work practice control, Personal protective equipment, Administrative control.

Training and education- general training, Job specific training, Training for supervisor, Training for manager, Training for engineers and maintenance personal.

Site analysis- gathering information from available sources (injury report, employee, worker medications to Workstation), Conducting screening survey, Performing ergonomic job hazard analysis, Conducting periodic survey and follow up.

a) **Information Sources-** perform record analysis and tracking to identify ergonomic hazards, medical safety, and employee surveys

b) Incidence Rates-

- IR= new cases/yr (200,000hr) hours worked/ year
- Note: per facility
- Why 200,000hrs? Average worker puts in 2000 hours (work) per year- the IR consider the hours of 100 workers in its determination.⁽⁶⁻⁷⁾

Hazard prevention and control-

Purpose- make the job fit the person and to not make the person fit the job.

Activities- work station design, design of work methods, tool design and handles, understand you workplace population.

Work station design- a) designed for the individuals who actually use them. b)Not sufficient to design it for the average person. C) Should be designed large enough to allow for a full range of required movements.

Ergonomic Improvements- ergonomic improvements are changes that can be made to improve the fit between the job and the capabilities of the employee performing it. They are commonly grouped into 3 categories- a) engineering improvements b) administrative improvement c) personal protective equipment.

a) **Engineering Improvements-** it includes rearranging, modifying, redesigning or replacing tools, equipment, work station, packing, parts or products. These improvements can be very effective because they may reduce or eliminate contributing factors.

b) **Administrative Improvement-** it include changing work practice or the way work is organized administrative improvements usually require continual management and employee feedback to ensure that the new practices and policies are effective.

c) **Personal Protective Equipment-** it includes gloves, knee and elbow pads, footwear and other items that employees wear.

Training- an important part of effective ergonomics program is training and education. Training for affected employees should consist of both general and job

specific training:

a) **General Training-** employee who is potentially exposed to ergonomic hazards should be given formal instruction on the hazards associated with their jobs and with their equipment. This includes information on varieties of CTD what risk factors causes or contribute to them, how to recognize and report symptoms and how to prevent these disorders.

b) **Job Specific Training-** new employee and reassigned employees should receive an initial orientation and hands on training prior to starting their duties. Each new hire should receive a demonstration to the proper use of and procedures for all tools and equipment.

c) **Training For Supervisors-** supervisors are responsible for ensuring that employees follow safe work practices and receive appropriate training to enable them to do so.

d) **Training For Managers'-** managers' should be aware of their safety and health responsibilities and should receive sufficient training pertaining to ergonomic issue at each work station and at the organizational level as a whole so that they can effectively carry out their responsibilities.

e) **Training For Engineers And Maintenance Personal-** plant engineers and maintenance personnel should be trained in the prevention and correction of ergonomic hazards through job and work station design and proper maintenance, both in general and as applied to the specific conditions of the facility.⁽⁸⁾

Job stress- it can be defined as the harmful physical and emotional response that occurs when the requirements of the job do not match the capabilities, resources, or needs of the worker. Job stress can lead to poor health and even injury. It results when there is an imbalance between the demand of the job with the workers capability, need and resources. The causes of job stress are nature of work (hectic and continuous long working hours without rest and breaks). Environment (sound and air pollution may also lead to stress). Management style(lack of participation by workers in decision making, poor communication in the organization, lack of family- friendly policies. Social relationship (lack of support from the co-worker and senior administrative

workers. job expectation (improper balance between the job demand and job expectations). Job satisfaction (workers feel that there is no job security, slow growth and promotion in his career)

Steps towards prevention- low moral, health and job complains, and employee turnover often provides the first sign of job stress. Lack of obvious or widespread signs is not a good reason to dismiss concerns about job stress or minimized the importance of a preventive programme.

Step 1- identifying the problem: the best method to explore the scope and source of a suspected stress problem in an organization depends partly on the size of the organization and the available resources. Group discussion among managers, labor representatives, and employee can provide rich source of information. Such discussions may be all that is needed to track down and remedy stress problems in a small company, in a larger organization, such discussion can be used to help design formal surveys for gathering input about stressful job condition from larger number of employees.

Step 2- design and implement intervention- once the sources of stress at work have been identified and the scope of the problem is understood, the stage is set for design and implementation of an intervention strategies.

Step 3- evaluate the interventions- evaluation is an essential step in the intervention process. Evaluation is necessary to determine whether the intervention is producing desired effects and weather changes in direction are needed. The job stress prevention process does not end with evaluation. Rather, job stress prevention should be seen as continuous process that uses evaluation data to refine or redirect the intervention strategy.⁽⁹⁾

Ethical Clearance- the institutional ethics committee has given permission to initiate the research project.

Source of Funding- Self.

Conflict of Interest- Nil

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Effect of VMO Strengthening Versus Patellar Taping in Patellofemoral Pain Syndrome- A Comparative Study

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Abstract

Background: Patellofemoral pain syndrome (PFPS) which is often used interchangeably with “anterior knee pain” or “runner’s knee” is the clinical entity of stiffness or pain or both on prolonged sitting with the knees flexed and pain with activities that load the patellofemoral joint, such as climbing or descending stairs, squatting, running and kneeling. Varieties of conservative treatments are suggested like quadriceps strengthening, stretching, braces and straps, electrotherapy, foot orthosis, patellar taping etc. Hence, comparison between the two techniques vastus medialis obliquus muscle strengthening and patellar taping were undertaken to determine their effectiveness with respect to pain and function.

Materials and Method: After taking informed and written consent, 30 subjects diagnosed with unilateral or bilateral PFPS were randomly selected and allocated into two groups - Group A (VMO muscle strengthening and conventional physiotherapy treatment) and Group B (Patellar taping and conventional physiotherapy treatment). Both groups received five treatment sessions per week for 6 weeks. Pre and post pain and function were measured by visual analogue scale (VAS) and kujala patellofemoral scale (KPS) respectively. Wilcoxon Signed Rank Test and Mann Whitney ‘U’ Test were used for statistical analysis.

Findings: There was significant improvement in pain and function in patients with Patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS within both groups ($p < 0.05$). But there was no significant difference regarding improvement in pain and functional status in patients with Patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS between groups.

Conclusion: The effect of conventional physiotherapy treatment along with VMO muscle strengthening is similar to the conventional physiotherapy treatment along with patellar taping in improving pain and functional level in patients with patellofemoral pain syndrome at the end of 6 weeks.

Key words: Patellofemoral pain syndrome, Vastus Medialis obliquus strengthening, Patellar taping, Visual analogue scale, Kujala patellofemoral scale.

Introduction

Patellofemoral pain syndrome (PFPS) is the most common cause of the knee pain in which there is retropatellar or peripatellar knee pain.¹⁻⁴ The term “PFPS” is often used interchangeably with “anterior knee pain” or “runner’s knee”¹⁻⁵ involving the patella and retinaculum that excludes other intraarticular and peripatellar pathology.^{1,6}

Stability of the patellofemoral joint involves dynamic and static stabilizers which control movement

of the patella within the trochlea, referred to as “patellar tracking”. Patellar tracking can be altered by imbalances in these stabilizing forces affecting the distribution of forces along the patellofemoral articular surface, the patellar and quadriceps tendons and the adjacent soft tissues. Forces on the patella range from between one third and one half of a person’s body weight during walking to three times body weight during stair climbing and up to seven times body weight during squatting.^{1,7}

Symptoms are usually of gradual onset.¹ Common symptoms include stiffness or pain or both, on prolonged

sitting with the knees flexed and pain with activities that load the patella femoral joint, such as climbing or descending stairs, squatting, running and kneeling.^{1,5,8,9}

Prevalence of patellofemoral pain syndrome is 15% in females which is higher as compared to males in which it is 12%¹⁰. Females are 2.23 times more affected than males.¹¹ Incidence rate for patellofemoral pain syndrome is 22/1000 persons per year.^{10, 11} Incidence rate of 25% to 43% have been reported in sports person and during basic military training.¹⁰

Several studies have shown physical therapy to be effective in treating PFPS. A variety of conservative treatments have been suggested like quadriceps strengthening, stretching, braces and straps, electrotherapy, foot orthosis, patellar taping etc. Most patients respond well to conservative interventions.¹²⁻¹⁵

The rehabilitation program should focus on correcting maltracking of the patella by addressing the findings identified on the physical examination.⁹ The vastus medialis obliquus (VMO) is of primary importance because weakness of this muscle allows the patella to track too far laterally, which increases patellofemoral joint stress and subsequent articular cartilage wear. To maintain the normal patellofemoral alignment, it is vital to achieve a balanced activity between the VMO and vastus lateralis (VL). Therefore, VMO training has become an integral part of rehabilitation for patients with PFPS.^{16, 17}

Patellar taping invented by Jenny McConnell, a Physiotherapist from Australia, who used taping to help patients with patellar maltracking and was effective in reducing the pain.¹⁸⁻²² McConnell Tape is a rigid, highly adhesive tape that is applied for upto 18 hours or less depending on patient's comfort.¹⁸⁻²²

Hence primary aim of this study was to determine which technique was better to improve pain and function level of the patients with patellofemoral pain syndrome whether vastus medialis obliquus muscle strengthening or patellar taping?

Material and Method

Study design was an experimental study. This study was conducted at a B1 Physiotherapy department, Civil Hospital, Ahmedabad, Gujarat, India. Study duration

was of six weeks.

• Participants

55 subjects were referred from orthopaedic OPD, Civil hospital, Ahmedabad, out of which, 45 subjects fulfilled the eligibility criteria and 35 subjects were agreed to participate in the study. Subjects were randomly divided into two groups; so in Group A there were 18 subjects and in Group B there were 17 subjects. 3 subjects from Group A and 2 subjects from Group B discontinued the intervention because of social crisis, not ready to come for 6 weeks, got functional recovery, not comfortable to come because of rate of travelling. So total 30 (thirty) subjects were taken for the study with diagnosis of patellofemoral pain syndrome; 10 males and 20 females.

Inclusion criteria were willing to participate in study, patient referred to physiotherapy department with primary diagnosis of patellofemoral pain syndrome, age between 17 to 35 years, both male and female, having patellar maltracking, pain in one or both knee, had duration of symptoms greater than 4 weeks, had history of insidious onset, not related to trauma and Pain during activities like prolonged sitting, stair climbing, running, kneeling.

Exclusion criteria were history of previous patellar subluxation/dislocation, history of knee surgery or intra articular corticosteroid injection to affected knee joint, knee ligament injury or laxity, infection, malignancy, concomitant diagnosis of peripatellar bursitis or tendonitis, internal knee derangement, plica syndrome, Osgood-Schlatter's disease, any musculoskeletal or neurological lower extremity involvement that interferes with physical activity, pregnancy, low back pain radiating to knee joint and any central/ peripheral neuropathy.

An institutional ethics committee approval was obtained before the commencement of the study. An informed and written consent was obtained from each subject prior to participation in the study. All the subjects were randomly allocated into groups and assessed as per the assessment form.

• Outcome Measures

Pre-participation VISUAL ANALOGUE SCALE

(VAS) and KUJALA PATELLOFEMORAL SCALE (KPS) were taken for subjects of both groups. The VAS is a self-assessing questionnaire. It comprises 10 cm line with 0 representing no pain and 10 representing worst pain. The reliability of VAS scoring in the patients with PFPS is established through a number of studies showing ICCs of .60 to .79 for usual pain and .88 for worst pain.⁷¹The KUJALA scale which is also known as ANTERIOR KNEE PAIN SCALE (AKPS) is a valid and reliable tool in assessing PFPS, which is used to assess knee pain and function. This KPS scoring system is valid in the evaluation of patients with PFPS^{23, 24} with an intraclass reliability correlation coefficient range of .90 to .98.²³

Materials used were consent form, assessment form, visual analogue scale, kujala scale (anterior knee pain scale), short wave diathermy machine, firm squeezable ball (circumference of approximately 20 inch), non rigid adhesive hypoallergenic tape, adhesive rigid leukotape p, examination table, stools of different sizes, weight cuff, towel roll, scissor, paper, scale and digital camera.

• **Clinical intervention**

Subjects were randomly divided into two groups for the study; group A received vastus medialis obliquus muscle strengthening with conventional physiotherapy treatment and group B received patellar taping with conventional physiotherapy treatment. Each subject of the study was treated for a period of 6 weeks, 5 times a week. An assessment was done prior to starting of treatment and every 2 week assessment was taken for these subjects.

Conventional physiotherapy treatment given to the subjects of both the groups was in the form of short wave diathermy (SWD), quadriceps setting exercise, straight leg raising, hip abductor strengthening, high sitting quadriceps muscle strengthening, mini squats, forward and side step ups & stretching exercises for gastronemous-soleus, hamstring and tensor fascia lata. **Frequency:** 3 sets of 10 repetitions daily for the first week. if patient is comfortable then progressed to 20 repetitions (2 sets of 10 repetitions per session) during second week and then progressed to 30 repetitions (3 sets of 10 repetitions per session) during third week. Continue with 30 repetitions upto 6 weeks.²⁵



Figure-1 Conventional physiotherapy treatment

• **VMO muscle strengthening**

VMO strengthening was done with patient in standing position with back supported. Patient was asked to do squat (40°-60° knee flexion) with hip adduction. A firm squeezable ball, circumference approximately 20 inch, was placed between the knees so that isometric contraction of adductors can be facilitated. The patient was asked to wall slide with squeezing that ball along with squat. During this medial rotation of hip up to 30° was allowed. The association of isometric hip adduction with semi squat exercises produced a more overall quadriceps activity.



Figure-2 VMO muscle strengthening

• **Patellar taping**

In patellar maltracking, lateral shifting of the patella is present. The patellar taping was applied by using the medial gliding technique established by McConnell.

The white non-rigid zinc oxide hypoallergenic tape was applied first directly onto the skin to prevent skin irritation. The Leukotape P, rigid tape was then applied, starting from the lateral femoral condyle, anchoring over the patella, and ending at the posterior knee, with enough medial force applied to shift the patella medially, was used.



Figure-3 Patellar taping

Findings

All the outcome measures (VAS and KPS) were analysed on the 1st day & after completion of training at 6weeks. Results were made using SPSS version 16.0. Wilcoxon Signed Rank Test was applied for with-in group analysis and Mann Whitney ‘U’ Test was applied for between group analysis.

In this study, there were 10 females and 5 males in each group suggesting there was a female predominance in both the groups. For age distribution among 30 subjects, the mean age of 15 subjects in group A was 30.06 years with a standard deviation (SD) of 4.19 years and mean age of 15 subjects in group B was 29.80 years with a standard deviation of 4.36 years. No significant age difference was seen across the two groups.

Table 1 shows results of Wilcoxon signed rank test for VAS. The Test was applied to both groups for VAS score with-in group analysis which shows there was significant improvement on VAS score in both groups. (T = 0, p < 0.05)

Table-1 Results of Wilcoxon signed rank test for VAS

Group	Pre Mean ± SD	Post Mean ± SD	Pre Median	Post Median	T value	P value	Result
A	6.4+2.32	2.0+1.28	6	2	0	0.001	Highly Significant
B	6.47+2.29	2.2+1.47	6	2	0	0.001	Highly Significant

Table 2 shows Results of Wilcoxon signed rank test for KPS. The Test was applied to both groups for KPS score with-in group analysis which shows there was significant improvement on KPS score in both groups (T = -120, p<0.05).

Table-2 Results of Wilcoxon signed rank test for KPS

Group	Pre Mean \pm SD	Post Mean \pm SD	Pre Median	Post Median	T value	P value	Result
A	71.13 \pm 11.51	92.66 \pm 4.56	72	92	-120	0.001	Highly Significant
B	71.73 \pm 12.04	91.73 \pm 3.69	72	92	-120	0.001	Highly Significant

Table 3 shows results of Mann Whitney test for comparison between group A & B. On comparing group A and group B for post-treatment VAS score and KPS, result shows no significant difference in improvement in terms of VAS and KPS.

Table-3 Results of Mann Whitney test for comparison between Group A & B

Out Come	Group A Mean \pm SD	Group B Mean \pm SD	Group A Median	Group B Median	U value	P value
POST VAS	2.0 + 1.28	2.2 + 1.47	2	2	103.50	0.699
POST KPS	92.66 + 4.56	91.73 + 3.69	92	92	97.00	0.512

Results indicate that there was significant improvement in pain and function in patients with patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS within both groups. But there was no significant difference regarding improvement in pain and function in patients with patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS between both groups.

It was observed that both VMO muscle strengthening and patellar taping is helpful in improving pain and function in patients with PFPS but the group B which received patellar taping showed faster pain relief and improvement in function compared to group A which received VMO muscle strengthening. However, at the end of 6 weeks both groups did not show significant difference.

Conclusion

It can be concluded that the effect of conventional physiotherapy treatment along with VMO strengthening is similar to the conventional physiotherapy treatment along with patellar taping in improving pain and functional level in patients with patellofemoral pain syndrome at the end of 6 weeks.

Conflict of Interest- There is no any conflict of interest.

Source of Funding – Self

Ethical Clearance – Approval was taken from Institutional Ethics Committee, Government (CL & SC) Spine Institute, Civil Hospital, Ahmedabad.

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Role of Physiotherapy Intervention in Rare Case of Moya Moya Syndrome - A Single Case Study

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Abstract

Introduction: Moya moya syndrome is a moya moya angiopathy related secondarily to any neurological symptom or because of a specific acquired or inherited origin presenting with sensory and motor impairments. Although the disease is quite common in Japan, many cases have been reported around the globe, including North America, Europe, and India. Epidemiologic studies in Japan have estimated the annual incidence of moya moya disease to be 0.35 to 0.94 per 100000 people. This case studies the role of physiotherapy as it is not explored much in the paediatric population.

Material and Methodology: A child who was diagnosed with moya moya syndrome presented to us at the age of 3.3 years and was evaluated on GMFM-88 scale, Visuo-Motor Integration (VMI) component of PDMS-2 scale along with Manual Ability Classification System (MACS). Physiotherapy intervention was done based on impairments to improve motor function.

Results: GMFM-88 was administered for 4 times in 18 months. A total score of 38 was observed at first administration and a total of 24 score was observed at 18th month of administration. The VMI score of PDMS-2 scale did not change pre and post intervention.

Conclusion: This single case study shows about the nature of the syndrome and individualized integrated protocol which is needed for the evaluation and treatment in the cases of moya moya syndrome population which needs to be segregated from cerebral palsy.

Keywords: Moya moya syndrome, GMFM-88, VMI, MACS, Physiotherapy.

Introduction

Moya moya disease (MMD) was first described in 1957 by Takeuchi and Shimizu in Japan.¹ "Moya moya disease" for the first time was coined by Suzuki and Takaku in 1969.² Although the disease is most

common in Japan, several subsequent cases have been reported in North America, Europe, and India as well.^{3,4,5} Epidemiologic studies in Japan have estimated the annual incidence of moya moya disease to be 0.35 to 0.94 per 100000 people.^{6,7} In the present literature, the incidence and prevalence rate of this disease and syndrome in India is not yet known.⁸

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Moya moya disease is a chronic progressive non-atherosclerotic, non-inflammatory and non-amyloid cerebrovascular disorder which is defined as progressive stenosis of the intracranial vessels.^{9,10} MMD is a cerebrovascular disease which is rare and progressive in nature, characterized by bilateral occlusion and

abnormal formation of collateral vessels substituting internal carotid artery and branches forming the circle of Willis.^{11,12} Moya moya syndromes (MMS) correspond to moyamoya angiopathy which is amalgamated with further neurological or extra-neurological presentations, with or without an inherited or an acquired condition.⁸ The stenosis begins from the terminal bifurcation of internal carotid arteries and gradually progresses to the anterior, middle, and posterior cerebral arteries.^{10,13}

Children present most frequently with transient ischemic attacks or ischemic strokes with acute infantile hemiplegia. Headaches, involuntary choreiform movements and motor disturbances are the most common mode of presentation occurring in 80.5% of the population. Convulsions occur in about 9%.¹⁴

In the literature there is an inadequate amount of knowledge about physical rehabilitation in MMD. Generally, the studies have mostly focused on applications and complications of revascularization surgery techniques.¹⁵ For this purpose, this single-case study reports the changes in motor function and functional ability of a child with Moya moya syndrome, over a clinical observation. Moya moya syndrome is rare and role of physiotherapy is not broadly explained as it is explained in other condition like cerebral palsy as literature is limited on this topic. Hence, this post operative case is taken to study the role of physical therapy intervention and study the course of syndrome.

Case description

A 3.3 years old male presented to us with a complaint of no head holding since two years and was diagnosed with moya moya syndrome by the paediatric neurologist. When the child presented to us his height was 92 cms, weight was 13.5 kgs and BMI was 15.9kg/m². The child was apparently normal until 8 and a half months of age and was said to have achieved all the milestones. The first episode of convulsion lasted for 3 seconds with upward gaze and clenching of teeth. There was a history of two more episodes of epilepsy at 9 and a half month and 11 months of age respectively.

Both the plantar reflexes were up going. The child presented to us with exaggerated reflexes present in the upper and lower limbs. Also, the tone in the upper and lower limb muscles was increased which was assessed

on Modified Ashworth Scale. The tone in the biceps was 1 on the right side whereas on the left it was 1+, in the hip extensors it was 2 bilaterally, in the knee flexors and plantar flexors it was 3 bilaterally.

The result of brain MR imaging showed subacute infarct in right Middle cerebral artery (MCA) territory, lacunar infarct in right frontal region and gliosis due to old vascular insult in right basal ganglia. Also, there were acute non-hemorrhagic infarcts in left frontoparietal lobes in parafalcine region, genu and anterior limb of left internal capsule in left Anterior cerebral artery (ACA) territory with tiny acute infarct in right frontal white matter and right lentiform nucleus infarct. According to the child's medical record he underwent a surgery for bilateral pterional craniotomy and bilateral encephalo-duro-arterio-myosynangiosis (EDAMS) with bilateral frontal burrhole. The MRI and MRA of our child showed classical internal carotid artery stenosis and infarct of the brain tissue.

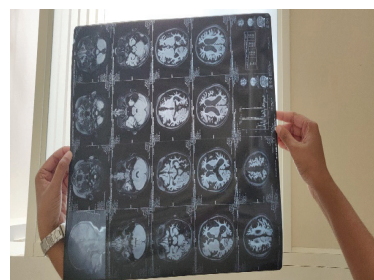


Figure - 1

1) MRI showing atrophy of parenchyma

The child is currently on Clobazam, Baclofen, Amantadine hydrochloride, Cholecalciferol capsule, Ferrous ascorbate, Folic acid and Mecobalamin suspension.

Post surgery when the child was stable he was brought to us for further physical rehabilitation. Informed consent was taken from the parent before initiating the rehabilitation and the child was evaluated on GMFM-88, VMI component of PDMS-2 and also on MACS level. The therapy was given for a total of 45-60 minutes for 3-4 days a week. The intervention consisted of visual stimulation, neck holding facilitation, creeping facilitation, rolling facilitation and hand weight bearing which was given for 7-10 minutes each with oral motor facilitation given for 3-5 minutes. Treadmill walking was done along with all these exercises for 10 minutes.

Home exercises were taught to the parent. The present developmental stage of the child showed intermittent neck holding in the gross motor domain, fine motor activity was not achieved, there was a severe impairment in the cognition level of the child. In the speech and language domain, child had achieved cooing whereas in the visual domain, he could not fix nor track the light and was able to feed on semi solid foods.



A)



B)

Figures-Intervention protocol pictures

Table 1: GMFM SCORES

Items	COMPONENTS	I ADMINIS-TRATION	II ADMINIS-TARTION	III ADMINIS-TRATION	IV ADMINISTRATION
A	LYING AND ROLLING	27	36	36	15
B	SITTING	11	12	14	9
C	CRAWLNG	0	0	0	0
D	STANDING	0	0	0	0
E	WALKING	0	0	0	0
	TOTAL SESSIONS		Between I and II administration-52	Between II and III administration-12	Between III and IV administration-35

TABLE 1- The participant of the current study had been following with us for 18 months and was assessed on GMFM-88 and VMI component of PDMS-2 for this current study. The number of sessions completed between I & II administration were 52 and the score improved from 38 to 48 (+10) which showed 3.79% gain. Whereas between II & III administration the sessions were 12 and the score improved from 48 to 50 (+2) which showed a gain of 1.51%. From III & IV administration there was an increase in the number of sessions upto 35 but the score deteriorated from 50 to 24 (-26) wherein we had a loss of -9.84%. Therefore, the net score was found to be 14 for 99 sessions when calculated between the first (38) and the final administration (24). The VMI score of PDMS-2 component scale when administered; pre intervention score was zero and post intervention the score did not change.

Discussion

The prognosis of MMD may present with gradual, fulminate, intermittent attacks or rapid loss of neurological signs.^{11,12}

In the previous literature, GMFM-88 was used to assess the gross motor function as it is a gold standard method. The child who was of 4 years of age at the time of his diagnosis was rehabilitated for 2 years and showed about a 100% improvement for his functional recovery in his gross motor function. The GMFM-88 scores were assessed every month.¹⁴ In another study wherein the child was of 10 years of age. The manual function test (MFT) was adopted for evaluation of upper limb movement and hand manipulative function in each segmental joint of the affected limb. In addition, the child's ambulatory ability was tested using the functional ambulatory category (FAC).¹⁵ In the previous studies both the children had not undergone surgery whereas in this study the child had undergone bilateral EDAMS surgery.

In our study the total number of sessions were 99 and the child was assessed on GMFM-88 on regular basis wherein we found a change in score initially but later the scores did not change and this could be contributed towards the illness of the child, the nature of the progression of the disease along with multiple system involvement of cognitive and visual system.

Also, in our study we have considered VMI component of PDMS-2 scale wherein the score remained zero pre and post intervention. Besides this we have included MACS level of the child and the child falls in level V of this classification system. Although the same classification system was not considered in the previous literature.^{14,15}

As per the literature, this is one of the very few studies that investigated the role of physiotherapy program in MMS. Previous studies have described the role of MMS in adult population^{16,17,18} and thus the role of MMS ought to be explored more in the paediatric population. Along with the diagnostic methods and surgical applications, it should be accentuated that further studies should be done on physical therapy assessment and applications with appropriate sample size and randomized clinical trials.^{14, 15}

As physiotherapy rehabilitation may improve the functional status and reduce the disabilities in MMS, this population is under more risk from other childhood neurological disability such as Cerebral palsy and other neurodevelopmental disorders. In addition, MMS have a similar representation as cerebral palsy and the cases are treated for the same as spastic quadriplegic cerebral palsy. Hence, this component should be taken into consideration for physiotherapy management as it is one of the main approaches. And this study describes the role of physiotherapy in moya moya syndrome.¹⁴

In contrast to the previous studies, this single case, studies the regression in development that may be due to multi-system deficits like cognitive, visual, motor and other barriers in rehabilitation like regularity in therapy.^{14,15}

Conclusion

In conclusion, this study gives us a guidance that as our child had visual and cognitive impairment, there was no much improvement seen. As moya moya syndrome is progressive in nature, the therapist should be aware that it may not show the outcome as seen in non progressive disease. Hence, maintenance therapy plays a major role.

Conflict of Interest: None

Source of Funding: Self

Further scope: 1) Case series.

2) Longer follow-up.

3) To study the prevalence and incidence of Moya Moya Syndrome in Indian scenario.

Ethical Clearance- Patient informed consent was taken from the parents for publication and all the other norms were followed.

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Effect of Footwear on Balance and Fall Risk of Elderly Individuals in Selected Old Age Homes

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Abstract

Background & Purpose: Falls in older people is a major public health problem, with 1 in 3 people in the community aged over 65 years falling each year. To perform daily activities under both static and dynamic conditions, maintenance of balance and stability plays an important role to prevent slip and falls. Maintenance of balance is essential to prevent falls and fall related injuries. Balance is maintained by visual, vestibular and somatosensory senses coupled with an intact, musculoskeletal system along with a higher level of cognitive neural function. Degradation in one system increases the chances of lowering balance performance with resultant possibility of a fall. The type of footwear plays a major role for maintaining balance and stability as it serves as the medium between foot and the surface and contributes to somatosensory feedback mechanisms. Design features of footwear such as mid sole hardness, heel elevation play an important role in posture and balance. The aim of present study was to measure the effects of footwear on balance and fall risk in older population. **METHODOLOGY:** Subjects were selected from R.V. College of Physiotherapy OPD Bengaluru, Dignity Foundation Bengaluru. Elderly population above 60 years were recruited for the study. Purposive sampling technique was used to recruit sample size of 80 subjects. **FUNCTIONAL REACH TEST (FRT):** (Group A)=40 subjects and **BERG BALANCE TEST:** (Group B)=40 subjects were analyzed. **Results:** The result was expressed in asymptotic Z-value because for both the groups sample size was more than 20. Hence the median was tested between the two scales and asymptotic Z-value was 7.852 with P value of $p < 0.001$. This shows that those with footwear have maintained better balance as compared those without footwear.

Conclusion: The present study concluded that respondents recruited for Berg balance scale with footwear showed better balance and stability as compared to bare foot performing Functional reach test

Keywords: Fall Risk, Elderly Population, Balance, Functional Reach Test, Berg Balance Scale, Footwear.

Introduction

Falls in older people is a major public health problem, with 1 in 3 people in the community aged over 65 years falling each year. Up to 15% of falls result in serious injury such as head trauma, fractures, dislocations, lacerations, making falls the leading cause of injuries-related hospitalizations and mortality in older people.¹

As humans age, they become less adept at recovering stable equilibrium after encountering environmental factors that produce instability. This is mainly due to slowing of compensatory behavioral response to

perceived unstable equilibrium. External factors play a dominant role in both initiating falls and impairing recovery.²

To perform daily activities under both static and dynamic conditions, maintenance of balance and stability plays an important role to prevent slip and falls. Maintenance of balance is essential to prevent falls and fall related injuries. Balance is maintained by visual, vestibular and somatosensory senses coupled with an intact, musculoskeletal system along with a higher level of cognitive neural function. Degradation in one system increases the chances of lowering balance performance with resultant possibility of a fall.³

Footwear has a vital role in improving the well-being of an individual. Previous studies reported an association between footwear and balance. Footwear facilitates sensory information to the foot and control postural stability through touch and proprioceptive system. The tactile stimulation is detected by cutaneous mechanoreceptors of the plantar surface of the feet and gives information of plantar pressure distribution to the central nervous system. Types of footwear may influence of the sensory feedback from the feet. Few studies have reported postural stability in elderly population who has poor footwear type and poor footwear characteristics.⁴ Many authors feel that footwear sole construction is an external factor that substantially influences instability during locomotion in older individuals.²

Several laboratory based studies have demonstrated that elevated heels and thick, soft soles are detrimental to balance, while footwear with high collars and firm soles are beneficial. Prospective studies have also shown that wearing shoes with slippery soles high heels and reduced sole contact area increase the risk of falls in older people.⁵

Although falls are complex and multifactorial, the risk factor is high in women than in men. The indoor footwear tends to be less supportive than outdoor footwear and is selected primarily for comfort.¹

Certain type of footwear such as slippers, socks without shoes, and going barefoot increases the risk of fall among elderly. Few studies have reported that going barefoot, wearing socks without shoes and wearing slippers are associated with increased risk for falls particularly indoor falls. Although wearing shoes with high heels is also likely to increase the risk for falls, very few elderly people wear such shoes.⁶

Several studies have shown that wearing slippers is a risk factor for falls and fall related injury in older people. In response to these several authors have suggested that older people should wear more supportive footwear inside the home thus there is need to develop indoor footwear that is both comfortable and safe for older people at risk of falling. Thus primary aim of this study is to assess balance.¹ Number of other pathologies such as diabetes, neuropathies and dementia also contribute for the imbalance and fall.

The incidence of dementia worldwide continues to increase as the world's population ages. For the community dwelling elderly with dementia or cognitive impairment, their fall risk is higher compared to their peers with normal cognition, and their risks of sustaining serious injuries after falls are trebled or quadrupled.⁷

People with diabetes and neuropathy are 15 times more likely to report to an injurious fall than those without neuropathies. In addition to the obvious physical burden, the physiologic consequence of falling has been associated with significant loss of independence and decreased quality of life. The prevention of fall is, therefore important to reduce morbidity and mortality in people with diabetes. Therapeutic footwear and insoles offer an external modifiable additional factor with the potential to influence balance. Footwear characteristics, including heel collar height, sole hardness and sole geometry have been found to influence quantitative measures of balance and gait.⁸

The type of footwear plays a major role for maintaining balance and stability as it serves as the medium between foot and the surface and contributes to somatosensory feedback mechanisms. Design features of footwear such as mid sole hardness, heel elevation play an important role in posture and balance.³

Aim and Objectives of the Study

AIM: To measure the effects of footwear on balance and fall risk in older population

Objectives:

1. To assess balance performance on Functional Reach test (FRT) and Berg Balance Scale in elderly.
2. To assess and compare the balance performance among elderly those wearing flat footwear and barefoot.

Hypothesis: The balance with and without footwear may be the same

Alternate hypothesis: The balance with footwear may be better compared to without footwear

Methodology

Materials and Method

Source Of Study:

Subjects were selected from R.V. College of Physiotherapy OPD Bengaluru, Dignity Foundation Bengaluru,

Definition of the study subjects:

Elderly population above 60 years were recruited for the study.

Methods of Data Collection:

The investigator personally contacted corresponded concerned authorities and obtained permission and with the subjects signed consent form. Subsequently after obtaining the permission, the investigator screened the subjects for meeting the requirements of inclusion criteria and exclusion criteria the study was continued.

The subjects were assigned in to two groups. Group A (N=40) Berg Balance Test and Group B (N=40) Functional Reach Test(FRT) was recorded.

Research Design:

Comparative study

SAMPLE AND SAMPLING TECHNIQUE

•**Sample size** – Total 80 samples were recruited from which they were divided equally into two groups. Group A(n=40) and Group B(n=40). Number of elderly patients treated in Musculoskeletal OPD and Neurological and Psychosomatic disorders for interval period of one week duration at R.V. College of Physiotherapy was total number N=44 out which 11 subjects fulfilled inclusion and exclusion criteria .

Sample size calculation made on formula

$$P=11/44=0.25$$

$$N=72$$

+10%Non-response errors

$$N=72+8=80$$

Sampling technique – Purposive sampling.

Duration of the study:

Data was collected over a period of approximately 3months

Materials Required:

- A ruler
- 2 standard chairs (one with arm rests, one without)
- A foot stool or step
- Stopwatch
- Inch tape
- Screening form
- Stationaries
- Yard stick

Inclusion Criteria:

- Elderly above 60 years of age
- Subjects willing to participate and ready to sign consent form.
- Owns at least one pair of flat footwear and also is used to walking barefoot.
- Have at least 90 degrees of shoulder flexion.
- Transfer independently.
- Stand unsupported for 30seconds or more.
- Could walk independently and turn 180 degrees, with or without an ambulatory aid.

Exclusion Criteria:

- Wearing any lower extremity brace or orthosis.
- Subjects with any Musculoskeletal issues of lower limb and lower back, spine deformities.
- Subjects with neurological disorder affecting balance such as stroke, movement disorders.
- Presence of any foot abnormalities including hallux valgus, hallux rigidus, hammertoes, claw toes, overlapping of toes.
- Painful corns in feet.
- Foot Ulcers.

- Foot pain.
- Diabetic neuropathy
- Gout arthritis with involvement of heel pain.

Procedure:

FUNCTIONAL REACH TEST (FRT): (Group A)=40 subjects

Functional reach test was measured with the subjects in a standing position, with her/his dominant upper extremity next to a wall. The dominant arm is used for consistency with procedures described by Duncan et al for development of the FRT. The selection of dominant arm would be based on the subject’s self-report of the hand used for writing. He/she would be asked to attain a comfortable standing position, and the position of her/his feet would be marked on the floor for each footwear condition. A measuring stick with a built-in level would be placed on the wall at acromion height, levelled, and secured to the wall with marking tape. The subject would make a fist and raise her dominant arm to approximately 90 degrees of shoulder flexion. In this position, the placement of the end of the third metacarpal bone along the measuring stick would be recorded to the closest centimeter as position 1. The subject would be then instructed to reach as far forward as possible without taking a step or losing balance, and the location of the end of the third metacarpal would be recorded to the closest centimeter as position 2. Functional reach is defined as the difference between the 2 positions. After 2 practice trials, 3 measurements of functional reach would be recorded and averaged to establish the FRT measure.

BERG BALANCE TEST: (Group B)=40 subjects

This ordinary scale(0-4: 0-unable to perform, 4-able to perform the task safely and independently). Evaluates patient performance on 14 tasks commonly performed in day to day life. Subjects were asked to perform the test and according to the items of the scale it is recorded.

Items of scale are-

- Sitting to standing
- Standing unsupported

- Siting unsupported
- Standing to sitting
- Transferring
- Standing with eye closed
- Standing with feet together
- Reaching forward without stretched arm
- Retrieving object from floor
- Turning to look behind
- Turning 360°
- Placing alternate foot on stool
- Standing with one foot in front
- Standing on one foot

Result Analysis

Statistical Analysis:

The data collected in this study was analyzed statistically and presented as follows: The categorical variables like age and gender are presented in the form of frequency tables and along with graphs.

Age (yrs)	Functional reach test		Berg balance scale	
	No.	%	No.	%
60 – 64	13	30.95	17	41.46
65 – 69	13	30.95	10	24.39
70 – 74	9	21.43	7	17.07
75 – 79	7	16.67	7	17.07
Total	42	100.00	41	100.00

Table 1 :The descriptive statistics of age was observed in this study that majority of the respondents in Functional reach test were between the age of 60-69 ie 30.95% where as in Berg balance scale 41.46% were 60-64.

It was observed in this study that majority of the study subjects were in the age group of 60-69 years both for Functional reach test and Berg balance scale with respective percentages 61.9% and 65.85%

Gender	Functional reach test		Berg balance scale	
	No.	%	No.	%
Male	22	52.38	21	51.22
Female	20	47.62	20	48.78
Total	42	100.00	41	100.00

Table 2. Gender distribution of Functional reach test and Berg balance scale

It was noticed in this study that the distribution of gender was almost similar in both the study groups.

The above Table 2 shows that out of 42 subjects in Functional reach test, 52.38% (n=22) were male, 47.62% (n=20) were female and in Berg balance scale out of 41 subjects, 51.22% (n=21) were male, 48.78% (n=20) were female.

Table 3. Distribution of age and mean, SD of Functional reach test and Berg balance scale

Age (yrs)	No. of subjects (n)	Minimum	Maximum	Mean	SD	Std. Error	95% Confidence Interval for Mean	
							Lower Bound	Upper Bound
Functional reach test	42	60	87	68.29	6.21	0.96	66.35	70.22
Berg balance scale	41	60	81	67.20	6.12	0.96	65.26	69.13

The present study showed that the mean \pm SD for Functional reach test 68.29 \pm 6.21 and for Berg balance it was 67.20 \pm 6.12. With 95% confidence interval for Functional reach test is(66.35,70.22) and for Berg balance scale(65.26,69.13)

Table 4: Inferential analysis of both groups (Group A and Group B) and Z value comparative assessment of Functional reach test and Berg balance scale.

Total score	No. of subjects (n)	Min	Max	Mean	SD	Std. Error	95% Confidence Interval for Mean		Mann-Whitney test (Asymptotic Z - value)	P - value
							Lower Bound	Upper Bound		
Functional reach test	42	3.0	8.25	5.75	1.28	0.20	5.35	6.15	7.852	P < 0.001
Berg balance scale	41	32.0	54.0	44.39	5.44	0.85	42.67	46.11		

In the inferential statistics based on Functional reach test and Berg balance scores, even though the mean and SD for with in normal limits the range of scale was different and therefore instead of parametric student t test and non- parametric Mann -Whitney test was applied

The result was expressed in asymptotic Z-value because for both the groups sample size was more than 20.Hence the median was tested between the two scales and asymptotic Z-value was 7.852 with P value of $p < 0.001$. This shows that those with footwear have maintained better balance as compared those without footwear.

Discussion

Comparative study was done at R. V. College of Physiotherapy OPD Bengaluru and Dignity Foundation Bengaluru among elderly population above 60 years. The aim of the study was to measure the effects of footwear on balance and fall risk in older population.

In this study the statistics observed that majority of participants in Functional reach test were between the age group of 60-69 ie 30.95% where as in Berg balance scale 41.46% were age group of 60-64. Gender distribution was noticed all most similar both the groups. Distribution age mean and SD of Functional reach test and Berg balance scale was 68.29 ± 6.21 and 67.20 ± 6.12 . With 95% confidence interval for Functional reach test was (66.35,70.22) and for Berg balance scale (65.26,69.13). Earlier study by Kelsey JL et al⁶ concluded that it may be advisable for older individuals to wear shoes in their homes whenever possible to minimize fall risk. Ven Der Cammen TJM et al⁹ conducted a study to investigate the influence of 3 different types shoe models frequently worn at home to determine the gait parameter and associated fall risk. The study showed that gait velocity and stride length were significantly reduced. Kunkel D et al¹⁰ conducted a study to explore balance and gait performance in people with Parkinson's using indoor and outdoor footwear. The study concluded that with indoor footwear walking speed was significantly slower and decreased stride length as compared to out-door footwear.

The interferential statistics expressed in asymptotic Z- value was 7.852 with P value $p < 0.001$. Which showed

subjects with footwear have maintained better balance as compared to those without footwear.

Scope of The Present Study Was:

1. To assess balance and fall risk
2. Awareness on effect of footwear on balance and fall risk
3. Design appropriate gait rehabilitation to prevent fall risk
4. Appropriate footwear use in geriatric rehabilitation

Conclusion

The present study concluded that respondents recruited for Berg balance scale with footwear showed better balance and stability as compared to bare foot performing Functional reach test

Further scope of the study: To assess balance fall risk and to create awareness on effect of footwear on balance and fall risk, To prescribe appropriate footwear and to design gait rehabilitation to prevent fall risk and study can be conducted in community set up to create awareness.

Limitation: Sample size could have been larger population, Both gender were not equally distributed ,It can be applied on vast population to identify fall risk in elderly as community cross sectional study, Study didn't focused on prescription of exercise on fall risk and to train balance .

Conflict of Interest: There was no personal or institutional conflict of interest for this study

Source of Funding: Research is funded by Rajiv Gandhi University of Health Sciences under graduate research grant for the year 2019.

Ethical Clearance: Ethical clearance taken from R.V.COLLEGE OF PHYSIOTHERAPY ,Bengaluru

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Proprioceptive Neuromuscular Facilitation in LMN Facial Palsy: A Case Report

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Abstract

Background: LMN facial palsy changes facial expression and leads to functional problems in facial movement and negative psychological effects on patients. Fortunately, some of LMN facial palsy problems recover completely, but some others remain with some sequelae like asymmetry, muscle contracture, synkinesis, and hyperkinesias that need rehabilitation. **Aim of Study:** The main purpose of this case report is to analyze the effect of proprioceptive Neuromuscular Facilitation (Rhythmic initiation, repeated stretch, 3 session /week) on LMN Facial palsy. **Method:** Patient was assessed by HOUSE BRACKMANN GRADING SCALE (HBGS) and then after he was given PNF treatment for a period of one month and once again the patient was reassessed by HOUSE BRACKMANN GRADING SCALE. **Result:** The finding of the case showed that there was overall improvement in functions of face muscle in LMN Facial palsy patients. **Conclusion:** The significant result shows the improvement in facial symmetry in bell palsy patients.

Keywords: Proprioceptive Neuromuscular Technique, LMN Facial palsy, Rhythmic initiation, repeated stretch, House brackmann grading scale (HBGS).

Introduction

LMN Facial Palsy is a type of facial palsy which occurs due to involvement of lower motor neurons and could be due to various reasons such as trauma, infection, idiopathic, leading to weakness of one side of the face. Muscle of the affected side of the face become lax, facial lines are distorted, effort by the patient to smile leads to drooling of saliva from the paralysed side. The causes for the same can be attributed to the history of exposure to extreme cold, water retention in pregnancy, infection of the middle ear, herpes zoster infection. Electrical Muscle Stimulation stimulates muscles as well as nerves or a combination of both. The physiological effects of stimulation are used therapeutically to strengthen muscles, helps in wound healing, to relieve pain and reduce edema. Numerous muscles may act at the same time to create movement (e.g., grimace), or movement may occur in a single area (e.g., as in raising an eyebrow). Failure of the facial muscles function leads to difficulty in communication¹. Myofunctional therapy developed by Rogers or PNF devised by Kabat, Knott and Voss has been noted to permit improvement in the function of the muscle, PNF is normalised, facilitated

training method for muscle that involved stretching, resisted movement, traction and approximation to ameliorate muscle decline, atrophy, and joint movement limitation.² There are many studies which have reported the effect of stimulation on facial muscle toning and combination effect of stimulation and PNF on strength of facial muscle. The present case report has tried to examine the isolated effect of PNF on facial muscle strengthening.

Clinical Presentation

In the present case study we have examined, a 32 year old male patient who met with aRTA and difficulty in speech with complain of tingling and numbness. On examination the patient had grade 5 facial weaknesses on House Brackmann grading system. The reflexes were diminished on right side of face and the radiological investigation (MRI) revealed that there was fracture of left zygomatic arch and lateral wall of right orbit. This investigation correlated with clinical presentation revealed the evidence of injury to facial nerve. The patient was under medical treatment as per standard medical protocol in case of LMN Facial Palsy.

Methodology

Prior to start of treatment proper explanation of the condition was given to the patient and demographic detail was collected and the written informed consent from the patient was taken prior to the start of the study. House-Brackmann scale was used to describe the severity of symptoms and accordingly grading was done. The concept of manual stimulation for the functional re-education, the concept of H. Kabat was used. This

approach was used in clinical setting on LMN Facial palsy patient with more profound effects on increasing muscle control and overall functionality. The techniques that were used in LMN Facial palsy patient are Rhythmic initiation and repeated stretch.

Outcome Measure: The patients were evaluated pre and post treatment program using House-Brackmann Scale (HBS) to assess facial symmetry.³

STRETCH

RESISTANCE

FIGURE 1
FRONTALIS

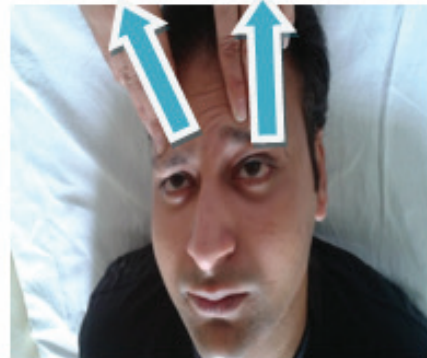


FIGURE 2
ORBICULARIS OCULI



FIGURE 3
ZYGOMATIC MAJOR & LEVATOR LABII



Discussion and Conclusion

The aim of the study was to assess the efficacy of proprioceptive Neuromuscular Facilitation (Kabat technique) in case of LMN Facial palsy patients. The significant improvement in post treatment on HBG Scale after 1 month. As the PNF technique had the effects of facilitation, so it has effect on neuromuscular education there by reducing facial disability. The functional status of the patient progressed from grade V to grade II. This helps to improve the facial expression as early as possible. Expressions in traumatic LMN facial palsy become the major limiting factor for subjects. It causes social impairment and also functional impairments. It affects self-esteem.

The finding of the present study are supported by Barbara. M et al⁴ (2010) that the role of kabat physical rehabilitation in bell's palsy as seen in randomized trial and concluded that When applied at an early stage, Kabat's rehabilitation has shown to provide a better and faster recovery rate. Similar results were put forwarded by Ghous. M et al⁵ (2018) who studied the effect of kabat rehabilitation versus taping to reduce facial disability and synkinesis in bell's palsy and concluded that PNF is more effective than the taping in bells palsy patients. Kumar et al⁶ had reported that comparison between proprioceptive Neuromuscular Facilitation and Neuromuscular re-education for reducing facial disability and synkinesis in patient with Bells palsy, a Randomised clinical Trial and concluded PNF with conventional PT Is more effective

in improving facial function and reducing the facial disability. Tandon, et al had studied advance approach effectiveness of PNF technique for bell's parasis case control study along with conventional PT and concluded that , electrical with proprioceptive neuromuscular facilitation is more effective than electrical stimulation without proprioceptive neuromuscular facilitation with conventional therapy in Bell's paresis rehabilitation.⁷

Conclusion

In this case report we have studied the efficacy of PNF on Traumatic facial palsy and found the PNF is an effective means of strengthening the weakness facial muscle after LMN palsy due to facial trauma.

Conflict of Interest: There is no conflict of interest was between author

Financial Aid: Nil

Ethical Clearance: The case study has been taken up after clearance from the college research ethical committee

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Prevalence of Carpal Tunnel Syndrome in Obese Individuals and Electrophysiological Assessment in Symptomatic and Asymptomatic Cases

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Abstract

Objective: to find out correlation between obesity and CTS and to check whether NCV can be used as a diagnostic tool in asymptomatic cases. **Method:** A 30 subjects out of 50 were undergone for nerve conduction studies and primary outcome measure is functional status scale symptoms severity scale. **Result:** results of this study failed to reveal a significant correlation between the BMI and CTS so null hypothesis is retained. results of NCV studies found no significant difference between symptomatic and asymptomatic group, so in that null hypothesis retained.

Keywords: carpal tunnel syndrome, nerve conduction studies, obesity.

Introduction

Carpal tunnel syndrome is a painful, progressive condition that occurs when the median nerve in the wrist is compressed. The nerve may become compressed because it has swollen, the tendons are inflamed, or both.¹Carpal tunnel syndrome (CTS) is the most commonly observed neuropathy in the general population.² In studies, an average of 30% of people complained of suffering from symptoms that indicate Carpal Tunnel Syndrome.³ "Numbness or pain that gets worse while using hand or wrist, gripping object or flexing hand. Stiffness of fingers can be felt in morning⁴. It frequently affects women, and the female: male ratio is 3:1.⁵ The known common risk factors for carpal tunnel syndrome are female gender, increased age, diabetes, and vocations involving vibration and repetitive hand movements. Obesity is being discussed as an important risk factor

⁶⁻⁷. There are many other factors that place an individual at risk for CTS. Certain medical conditions are the risk for developing CTS[1] personal factors such as gender, age, BMI were reported to be important risk factors.^{1,8-9} The risk factors of the CTS could be the age, gender, and body mass index (BMI).^{11,12} BMI is a good indicator of body fat and it is calculated by dividing weight (kilogram) with the square of height (meter).¹³ Although there are some studies showing a relationship between the BMI and CTS^{12,14}. The Electro diagnostic (EDx) studies are a valid and reliable tool for confirming diagnosis of CTS¹⁰.

Methodology: Source Of Data: different institutes of Maliba campus **Study Design:** cross sectional **Sample Size:** total 50 subjects and 30 were selected for NCV **Sampling Method:** convenient sampling.

Tools And Materials:

Electromyography machine: NeuroStim NS-4 computerized E.M.G. with N.C.V. and evoked potentials, manufacture Biotech, India.

Electrodes : button, Bar, Ring, Disc electrode. Electrode box, Stimulator, Ground electrode.

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Conducting gel, Adhesive tape, Cotton, Inch tape, Chair, Pillow, Weighting machine, Pen, Paper, Calculator, Informed consent form, Screening form, Function status scale, Symptom severity scale, Data recording sheet.

Outcome Measures: Carpal tunnel syndrome symptom severity and functional scale, Nerve conduction studies, Motor nerve conduction velocity and motor latency of Median nerve, Sensory nerve conduction velocity and latency of Median nerve.

Procedure: After being issued clearance by The Institutional Committee of Ethics of The Shrimad Rajchandra College of Physiotherapy initiated. The subjects from Maliba campus who met the inclusion criteria, were informed about the study and a written consent was taken. First they assessed for obesity by calculating the BMI of respective individuals and for that weighing scale were used for measuring the weight and height was measured in cm by height measure on wall. After getting weight in kilo grams and height in meter their BMI was calculated by the following equation. $BMI = \text{weight (kg)} / \text{height}^2 (\text{m}^2)$. BMI more than 25 were selected. The selected individuals were given carpal tunnel syndrome symptom severity and functional scale. If, the participants were found symptomatic, and they were taken for NCS. Thus, two groups were formed: Symptomatic individuals diagnosed with CTS, Asymptomatic individuals who seemed to be at risk of developing CTS due to years of exposure to etiological risk factors. For subject classification, as CTS was defined as numbness, tingling, burning or pain in at least one of digits index finger, middle finger, or ring finger as well as confirmed electrophysiological deficiencies as described below. All participants were asked a series of questions prior to their participation to make sure they were eligible. The proposed sample size was 20 per group and was based on power calculations performed on published data. All participants were required to be between the ages of 25 and 45, as only adults were included. The upper age limit was set because sensory and motor nerve conduction changes have been found in individuals older than 50, and these could have compromised the study outcomes. Participants were excluded as per the exclusion criteria.

Protocol: After providing written informed consent

and subjects were asked to fill demographic information. Then a brief physical examination was done. The tests were performed for each subject. The protocol commenced with a clinical exam, which was performed, that included Phalen's test, Tinel's sign, and a test for cervical radiculopathy. This evaluation was done first in order to reduce the potential impact of the functional tasks and nerve conduction studies on the results of the clinical tests. This helped to exclude the patients with cervical radiculopathy. After that patient was asked to fill the Boston Carpal Tunnel Questionnaire, which consists of the symptom severity scale (SSS) and the functional status scale (FSS).

Boston Questionnaires: The questionnaires that were completed by the participants were used to gather descriptive demographic information: the Boston Carpal Tunnel Questionnaire it consists of 11 questions. Total 100 subjects who were having $BMI < 25$, were eligible to fill the questionnaire. After that the subjects who showed score more than 1 for any of hand in questionnaire were selected as symptomatic subject for further neurophysiological assessment and same as subjects who were not having symptoms or having grade 1 in questionnaire in any of hand were selected as a asymptomatic subject for neurophysiological assessment. After the subjects completed the hand symptom questionnaire, NCS were performed on Hands of each subject. NCV study was done by using neuro perfect nerve conduction equipment. The choice of electro physiologic studies was based on the recommendations set forth by the American Association of Electro diagnostic Medicine. NCV study was carried out on the hand for which they have filled the questionnaire and the parameters used were distal motor latency and sensory conduction velocity and latency. For the sensory nerve velocity estimation, the electrodes used were the ring type finger electrodes.

Procedure For Ncs:skin Preparation: The skin area where recording, ground, and stimulating electrodes were placed was cleansed using a water swab. The subjects were positioned with the palm facing upwards and the wrist and forearm exposed. The sites for placement of the stimulating and the recording electrode were marked. Temperature was measured using a skin temperature probe. Temperature was measured at the web space of the palm between the first and second metacarpal. Nerve

conduction studies involve the stimulation of nerves with small electrical impulses over stimulation site at where nerve is more superficial and measuring the resultant responses. Surface electrodes are used to both deliver and detect the electrical impulses. The test is safe and well tolerated with only minor discomfort and no long term side effects. Patients should avoid prior application of topical creams as these may increase skin resistance to the applied current, and therefore require stronger levels of electrical stimulation. In cold environments, the limbs may need warming as cool peripheries ($<32^{\circ}\text{C}$) slow the conduction velocity of nerves.

Placement of Electrodes:

1. **Sensory nerve conduction:** Orthodromic, midpalmar- wrist mixed nerve latencies were determined for median nerve by performing supramaximal stimulation in the palm with a handheld bipolar stimulator. An Orthodromic electrical impulse travels in the same direction as normal physiologic conduction median nerve latencies were recorded, with the electrodes that are ring electrodes placed on index fingers over with the anode angled toward the web between the index and middle finger. Ring electrode was used as it mean to measures sensory nerve conduction. The ground electrode was placed on the dorsum of the hand; one can place it nearby cathode but preferably between the stimulating and recording electrodes. Cathode placed on proximal phalanx and anode on middle phalanx. Stimulation was given on approx 10-12 cm proximal to the cathode on the center of the wrist, directly over the median nerve proximal to the distal wrist crease. Stimulation given till it reaches to its supramaximal level.

2. **Motor nerve conduction:** Orthodromic median motor nerve velocities measures by using disc electrodes. The active recording electrode (negative) was placed over the belly of the abductor pollicis brevis muscle and the reference electrode was placed at the base of the thumb. The bipolar stimulator was placed 8cm from the recording electrode on the median nerve at the wrist between the tendons of the flexor carpi radialis and the Palmaris longus. Other stimulation was given just below the elbow beside biceps tendon. Stimulation to wrist will give latency1 for wrist, latency 2 for wrist and velocity for wrist and stimulation to elbow will give latency 1 for elbow, latency 2 for elbow and velocity for elbow in

case of motor nerve conduction. In sensory conduction only stimulation to wrist is there that gives latency1 for wrist, latency 2 for wrist and velocity for wrist. In all cases, median sensory nerve distal latencies should be measured. There are multiple techniques to accomplish this. Thus, two comparison techniques that clearly agree (either normal or abnormal) should be adequate to confirm the diagnosis. The American Association of Neuromuscular and Electro diagnostic Medicine guidelines do not recommend performing NCSs on the opposite hand. If the symptoms are bilateral, or more diffuse, then NCSs on the opposite side are useful. If initial comparisons NCSs on the symptomatic side are normal, further NCSs are rarely needed. NCSs in the asymptomatic or minimally symptomatic limb are based on clinical utility, and they need to correlate with clinical tests. There are 3 parameters used in determining whether a conduction study is normal or abnormal. These parameters are amplitude of the MUAP, latency of the response, and conduction velocity. The motor amplitude represents the summation of the individual muscle fiber action potentials within that muscle and correlates highly with the number of viable axons. The amplitude is measured in milli volt from the baseline to the negative peak of the response obtained from supramaximal nerve stimulation. Sensory amplitude (peak-to-peak) is measured in microvolt and also correlates with the number of viable axons. The latency is measured in milliseconds from the onset of the stimulus to the first negative deflection from the baseline in motor conduction and to the peak of the response in sensory conduction. The conduction velocity is obtained by stimulating the nerve at two different points along the nerve at least 10 cm apart. To calculate the conduction velocity, the difference between the latencies' onset obtained at the two points is divided by the distance between the two points. It is calculated in meters per second.

Results

The obtained results were considered significant if the value of $p < 0.05$. Data analysis was done using the SPSS software (version 20.0).

TABLE: 1: AGE DISTRIBUTION AND BMI IN 50 INDIVIDUALS

	MEAN	S.D.	TOTAL NUMBER
BMI	28.3	2.35	50
AGE	34.44	4.57	50

In above table mean and standard deviation of BMI and age of 50 individuals is mentioned.

TABLE:2:CARPAL TUNNEL SYNDROME AMONG COMPUTER WORKER

TOTAL	50
ASYMPTOMATIC	35
SYMPTOMATIC	15
PERCENTAGE	70=ASYMPTOMATIC 30=SYMPTOMATIC

TABLE: 3: MOTOR NERVE LATENCY-1 AND 2 FOR WRIST AND ELBOW

	GROUP	N	MEAN OF RANK	SUM OF RANK	SIGNIFICANCE
LATENCY 1 FOR WRIST	SYMPTOMATIC	15	3.185	265	0.184
	ASYMPTOMATIC	15	2.364	200	
	TOTAL	30			
LATENCY 1 FOR ELBOW	SYMPTOMATIC	15	3.409	278	0.061
	ASYMPTOMATIC	15	2.220	187	
LATENCY 2 FOR WRIST	SYMPTOMATIC	15	10.64		0.119
	ASYMPTOMATIC	15	12.21		
LATENCY 2 FOR ELBOW	SYMPTOMATIC	15	11.13		0.633
	ASYMPTOMATIC	15	11.45		
	TOTAL	30			

TABLE:4: MNCV FOR WRIST AND ELBOW

	GROUP	N	MEAN OF RANK	SUM OF RANK	SIGNIFICANCE
MNCV AT WRIST	SYMPTOMATIC	15	2.77	3.0	0.33
	ASYMPTOMATIC	15	11.42	7.0	
	TOTAL	30			
MNCV AT ELBOW	SYMPTOMATIC	15	2.81	3.0	0.33
	ASYMPTOMATIC	15	11.29	3.0	
	TOTAL	30			

TABLE:5:SENSORY NERVE LATENCY-1 AND LATENCY 2 FOR ELBOW AND WRIST

	GROUP	N	MEAN OF RANK	SUM OF RANK	SIGNIFICANCE
LATENCY 1 FOR WRIST	SYMPTOMATIC	15	3.11	280.0	0.050
	ASYMPTOMATIC	15	2.01	185.0	
	TOTAL	30			
LATENCY 1 FOR ELBOW	SYMPTOMATIC	15	3.26	277.5	0.063
	ASYMPTOMATIC	15	2.13	187.5	
LATENCY 2 FOR WRIST	SYPTOMATIC	15	9.93	227.0	0.835
	ASYMPTOMATIC	15	10.04	238.0	
LATENCY 2 FOR ELBOW	SYMPTOMATIC	15	10.11	240.5	0.755
	ASYMPTOMATIC	15	9.77	224.5	
	TOTAL	30			

TABLE:6: SNCV FOR WRIST AND ELBOW

	GROUP	N	MEAN OF RANK	SUM OF RANK	SIGNIFICANCE
SNCV AT WRIST	SYMPTOMATIC	15	2.56	3.0	0.33
	ASYMPTOMATIC	15	9.98	7.0	
	TOTAL	30			
SNCV AT ELBOW	SYMPTOMATIC	15	2.70	3.0	0.33
	ASYMPTOMATIC	15	9.94	7.0	
	TOTAL	30			

In above table:3 to 6 [1: Mann Whitney U test for sensory ncv and mean value for both the group is given.2:it doesn't show any difference.3:significance level is mentioned]

Discussion

For the first part of the study that is prevalence of CTS 50 people were given the questionnaire and out of 50 only 15 were having symptoms. All the 15 was both male and female. Another 35 people were asymptomatic. The reason for not finding much correlation between the obesity and CTS can be because if i can't get enough sample size. Another reason for not finding correlation is that NCV is quite sensitive to room temperature and many other factors, Readings may get deviated as some participants came in morning hours and some at afternoon hours. And another limitation of this study is that NCV room settings require electrically shielded room which was not fulfilled. The reason for not finding much correlation between obesity and CTS can be because of data selection. Also some studies shows that computer work induces very little force ,the position of fingers, wrist and foremen requires for computer work have shown that carpal tunnel pressure increases but not to the level that generally believed to be harmful. The obesity among the participant is not sever enough to exert pressure on carpal tunnel. Other reason for the same include ethnicity, male gender and younger age group. Study was done by deepanairet on effect of BMI

on distal motor and sensory latency in obese individuals and concluded there is no correlation between BMI and DML and DSL. most of the studies carried out in industrial workers suggested positive association between slowing of sensory component of median nerve across the wrist with obesity. **LIMITATIONS:** A larger sample of participants would be required to have sufficient power in calculations, and decrease the probability of potential error to allow for more conclusive results on between group differences. In addition, we used only obese individuals for our study; it can be done on normal individual also. Other neuropathy condition can be taken for ncv studies. As the group was formed based on symptoms and its weakness is it is subjective and influences more on homogeneity. The results of ncv shows no difference in between groups and it can be result due to technical problems and for that one can use more reliable instrument and more precise procedure.

Conclusion

Results of this study failed to reveal a significant correlation between the BMI and CTS so null hypothesis is retained. results of NCV studies found no significant difference between symptomatic and asymptomatic

group, so in that null hypothesis retained.

Conflict of Interest – No.

Source of Funding- Self

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Prevalence of Flat Foot and Correlation between BMI and Planter Arch Index in Obese School Children

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Abstract

Aims: To find out the prevalence and correlation between the BMI and planter arch index in obese school children.

Method: 50 participants (26 Girls and 24 Boys) of mean age 9.960 ± 0.925 were recruited based on inclusion and exclusion criteria. It was a cross sectional study among the school children. The data was obtained by using means of the footprint and the planter arch index, which establishes the ratio between central and posterior regions of this footprint, determining a mean PAI and a limit to the flat-foot.

Result: Among the 26 girls, 42% had flat foot and 58% did not have flat foot and among the 24 boys, 45% had flat foot and 55% did not have flat foot. The result shows that there was no significant correlation ($r = 0.02773$) of BMI and planter arch index.

Conclusion: This Study concluded that there was no significant correlation between planter arch index and BMI in obese school children ($P=0.6324$) as indicated by correlation values (for right foot A=0.1413 B=0.1137 and left foot A=0.1410 B=0.1066).

Keywords: Flat foot, Planter arch index.

Introduction

In bipeds, the foot takes on the important responsibility of receiving the weight of the whole body and at the same time stabilizing the individual in changing postural and environmental conditions.² Children with flexible flatfoot often do not begin to develop an arch until the age of 5 years or older. Some children never develop an arch. If flexible flatfoot continues into adolescence, a child may experience aching pain along the bottom of the foot.⁴ The arches present right from

birth, although they are masked by excessive amount of fat in their sole, an apparent flat foot (fat foot) is present in many children up to the age of 2 years.³

Most children are born with very little arch in the feet. As they grow and walk, the soft tissues along the bottom of the feet tighten, which gradually shapes the arches of the feet.⁴ These arches maintain proportional distribution of the body weight. Concavity of the arches protects the plantar vessels and nerves from compression.³

The concept of Arch Index was first described by Cavanaugh et al. as the ratio of the area of the middle third of the foot to the entire foot area excluding the toes.⁵ Importance of "arch-index" as a sensitive podographic indicator was later on confirmed in different studies.¹ Later it has been established the Arch Index, derived from footprint to show a significant negative correlation with the navicular height.⁵

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Arch index also varies with age, falling into the normal adult range by age 5.¹¹ Whether among obese or non-obese people, school-aged children or adults, or men or women from different countries, arch index values fall into the different ranges of arch index values suggested and used as a potential method to classify high-arched, normal, and low-arched foot types.⁶

An arch index of less than 0.21 has been said to be indicative of a cavus foot, while it greater than 0.26 is indicative of planus foot whereas Arch Index between 0.21~0.26 corroborates normal arch height.⁵ A “gold standard” method for determining foot type has yet to be established, and clinical observation remains the method most often relied upon.⁶

Procurement of, and processing the footprint being easier and cheaper, is more acceptable for the patient than radiography. Hence, in spite of the fact that radiography is still important in establishing the arch height, footprint procedures are preferred to it.⁵

This can be conveniently taken on a graph paper and the Arch Index can be calculated thereafter to ascertain the height of the arch of foot.⁵ Measures of navicular drop, arch height, dorsal foot height, longitudinal arch angle, and hind foot angle have demonstrated poor to good reliability in supporting clinical determinations of foot type⁶. But unfortunately almost no studies have inter-related mathematically the foot-print derived arch-index values with the radio graphically evaluated standing arch-height measurements with an acceptable equation, by which one can interpret directly the standing navicular or talar height with the help of arch index without proceeding through actual maneuver. Especially such information lacks in pertinent literature so far in Indian population is concerned⁵. But the reliability of these measurements in classifying foot type has not been investigated.⁶ Arch index values, based on the contact area of the middle section of the plantar footprint, have been used to determine foot type. Arch index values calculated by footprint analysis have been obtained from force plate⁶. A moderate correlation between BMI and occurrence of pes planus exists; ⁹differences have been found between children with and without obesity.⁶ High BMI some time may be a cause of flat foot. The assessment of plantar arch development, by the relationship between arch region width and heel region

width obtained on a footprint, is proposed by Engel and Staheli.⁷

Methodology

Source of Data: Santaniketan school , Rankuva.

Study Design: Cross sectional observational study.

Sample size: 50 Participants.

Participants: Preschool children (age between 8 to 11 years).

Sampling Method: Random sampling method.

Materials used: Pen, paper, record sheet, weighing machine, measure tap, calculator

inclusion criteria: Children in the age group of 8 to 11 year [boys and girls] and Children with BMI(boys: > 17.7 (obese), Girls: > 18.3 (obese))

Exclusion criteria: Children beyond the age of 11 year, Congenital Talipes Equinovarus , Polio, Cerebral palsy, Trauma fracture of lower limb and pelvic. Children with BMI(Boys: <17.7, Girls: <18.3)

Outcome measures: BMI and Planter arch index

Procedure:

The present study was initiated after the clearance obtained from the institutional committee of ethics of the Shrimad Rajchandra College of Physiotherapy, Bardoli.

A total 50 children who were in preschool of age between 8 to 11 years were found to be satisfying all the inclusion criteria. A detailed explanation regarding the complete procedure was given to each subject and as a formality towards their willingness to be a part of this study, they were asked to sign a written consent. After taking written consent, the demographic data that is age, gender, standard, weight, height and BMI were calculated. All the test was performed in quiet and proper ventilated room. Static foot print of both feet was obtained on a chart paper using ink. The calculation of the PLANTAR ARCH INDEX was carried out as follows.

A line is drawn tangent to the medial fore foot edge to the mid heel region. The mean of this line was calculated. From this point, a perpendicular is drawn,

crossing the foot print [mid foot region, the arch width =A]. The same is repeated for the heel tangency point [Mid heel width =B]. PAI will be obtained by dividing the value of arch width [A] by the value of mid heel width [B]. The equation to calculate this is: $PAI = A/B$. The range of normal was defined as being within 2SD from the mean. After collecting data from the subjects, all data was gathered and a master sheet was prepared. Next, for the statistical analysis, the descriptive statistics of age, gender, standard, weight, height, BMI and planter arch index were taken out. Spearman Correlation test was carried out for this study. It is the color that was used for foot-print of participants on blank white paper.

Data Analysis and Results

Data Analysis

This study aimed to evaluate the prevalence of flat

foot and correlation between BMI and planter arch index in obese school children. The data was collected for Flat foot in Children.

Evaluation of average, minimum, maximum and standard deviation values for central arch region (A) and heel (B) on footprint was taken. And for the planter arch index (PAI) corresponding to right and left feet, respectively was taken. Descriptive statistics including mean, standard deviation for age and BMI was calculated using Microsoft office excel. Frequency percentages of gender were analyzed by pie chart. As all the data was not normally distributed, Non-parametric test, i.e., Spearman correlation test was used to analyze the data

The obtained result was considered significant if the value of $p < 0.05$

Results

1 Demographic Data

Demographic data of participants (N=50)

	Mean	SD
Age	9.960	0.925
BMI	20.094	2.217
Right A	8.574	0.718
Right B	4.264	0.352
Left A	8.572	0.718
Left B	4.268	0.351

Table 1 shows the descriptive statistic of Age, BMI and arch index for right and left foot of all participants.

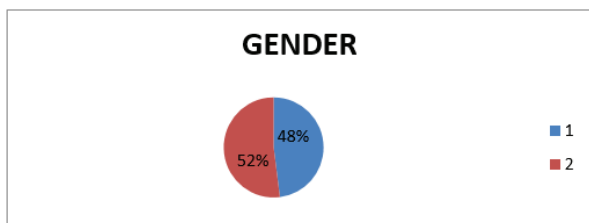
Table 2: Associations between BMI and PAI

Associations coefficient	RIGHT A	RIGHT B	LEFT A	LEFT B
p value	0.1413	0.1137	0.1410	0.1066
R value	0.2110	0.2265	0.2112	0.2310

Table 2 shows the p value of correlation between BMI and Planter arch Index of Right and left foot.

Association is significant at the 0.05 level [2-tailed]

Association is significant at the 0.01 level [2-tailed]



Graph 1 Gender distribution among the school children

Series: 1 Boys Series: 2 Girls

In above pie chart there were 48% of boys and 52% of girls among the school children.

Discussion

This cross sectional study aimed to find the prevalence of flat foot and correlation between the BMI and planter arch index in obese school children.

For this study total 50 school children were selected and out of this, sample size, only 52% were girls and 48% were boys. As data was not normally distributed, nonparametric test was used to correlate BMI and planter arch index, analyzed using Spearman Correlation test.

The result of the present study are not consistent with previously reported findings on prevalence of flat foot in obese school children. The foot functions as strong and stable support for the body as well as the lever of ambulation¹³. During successive loading and unloading cycle of ambulation these functions of feet makes it to present a unique behaviour¹³. Feet is the region suffering highest variation in human body because of the deformation experienced by the medial longitudinal arch during stance phase¹³. Because of these features it is necessary to clinically examine this region which may be a complex one¹. The foot has following arches: medial and lateral longitudinal arch, transverse half arch at the level of mid tarsal joint and anterior transverse arch at the level of head of metatarsals³. The static function of foot works during stable weight bearing support whereas the dynamic functions during walking as an efficient lever to propel the body weight forward. These are the two major functions of foot³. Decreased participation of obese students in physical activity is due to the structural changes in their foot⁷.

Engel and Staheli found a strong reduction in incidence of flaccid flat feet up to the age of 4, because medial longitudinal arch development happens through this age, thus, higher plantar arch indexes are expected in younger children, while these indexes are lower in older children¹. Other authors admit that major variations on plantar arch happen until the age of 7. The suggestion of this index having a decreasing incidence up to approximately 5 years old, remaining stable after that was responsible for our decision to study a group of children above that age; so by working with lower age groups we could reduce the usefulness of our indexes to the intended end. Some genetic pathological conditions also affect flat feet¹. The identification of congenital problems, particularly involving the feet ; postural abnormalities of the spine, pelvis, hips and knees ; Achilles Tendon shortening, and restraint to subtalar joint movements are essential for ruling out the possibility of secondary flat feet¹. The plantar arch index and the navicular vertical height are correlated, but the second is better, because it directly measures navicular, which is the key to medial arch, in addition it is easy to achieve¹. Using a sophisticated methodology, such as strength platforms, graded scales or “moire” photopodometry , increases measurements accuracy, but these are more difficult to apply in clinical routine¹³. The classification proposed by these authors may be used by obtaining a carton-based template of the area of plantar region of the feet , which allows for calculating the plantar index from the areas of different regions of the feet¹. Although the two novice testers had different levels of clinical experience, our results suggest that the study methods can be learned quickly. Reliability may have been enhanced by using AutoCAD to analyze the digital photographs⁵. The standing navicular height (NHSTD), talar height (THSTD) and normalized navicular height (NNHSTD) along with normalized talar height (NTHSTD) individually has been correlated with the arch-index at the margin of statistical significance⁴. The results of this study shows that without going in the unnecessary time-taking radiological procedures, it is better to have the foot-print of the subject to analyze the arch-index, from which standing arch-height values easily can be calculated⁴.

A study found a global prevalence of 15.74% for the population analyzed, compared to other studies ranging between 2.7 and 44% in the Pfeiffer study¹¹. The

difference of results with the 2.7% prevalence reported by Garcia et al.⁴, seems explainable given that the study by this author considered a population that included older age groups (13 to 15 years of age) in which the arch was completely developed, considering as flat footed only those subjects with at least a Denis grade 2¹¹. Few studies in literature determine the prevalence of flat footedness; among them, there is the study by Echarri and Forriol who reported 70% prevalence for flat feet in children 3 to 4 years of age and of 40% between 5 and 8 years of age¹¹. While this study did not elaborate on any effect excess weight may have on foot development or efficiency, Welton suggested that, although many footprints registered outside the normal range, they would not necessarily require intervention or treatment but rather monitoring for potential problems⁷. However, Hennig et al identified body weight as a major influence on the magnitude of the pressures under the feet of 125 children aged 6 ± 10 years⁷.

Limitations:

this study included age group between 8-11 years. Another limitation of this study is that only BMI of 17.7 (boys) and 18.3 (girls) were included. Further studies can be done on under-weight children of same age that may prevail structural abnormalities in children.

Conclusion

The prevalence rate of flat foot among the obese school students of ages between 8 -11 years is, out of the 50 students, 26 were girls and 24 were boys. Among the 26 girls, 42% had flat foot and 58% did not have flat foot. Among the 24 boys, 45% had flat foot and 55% did not have flat foot.

This Study concluded that there was no significant correlation between planter arch index and BMI (P=0.6324) as indicated by correlation values (for right foot A =0.1413 B=0.1137 and left foot A=0.1410 B=0.1066).

Ethical Clearance: obtained from the institutional committee of ethics of the Shrimad Rajchandra College of Physiotherapy.

Funding: Self

Conflict of Interest: Nil

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Cross-Sectional Study to Evaluate Pattern and Risk Factors among School Teachers

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Abstract

Objective: To evaluate the pattern and risk factors of musculoskeletal pain by using Nordic musculoskeletal questionnaire.

Method: A total 50 participants were recruited using cross-sectional study. The data was obtained by using modified musculoskeletal questionnaire, analyzed using descriptive statistics for frequency and percentage.

Results: This study comprised 70% of females and 30% of males between the ages of 25-60 years. The finding showed that the most common musculoskeletal pain included shoulder pain (14%), low back pain (16%) and knee (14%). The factors of musculoskeletal pain are working hours/day, prolong standing, overhead activity and working posture.

Conclusion: According to this study shoulder pain, low back pain and knee pain is common pain sites among school teachers. The factors of musculoskeletal pain are working hours/day, overhead activities, prolong standing and working posture.

Keywords: Pain, Risk factors, School teachers.

Introduction

Pain is defined as a sensory and emotional experience due to tissue damage. The musculoskeletal disorder is common in general populations that affect the quality of life. Musculoskeletal pain is caused by occupational stress that leads to pain and physical disabilities¹.

Musculoskeletal disorder may affect the muscles, joint, ligament, tendon and nerves. The acute symptoms are discomfort, minor aches and pain. If it doesn't treated in acute phase that may result of permanent disability².

Musculoskeletal disorder is also caused by the limitation of physical activity, away from work and recently retirement, weight bearing muscles weakness, unhealthy lifestyle, incorrect position of body etc^{2,6}. Musculoskeletal disorder is reported in developed and developing countries with suboptimal conditions and lack of awareness of ergonomics issues, education and training programmes⁸. Musculoskeletal system is affected by inflammatory and degenerative changes and also occur by single traumatic event¹⁰.

The teachers having a problem related to the musculoskeletal disorder due to prepare for lesson, assess student's exercises, carry out guidance work, performing nonteaching clerical duties, prepare for external school reviews, participate in continuing professional development, satisfy request from management etc³.

Teaching is a profession in which school teachers suffer from physical health problem⁵. In physical health problem includes shoulder pain, neck pain, and low back pain. The causes of back pain and neck pain are physical activity, weight bearing muscles weakness, unhealthy lifestyle and faulty posture of body etc⁶.

Low back pain is a common health problem in working population and major cause of disability among the workforce¹³. The low back pain is caused by poor posture because of improper furniture and inappropriate technique of lifting¹¹. It is also caused by incorrect making homework at student's bench and prolongs period of standing posture and also because of the continuous bending posture that result content

mechanical load on the spine⁷.

Prolong sitting and standing which causes fatigue of Para-spinal muscles and ligaments, lumbar disc fluttering, disc fiber strain, increase in intradiscal pressure and micro fractures in the vertebral end plates¹³.

There are some reasons for differences in prevalence rate of LBP in teachers, such as different methodologies used, unclear operational definition for LBP, unclear prevalence period's, heterogeneity of study samples, and different sample size⁸.

Treatment plan for low back pain include extension-oriented exercise. In extension-oriented exercises active or passive movements are performed and strengthening exercise for stabilizes the spine⁷.

The National Institute of Occupational Health in US concluded that there was "strong evidence" for an association between neck complaints and static loading of neck-shoulder musculature at work. Second evidence was "suggestive evidence" that include risks from continuous arm and hand movements and forceful movements involving same muscle group¹³.

Normally, the position of scapula is posterior to the thorax approximately two inches from the midline, between the second and seventh ribs¹³. The epidemiological study concluded that the shoulder pain and neck pain is occurred due overhead continuous scapular motion and hand movements which affect the muscles of neck and shoulder and resulting in altered scapular position^{5,13}. Alterations that have been identified in school teachers include increase shoulder flexion and abduction more than 60 degrees.

Due to repeat this activity, the teachers may get fatigue of musculoskeletal structure⁵. The reason behind fatigue is faulty posture which includes neck flexion, forward head posture, scapular retraction, forward stoop posture etc¹³.

Many studies have been conducted to investigate the relationship between MSP and occupation. Some groups of workers, due to occupational characteristics, are more exposed to work related MSP.

The economic impact of such widespread and disabling phenomenon is also enormous (McGeary et

al., 2003). However, available studies on these issues among teachers are limited⁴. Cardoso et al, in his study found that the complaints of musculoskeletal pain in upper limb in teachers were significantly associated with working more than 5 years, more than 30 students per class, weekly schedule greater than 40⁵.

According to the data recorded by the European Agency for Safety and Health at Work, nearly 24% of employees from the European Union – 25 countries complain about the back pain⁶.

The risk factors of musculoskeletal pain are age, sex, working in improper position, daily lifting of load and physically strenuous work⁴. Fatigue is most common risk factor for musculoskeletal pain. Fatigue is occurred by overuse of musculoskeletal during job hours⁵.

School teachers are performed combine activities of childcare and teaching duties. During flexion activities of lower back, continuous mechanical load present over lower back. So, these activities are risk factors for musculoskeletal disorder⁷.

Prolong standing or sitting posture may be consider as a risk factor for musculoskeletal pain because of different working condition and teachers demand⁸. Ergonomic factors is also considered as a risk factor for it due to inappropriate furniture that may lead to musculoskeletal disorders⁹.

The risk factors of low back pain are manual handling, heavy lifting, flexion and lateral bending of the trunk, awkward postures for prolong period of time¹³.

In work environment factors include repetitive work and exposure level. The psychosocial factors are stress, high job demand and low decision latitude¹³.

In this study, Nordic Musculoskeletal questionnaire is used. Standardized musculoskeletal questionnaire that could be used for the Screening of musculoskeletal disorders as a part of Ergonomic programs and for epidemiological studies of musculoskeletal disorders¹².

Methodology

Material and Methods: Source of Data: Mohanlal Lallubhai Maheta High School, Sayan., Dr.Dhirubhai Gandabhai Desai Sarvjanik vidhyalaya, Sayan.

Study Design: the Cross sectional study

Sample size: A total of 50 subjects

Participants: School teachers.

Sampling Method: cross-sectional observational study.

Materials used: Pen, Paper, Record sheet, Measure tap, Weighing machine

Inclusion criteria: Age: 25-60 year, Gender: Female and male, Marital status: married and unmarried, Qualification: bachelors and post graduated, Working hours per day: 5-8 hours

Exclusion criteria: Below 25 year and more than 60 year, Working hours :more than 8 hours, Congenital anomalies, Previous musculoskeletal surgery, Any Cardiac, Psychological, Neurological conditions

Outcome measures: BMI and Nordic musculoskeletal questionnaire

Procedure:

The present study was initiated after the clearance obtained from the institutional committee of ethics of the Shrimad Rajchandra College of Physiotherapy. Wherein,

a total 50 subjects who were found to be falling under the category of inclusion criteria were included in the present study for analysis. A detailed explanation regarding the complete procedure was done for each subject and as a formality towards their willingness to be a part of this study: They were asked to sign written consent. After taking written consent, all participants were asked to rest on plinth or chair or on the bed with shoes removed for 5 minutes and remain comfortable and relaxed. All the participants were administered Nordic musculoskeletal questionnaire for the assessment of musculoskeletal pain. It consists of 39 questions divided in to 3 main sections: 1) socio-demographic data with 5 questions, 2) questions with complaints about musculoskeletal pain in different body parts and 3) assessed risk factors with 7 questions. All the questionnaires were retrieved the same days/following days with 100% response rate.

Data Analysis

Descriptive statistical analysis was done for Age, Gender, Pain site and BMI.

The mean and standard deviation was included for age, gender, pain site and BMI. The frequency and percentage was analyzed for pain site for different body parts.

1 Demographic Data

TABLE 1: FOR DEMOGRAPHIC DATA OF PARTICIPANTS (n=50)

	MEAN	SD
AGE	43.02	7.81
GENDER	1.30	0.46

Table 1 shows the descriptive statistics of Age and Gender for all participants.

Table 2: PARTICIPANTS DESCRIPTIVE RESULT OF BMI AND PAIN SITE.

	MEAN	SD
BMI	23.06	4.06
PAIN SITE	7.32	3.17

Table 2 shows the descriptive statistics of BMI and Pain site for all participants.

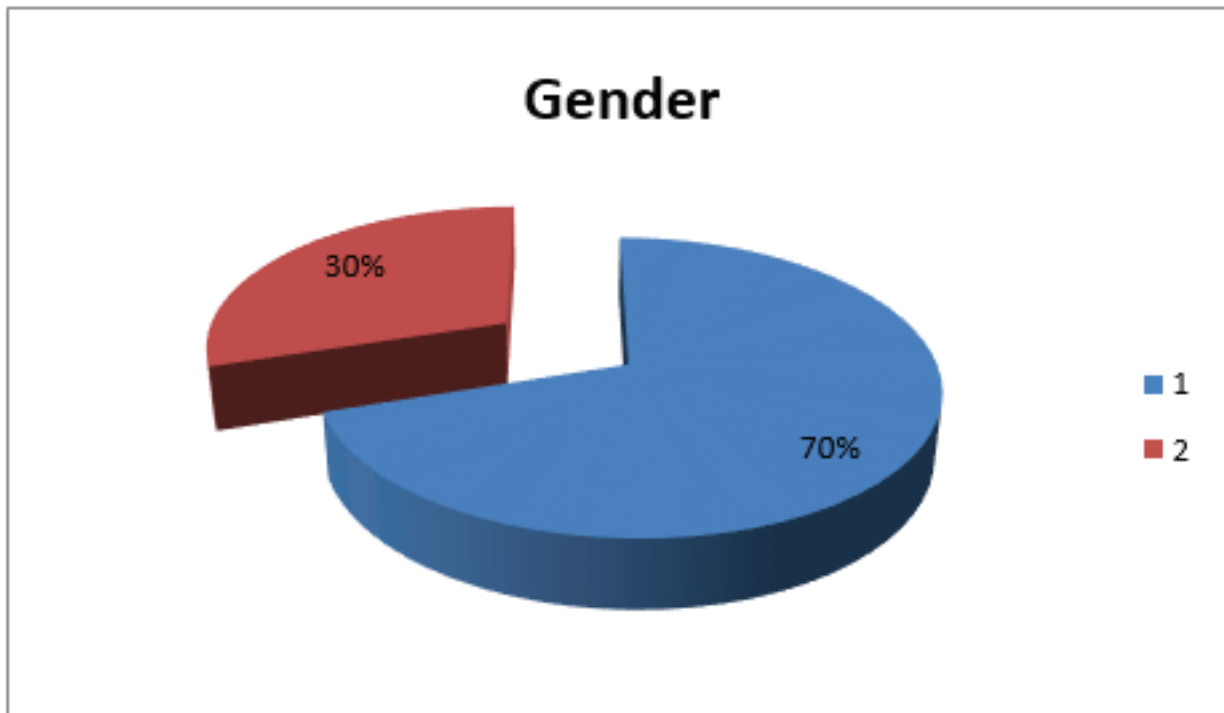


Chart 1 shows 1= Female 2= male

Graph 1: GENDER DISTRIBUTIONS AMONG SCHOOL TEACHERS

In above pie chart there were 30% male and 70% female school teachers

TABLE 3: FREQUENCY PECENTAGE OF PAIN SITE

PAIN SITE	YES(n)	NO	(%)
Neck	2	48	4%
Shoulder	7	43	14%
Elbow	1	49	2%
Wrist	1	49	2%
Upper Back	0	50	0%
Lower Back	8	42	16%
Hip	0	50	0%
Knee	7	43	14%
Ankle	1	49	2%

Table 3 shows the pain description in different body parts among school teachers.

Results

Descriptive statistics including mean, standard deviation for age, gender, BMI and pain site were analyzed. Frequency percentages of Gender were analyzed by pie chart. The updated data were collected for Nordic Musculoskeletal questionnaire components.

According to analysis, most common musculoskeletal pain was shoulder joint (14%), low back (16%) and knee joint (14%). Out of 50 school teachers 70% were female and 30% were males.

Discussion

The result of the previous study shows that the male school teachers were more than the female school teachers but in this the female school teachers were more than the male school teachers. Study can be made more effective if there will be a large sample size, less variation in gender. Affected areas were more in shoulder, neck and low back. But in this study the showed areas more affected like shoulder, low back and knee. All participants were filled the questionnaire. All participants were assessed in same environment. Result of present study is not consistent with previously reported finding pattern and risk factors of musculoskeletal pain among secondary school teachers in Kano Metropolis. The reason may be the larger numbers of participants recruited for that study. The formal study which included all other pain sites. All participants with significant muscular surgeries or congenital anomalies excluded in both studies. The risk factors of musculoskeletal pain include hours/days of working, years of experience and working posture¹. Risk factors of musculoskeletal pain is sociodemographic characteristics, Background characteristics, and work related backgrounds². The causes of back pain include poor posture, bad lifting, pushing and pulling activities¹⁵. Mostly low back pain and ankle pain is developed by repetitive and forceful motion during hours/days work. It is also developed by prolonged period of standing posture for 5-8 hours per day or 5-6 days per week of job¹. The low back pain and neck pain is caused by prolonged period of static work. Because of static work the continuous compression is taken place on spine. The inactivity of muscles retard the blood supply to the area and causes deposition of waste resulting in pain¹⁵.

The shoulder pain and low back pain is developed by repetitive overhead writing on board¹. In school teachers the shoulder pain is a common complaint. Arun Garg et al. reported that female teachers have less strength in shoulder muscles. If female teachers were work on black-board more than 2 hours that results alteration in scapular position.

The reason for this can be due to less muscular strength include serratus anterior, increased upper trapezius activation and tightness of pectoral minor or posterior shoulder muscles and thoracic kyphosis or flexed thoracic postures. It also occurred by reduce subacromial space due to scapular upward rotation and posterior tilting during elevation that results impingement in shoulder joint⁵.

Hand pain, hip pain and low back pain is developed by years of teaching duties. Musculoskeletal pain is also developing in younger teachers who have less than 10 years of experience because of greater work demand, take over activities and tasks that are performed in beginning of the career¹.

Musculoskeletal disorders in lower extremities are reported in Brazilian and Chinese school teachers having 41.1% and 54.6% respectively. In a recent Turkish study, lower extremity pain had been experienced by 8.4% of teachers in the hip area, 32% in the knees, and 21.8% in the ankles¹.

Pain in the cervical spine may have a stronger link with psychosocial factors than with physical activity or habitual position, typically assumed, during the performance of daily activities⁶.

Continuous standing requires static loading on neck muscles and also to maintain the neck in neutral position. During duties in standing position, the neck may go in flexion position and that leads to major load on C7-T1 joint. This load may affect the ligaments and joint capsule of spine¹³.

Poor working posture is a major risk factor for school teachers because they assume twisting activities in class¹. The major risk for low back pain include accumulation of metabolites, acceleration of disc degeneration and disc herniation because of prolonged sitting that results increase static load on muscles and soft tissues¹³.

The minor risk of low back pain caused by bending and twisting activities and no lumbar support during sitting. Tensile stress on convex side caused by bending activities like forward flexion, lateral flexion or extension of the spine and compressive stress take place during body weight on concave side¹³.

Tensile stress and shear stress are produce during twisting and rotational movement of one vertebra on another vertebra. The strain of muscles and sprain of ligaments are also caused by stress. The combination of bending, twisting and rotational movements results more load on spine and it affect the intervertebral disc¹³. The highest shoulder pain prevalence 73.4% for the previous month has been reported by Chinese school teachers¹. According to Eriksen et al. studies, the women were more to prone to musculoskeletal pain , headache and migraine. School teachers are also suffered from pseudo-neurological complaint that including tiredness, sleep problem and anxiety. The results of the current study showed that female teachers were more likely than male ones to report all single musculoskeletal complaints, which is consistent with Jensen, Ryholt, Burr, et al.'s findings³. In this cross-section study teachers were found to have high-risk for musculoskeletal pain and general risk factors are age, gender, improper posture and depression⁴. According to Chiu and Lam (2007) stated that there was a significant difference among different age groups in the prevalence of neck and upper limb pain⁴.

Due to lack of nutrition and knowledge of working procedure, the school teachers may face the long-term musculoskeletal disorder¹⁵.

Conclusion

According to this study shoulder pain, low back pain and knee pain is common pain sites among school teachers. The factors of musculoskeletal pain are working hours/day, overhead activities, prolong standing and working posture.

Ethical Clearance: obtained from the institutional committee of ethics of the Shrimad Rajchandra College of Physiotherapy.

Conflict of interest – no conflict of interest

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Presence of Pectoralis Minor Tightness in Healthy Collegiate Individuals

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Abstract

Aim of The Study: To assess the presence of pectoralis minor tightness in healthy collegiate individuals. **Objectives: (1) Primary Objective:** To assess pectoralis minor length through tabletop test and digital vernier caliper. **(2) Secondary Objective:** To assess the internal and external passive range of motion of shoulder. **Methods:** 53 healthy male collegiate individuals of 18-22 years were taken. Pectoralis minor tightness was measured by using pectoralis minor length test. Measurements were made in supine position where the linear distance from the treatment table to the posterior aspect of the acromion was measured by protractor. A distance greater than 2.6 cm would suggest the muscle head shortened. Measurements were also made with a digital vernier caliper. Range of motion measurements were recorded. Demographic information of the students was also recorded.

Result: Higher percentage presence of pectoralis minor tightness was found in normal healthy collegiate individuals. **Conclusion:** This study concludes that there is presence of pectoralis minor tightness in healthy collegiate individuals.

Keywords: Digital vernier caliper, length measurement, pectoralis minor muscle, PROM, tabletop test

Introduction

Scapula, normally called as shoulder blade, it rests at a position on the posterior thorax approximately 2 inches from the midline, between the second and seven through. The scapula is internally rotated from vertical and is upwardly rotated 10° to 20° from vertical.^{1,2} The pectoralis minor originates on ribs 3, 4, and 5 and attaches on the medial border of the coracoid process. It is the only anterior scapulothoracic muscle. The pectoralis minor is passively lengthened during the active scapular upward rotation, external rotation, and posterior tipping that occurs with arm elevation in healthy individuals.

³The position of scapula is very important for muscle balance, there is a significant relationship between the contraction abilities of the muscles in the shoulder region, and the position of scapula and shoulder protraction is developed due to the poor posture creates disadvantage for muscle function.⁴ The pectoralis minor has also been identified as a muscle requiring stretching in individuals with forward shoulder posture. A pectoralis minor muscle that is relatively short through adaptation would not demonstrate normal flexibility.⁵ Repetitive use of the upper extremity for activities that protract and downwardly rotate the scapula may contribute to adaptive shortening of the PM.^{6,7} Adaptive shortening of the PM can subsequently modify the resting position of the scapula, altering scapular mechanics during elevation.^{8,9} Because of this anatomical position of the pectoralis minor, shortening can lead to an increase in scapular anterior tilting¹⁰ and internal rotation and a decrease in scapular up but rotation, which can be predisposed condition for shoulder impingement syndrome.¹¹

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Changes in muscle lengths, joint congruency, and soft tissue flexibility may occur as a result of prolonged postural deviations. In the absence of a specific or identifiable cause of symptoms, poor upper body posture, colloquially referred to as a 'forward head posture', 'slouched posture', 'poking chin posture' or 'rounded shoulder posture' has been cited as a potential etiological factor in the pathogenesis and perpetuation of many clinical syndromes involving the shoulder.^{12,13}

One of the more common postural deviations seen clinically is the "forward shoulder". During a coronal plane assessment, the lobe of the ear, the body of the seventh cervical vertebra, and the greater trochanter of a patient with ideal posture should be colinear. A patient is considered to have a forward shoulder if the acromion process is located anterior to this line.¹⁴

Sahrmann has stated that the shoulders tilt anteriorly because of shortness of pectoralis minor and that the lateral border of the spine (posterior aspect of the acromion) should be no more than 2.54^(2.6) cm from the treatment table when the subject is in supine.^{15,16}

A distance greater than this would suggest a muscle imbalance had occurred and the muscle had shortened. Studies have also looked at how range of motion at the shoulder joint is linked to shoulder dysfunction.¹⁷ Other scholars have hypothesized that forward shoulder posture would be associated with a decrease in external rotation due to tightness of pectoralis major and minor, as well as latissimus dorsi muscles.¹⁸ Bang and Deyle analyzed an exercise group and an exercise plus manual therapy group to compare the effect of these intervention programs on shoulder pain. Specific manual therapy techniques, including pectoralis minor stretching and soft tissue mobilization, were given when indicated, based on the examination of each patient.¹⁹ Wang et al tested the 3-dimensional kinematics of a group of individuals with forward shoulder posture before and after a 6-week home exercise program. The exercise program included a self-stretch for the pectoralis minor as 1 of 6 exercises.²⁰

Ludewig and Borstad compared symptoms and function between a group with shoulder impingement and a non-painful group of construction workers before and after an 8-week home exercise program. A pectoralis minor stretch was included as 1 of 5 exercises.

The validity of using surface landmarks and readily available clinical instruments to measure the pectoralis minor length established in the present analysis creates the opportunity to examine muscle length change as a potential mechanism for the effectiveness of an intervention at the shoulder.¹³

A standard goniometer is used to measure the bilateral glenohumeral passive range of motion (PROM). Length of the PM is indirectly measured using the table-to-acromion distance, or "tabletop test." Designed to identify postural shortening of the PM, the tabletop test has been shown to have an excellent ICC. A digital vernier caliper is used to measure the PM length distance from the medial-inferior tip of the coracoid process to the inferior portion of the fourth rib, immediately lateral to the sternocostal junction. Measurements are taken in sitting with arms at rest, and sitting with shoulders in maximal external rotation.²¹

Methodology

Source of Data: Uka Tarsadia University, Maliba Campus, Bardoli. **Study Design:**

This is a cross-sectional study to evaluate the tightness of pectoralis minor in healthy collegiate individuals. **Sample size:** Total 53 subjects were selected which were falling under the inclusion criteria. **Study Population:** Healthy male college students. **Sampling Method:** Convenient sampling **Materials used:** Pen , Paper , Plinth , Consent form , Goniometer

MATERIALS AND METHODS : Plastic protractor, Digital vernier caliper **Inclusion criteria:** Age 18-22 years ,Gender: male **Exclusion criteria:** Any neurological impairment ,Any deformity, Fracture of cervical spine or shoulder ,Any surgical history, Any musculoskeletal disorders, No lumbar, thoracic and cervical symptoms **Outcome Measures:** The study mainly focused on the presence of pectoralis minor tightness in college students., Primary outcome: (1) Tabletop test

(2) Digital vernier caliper length measurement , Secondary outcome: (1) Internal and External rotation PROM **Procedure :** The study was initiated after the clearance obtained from the institutional committee of ethics of the Shrimad Rajchandra college of

physiotherapy, wherein a total of 50 subjects were found to be falling under the category of students and who were found to be satisfying all the inclusion criteria which were included. The subjects, who met the inclusion criteria, were given a detailed explanation regarding the complete procedure and as a formality towards their willingness to be a part of this study, they were asked to sign written consent. After taking written consent, all patients were asked to rest on plinth or on the bed with shoes removed for five minutes and remain comfortable and relaxed. After getting all these information and giving proper positions, the clinical tests like, (1) tabletop test, (2) passive range of motion, (3) pectoralis minor length measurement were performed. Tests were performed in quiet and proper ventilated room. The subjects who met the inclusion criteria i.e. collegiate students were first checked for internal and external passive range of motion of shoulder while in supine. A standard goniometer was used. All pectoralis minor measurements were performed on the college going students by a single observer. Patient position: Supine with shoulder abducted to 90° and elbow flexed to 90°. Therapist position: Walk standing along the side of the plinth. Fulcrum: olecranon process **Tabletop test**: Length of the pectoralis minor was indirectly measured using the table to acromion distance, or "tabletop test". The linear distance in centimeters using a rigid standard plastic transparent right angle protractor was measured. **Tabletop test**: Without exerting any downward pressure into the table, the base of the protractor was placed on the treatment table and vertical side was placed adjacent to the lateral aspect of the acromion. **Digital vernier caliper length measurement**: Measurements of pectoralis minor length were performed in accordance with the technique that was previously validated and reproduced in subsequent clinical studies. Pectoralis minor length was estimated by the measured distance from the medial inferior tip of the coracoid process to the inferior portion of the fourth rib, immediately lateral to the sternocostal junction. Patient position: Supine with arms at rest Lengths were recorded in inches and were then converted in centimeters.

Data Analysis

The data was analyzed by Microsoft excel sheet. Descriptive statistics was calculated to find out the overall percentage and frequency of pectoralis minor

tightness. Mean and standard deviation (SD) was taken out of the inventory. **Demographic Data**: Descriptive statistics including mean and standard deviation were analyzed.

TABLE:1: Demographic Data of the students (n=53)

Demographic Data of the students (n=53) Variables	Mean±SD
Age	20.037±1.285
Working hours	6.132±0.785

TABLE: 1: Shows the descriptive statistics of Age and Working hours for all students.

Tabletop test

Percentage of pectoralis minor tightness according to tabletop test Shows 67.92% presence of pectoralis minor tightness and 32.07% were found with absence of pectoralis minor tightness. Percentage of digital vernier caliper length measurement Shows 75% presence of pectoralis minor tightness and 25% were found with absence of tightness.

TABLE:2:Descriptive results of PROM, Tabletop Test and Digital vernier caliper length measurement (n=53)

Variables	Mean±SD
Internal rotation	66.075±3.550
External rotation	82±6.201
Tabletop test	3.103±0.601
Digital vernier caliper measurement	2.73±0.180

TABLE:2: Shows the descriptive results for clinical measures of the internal and external PROM, tabletop test and digital vernier caliper length measurement

Result

The updated data were collected for internal and external passive range of motion of shoulder, tabletop test and digital vernier caliper length measurement.

Descriptive statistics including mean and standard deviation for age and working hours were analyzed. The frequency and percentage of pectoralis minor tightness was analyzed by calculating the average percentage of tabletop test. In this study 67.92% students had presence of pectoralis minor tightness and 32.07% were found with absence of pectoralis minor tightness according to tabletop test. Also, 75% students had presence of pectoralis minor tightness and 25% were found with absence of pectoralis minor tightness according to digital vernier caliper length measurement.

Discussion

The participants of the study had presence of pectoralis minor tightness, this may be due to the presence of poor posture among students. Postural and muscle imbalance theory suggests that a short pectoralis minor is associated with a number of syndromes effecting the shoulder and upper quadrant. This present study is based on MANKAD V. et al, 2016 who did study on "Prevalence of pectoralis minor tightness in healthy collegiate students", in which they included healthy collegiate students.

This present study shows that high level of college going students have presence of pectoralis minor tightness. Working for hours in class while sitting in poor posture can have more negative impact on pectoralis minor tightness. The study comprised of 53 subjects. All students were male; they were dominantly right-handed. Adaptive tightness in the pectoralis minor is characteristic in the development of scapular malpositioning, inferior medial border prominence, coracoid pain, and malposition syndrome. Here, impingement-like symptoms result from the anteroinferior angulation of the acromion secondary to scapular protraction in students.²¹ Therefore, the detection of pectoralis minor shortening via a reliable clinical test may be helpful in identifying students at risk and may allow for a preventive stretching routine. Two main techniques for measuring the pectoralis minor muscle have been described in the literature. The pectoralis length test is one method that has been recommended to determine if his muscle is of normal length or is short and the 2.6 cm distance has been proposed as the length that separates a muscle of normal length that is short and may be associated with symptoms.²¹ The mean measurement

was 3.103 in students. The direct method, which entails using a vernier caliper to measure the resting length of the pectoralis minor muscle from the coracoid process to the fourth rib space, has been validated.²¹

In our study, absolute pectoralis minor muscle lengths were significantly shorter in students.

To assess the scapular profile of the students, static measurements were taken from palpable anatomic landmarks. In theory, those individuals with shorter pectoralis minor resting lengths should exhibit increased scapular internal rotation, therefore having a shorter resting sternal notch to coracoid process distance with a concurrent increase in thoracic spine to posterolateral angle of the acromion distance.²¹ A syndrome associated with a tight pectoralis minor is the scapular downward rotation syndrome. The assumption is that increased scapular downward rotation is a posturally abnormal position and considered to be a cause or mechanism for the perpetuation of shoulder symptoms.¹² In support of this, Basmajian and Bazant have described that when correctly orientated the glenoid fossa of the scapula should face superiorly. Although no explanation was provided how the correct orientation was determined, Basmajian and Bazant argued that a superior inclination was important to provide a bony support for the humeral head. However, and in contrast to this the findings of two radiological studies have described that normally the glenoid fossa displays a downward inclination.¹² It is acknowledged that though subjects were asymptomatic in this investigation they were found to have a pectoralis minor length test distance of more than 2.6 cm and may develop shoulder and upper quadrant symptoms at some stage in the future.¹²

Limitations of the Study : Only subjects with age 18-22 years were recruited. Only male students were taken Only college going students were included. Sample size was small , Only Maliba Campus students were included in the study.

Conclusion

This study concludes that there is presence of pectoralis minor tightness in healthy collegiate individuals. The findings reveal a high percentage of tightness in college students. 67.92% tightness found through tabletop test and 75% tightness found through

digital vernier caliper length measurement, necessitates the need for interventions like preventive stretching routine.

Conflict of Interest – No.

Source of Funding- Self

Ethical Clearance – Obtained by The Institutional Committee of Ethics of The Shrimad Rajchandra College of Physiotherapy.

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A Study to Correlate Modified Modified Ashworth Scale(Mmas) and Modified Tardieu Scale(Mts) with H-Reflex to Assess Planterflexor Spasticity in Chronic Post-Stroke Patients- An Observational Study

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Abstract

Background : Stroke or cerebrovascular accident is the sudden loss of neurological function caused by an interruption of the blood flow to the brain. Stroke leads to various signs and symptoms, which includes alteration in tone (commonly spasticity), loss of superficial and deep sensations, muscle weakness, abnormal synergy patterns, abnormal reflexes, gait abnormality, altered coordination, etc. Modified Modified Ashworth scale and Modified Tardieu scale both are tools to assess spasticity in stroke patients. Modified Ashworth Scale was less reliable than Modified Tardieu scale hence Ansari et al. developed Modified Modified Tardieu scale.

Aim: The aim of the study is to correlate Modified Modified Ashworth Scale with H-reflex and Modified Tardieu Scale with H-reflex to assess Planterflexor spasticity in Chronic post-Stroke patients.

Method: This Observational study which included 40 chronic post- stroke patients whose age was between 45-60 years and having stroke since at least 1 year. The patients were assessed with MMAS and MTS along with H/M ratio to find spasticity in Planterflexors.

Result: Data was analysed using SPSS software version 23.0 using Spearman's correlation test. The statistical analysis showed MMAS has more positive correlation has H/M ratio as compared to MTS. ($p < 0.05$)

Conclusion: From the above study it can be concluded that both MTS and MMAS have a positive correlation with H/M ratio. But MMAS has better positive correlation when compared and hence should be used as assessment tool in assessing planterflexor spasticity in chronic post-stroke patients.

Keywords: Stoke, Modified Ashworth Scale, Modified Tardieu scale, Modified Modified Ashworth Scale, H-reflex, H/m ratio.

Introduction

Stroke is defined as sudden loss of neurological functions resulting from ischemic or hemorrhagic

lesions in the brain, which lasts more than 24 hours. It is caused by interruption of blood flow to the brain usually by atherosclerotic plaques that occur at certain sites of predilection. These sites generally include bifurcations, constrictions, dilation, or angulations of arteries.¹

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Spasticity is a common symptom observed following upper motor neuron syndrome. Diseases such as stroke, traumatic brain injury, spinal cord injury, cerebral palsy and multiple sclerosis are associated with significant spasticity. Spasticity has been defined classically by

Lance as a motor disorder characterised by a velocity-dependent increase in tonic stretch reflexes.²

In 1994, Young added neurophysiological elements to define spasticity independently of the type of movement: “a motor disorder characterized by a velocity-dependent increase in tonic stretch reflex that result from abnormal intra-spinal processing of primary afferent input”.³

Spasticity arises when the balance between inhibitory and excitatory fibers is disturbed i.e. either if the inhibitory pathways are interrupted or if there is increased activity in facilitatory pathways.^{1,4,5}

It is important to measure spasticity to evaluate the impact of specific treatments and to choose the most efficient and cost effective management option for each patient.⁶ To assess spasticity accurately in clinical practice and for research purposes, reliable and valid tools must be used.

Measurement of spasticity can be done by clinical and laboratory methods⁷. Several scales have been developed and validated to assess spasticity in patients with brain injury. The two most commonly used scales are the Modified Modified Ashworth Scale (MMAS) and the Modified Tardieu Scale (MTS).

The Ashworth Scale was originally developed in 1964, and modified by Bohannon and Smith in 1987.^{8,9} The Bohannon-Smith Modified Ashworth Scale (MAS) has been recently modified by Ansari et al¹⁵ in 2006 as the Modified Modified Ashworth Scale (MMAS; table 1). The MMAS is an ordinal level measure of spasticity, which grades the intensity of spasticity from 0 to 4. The results of several studies have demonstrated that the MMAS is a reliable measure for assessing spasticity in lower limbs of patients with spasticity.¹⁰⁻¹³

The Tardieu Scale was developed by Tardieu et al¹⁴ in 1954. Held and Pierrot-Deseilligny¹⁵ modified it in 1969, and it was further modified in 1999 by Boyd and Graham. This latest version of the Tardieu Scale is called the Modified Tardieu Scale (MTS).^{16,17} The MTS

considers R2, R1 and R2–R1 to measure spasticity. The R2 is the passive range of motion measured during slow passive stretch. The R1 is the angle of muscle reaction measured during fast passive stretch, and occurs in a particular angle of ‘catch’ from hyperactive stretch reflex. Large and small differences between R2 and R1 indicate spasticity and muscle contracture, respectively.^{16,18} Quality of muscle reaction during fast passive stretch is also graded based on 0–4 scores and is defined as the MTS scores (table 1).^{19,20}

H-reflex was described by Johanan Hoffmann in 1918, hence called H-reflex.²¹ It is a mono synaptic reflex elicited by submaximal stimulation of the nerve. It is analogous to the mechanically induced spinal stretch reflex. The primary difference between the H-reflex and the spinal stretch reflex is that the H-reflex bypasses the muscle spindle, and, therefore, is a valuable tool in assessing modulation of monosynaptic reflex activity in the spinal cord. The H-wave is a good indicator of the strength and distribution of the stimulus input from muscle spindle to the motor neuron pool, which lies at the site of the anterior horn of the spinal cord²¹ and hence is an objective method for the measurement of spasticity. The reflex arc of H-reflex includes, i) large fast conducting group 1a sensory fibers, ii) spinal cord where afferent fibers synapse with alpha muscle. (As shown in fig 1.4) H-reflex is facilitated by submaximal stimulation. The inhibition of H orthodromic conduction in motor axons. In lower limb H-reflex is recorded from calf muscles by percutaneous stimulation at mid-popliteal crease with anode distal. H-reflex is influenced by a number of spinal and supraspinal variables. The H studies therefore provide valuable information, which are helpful in understanding the pathophysiology of various CNS abnormalities. The fraction of motor neuron pool activated in H be as high as 100%. The ratio of peak to peak maximum H M amplitude (Hmax/Mmax) provides an easy estimate of motor neuron pool activation, and therefore excitability. Although there is considerable variability of Hmax/Mmax ratio, Hmax/Mmax is normally less than 0.7.⁸

A study observed that spasticity primarily affects Elbow(79%), Wrist(66%) and Ankle(66%).²²

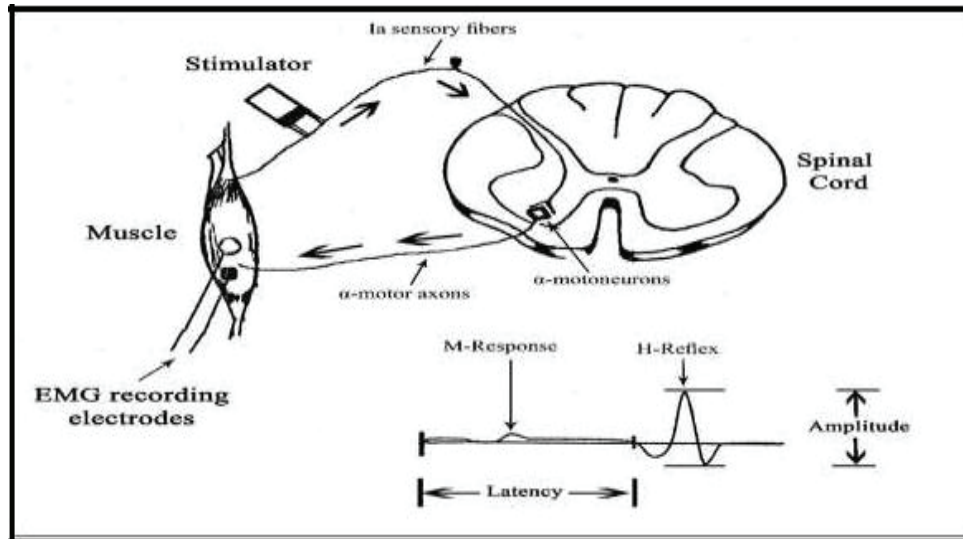


Figure 1: H-reflex Pathway

Aims and Objectives:

Aim:

- The Aim of the study is to find effective and reliable tool for measuring spasticity among Modified Modified Ashworth Scale and Modified Tardieu Scale for Ankle Planter Flexor Spasticity in Post-Stroke Patients.

Objectives:

- To assess Planter flexor Spasticity of Post Stroke Patients with Modified Modified Ashworth Scale.
- To assess Planter flexor Spasticity of Post Stroke Patients with Modified Tardieu Scale
- To assess Planter flexor Spasticity of Post Stroke Patients with H-reflex.
- To correlate and find effective and reliable tool for measuring spasticity among Modified Modified Ashworth Scale and Modified Tardieu Scale for Ankle Planter Flexor Spasticity in Post-Stroke Patients.

Hypothesis:

- Null Hypothesis:** MTS is more correlated to H/M ratio in assessing Planter-flexor Spasticity in chronic post-stroke patients as compare to MMAS.

- Experimental Hypothesis:** MMAS is more correlated to H/M ratio in assessing Planter-flexor Spasticity in chronic post-stroke patients as compare to MTS.

Method:

- SOURCE OF DATA:** Physiotherapy Centres in and around Rajkot and Surat.
- STUDY DESIGN:** Observational study.
- SAMPLE SIZE:** 40 Post-Stroke Patients
- STUDY POPULATION:** Post-Stroke Patients with post stroke duration more than 1 year.
- STUDY DURATION:** One-time study
- SAMPLING METHOD:** Purposive Sampling
- STUDY SETTING:** Shree K. K. Sheth Physiotherapy College, Rajkot.

P P Savani University, Surat.

Materials and Tools

- Pen
- Paper
- Record and Data collection sheet

- Consent form
- Treatment table
- Pillow
- Spirit
- Cotton
- Electrodes
- Gel
- White Paper
- EMG-NCV machine (RMS EPMK-II, version 1.1)
- Micropore
- Universal Goniometer

Methodology

Ethical Approval regarding the methodology was taken from Ethical committee before starting the study.

A brief assessment was taken to include or exclude the patient in the study.

Inclusion Criterion:

- Patients having Stroke.
- Age: Between 40 and 65 years of age.
- Gender: Male as well as Female.
- Type of Stroke: Ischemic as well as Hemorrhagic type of stroke.
- Post-stroke period: Post-Stroke Patients with post stroke duration more than 1 year.
- Patient able to ambulate independently with or without assistive aid.
- Modified Ashworth Scale for planter-flexors: Grade 2 or more.

Exclusion criteria:

- Subjects having language, visual, or cognitive impairments.

- Any type of recent lower limb fracture.
- Any type of recent non-paretic lower limb fracture.
- Uncooperative patient.
- Subjects having associated other neurological disorder.
- Subject having Perceptual disorder.

Procedure:

The purpose and procedure of the study was explained to patient and a written consent was taken along with demographic data including name, age, sex, affected side and post stroke duration.

All measurements will be taken in the morning hours between 10:00 and 11:30 AM.

- The H-reflex was taken for spastic calf muscle.

Position : Prone lying

Recording :

- Active Electrode : Distal Edge of Calf Muscle
- Reference Electrode : Achilles Tendon.

Stimulation -

- Square Wave pulse of 1 ms duration.²¹
- Modified Tardieu Scale:

A standard goniometer was used for angle measurements The leg position for measurement of R1 was the same as the position for PROM (knee maintained flexed at 30). The zero position for the measurement was set at 90. Ankle dorsiflexion and plantarflexion from this position were assigned positive and negative values, respectively. To measure R1, the joint was moved through the available range of motion with velocity V3 (i.e. as fast as possible) and the quality of muscle reaction was scored from 0–4 (Table I). If the MTS score was 2 or higher, the point of ‘catch’ was measured as the R1 using the goniometer. To rate spasticity, only one passive stretch was performed.²³

- Modified Modified Ashworth Scale:

The patient was in supine position, lower limb in extension, with head in midline and the arms alongside the trunk. The rater, on the side being tested, placed one hand under the ball of the foot, while the other hand stabilized the limb around the ankle joint. The rater then moved the ankle into maximum possible dorsiflexion.²⁴

Result

The patients' demographic and clinical variables are presented in Table 1 and Table 2 respectively. The MMAS and MTS scores ranged from '0' to '4'.

Graphical representation of Age and Gender distribution is depicted in Graph 1 and 2 respectively.

Table 1: Patient's Demographic			
Gender (M/F)	Minimum	Maximum	Mean (SD)
Age	45	60	57.96
Height (cm)	168	188	172.34
Weight (kg)	47	88	63.22
BMI	17.4	27.8	19.18
Time since stroke (years)	1	5	2.37

Table 2: Clinical Variables			
Variables	Minimum	Maximum	Mean (SD)
H/M RATIO	0.728	1.287	0.857
MMAS	2	4	2.833
MTS	1	3	1.9444

Statistics were performed using SPSS version 23.0 for Windows and Spearman correlation test was performed.

The result suggests that a positive correlation exists between H/M ratio-MMAS ($R_s=0.812$) and also between H/M ratio-MTS ($R_s=0.562$), while p value was less than

0.05.

But a strong correlation was found between H/M and MMAS as compared to H/M and MTS.

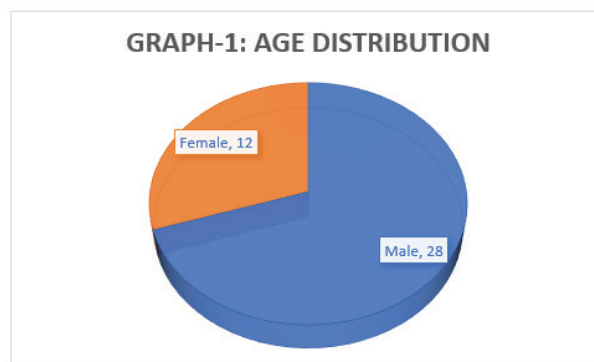


Chart 1 and Chart 2 represent Scatter diagram relation of H/M ratio with MMAS and MTS respectively.

Discussion

The result of the study shows that MMAS is more significantly correlated to H/M ratio compared to MTS. This proves the experimental hypothesis that MMAS is more correlated to H/M ratio in assessing Planterflexor Spasticity as compare to MTS. This protocol utilises conventional and new indicators of motoneuron excitability in spasticity for comparative validity evaluation. Further, the protocol utilises standard methodology for spasticity assessment to indicate the excitability of the α motoneuron pool.²⁵ Hamid et al., in 2018 compared MMAS and MTS with H-reflex on wrist flexor spasticity and concluded that MMAS is more reliable assessment tool to assess spasticity in stroke patients. This supports the findings on the research.

Furthermore, MMAS as developed, by Ansari et al., is specifically modified to overcome limitation of MAS and make it more reliable assessment tool. Though MTS has more specific angle of reaction and quality of muscle reaction assessment, it takes more time to administer and also multiple repetitions for same muscle group. Whereas MMAS can be used and muscle spasticity be graded by single repetition.

Conclusion

From the above study it can be concluded that both MTS and MMAS have a positive correlation with H/M ratio. But MMAS has better positive correlation when compared and hence should be used as assessment tool

in assessing planterflexor spasticity in chronic post-stroke patients.

Limitations

- Neither therapist nor the subjects were blinded to the study.
- Room temperature could not be controlled.
- Type and site of lesion was not considered.

Furthur Recommendation

- Double-blinded study should be done to prove the above mentioned findings.
- Specific ACA infarct stroke patients should be taken.

Source of Funding:

- No Funding was required for this study.

Conflict of Interest: The study did not have any conflict of interest.

Ethical Clearance: Ethical Clearance was obtained from P P Savani University Ethical Committee.

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A Study to Co-Relate the Foot Posture Index, H/M Ratio and Spatial Gait Parameters in Post-Stroke Patients with Ankle Planter-Flexor(Calf) Spasticity- An Observational Study

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Abstract

Background: Stroke is one of the most commonly occurring disease which leads to hemiparesis along with other symptoms like spasticity, sensory disturbances etc. considered to be a part of positive signs of upper motor neuron (UMN) syndrome. Spasticity is a common disorder in patients with injury of the brain and spinal cord.

Aim: The aim of the present study was to correlate the foot posture index, H/M ratio and spatial gait parameters in the assessment of poststroke patients with ankle planter-flexor spasticity.

Methodology: It was an observational study which consisted of 32 chronic stroke patients. Both male and female with age group 45-70 years and stroke duration more than 3 months were included in the study. Spasticity was assessed using H/M ratio, foot posture was assessed by Foot Posture Index (FPI) and Step length and Stride length were taken.

Result: Statistical analysis was done using SPSS 20 for windows. The correlation between Hmax/Mmax ratio, FPI, step length and Stride length were evaluated using Spearman's correlation coefficient test. It was suggestive of strong negative correlation between FPI and Hmax/Mmax ratio, weak negative correlation between step length Hmax/Mmax ratio, strong negative co-relation between stride length and H/M ratio, moderate positive co-relation between Foot Posture Index (FPI) and step length and strong positive co-relation between FPI and stride length. ($p < 0.05$)

Conclusion: From the present study it can be concluded that there is co-relation between Spasticity, Foot posture and Gait parameters in planter-flexor spasticity in post-stroke patients. It can also be concluded that Hmax/Mmax ratio and FPI are needed to be assessed in every post stroke patient as it has influence on Gait parameters such as step length and stride length.

Keywords: Stoke, Foot Posture Index, Gait, Step Length, Stride Length, H-reflex, H/m ratio.

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Introduction

Stroke is defined as sudden loss of neurological functions resulting from ischemic or hemorrhagic lesions in the brain, which lasts more than 24 hours. It is caused by interruption of blood flow to the brain usually by atherosclerotic plaques that occur at certain sites of predilection. These sites generally include bifurcations, constrictions, dilation, or angulations of arteries.¹

Stroke is defined by World Health Organization (WHO) as a clinical syndrome characterized by rapidly developing clinical symptoms and/or signs of focal and at times global loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin.^{2,3}

Similarly, the incidence rate increases from 27 to 34/100,000 in the 35 to 44 years age groups to 822 to 1116/100,000 in the above 75 years age group.⁴

Spasticity (hypertonicity) is a term, which was introduced to describe the velocity-sensitive increased resistance to a limb movement in subjects with lesions of descending corticospinal pathways.⁵ It is considered to be a part of positive signs of upper motor neuron (UMN) syndrome.⁶

The reflex hyper excitability develops over several months following the primary lesion and involves adaptation in the spinal neuronal circuitries caudal to the lesion.⁵ However, the onset of spasticity is highly variable and can occur in the short-, medium- or long-term post-stroke period.⁶ In post-stroke patients, the prevalence of spasticity has been reported to be 19% after 3 months and 20% after 18 months.⁷ Another study observed that spasticity primarily affects the elbow (79%), the wrist (66%) and the ankle (66%).

Other significant consequences of spasticity are tightness in muscles which may result in pain and contracture. These changes contribute as a biomechanical component, in addition to the neural components, to the disability resulting from spasticity.⁸

H-reflex was described by Johanan Hoffmann in 1918, hence called H-reflex.⁹ It is a mono synaptic reflex elicited by submaximal stimulation of the nerve. It is analogous to the mechanically induced spinal stretch reflex. The H-wave is a good indicator of the strength and distribution of the stimulus input from muscle spindle to the motor neuron pool, which lies at the site of the anterior horn of the spinal cord⁹ and hence is an objective method for the measurement of spasticity.

The FPI-6 is a novel method of rating foot posture using set criteria and a simple scale. The FPI is a diagnostic tool devised to provide objective numerical values that reflect the condition of the foot, whether the

foot is pronated, supinated, or neutral. When the sum of each measured value is a high positive number, the foot is considered to be pronated, while the lower the negative number of the sum is, the more supinated the foot.¹⁰

Increased muscle tone causes spastic muscles to resist stretch and to remain shortened for longer duration. Prolonged muscle shortening leads to joint deformation and changes in intrinsic properties of soft tissue and muscle fibres, which in turn restricts range of motion and collectively leads in volition movements and activity limitations.¹¹ Also, due to spasticity, change in biomechanical component can occur which may lead to disability.¹² Uncontrolled spasticity leads to muscular contracture, leading to abnormal posture; therefore, it has high clinical significance to be able to evaluate the influence of spasticity on motor performance.¹² Spasticity in planter-flexors may lead to impairment in gait.⁹ Thus, there is a need to study spasticity and correlate them with biomechanical changes and gait.

Aims and Objectives

Aim:

- The aim of the study is to co-relate the foot posture index, H/M ratio and spatial gait parameters in the assessment of post-stroke patients with ankle planter-flexor spasticity.

Objectives:

- To assess spasticity by H/M ratio in post stroke patients.
- To assess foot posture by Foot Posture Index in post stroke patients.
- To assess spatial gait parameters in post stroke patients.
- To find co-relation among all the above factors in post-stroke patients..

Hypothesis:

- **Null Hypothesis:** There will be no correlation between H/M ratio, Foot posture index and Spatial gait parameters in Planter-flexor spasticity of chronic stroke patients.

• **Experimental Hypothesis:** : There will be significant correlation between H/M ratio, Foot posture index and Spatial gait parameters in Planter-flexor spasticity of chronic stroke patients.

Method:

• Study Setting: Shri K.K. Sheth Physiotherapy College, Rajkot.

• Source of data: Various physiotherapy centers in Rajkot.

- Study population: Ambulatory stroke patients.
- Sample size: 32 patients.
- Sampling method: Convenient sampling.
- Study Design: A co-relational study.
- Study Duration: One-time study.

Materials And Tools

- Pen
- Paper
- Record and Data collection sheet (Annexure 10.2 and 10.3)
- Consent form (Annexure 10.1)
- Chair
- Ink
- White Paper
- NCV machine (RMS EMG EP MK-II, Version 1.1)
- Micropore
- Plinth

Methodology

Ethical Approval regarding the methodology was taken from Ethical committee before starting the study.

A brief assessment was taken to include or exclude the patient in the study.

Inclusion criteria:

- Patients having Stroke.
- Age: Between 45 and 65 years of age.
- Gender: Male as well as Female.
- Type of Stroke: Ischemic as well as Hemorrhagic type of stroke.
- Post-stroke period: 3 months to 2 years.
- Patient able to ambulate independently with or without assistive aid.
- Modified Ashworth Scale for planter-flexors: Grade 2 or more.
- Subjects having unilateral hemi-paresis with Brunnstrom recovery stage 2-4.
- Ability to understand and follow instructions.

Exclusion criteria:

- Subjects having language, visual, perceptual or cognitive impairments.
- Any type of recent lower limb fracture.
- Any type of recent non-paretic lower limb fracture.
- Uncooperative patient.
- Subjects having associated other neurological disorder.

Procedure:

After proper explanation about the purpose and procedure of the study, patients who were willing to participate in the study were requested to sign a written consent form. The selection of patients was done by convenient sampling.

The data measured were recorded in the data collection form which included name, age, gender, dominance, side involved, post stroke duration and Brunnstrom stage of recovery for the upper extremity. The study included evaluation of foot posture by FPI, spasticity by H/M ratio and spatial gait parameters.

For FPI patient had to assume stance position with double limb support. Then patient was asked to stand

still, with arms by their side and looking straight ahead. Components of FPI were: Talar head palpation, Supra and infra lateral malleolar curvature, calcaneal frontal plane position, Bulging in the region of talo-navicular joint, Height and congruence of the medial longitudinal arch and Abduction/ adduction of the forefoot on the rearfoot.

Each component of FPI was taken and final score was obtained from data.

Next, the H/M ratio will be taken for spastic calf muscle.

Position: Prone lying

Recording:

- Active Electrode: Distal Edge of Calf Muscle
- Reference Electrode: Achilles Tendon.

Stimulation -

- Square Wave pulse of 1 ms duration

Instrumentation Parameters for motor nerve conduction study:

- Sensitivity: 200-500
- Filter setting: 5hz- 3 KHz

Instrumentation Parameters for H-reflex measurement:

- Sweep speed: 10ms/div
- Sensitivity: 200-500 $\mu\text{v}/\text{div}$
- Filter setting: 3 KHz¹³



Figure 1: H/M ratio Measurement

Gait parameters- Step length and stride length were assessed as follows:

- Patients were instructed to step on an inepad and were asked to walk on the paper roll.
- A paper of 8 m length was divided into a 5 m walkway, with 1.5 m area left at each end to start and finish lines.

- The footprints from the sole of the feet were produced on the paper as the patients walks from one end of the walkway to the other.¹⁴

Result

The patients' age wise distribution and Mean for Age are presented in Table 1 and Table 2 respectively.

Table 1: Patients' age wise distribution

Age Group (Years)	No of Stroke Subjects	
	Number	%
45-50	8	25
51-55	4	12.5
56-60	13	40.625
61-65	4	12.5
66-70	3	9.375
Total	32	

Table 2: Co-relation of FPI with H/M ratio, Step Length and Stride Length

Co-relation of FPI with H/M ratio, Step Length and Stride Length				
	Variables	H/M ratio	Step Length	Stride Length
FPI	r value	-0.692	0.431	0.523
	p value	0.01	0.05	0.01

Table 3: Co-relation of H/M ratio with Step Length and Stride Length

Co-relation of H/M ratio with Step Length and Stride Length			
	Variables	Step Length	Stride Length
H/M ratio	r value	-0.257	-0.513
	p value	0.05	0.03

The above table (1) displays the statistics of age distribution of the 32 stroke patients. Among the 32 stroke patients, the mean + SD of age of 32 stroke subjects was 56.5625 + 6.495 years.

Spearman correlation coefficient (rs) between FPI and H/M ratio is -.692 with $p = .01$. Above table (2) shows strong negative co-relation between FPI and H/M ratio.

Spearman correlation coefficient (rs) between FPI

and Step Length is .431 with $p = 0.05$. Above table (2) shows moderately positive co-relation between FPI and Step Length.

Spearman correlation coefficient (rs) between FPI and Stride Length is .523 with $p = .01$. Above table (2) shows strong positive co-relation between FPI and Stride Length.

Spearman correlation coefficient (rs) between H/M ratio and Stride Length is -.513 with $p = .03$. Above table (3) shows strong negative co-relation between H/M ratio

and Stride Length.

Spearman correlation coefficient (rs) between H/M ratio and Step Length is -.257 with $p = .005$. Above table (3) shows weak negative co-relation between H/M ratio and Step Length.

Discussion

Thus, Null hypothesis can be rejected and Experimental hypothesis is accepted as There is co-relation between H/M ratio, Foot posture Index and Gait parameters in assessment of planter-flexor spasticity in the patients with stroke.

In this study it was found that there is strong negative co-relation between FPI and H/M ratio, weak negative co-relation between H/M ratio and Step length, strong negative co- relation between H/M ration and Stride length, moderate positive co-relation between FPI and Step length and strong positive co-relation between FPI and Stride length.

A study by Wissel et al. showed that 25% of patients with stroke suffer from spasticity within the first 6 weeks of the event.⁵

A study by Given JD et al. reported that the muscles around the ankle joints easily develop changes in their mechanical property because they have more type I muscle fibers and connective tissue than other muscles. Owing to the characteristics of the ankle joints, stroke patients are known to be more likely to have increased spasticity and shortened fascia of the gastrocnemius on the paretic side, producing a reduced range of motion in dorsiflexion in the ankle joints. Such changes induce incorrect transmission of somatesthesia from the joint or the muscle receptors or motor response, accompanied by inappropriate ankle strategy, causing difficulty in balance control.¹⁵

From this study it was found that FPI and H/M ratio have strong negative co-relation suggesting more supinated foot with increased spasticity. This is supported by Ji-won Park et al (2011) who studied foot abnormalities of post stroke patients by comparing FPI and co- relating it to Spasticity. The study concluded that foot posture is related to stroke impairments, stroke patients with more severe spasticity have more severe foot abnormalities as supinated foot.

Additionally, from the result obtained it can be said that Stride length is more strongly co-related to H/M ratio and FPI as compared to Step Length. This can be supported by Pei- YiLin et al.(2006) who studied The Relation Between Ankle Impairments and Gait Velocity and Symmetry in People With Stroke and concluded that gait velocity and temporal asymmetry are mainly affected by the dorsiflexors strength, whereas dynamic spasticity of planter-flexors influenced the degree of spatial gait asymmetry in our patients who were able to walk outdoors.¹⁶

Also, due to spasticity changes in biomechanical component can occur which may lead to disability. Uncontrolled Spasticity leads to muscle contracture, leading to abnormal posture. This is supported by Kwah LK et al, who studied passive mechanical properties of Gastrocnemius muscle of people with ankle contracture after stroke and concluded that people with ankle contracture after stroke have shorter gastrocnemius muscle-tendon units and muscle fascicles than control participants at high tension.¹⁷

Conclusion

From the present study it can be concluded that there is co-relation between Spasticity, Foot posture and Gait parameters in planter-flexor spasticity in post-stroke patients.

It can also be concluded that Hmax/Mmax ratio and FPI are needed to be assessed in every post stroke patient as it has influence on Gait parameters such as step length and stride length.

This study also concludes that supinated foot posture is dominant in post stroke patients with planter-flexor spasticity.

Limitations

- Neither therapist nor the subjects were blinded to the study
- Room temperature could not be controlled.
- Type and site of the lesion was not considered.

Furthur Recommendation

- Study can be carried out specifically on patients

with anterior cerebral artery affection in which lower limb involvement is more prominent.

- Study can be conducted by assessing spasticity during various balance task instead of it taken at rest.
- This study can be done by taking different clinical and electrophysiological parameters to assess spasticity.

Source of Funding:

- No Funding was required for this study.

Conflict of Interest:

- The study did not have any conflict of interest.

Ethical Clearance: Ethical clearance was taken from Saurashtra University Ethical Committee.

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Improvement of Iliopsoas Flexibility: A Comparative Effectiveness between Post Isometric Relaxation and Static Stretching

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Abstract

Background and Purpose: Iliopsoas muscle not commonly gets stretched in the activities of daily living. So tightness may be developed. Most common component of the physical conditioning programme is flexibility used as an adjunct to the muscle strength and endurance training. The purpose of this study was to compare the effectiveness of MET (PIR) technique and Static stretching technique directed at the iliopsoas muscle on hip extension.

Objective: To find out pre and post interventional effect of MET (PIR) and Static stretching techniques and compare the effectiveness of both techniques for increasing flexibility of iliopsoas muscle.

Method: A Quasi Experimental study was conducted. Total 50 participants were included in our study on the basis of the inclusion criteria. Then participants divided in to two groups: Group A received MET (PIR) and Group B received Static Stretching. Iliopsoas tightness is assessed by modified Thomas test and degree of hip extension measured by the universal goniometer.

Result: The study show that the both the techniques MET (PIR) and Static Stretching significantly effective for the iliopsoas tightness. Comparison of both techniques shown MET (PIR) group was significantly effectiveness for iliopsoas tightness than Static Stretching group.

Conclusion: MET (PIR) technique was most effective for improving flexibility for iliopsoas than Static Stretching Technique.

Keywords: iliopsoas tightness, modify Thomas test, muscle energy technique (post isometric relaxation), and static stretching.

Introduction

Muscle is just too short to permit the full passive range of motion or active range of motion. Gastrocnemius-soleus, Tibialis posterior, Iliopsoas, Rectus Femoris, Hamstrings and Hip adductors muscles more prone for tightness in lower extremity¹. Sternocleidomastoid (SCM), Upper trapezius, Pectoralis major, and Levator Scapulae are more prone for tightness. Tightness of lower Iliopsoas leads to discomfort, pain and ache in the front of the hip socket. In the upper iliopsoas, the symptom that is most prevalent is the sense of holding or tension in solar plexes.

Flexibility is an important component of physical conditioning programme used as an adjunct to muscle

strength and endurance training. Flexibility of the Iliopsoas muscle is necessary because flexibility allow the tissue to accommodate more easily to stress to abandoned shock impact and to improving the efficiency and effectiveness of the movement. Flexibility is defined as the ability to move a joint through a normal range of motion (ROM) without excessive stress to the musculotendinous unit². Iliopsoas muscle very uncommonly to get stretched in the activities of daily living that lead to tightness of Iliopsoas. Iliopsoas muscle is the strongest hip joint flexors. It plays a significant role in the movement and stabilization of the pelvis³. Tightness of Iliopsoas has been significantly correlated with the back pain. Short Iliopsoas group pulls the spine in to hyperlordosis and an anterior tilted pelvis which

put stress on all the spinal muscles including the erector spinae. Shortness of Iliopsoas muscle can pull and twist the vertebrae causing excessive compression of the disc, which lead to herniation of disc. Iliopsoas dysfunction leads to symptoms like pain and discomfort in lower back and SI joint region⁴.

To reduce tightness of Iliopsoas, different techniques such as Proprioceptive neuromuscular facilitation technique⁵, Soft tissue mobilization, Stretching technique (static, balastic)⁶, Yoga (asanas such as Navasana, Virabhadrasana, Sarvangasana⁷, Myofascial release⁸ and Muscle energy technique⁹. Static stretching is the most commonly used form of stretching to improve the flexibility of muscle and safe. MET technique can be used to lengthening and strengthen of muscles to improve fluid mechanics and to decrease local oedema and to mobilization of a restricted articulation⁹. Post isometric relaxation is a part of a MET. It is used for relax tight muscles without initiating stretch reflex¹⁰.

The purpose of this study was to compare the effectiveness of two techniques, static stretching and post isometric relaxation for Iliopsoas tightness. Primary objective of this study was to find out pre and post interventional effect of MET (post isometric relaxation) and static stretching for increase Iliopsoas flexibility. Secondary objective of this study was to compare the effectiveness of MET (PIR) and Static Stretching for increase Iliopsoas flexibility.

Methodology

This is Quasi Experimental trial age group 18-30 year. Inclusion criteria were both male and female willing to participate, right or left lower limb, 10 or more than 10 degree of Iliopsoas tightness. Exclusion criteria were subjects with history of trauma of lumbar spine and pelvic, inflammatory condition that affect motion, chronic back pain, any cardiac problem, presence of tumours that can restrict hip range of motion, spinal deformity, and any recent injury and surgery. All the participants was signed the written inform consent. The purpose of the study was explained to all the subjects who volunteered to take part in the study. The subjected were selected according to inclusion an exclusion criteria. Total 90 subjects were assessed and 50 subjects included in study. The participants divided according to block randomization into two groups. Participants divided into

two groups: Group A (MET- PIR) and Group B (Static Stretching). Pre treatment measurement were taken by using Universal Goniometer for hip extension ROM. Hip extension range of motion was measured on the 1st day of treatment procedure and on the 6th day of treatment procedure for all the participants.

Group A – Post Isometric Relaxation:

Patient's position supine lying at the edge of the table, non tested leg in flexion at both hip and knee and experimental thigh and leg hang on the edge of table. Extend the knee of the opposite thigh up to the barrier. After that told the patient to flex the hip against minimal resistance (isometric) and to breath in for 7 seconds. Told the patient "relax" and exhale slowly. Wait for 5 seconds as long as relaxation takes place. Three times repeat this procedure. Perform this method for 6 days in a week and once in a day¹⁰.

Group B – Static Stretching

Patient position: Patient position close to the edge of the treatment table so the hip being stretched can be extended beyond the neutral position. The opposite hip and knee are flexed towards the patient's chest to stabilize the pelvis during the stretching.

Hand placement and procedure: Stabilize the opposite leg against the patient's chest with one hand, or if possible patient assist by grasping around the thigh and holding it to prevent tilt of the pelvis during the stretching.

Move the hip to be stretched into extension or hyperextension by placing downward pressure on the anterior aspect of distal thigh with your other hand. Allow the knee into extension so the two joint Rectus Femoris does not restrict the range. The stretched was maintained by 30 seconds and performs one time. Perform this method for 6 days in a week and once in a day⁹.

Modified Thomas Test: Patient held in supine position with buttocks as close to the end of the table as possible, the non-tested leg in flexion at both hip and knee hold by patient themselves. Full flexion of hip helps to maintain the pelvis in full rotation with the lumbar spine flat. If the tested thigh lies in horizontal positioning which it is parallel to the floor that indicates

Iliopsoas is not short. If the thigh rises above the horizontal positioning that indicates Iliopsoas is short¹¹

Goniometer Alignment: Fulcrum held at lateral aspect of the hip joint, reference point taken as a greater trochanter of the femur. Proximal arm held at lateral midline of the pelvis. Distal arm held at the lateral midline of the femur using the lateral condyle of tibia as a reference point¹².



Modified Thomas test Goniometer Alignment

Statistical analysis:

The data was analysed by using SPSS Version 2.4. The data was normally distributed check by the SPSS version 24. Comparison of post mean difference score between group A and group B was done by Wilcoxon Signed rank test. Comparison of pre and post scores within group A and group B was done by Mann Whitney U test.

Result

Table 1: Shows demographic characteristics of study participants

Variables	Group A (MET)	Group B (Static Stretching)
Age (mean ± SD)	20.32 ± 1.51	18.48 ± 0.50
Right (N %)	92%	92%
Left (N %)	8%	8%
Female	8	17
Male	7	18

Table 2: Shows post and pre hip extension ROM mean intervention data for MET group and static stretching group

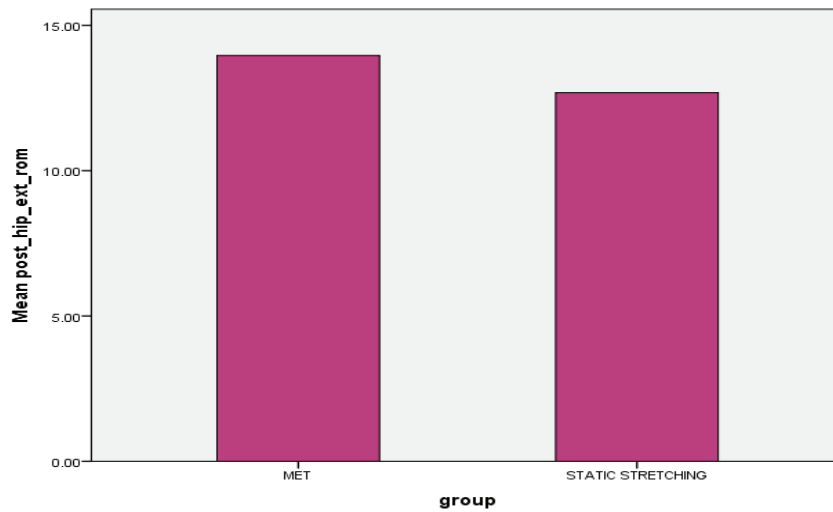
	Pre-post hip extension ROM mean	p value
Group A	13	0.000
Group B	13	0.000

Table 2 shows that the comparison for pre and post hip extension range of motion of MET group and Static Stretching group were done by using Wilcoxon signed rank test. In group A and group B the data was statistically significant ($p < 0.005$). Data showed that pre- post hip extension ROM improving in both the intervention groups for Iliopsoas tightness.

Table 3: Shows comparison of post hip extension ROM mean between the groups

	Post hip extension ROM mean	p value
Group A	33.46	0.000
Group B	17.54	

Table 3 shows that comparison for post hip extension ROM of both groups by using Mann Whitney U Test. The data was statistically significant ($p = 0.000$). It was found that Group A (MET- PIR) highly significant for improving the Iliopsoas flexibility.



Graph 1: Shown that comparison of post intervention value of MET and Static Stretching

Discussion

The review of literature regarding the role of different techniques in Iliopsoas tightness reveals confusing pictures. So that our study was design to obtain a more understand about which method more effective MET (PIR) or static stretching in Iliopsoas tightness. Our study suggested that both the techniques effective for improving Iliopsoas flexibility, but MET (PIR) technique were highly significant in increasing the flexibility of Iliopsoas than static stretching.

Many experimental study conducted for lengthening of shortened muscles but little research available for clinician to help in choose which method or technique is more beneficial. This study suggested that long term effect of pre and post comparison of hip extension range

of motion was significantly increase with MET (PIR) and static stretching group. The data of this study was statistically significant within the group after treatment suggested that both the techniques were effective in improving hip extension ROM and Iliopsoas flexibility.

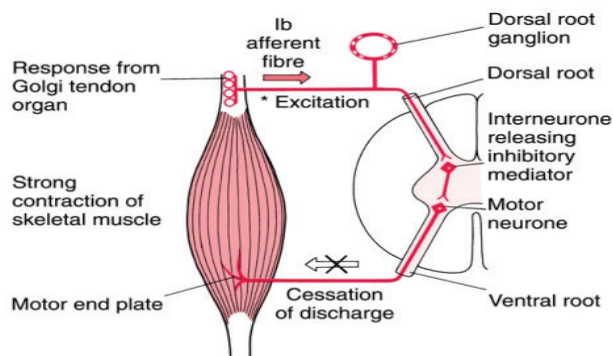
In this study MET (PIR) technique was highly significant in improving the Iliopsoas flexibility. This finding supported by Sonal et al. suggested that PIR and Reciprocal inhibition technique showed significant improvement on hamstring tightness. But PIR is more significant effective than the reciprocal inhibition technique in individual with the hamstring muscle tightness¹³.

Our study finding also supported by Rashad Ahmed et al. suggested that the MET and dynamic stretching

showed significant improvement in hamstring tightness. But MET was significantly more effective than dynamic stretching in healthy individuals with hamstring tightness¹⁴.

An improve flexibility after MET due to biomechanical or neurophysiological changes or due to increase tolerance to stretching. In neurological mechanism that may produce improved range of motion of a joint after MET, however little research available for these theories. Kuchera suggested that effectiveness of MET to the inhibitory golgi tendon reflex. This reflex is believed to be activated during isometric contraction of muscles, which is produced stretch on the golgi tendon organ and a reflex relaxation of the muscle¹⁵.

In PIR technique, strong muscle contraction against a counterforce triggers the Golgi Tendon Organ (GTO) and enters the dorsal root of spinal cord and meet with an inhibitory motor neuron. This stops the discharge of the efferent motor neurons impulse and thus prevent for further contraction, muscle tone reduced, which lead in agonist muscle relaxation and lengthening¹⁶.



The basic concept of PIR is to contraction of tense muscle isometric and then muscle encourage to lengthen during a period of complete voluntary relaxation. Gravity is used to encourage release of muscle tension and taken up to the slack¹⁷. Davis et al. suggested that static stretching technique was only effective for increasing length of hamstring¹⁸.

Limited evidence suggested that if muscle held in a lengthened position for an extended period of time, it adapts by increasing the number of sarcomere in series, referred as a myofibrillogenesis. It is theorized that number of sarcomere addition occurs to maintain the greatest functional overlap of actin and myosin filaments in muscle and it leads to permanent form of lengthening

if the newly gained length is used on a regular basis in functional activity¹⁹.

Met is more effective compared to static stretching because MET increases ROM faster rate due to active and precise recruitment of muscle fibers activity.

Conclusion

The study concluded that the both the MET (PIR) technique and Static Stretching are effective for improve flexibility of Iliopsoas. But the MET (PIR) is better and effective technique as compared to static stretching.

Limitation and further recommendation:

Limitation of our study: Intervention duration was short period of time, not taken long term follow up and small sample size. In future scope study conducted with large sample size, long term follow up, long treatment duration, also included subject with low back pain.

Conflict of Interest: None

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Ethical Clearance: Taken from institutional advisory board

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Can Brain Cure Pain and Fear? Effect of Graded Motor Imagery on Post Operative Lumbar Degenerative Diseases -Randomized Control Trial

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Abstract

Objective: The study aimed at evaluating the effect of GMI on fear of movement, LBP, leg pain and disability post degenerative lumbar spine surgery.

Design: RCT.

Materials and Method: 60 participants were randomly allocated to Group-A and Group-B. FAB, back & leg pain, and disability was assessed using FABQ, NPRS and ODI. In Group-A, participants were given GMI twice a week for 3 weeks. In Group-B, participants were not given any active intervention. After 3 weeks, both the groups were evaluated again on FABQ, NPRS and ODI.

Results: Pre and Post-treatment scores of FABQ, NPRS-back, NPRS-leg, and ODI was obtained. In both groups, each outcome measure had significant results with p value of 0.0001 (95% CI), however, Group-A showed better outcome compared to Group-B.

Conclusion: The study concluded that GMI training during immediate post-operative period may be beneficial for reducing fear of movement, pain and disability.

Key Words: Degenerative Lumbar Spine Surgery, Fear Avoidance Belief, Pain, Graded Motor Imagery.

Introduction

Spinal surgery is chosen over conservative treatment for patients only when they don't get relief from persistent pain, sciatica, motor deficits, decreased functional status, peripheral and central sensitization.^{1,2,3} Abnormal processing of pain can be due to multiple factors such as cognition (distraction and catastrophizing), mood, beliefs and genetics.^{4,5} Pain is not only caused by body tissues (i.e. anatomical structures of low back ache), but it is experience in the brain (output).⁶ Emerging advances in neuroscience and brain imaging studies argues that there is another reason for persistence of pain post lumbar spine surgery.⁷ Persistent pain may be due to the functional changes in the brain⁸

The perception of pain which is created by particular pattern of activity can be considered as 'neurotag' for

pain, which becomes 'Sensitized' and 'Disinhibited'.^{6,8} Because of Disinhibition, pain spreads, moves, defies the anatomical structure and can affect other body related neurotags leading to "Smudging and Blurring" of body maps. Smudging of the motor areas makes the body parts difficult to use. Smudging of sensory areas in brain makes nearby body parts sensitive.^{6,8} Fear is a powerful motivator that is associated with movements and pain. The way we move, behave and experience pain is also contributed by fear.^{6,8,9} All types of fear ultimately lead into the cycle of pain and disability from which it can be difficult to break free but not impossible.⁶

Graded Motor Imagery (GMI) is a collective term that describes various "brain exercise" which includes left/right discrimination, motor imagery, sensory discrimination, sensory integration and graphesthesia.¹⁰ Motor retraining involves, Implicit Motor Imagery

(Left/Right Discrimination Training), Explicit Motor Imagery (Imagined Movements) and mirror therapy.⁸ The functional representation of the brain gets replaced by perceptual disorganization of pain and activates neurotag. Any sensory or motor stimuli is a conditioned stimulus to neurotag causing central pain. Over a period of time, inaccuracy of left/right discrimination develops due to overlapping regional representation group. By giving left/right discrimination training, premotor cortex gets activated and it helps in re-establishing left/right concepts in the brain.^{11,12,13,14} Imagined movements will activate the same area of the brain as actual movement does without evoking pain neurotag.^{8,11,12,13,14}

Presence of fear and pain associated with movement can be expected to be dealt by GMI in post lumbar spine surgery patients.¹⁰ Very few studies are done to find the effectiveness of GMI in patients having fear and pain post lumbar surgeries. Hence, there is a need to find the effect of GMI on; fear of movement, low-back pain and leg-pain post lumbar spine surgery.

Method

A convenient sample size of 60 was taken, randomly allocated by concealed envelope method.

Inclusion Criteria:

1. Patients of either gender between the age group of 40-80 years.^{15,16}
2. Patients operated for Lumbar Degenerative Diseases.
3. Patients who had fear of movement and back/leg pain on Fear Avoidance Beliefs Questionnaire (FABQ) and NPRS (numerical pain rating scale), respectively.

Post operatively.^{17,18}

4. Patients who agreed to sign the consent form.

Exclusion Criteria:

1. Lumbar spine surgery secondary to tumor, trauma, infection, fusion surgeries re-operated for lumbar degenerative diseases.
3. Patients who scored zero on FABQ and NPRS.
4. Patients who are unable to follow the instructions

of motor imagery and not willing to participate.

Procedure:

The FABQ, NPRS and ODI was administered at 1st week and last day of 3rd week for both groups.

GROUP-A (experimental-group):

GMI approach was given twice a week for 3 weeks.^{10,19}

A. Laterality Training

This was carried out using Recognize Back App. Further, left/right discrimination was divided into 5 stages of tests, where every next stage becomes more challenging than the previous stage. Quick test was done in the app before starting the training. This test consisted of random pictures of either left/right side of the trunk. Patient needs to recognize and answer by selecting left or right on the screen of the cell phone. It was performed in order to make the patient understand the technique of using it. Once the patient understood it, they were then made to practice in the app. Stage wise progression was made if the participant scored $\geq 80\%$ of accuracy in the previous stage. Participants who scored $< 80\%$, were given the same stage to perform again in every session until they reached $\geq 80\%$.

B. Motor Imagery

This stage involved imagining movements. Two videos were made of a person who slowly performed 10 repetitions of variety of movements. The first video shown in the first week of therapy included small-range lumbar spine movements (pelvic tilt and rotations), bilateral arm elevation keeping back still, and in standing position performing hip flexion keeping back still. The second video shown in the 2nd week included full-range lumbar spine movements including forward flexion, extension, side flexion and rotation. Patients were instructed to watch the videos and imagine themselves performing the same movements in pain free manner. Each video lasted for about 5-6 minutes. Participants were asked to watch the videos twice per session, 3 times each day.

C. LOCALIZATION TRAINING

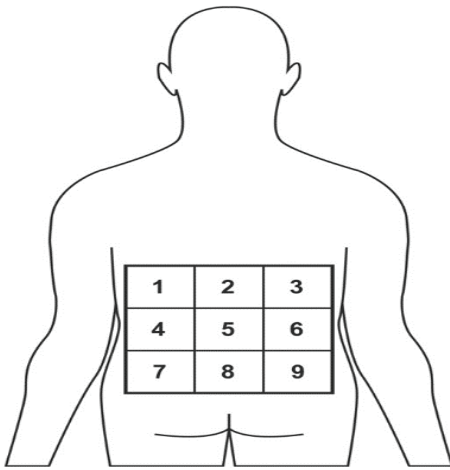


Figure 1: Localization Grid

Patients in high sitting position with lower back exposed. A grid picture of lumbar spine was shown to the participants on whom 9 dots were marked (Refer Figure-1). Randomly, using the blunt end of the pen, therapist lightly presses on a particular point for about 2seconds. Participants were instructed to refer the picture and answer which point has been stimulated. All the participants who gave wrong answers were corrected and same point was stimulated again. Using a random number sequence, 60 stimuli were given during the therapy. Patients were advised to practice the same at home, 60 stimuli for 3 times a day. In the next session, same procedure was continued as above but this time patient had to identify which block has been stimulated without looking at the grid picture. Participants were eligible for the next step only when they achieve an accuracy of $\geq 80\%$ in this stage.

D. SENSORY DISCRIMINATION

In this stage participants should localize the stimuli and type of stimuli used. To facilitate sensory discrimination, the participant's low-back was stimulated with the dull-end of the pen and the sharp-end of paper clip. Using a random number table, both position of the

stimuli and type of stimuli were randomized. A total of 60 stimuli were given and participants were advised to practice the same at home, 60 stimuli for 3 times a day. An accuracy of $\geq 80\%$ was required to proceed further in treatment.

E. GRAPHESTHESIA

This training was done by using various letters or numbers over the patient's low-back with dull-end of pen. A random sequence of 60 letters/numbers were generated for each treatment, 3 sets of 60 letters/numbers were used. Participants were instructed to identify the number/letter drawn. Progression was made by reducing the size of the letter/number, alternating the speed or using 2 or 3 letter words. An accuracy of $\geq 80\%$ is required to proceed further.

F. TWO-POINT DISCRIMINATION

Aesthesiometer was used by alternating the skin pressure between one and two-point stimulation. Patient was asked to determine the feeling of one or two points. Distance at which the patient first perceived two distinct points was taken as the initial threshold value. To facilitate two-point discrimination, the process was then repeated by reducing the distance from the initial threshold value.

GROUP-B (control-group):

Based on the literature present exercises were initiated post 6-weeks of surgery so that there is sufficient tissue healing. Hence, no active intervention was given to the Group-B.^{20,21,22}

Data Analysis

Statistical analysis was done using SPSS version 20.0. Descriptive analysis was done and presented as means, percentages, and standard deviation (SD) for the baseline characteristics. Level of significance was kept at $p \leq 0.05$.

Results

Table-1: Sociodemographic data and clinical characteristics

Characteristics	Group-A	%	Group-B	%
Age(years)				
40-49	17	56.67	14	46.67
50-59	7	23.33	10	33.33
60-70	6	20.00	6	20.00
Chi-square= 0.8201 P = 0.6642				
Sex				
Male	14	46.67	18	60.00
Female	16	53.33	12	40.00
Chi-square=1.0710 P = 0.301				
Occupation				
Not working	14	46.67	13	43.33
Working	16	53.33	17	56.67
Chi-square=0.0672 P = 0.7951				
No. of levels				
2 level Laminectomy Discectomy	17	56.67	12	40.00
3 levels Laminectomy Discectomy	7	23.33	9	30.00
4 levels Laminectomy Discectomy	1	3.33	1	3.33
2 levels Laminectomy 3 levels Discectomy, 3 levels Laminectomy 2 levels Discectomy, 4 levels Laminectomy 2 levels Discectomy, 5 levels Laminectomy	5	16.67	8	26.67
Chi-square=1.7126 P = 0.4255				
Duration of back-pain				
<=2	22	73.33	22	73.33
<=5	8	26.67	6	20.00
>=6	0	0.00	2	6.67
Chi-square=2.2862 P = 0.3191				

Table-2: Comparisons of FABQ scores by independent t test

Time points	Group-A		Group-B		t-value	p-value
	Mean	SD	Mean	SD		
Pre-test	51.23	5.79	53.20	4.96	-1.4127	0.1631
Post-test	23.63	7.77	41.90	6.74	-9.7215	0.0001*
Difference	27.60	8.78	11.30	6.18	8.3197	0.0001*
% of change	53.87		21.24			
Paired t	17.2268		10.0208			
p-value	0.0001*		0.0001*			

Table-3: Comparison of NPRS back scores by Mann-Whitney U Test

Time points	Group-A		Group-B		MW, Z-value	p-value
	Mean	SD	Mean	SD		
Pre-test	5.40	1.45	5.53	1.38	-0.4066	0.6843
post-test	1.53	1.31	3.47	1.55	-4.3836	0.0001*
Difference	3.87	1.14	2.07	1.51	-4.4797	0.0001*
% of change	78.02		44.71			
WM, Z-value	4.7821#		4.1558#			
p-value	0.0001*		0.0001*			

Table-4: Comparison of NPRS leg scores by Mann-Whitney U Test

Time points	Group-A	Group-B	MW, Z-value	p-value
	Mean (SD)	Mean (SD) SD		
Pre-test	6.10 (1.06)	5.47(1.17) 1.17	-2.0698	0.0385
post-test	1.70 (1.42)	3.77(1.81) 1.81	-4.1840	0.0001*
Difference	4.40 (1.22)	1.70(1.37) 1.37	-5.8177	0.0001*
% of change	72.13	31.10		
WM, Z-value	4.7821#	4.1203#		
p-value	0.0001*	0.0001*		

Table-5: Comparisons of ODI scores by independent t test

Time points	Group-A		Group-B		t-value	p-value
	Mean	SD	Mean	SD		
Pre-test	54.35	5.69	55.02	4.60	-0.5040	0.6162
post-test	28.79	11.39	45.53	7.23	-6.7965	0.0001*
Difference	25.56	8.87	9.50	6.86	7.8458	0.0001*
% of change	47.03		17.26			
Paired t	15.7820		7.5765			
p-value	0.0001*		0.0001*			

Discussion

Table-1 shows Sociodemographic and clinical characteristics. Table-2 shows the total scores of FABQ, where pre-test to post-test change in Group-A was 53.87% and in Group-B was 21.24%, which was statistically significant with p value of 0.0001. Based on the literature present, fear avoidance beliefs are important factors for low-back pain. Studies have shown that, pre-operative and early post-operative (6 weeks) fear of movement predicted pain intensity and disability at six months.¹⁷ Our study showed significant scores of FABQ post-operatively between 2-3 weeks. High levels of fear-avoidance are often closely associated with pain, limited movement and function.²³ GMI would have reduced pain associated with movement and so FABQ improved. There could also be a reversal of processes in anterior cingulate gyrus and precuneus which mediate fear avoidance aspect of pain processing.⁷

In our study, the NPRS back (table-3) and NPRS leg (table-4) scores showed significant difference within Group-A and within Group-B with p value of 0.0001. But Group-A showed better reduction in pain as compared to Group-B.

The mechanisms involved in reduction of back-pain and leg-pain could be due to the graded stages of mental exercises. Implicit motor imagery activates the premotor cortex, which is important in planning of movement and sends messages to specific cells of the primary motor cortex that is involved with the movement. This means that, premotor brain cells have the capability of causing change in the excitement of M1 cells without even activating them. This basically decreases sensitization and increases inhibition.^{6,8,10} Mental exercises aim to engage the cortical motor networks without triggering the protective response of pain. The altered image of our pain perception due to threatening stimulus is conditioned by the mental imagery program.^{6,8,10}

In our study as FABQ improved, the ODI scores also improved and patient were less dependent and disabled. Table-5 shows change in ODI scores in Group-A was 47.03% with p value of 0.0001 and in Group-B was 17.26% with p value of 0.0001. Fear avoidance beliefs is considered as a conditioned stimulus that can ultimately lead to disability. Studies have shown that fear avoidance is a significant predictor of disability.²³ In our study there

was a significant improvement in the FABQ and NPRS scores, which could have had an impact on disability.

Conclusion

Based on the results of this study, there was increase fear avoidance beliefs, persistent leg/back pain in patients post lumbar spine surgery. These factors also affected the daily activities of the patients and it was also found that these patients were more disabled. Patients when evaluated on FABQ, NPRS for leg and back and ODI at baseline and at 3 weeks, both the group showed significant changes. As rest is advised in post lumbar surgery, no active intervention was given to the control group. But experimental group that received graded motor imagery during this period showed better improvement as compared to controls. These additional changes can be due to the effect of GMI program.

Conflict of Interest – No Conflict of Interest

Source of Funding- Self

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Immediate Effects of Median Nerve Mobilization on Nerve Conduction Velocities, Upperlimb Strength and Bimanual Co-Ordination in Normal Healthy Subjects

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Abstract

Background and Objectives: - Neural tissue mobilization is a manipulative technique by which tissues are moved and stretched either by movement relative to surrounding structures or tension development. Mobilization of neural structures dependently or independently improves patient's signs and symptoms. Nervous system adapts to lengthening through increase in intraneural or intramural pressures. Thus the continuum of the nervous system serve its ability to move either alone or through surrounding tissue interface to relieve contributing neural tension to patient's symptoms. This Study assesses the immediate effects of neural tissue mobilization on the Nerve Conduction Velocities, the Bimanual Coordination and the Upper limb Grip Strength in normal healthy individuals. **Materials and Method:-** The participants in the study were normal healthy subjects. These subjects were assessed for their Upper limb Grip Strength, Bimanual coordination and the Nerve Conduction Velocities of the Median Nerve before and immediately after the Median Nerve Mobilization and analysis was done for the same. **Result:** - Data was analyzed by statistical means, standard deviation and students t- test and the results showed significant changes in terms of the nerve conduction velocity, upper limb strength and bimanual co-ordination in normal healthy subjects on an immediate basis. **Conclusion:** - This study concludes that immediate effects of median nerve mobilization on Nerve Conduction Velocities, Bimanual Coordination and Upper Limb Strength in normal healthy subjects are statistically significant. Hence immediate relief of discomfort through neural mobilization on these parameters can be obtained.

Keyword- Nerve Tissue Mobilization, Grip Strength, Nerve Conduction Velocity And Bimanual Coordination

Introduction

The concepts and technique of mobilization of nervous system are not new. A form of surgical treatment known as nerve stretching was in vogue late last century in France and England. This tech was usually applied to sciatic nerve or brachial plexus and was used for variety of complains. For e.g. in case of sciatic stretching surgeons made an incision at gluteal fold or lower and

attached a hook or placed fingers under sciatic nerve, then firmly pulled the nerve¹. However how hard to pull and in which direction to pull was matter of great debate. Results were therapeutic dosage should be between 30 lbs and the persons body weight. With forms of ataxy a pull downwards was considered best and for LBA a pull in rostral direction².

It is interesting to know that nerve stretching was accepted 100 years ago but it has been understood not more than 30Years and awareness of specific pathways for pain arose little more than 20 years ago and present stage of progression towards an understanding of neuro orthopedic disorder remain into a process^{3,4}.

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Nervous system cannot avoid being mobilized with any movement related treatment. For e.g. in Hamstring stretch the sciatic nerve, its branches and part of neuraxis and meninges will be moved and tensioned. Even gentlest stretch Mobilize the neural structures of spine and the plexus. Patient's signs and symptoms have been improved with passive and active mobilization techniques^{5,6,7}.

Neurobiomechanics

A. The Mechanical Interface:

One of the most outstanding features of the neural system is its mobility. Its mobility is such that it can act dependently or independently of the structure it spans. E.g. SLR involves movement and tension of the nervous system in the calf and foot, yet negligible activity in the foot non-neural structures.

However if the SLR was performed including ankle dorsiflexion, the neural structures in the calf and foot will loose their independence from the surrounding structures of the affected by the joint position. Thus the continuum of the nerve system serves its ability to move either alone or be influenced by surrounding.

Mechanical interface is defined as the tissue or material adjacent to the nerve system, that can move independently to the system (Butler 1989) e.g. the supinator muscle is an interface to the post interosseus branch of the radial nerve⁸.

B. NERVOUS SYSTEM ADAPTATIONS TO MOVEMENT

Nervous system adapts to lengthening in two ways by Development of tension or increase pressure within the tissues that is increase in intraneural or intermural pressures which occurs as a consequence of elongation

Movement

a. Gross Movements

b. Movement occurring intraneurally between connective tissues and nerve neural tissues.

Gross Movement refers to system as a whole in relation to interface e.g. (1) Peripheral nerve sliding through a tunnel. (2) Median nerve through carpal

tunnel (3) dural theca sliding in relation to a segment. Intraneural Movement refers to movement in between connective tissues and nerve neural tissue interfaces. E.g. (1) Fascicle can slide in relation to another fascicle in peripheral nerve and nerve roots (2) Nerve fibre can move in relation to endoneurium^{9,10}.

C. RELATIONSHIP BETWEEN MOVEMENT AND NERVE TENSION

If a body part is moved with other body parts in neutral position there will be less tension in more movements of nerve system relation to interfaces. Conversely if same movement were performed with body parts tension there will be increase intraneural tension but little of movement of the nerve system^{11,12}.

Materials and Methodology

Study design was Experimental study design. Study was conducted at College of Physiotherapy, Jawaharlal Nehru Medical College, and Belgaum. Sampling method used was Convenient sampling done on a sample size of 60 subjects. Normal healthy subjects of age group 18-22 years were included in the study who were students of Jawaharlal Nehru Medical, Dental, Physiotherapy and Pharmacy College. Students with UL neurological pathologies, cervical pathology, UE Fractures, Local skin lesions and disorders were excluded. Outcome Measure: Hand Dynamometer. Name: Jamar Hand Dynamometer. Model: 5030 Kit. Markings: 0-60 Kgs., Two Hand Coordination Test with electronic Chronoscope. Students Physiograph Neurocare™ 2020 Computerized EMG/NCV/EP Equipment.

Procedure

After obtaining ethical clearance from the committee subjects were selected on the inclusion and exclusion criteria by convenient sampling method. An informed consent was obtained from the students. Each subject was explained in detail the functioning of the equipments used and the purpose of the study and its non-invasive nature. The recordings of each individual PRE and POST Median Nerve Mobilization (Stretch) for Upper Limb Grip Strength was measured with Hand Dynamometer and mean reading noted down in kgs., the Bimanual Coordination was assessed with the Two Hand Coordination Test with electronic Chronoscope

using Stop Watch and the time taken was noted. The nerve conduction velocity was assessed with the Students Physiograph Neurocare™ 2020 Computerized EMG/NCV/EP Equipment. Neural Stretch ULTT1 (Median Nerve) dominant hand utilizing Shoulder depression, Abduction, Elbow extension, Forearm supination, wrist and finger extension. Nerve mobilization of 2 sets of 20 seconds Grade IV mobilization in same position ULTT2 (David Butler).

Result

Table No.1 – Statistical Analysis of Strength and Nerve Mobilization

	STRENGTH	
	PRE	POST
Mean± SD	19.6±4.3	22.6±4.4
p value	0.0001	
Students t- test value	4.6	
Coefficient of correlation (r)	0.83	

This table shows changes of post median nerve mobilization with the p-value = 0.0001 and the students t-test value = 4.6. The changes in the upper limb strength values immediately after median nerve mobilization were statistically significant.

Table No.2 – Statistical Analysis of Bimanual Coordination and Nerve Mobilization along with time taken to complete the task

	BIMANUAL COORDINATION	
	PRE(time taken)	POST(time taken)
Mean ±SD	256±57.2	215±36.3
p value	0.01	
Students t- test value	2.81	
Coefficient of correlation (r)	0.69	

This table shows significant changes in bimanual coordination with the p-value = 0.01 and the students t-test value = 2.81. The time taken to complete the task was statistically significant.

Table No. 3 –Statistical Analysis of Nerve Conduction Velocity and Nerve Mobilization.

	NERVE CONDUCTION VELOCITY	
	PRE	POST
Mean ± SD	59.7±4.16	62±3.58
p value	0.004	
Students t- test value	3.631	
Coefficient of correlation (r)	0.90	

This table shows significant changes in the nerve conduction velocities in the subjects immediately after median nerve mobilization with p-value=0.004 and students t-test value=3.63.

Discussion

This study intends to find out immediate effect of Median Nerve Mobilization on normal healthy subjects in one single session. The changes in the upper limb strength post median nerve mobilization with the p-value = 0.0001 and the students t-test value =4.6 proved to be highly significant. Study also shows significant changes in the nerve conduction velocities in the subjects immediately after median nerve mobilization with p-value=0.004 and students t-test value=3.631. Significant changes in bimanual coordination with the p-value = 0.01 and the students t-test value =2.81 were observed.

The above result seems to be similar to previous study done by a follower of David Butler on patients — performed stretch just to the very edge of pain and held it for 5 seconds on 50 subjects and found that all the symptoms subsided immediately. Results of that study were increase in the Range Of Motion by two folds. LI Alan Weismantel’s (functional manual therapy.) (1978). Also, when directing movement to the soft tissue complex is accomplished towards the resistance

experienced by patients. The resulting mobilization affects nerve, vascular, fascia & muscular tissue. Studies conducted by David Butler show a significant improvement with cervical mobilization and upper limb tension over a period of 14 days, with 70% reduction in their symptoms and improvement in their functional activities.

Upper limb nerve mobilization is widely used treatment method for dysfunction of the upper limbs. Butler reported that upper limb NM suppresses spasm and facilitates muscular tension and the overall recovery of patients with upper limb dysfunction due to brain damage. Park JW also reported significant differences in restoration of muscular power, spasticity, and functional recovery of post stroke hemiplegic patients with upper limb neural mobilization. The tension placed on the neural systems compresses the small blood vessels thus increasing blood flow and axonal transport systems increase the flexibility accelerating the NCV. A randomized control trail (A.S.Likhite, G.M.Balthillaya, Anupama Prabhu 2007) to study the effect of upper limb neural mobilization on vibration threshold and hand grip strength in asymptomatic individuals was done which showed significant results in neural extensibility as measured by elbow extension range of motion but no effect on grip strength was observed with one session of Nerve Tissue Mobilization. Hence in this study two sessions of Nerve Tissue Mobilization were used to compare the baseline and immediate effects. Studying the immediate effects on bimanual coordination and time take to complete a task after neural tissue mobilization is subject which can be further investigated.

Limitations

- Experimental study conducted as a single session

- Normal subjects with no prior pathology

Recommendations

- Present study can be done on a larger sample size

- Further study can be done to investigate the long term effects on patient population.

Ethical Clearance- Taken from institutional ethical

committee

Source of Funding- Self

Conflict of Interest - NIL

Conclusion

This study concludes that median nerve mobilization shows significant improvement on Nerve Conduction Velocities, Bimanual Coordination and Upper Limb Strength in normal healthy subjects. Thus the experimental hypothesis is accepted and the null hypothesis is rejected in the present study. As on long term Neural Tissue Mobilization is an important form of treatment technique given by physiotherapist which can bring about significant changes in extensibility, muscle strength, nerve conduction velocities and thus reaction time and relief of pain and discomfort. Hence immediate relief of discomfort through neural mobilization on these parameters needs to be further investigated in patients.

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Comparative Study of Flutter Device and Active Cycle of Breathing Technique in Airway Clearance in Subjects with Chronic Obstructive Pulmonary Disease

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Abstract

Background and Objectives: Chronic obstructive pulmonary disease is a disorder characterized by presence of air flow obstruction that is generally progressive, may be accompanied by airway hyperactivity and maybe partially reversible. COPD comprises major pathological changes. Conventional airway clearance techniques form the main stay of the routine Pulmonary Rehabilitation of subjects with chronic obstructive pulmonary disease. The procedure of Active Cycle of Breathing Technique causes an increase in lung volume which allows air to flow via collateral channels and may assist in mobilizing the secretions which but incorporating newer techniques that are effective, comfortable and can be independently performed by the subject without assistance help motivate the subjects to participate actively in their own health care. A device is proposed to have good efficacy, reliability and provides relief of the symptoms in a better way than the manual therapy in a way by excluding the bias and thus can be used as an alternative to it, so proves efficient to it. This study incorporates a device called 'THE FLUTTER DEVICE' which aids in mucus clearance in subjects with COPD effectively. **Materials and Methodology:** The Study participants were thirty subjects aged 35 to 45yrs with chronic obstructive pulmonary disease. After two weeks of ACBT and Flutter therapy with routine Physiotherapy each patient was told to record their VAS score for breathlessness on Visual Analogue Scale for breathlessness, the patient's peak expiratory flow rate was then checked with the peak flow meter and FEV₁/FVC percentage was also obtained from the patient's Pulmonary Function Test reports. **Results:** Data was analyzed by statistical means, standard deviation and students t- test and the results showed significant changes in terms of the VAS score for breathlessness, PEFr, FEV₁/FVC percentage of PFT. **Conclusion:** It can be concluded that application of flutter therapy for airway clearance to patients with Chronic obstructive pulmonary disease decreased the breathlessness drastically and increased the peak expiratory flow rate and FEV₁/FVC percentage than the application of ACBT.

Key Words: COPD- Chronic Obstructive Pulmonary Disease, PEFr- peak expiratory flow rate, FEV₁/FVC- Ratio of forced expiratory volume in one second to Forced Vital Capacity, ACBT- Active Cycle of Breathing Technique.

Introduction

Chronic obstructive pulmonary disease is a disorder characterized by presence of air flow obstruction that is

generally progressive, may be accompanied by airway hyperactivity and maybe partially reversible. This disorder includes conditions like chronic bronchitis, Emphysema and Asthma. Diagnosis of COPD should be considered in any patient with symptoms of cough, sputum production, dyspnea and history of exposure to risk factors for the disease. The diagnosis requires spirometry, post-bronchodilator FEV₁/FVC < 0.7 confirms presence of airflow limitation that is not fully reversible. A Spiro-metric classification predicts health status, utilization of health care resources⁰¹, development

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of exacerbation^{02, 03} and mortality in COPD. A post-bronchodilator $FEV_1/FVC < 70\%$, in combination with an $FEV_1 < 80\%$ predicted, in an individual cough, sputum production or dyspnoea and exposure to risk factors confirms the diagnosis.

The different pathogenic mechanisms include Mucous hyper secretion and Ciliary dysfunction, Airflow limitation and hyperinflation, Gas exchange abnormalities, Pulmonary hypertension with other Systemic effects.

The goals of physiotherapy are to optimize oxygen transport, improve ventilation-perfusion mismatching, increase lung volume and enhance mucociliary clearance (Ciesla 1996, Stiller2000). In the more recent years incorporating newer techniques that are effective, comfortable and can be independently performed by the subject without assistance help motivate the subjects to participate actively in their own health care. A device is proposed to have good efficacy, reliability and provides relief of the symptoms excluding the bias can be used as an alternative to it. This study incorporates a device called 'THE FLUTTER DEVICE' which aids in mucus clearance in subjects with COPD effectively¹⁴.

Materials and Methodology

Study participants were sixty male and female COPD subjects according to American Thoracic Society criteria aged 35 to 45yrs. Patients who enrolled in the study were from Tertiary care Hospitals and Clinics in Bangalore. Simple Random Sampling Technique was used and it was a Comparative Study Design. Subjects with dyspnoea at rest, chest pain, hemoptysis and hematemesis, Un co-operative patients, previous history of cardiac, lung and abdominal surgeries, Pregnant women, previous hernias, prolapsed uterus, any underlying cardiac disease, or musculoskeletal disorders were excluded from the study. After selection they were randomly assigned into two groups,

Group A- 30 subjects received Flutter device.

Group B- 30 subjects received Active Cycle of Breathing Technique

Outcome Measure : VAS score for breathlessness on Visual Analogue Scale for breathlessness, peak expiratory flow rate with the peak flow meter and $FEV_1/$

FVC percentage from the patient's Pulmonary Function Test Reports.

Procedure

After obtaining ethical clearance from the committee subjects were selected, screened and diagnosed with COPD by chest physician for the study. On obtaining the filled consent, the subjects were thoroughly assessed before taking them in the study. Subjects were assigned to two groups i.e. Group A and Group B having 30 patients in each group.

Each patient was then told to record their VAS score for breathlessness, Peak expiratory flow rate checked with Peak flow meter and FEV_1/FVC percentage from patient's Pulmonary Function Test reports.

Group A was assigned for Flutter therapy. All 15 subjects were given flutter therapy for 15mins for two weeks alongwith routine Physiotherapy treatment^{5,6}.

Stage 1 - Mucus Loosening and Mucus Mobilization: Patient slowly inhaled to approximately 3/4 of a full breath. Flutter positioned at proper angle was placed in the mouth with lips closed firmly then 2 to 3 second breath-hold was performed and Patient was asked to exhale through Flutter fast but not too forceful and repeated for 5 breaths.

Stage 2- Mucus Elimination: The patient was made perform 1 or 2 additional breaths through the Flutter. This time full inspiration, breath hold and a forceful exhalation that moved mucus up to a level in the lungs that triggered a cough followed by a pause for breathing control following a huff or cough.⁶ continuing for a total session of 15mins.

Group B was assigned for Active cycle of breathing technique treatment for 15 min for two weeks alongwith routine Physiotherapy Treatment. The ACBT was performed according to guidelines developed by Patridge et al (1989) and Pryor (1991).

The standardized ACBT cycle consisted of Breathing Control; four Thoracic Expansion exercises; Breathing Control; three to four Thoracic Expansion exercises; Breathing control; two forced expirations (huffs and breathing control) (Pryor 1991). Each standardized ACBT cycle was around two minutes with

duration of each session for 15mins.

After two weeks of therapy each patient was told to record their VAS score for breathlessness on Visual Analogue Scale for breathlessness, the patient's peak

expiratory flow rate was then checked with the peak flow meter and FEV₁/FVC percentage was also obtained from the patient's Pulmonary Function Test reports.

Result

TABLE NO.1- Comparison of Breathlessness within Flutter device and Active cycle of breathing technique

Breathlessness (VAS)	Pre therapy		Post therapy		Effect size	z-value	P-value
	Mean	SD	Mean	SD			
Flutter device	6.80	0.86	2.60	0.99	1.23	3.535	<0.001
Active cycle of breathing technique	6.60	0.99	4.67	0.90	0.54	3.624	<0.001

In this study it is observed that in Flutter therapy the mean + SD for VAS score in pre-therapy is 6.80 ± 0.86 and post-therapy is $2.6 + 0.99$. It has an effect size of 1.23 hence the difference in mean is found to be statistically significant ($p < 0.001$). In ACBT group the mean + SD for VAS score in pre-therapy is $6.60 + 0.99$ and post-therapy is 4.6 ± 0.90 . It has an effect size of 0.54, hence the difference in mean found to be statistically significant ($p < 0.001$). This showed that within the group individually both the therapies can bring improvement in reducing breathlessness measured by VAS score for breathlessness from pre-therapy to post-therapy.

TABLE NO.2- Comparison of PEER from pre-test to post-test in Flutter device and Active cycle of breathing technique

Flutter Device	Pre therapy		Post therapy		Effect size	z-value	P-value
	Mean	SD	Mean	SD			
Flutter device	235.33	23.56	365.33	40.15	0.03	25.636	<0.001
Active cycle of breathing technique	263.33	45.93	278.67	49.98	0.002	4.219	<0.001

It is observed in this study that in Flutter therapy the mean + SD of PEFR in pre-therapy is 235.33 ± 23.56 and post-therapy is 365.33 ± 40.15 , it has an effect size of 0.03 hence the difference in mean is found to be statistically significant ($p < 0.001$). In ACBT group the mean \pm SD of PEFR in pre-therapy is $263.33 + 45.93$ and

post-therapy is 278 ± 49.98 . It has an effect size of 0.002, hence the difference in mean found to be statistically significant ($p < 0.001$). This showed that within the group individually both the therapies can bring improvement in peak expiratory flow rate measured peak expiratory flow meter from pre-therapy to post-therapy.

TABLE NO. 3- Comparison of FEV₁/FVC percentage from pre-test to post-test in Flutter device and Active cycle of breathing technique

Flutter Device	Pre therapy		Post therapy		Effect size	z-value	P-value
	Mean	SD	Mean	SD			
Flutter device	56.73	5.61	65.87	6.02	0.07	22.141	<0.001
Active cycle of breathing technique	54.80	4.77	55.73	4.27	0.01	2.824	<0.014

In Flutter therapy the mean \pm SD of FEV₁/FVC percentage in pre-therapy is 56.73 \pm 5.61 and post-therapy is 65.87 \pm 6.02, it has an effect size of 0.07 hence the difference in mean is found to be statistically significant ($p < 0.001$). In ACBT group the mean \pm SD of FEV₁/FVC percentage in pre-therapy is 54.80 \pm 4.77 and post-therapy is 55.73 \pm 4.27. It has an effect size of 0.01, hence the difference in mean found to be statistically significant ($p < 0.014$). This showed that within the group individually both the therapies can bring improvement in the ratio of forced expiratory volume in one second to forced vital capacity from pre-therapy to post-therapy.

TABLE NO.4- Comparison of breathlessness between Flutter device and Active cycle of breathing technique during pre and post therapy

Breathlessness (VAS)	Flutter device		Active cycle of breathing technique		Effect size	z-value	P-value
	Mean	SD	Mean	SD			
Pre therapy	6.80	0.86	6.60	0.99	0.23	0.482	>0.653
Post therapy	2.60	0.99	4.67	0.90	2.32	4.051	<0.001

In Flutter therapy group the mean \pm SD of VAS in pre therapy was 6.80 \pm 0.86 and 2.60 \pm 0.99 in post therapy. In ACBT group, the mean \pm SD of VAS in pre therapy is 6.60 \pm 0.99 and 4.67 \pm 0.90 in post therapy. The effect size in pre therapy between Flutter therapy and ACBT group was 0.23. It has a low effect size of and

hence the difference in mean is found to be statistically not significant (**P value > 0.634**). But the effect size in post therapy between Flutter therapy and ACBT group is 2.32 (**P value < 0.001**). Thus signifies that Flutter therapy is better reducing the breathlessness than Active cycle of breathing technique.

TABLE NO.5- Comparison of PEFR between Flutter device and Active cycle of breathing technique during pre-therapy.

PEFR	Flutter device		Active cycle of breathing technique		Effect size	z-value	P-value
	Mean	SD	Mean	SD			
Pre therapy	235.33	23.56	263.33	45.93	-0.01	2.101	<0.045
Post therapy	365.33	40.15	278.67	49.98	0.01	5.235	<0.001

In Flutter therapy group the mean + SD of PEFR in pre therapy was 235.33 ± 23.56 and 365.33 ± 40.15 in post therapy. In ACBT group, the mean \pm SD of PEFR in pre therapy is 263.33 ± 45.93 and 278.67 ± 49.98 in post therapy. The effect size in pre therapy between Flutter therapy and ACBT group was -0.01 (**P value < 0.045**). The effect size in post therapy between Flutter therapy and ACBT group is 0.01, statistically significant and (**P value < 0.001**) and greater than in pre-therapy. Thus signifies that Flutter therapy improves the peak expiratory flow rate better than Active cycle of breathing technique.

TABLE NO.6- Comparison of FEV₁/FVC percentage between Flutter device and Active cycle of breathing technique during pre-therapy

FEV ₁ /FVC (%)	Flutter device		Active cycle of breathing technique		Effect size	z-value	P-value
	Mean	SD	Mean	SD			
Pre therapy	56.73	5.61	54.80	4.77	0.02	1.107	>0.318
Post therapy	65.87	6.02	55.73	4.27	0.09	5.317	<0.001

In comparison the Flutter therapy group the mean + SD of FEV₁/FVC percentage in pre therapy is 56.73 ± 5.61 and 65.87 ± 6.02 in post therapy. The effect size in pre therapy between Flutter therapy and ACBT group was 0.02. It has a low effect size of and hence the difference in mean is found to be statistically not significant (**P value > 0.318**). In ACBT group, the mean + SD of FEV₁/FVC percentage in pre therapy is 54.80 ± 4.77 and 55.73 ± 4.27 in post therapy but the effect

size in post therapy between Flutter therapy and ACBT group is 0.09 (**P value < 0.001**). Thus signifies that Flutter therapy is better in improving the ratio of forced expiratory volume in one second to forced vital capacity from pre-therapy to post-therapy than Active cycle of breathing technique.

Discussion

Patients that received flutter therapy decreased

the breathlessness drastically than ACBT therapy. It also increased PEF and FEV₁/FVC percentage in two weeks as compared to ACBT therapy. No acute adverse response to flutter therapy or Active cycle of breathing technique in terms of oxygen saturation, heart rate, blood pressure, and respiratory rate was observed. The findings reveal that the Flutter therapy in the airway clearance of COPD patients accelerates recovery than Active cycle of breathing technique without any detrimental effects, whereas some studies have suggested undesirable acute effects of conventional chest physiotherapy on pulmonary function in patients with acute exacerbations of chronic bronchitis. Campbell (1975) and Wollmer et al (1985)^{13,14} demonstrated a decrease in FEV₁ as an acute response to head down positioning combined with chest percussion in patients with acute exacerbation of chronic bronchitis. Girard JP and Terki N¹⁰ demonstrated forced expiratory volume in one second; vital capacity and peak expiratory flow were significantly improved by daily use of this therapeutic device as the sole physiotherapy and did not take any mucolytics.

The Flutter assisted patients in achieving goal of airway clearance comfortably and efficiently. Also the findings reveal that the Flutter therapy accelerated recovery than ACBT without any detrimental effects. Thus, device showed to have better efficacy and provided relief of the symptoms in a better way than the manual therapy in a way by excluding the bias and thus can be used as an alternative to it, so proves efficient to it.

Limitation

- Some limitations of this study were that sputum production; health related quality of life like outcome measures could have been taken into consideration.
- Also a larger sample size could have been selected.

Suggestions For Future Study

- The same study can be done on a larger population
- The study duration can be increased.

Conclusion

From this study we can conclude that Flutter

therapy is more effective treatment approach for airway clearance in COPD patients. The findings showed that Active cycle of breathing technique therapy would take relatively more period of time for obtaining near similar results which were achieved by Flutter therapy. Thus it can be concluded that application of flutter therapy for airway clearance to patients with Chronic obstructive pulmonary disease decreased the breathlessness drastically and increased the peak expiratory flow rate and FEV₁/FVC percentage than the application of Active cycle of breathing technique.

Ethical Clearance- Taken from institutional ethical committee

Source of Funding- Self

Conflict of Interest - Nil

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Effectiveness of Home - based Physiotherapy on Berg Balance Scale Scores in Parkinson's Disease in India: An Observational Study

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Abstract

Background: Parkinson's disease (PD) is a progressive, neurodegenerative disease which leads to postural and gait disorders, limitation in mobility, activities of daily living and disability. Although a number of studies have shown that supervised exercise programs have short-term beneficial effects, there are few studies addressing the effectiveness of home-based physiotherapy. Therefore, this study was done to analyze the effects of home-based physiotherapy on balance in participants with Parkinson's disease.

Material and Method: From January 2018 to December 2018, 44 participants who were recipients of HealthCare at Home physiotherapy (HCAH) services across various locations were included in the main analysis. The age ranges from 63 years to 87 years (mean age 75.18 years), average treatment cycle duration was 74.2 days. Physiotherapy was performed for approximately 45-60 min aiming to improve general mobility, static and dynamic balance. Berg Balance Scale (BBS) were taken as an outcome and were recorded fortnightly.

Findings: Statistically significant improvement was seen in Berg Balance score (BBS) with mean difference of 6.09.

Conclusion: The results of the study shows that home- based physiotherapy interventions like stretching exercises, active assisted, active exercises, strengthening exercises, balance and gait training. were found to have a positive effect on Berg balance scores among patients with PD.

Keywords: Parkinson's Disease, Berg Balance Scale, Home-Based Physiotherapy.

Introduction

Parkinson's disease is a progressive neurodegenerative condition with both motor and non-motor symptoms. Progressive loss of substantia

nigra neurons, which produce dopamine, results in neurotransmitter imbalances in basal ganglia. Patient begin to experience a wide variety of difficulties if around 80% of neurons have been lost. ¹ It is the second most common neurological disease in the world that affects neurophysiologic function, movement abilities, and quality of life². The mean age of onset is between 58 and 62 years. Prevalence rises from 1% with those with 60 years age to 4% in population over 80 years. Males are slightly more at risk than females³

The most clinical features of Parkinson disease are motor symptoms including tremors at rest, rigidity and bradykinesia. These impairments cause difficulty for the

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patients to cope with the functional task such as walking, rising from a chair, moving in bed, eating, or putting on shoes¹. Impaired balance is one of the cardinal signs of Parkinson's disease (PD). Balance control and postural control are often used interchangeably. Posture instability and reduced mobility are result of the abnormal sensory integration within the basal ganglia, poor neuromuscular coordination and muscle tone⁴. This increased postural instability is considered one of the most incapacitating symptoms that directly threaten independent living⁵ and promotes an inactive lifestyle. Characteristic stooped PD posture together with decreased joint range of motion, narrow foot stance and axial rigidity add on to this posture instability⁶. Untreated balance dysfunction can lead to increased frequency of falls and injuries which in turn increases the chance of developing comorbidity and disability by causing alterations in postural control strategies during standing tasks and when performing voluntary movements².

Depending on the individual's PD severity, Parkinsonism is typically symptomatically managed throughout the individual's life with pharmacologic and non-pharmacologic treatment such as surgical, physical and psychosocial interventions⁷. Although the gold standard dopaminergic pharmacological interventions are effective in reducing bradykinesia, rigidity, and tremor, but there is limited literature about the effect of medications on improving balance deficits and reducing falls in people with PD². Recent findings recommend that intensive and challenging exercises induces neuroplasticity, suggesting that exercise should be essential in PD treatment^{5,8}. Physiotherapy intervention, that focus on balance exercises specifically, have shown positive effect in improving balance⁹, and reducing fall risk¹⁰.

Home-based exercises may be more practical and accessible for individuals with PD as previously been found¹¹. On the other hand the researchers also suggested that, due to other comorbidities often found in individuals with PD, a therapist supervised programme is best, and that group or individual sessions have different benefits. Home-based physiotherapy has several advantages because it not only increases independence and teaches self-management, but also promotes empowerment. Home-based services with regular visits from health care professionals, consistent monitoring, and follow-up ensures continuity of patient care and patient satisfaction^{12,13}.

Keeping in mind that the standardized home care physiotherapy services is an evolving model of care in India that can help bridge the gap in accessibility and possibly meet the functional rehabilitation needs of Parkinson's patients, this study was therefore conducted to analyze the effectiveness of home-based physiotherapy on balance in patient suffering from Parkinson's disease across various location in India

Material and Method

Out of 63 individuals with Parkinson's disease receiving HealthCare at Home physiotherapy services across various locations in India from January 2018 to December 2018, 44 individuals (32 males and 12 females) who consented with age ≥ 60 years (mean age 71.63 ± 6.19 years) were included in the study.

The study enrollment is described in the flow chart (Figure-1).

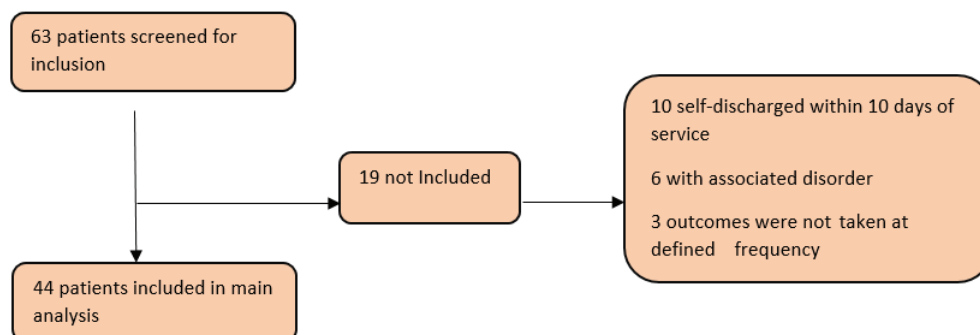


Fig 1: Cohort Chart

Individuals with any associated disorders like Alzheimer's disease, stroke, patients who didn't sign the informed consent, self discharge within 10 days of service were excluded from the study. Before starting the therapy, problems and expectations of the participants were clearly understood, and a goal was set individually, which was documented as part of a standard process of HealthCare at Home. All physiotherapists were trained on skills and techniques required to manage participants with stroke. Individual care plans were designed for all patients which were reviewed and modified as per change in the patient's condition by the physiotherapists. The study was conducted in agreement with the principles of the Helsinki Declaration of 1975, as revised in 1996.

To analyze the impact of home-based physiotherapy on balance, the Berg Balance scale (BBS) score as a functional outcome was taken at the time of initial assessment and reviewed fortnightly. In the present study the BBS consists of 14 items that are scored on a scale of 0 to 4. A score of 0 is given if the participant is unable to do the task, and a score of 4 is given if the participant is able to complete the task based on the criterion that has been assigned to it. The maximum total score on the test is 56¹⁴. Studies have reported the minimal detectable change for berg balance scores is values of 6.3 points, 4.9 points and 3.3 points for the ranges of 25–34, 35–44 and 45–56 on the BBS, respectively¹⁵

All the outcomes were documented in a HealthCare at Home registered platform patient care system (PCS). The individual supervised home physiotherapy program of 45–60 min was delivered to each patient. The duration and frequency of treatment was decided by the treating physiotherapist based upon acuteness and severity of patient condition. The mean treatment cycle duration was 74.2 days (mean number of sessions delivered, 66.8). The main goals of physiotherapy were to improve general mobility, static and dynamic balance in participants with Parkinson's disease and delivered in

the form of stretching exercises, active assisted, active exercises, strengthening exercises, balance and Gait training.

Care giver and family members were explained about the condition, its outcomes, precautions, risks involved as well as about the home exercise program. Progression in the exercise program was done basis the patient's performance and feedback during the sessions.

Findings

Data was meaningfully assorted through calculation of Mean and Standard Deviation (SD). Later on paired t-test was applied for comparison of values obtained from berg balance scale scores.

The Mean \pm Standard Deviation value for age was 75.18 \pm 7.42. Out of 44, 32 (73%) were males with the Mean \pm Standard Deviation value for age 75.97 \pm 7.59 and 12 (27%) were females with the Mean \pm Standard Deviation value for age 71.63 \pm 6.19.

Table 1: shows the number patients in different age groups.

Age (Yrs)	Number of Patients	Percentage
60-69	10	23%
70-79	20	45%
80-90	14	32%

Table 2 shows paired t-test results for comparison of initial and final values of Berg balance scale scores. The Mean \pm Standard Deviation value for initial BBS score was 31.40 \pm 16.2 and final BBS score was 37.49 \pm 17.15. T test value for comparison of initial and final values of BBS scores was 5.97 which was statistically significant at $p < 0.001$.

Table 2: Shows comparison of Initial and Final Values of Berg Balance scale

Paired Samples Statistics	Mean	SD	N	Mean Diff	t Test	p value	p value
BBS Score Initial Value	31.40	16.22	44	6.09	5.973	<0.001	Significant
BBS Score Final Value	37.49	17.15	44				

BBS: Berg Balance Scale, *Significant Difference at $p < 0.001$

Table 3: Shows the mean point improvement in BBS scores in different age groups. The mean point improvement in BBS in age group 60-69 yrs was 3.3, 70-79 yrs was 7.4 and 80-90 yrs was 6.7.

Table 3: Shows Mean point improvement in BBS scores in different age groups

Age Group (yrs)	Mean \pm SD of BBS Score Initial Value	Mean \pm SD of BBS Score Final Value	Mean point improvement in BBS
60-69	33.5 \pm 9.1	36.7 \pm 11.7	3.3
70-79	39.7 \pm 14.7	47.2 \pm 14.9	7.4
80-90	21.1 \pm 13.8	27.8 \pm 16.5	6.7
Mean Total	31.4 \pm 16.22	37.49 \pm 17.15	6.09

BBS: Berg Balance Scale

Discussion

Poor balance control and postural instability are among the most disabling features of PD. The sensorimotor control of posture involves a complex integration of proprioceptive, vestibular, and visual channels. All or some of these systems may be dysfunctional in Parkinson's patients. The increased muscle stiffness and inflexibility of postural reflexes contribute to balance control impairment⁴. Exercise in general can facilitate neuronal transmission and motor coordination that are essential for improved balance and overall function¹¹. However, PD research seldom indicates what the best practices are to deliver exercise interventions¹⁶.

The present study reflected that the home-based physiotherapy interventions like stretching exercises, active assisted, active exercises, strengthening exercises, balance and Gait training. were found to have a positive effect on Berg balance scores among patients with PD with the mean difference of 6.09 in berg balance score which is higher than what MDC reported in previous studies^{15,17}. In other study the MDC95 values of 6.3 points, 4.9 points and 3.3 points for the ranges of 25–34, 35–44 and 45–56 on the BBS, respectively were reported¹⁵. Whereas in our population 8.8 points, 7 points and 1.8 points for the ranges of 25–34, 35–44 and 45–56 on the BBS, respectively were observed.

The findings were in accordance with the results of other studies those have found that interventions including muscle strengthening, range of movement, balance training, walking training shows improvement in BBS immediately after intervention period by 5.98². Nicola Smania et al concluded that the out patient balance training improves the berg balance scores in patients with idiopathic Parkinson's disease with mean diffrence improvement of 5.4¹⁸. In a smiliar study 4 weeks intervention including cardiovascular warm up, balance and gait training were found to have a positive effect on balance dysfunction but at 1 year of follow up BBS does not show significant improvement as compared with the initial value¹.

Family support, the home environment of rehabilitation, an individually designed treatment plan and close follow-up have been considered to be the key factors in facilitating functional improvement. Literature suggests that physiotherapy provided at home shows effective improvement in function in Parkinson's disease patients^{19,20}.

A Systemic review has concluded that Home-based prescribed exercise improves balance-related activities in people with Parkinson's disease and has benefits similar to centre-based exercise²¹. Frazzitta G et al in a study founded that group physical therapy program improves the balance in patients with parkinson disease but not much studies are done on the effectiveness of home based physiotherapy on balance in PD²².

We observed a mean BBS value changed from 39.7 to 47.1 in the age group 70-79yrs. This change shifted from medium risk of fall to low risk of fall based on BBS²³. The average duration of treatment was minimum in age group 70-79 years (63.2 days) as compared with 60-69 years (85.5 days) and 80-90 years (78 days).

The present study had certain limitations, such as lack of assessment of some parameters like Hoehn and Yahr stage and quality of life. We also could not track the long-term outcome of home-based physiotherapy. Future research should focus on measuring quality of life in terms of tracking overall impact of home-based physiotherapy services. In conclusion, Home-based physiotherapy treatment can be effectively used for the improvement in balance in people suffering from Parkinson's disease. Age group 70-79yrs shows greater improvement in BBS scores with lesser average duration of treatment as compared with other age groups although this needs to be tested in future under well-controlled trials.

Conflict of Interest: The authors declare that they have no financial or non-financial conflict of interest.

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Ethical Clearance: Ethical clearance was not required in this study.

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Immediate Effect of Non Ballistic Active Knee Extension in Neural Slump Position Versus Muscle Energy Technique on Hamstring Flexibility in Young Adults-Comparative Study

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Abstract

Background and purpose: Amongst all of the bi-articular muscles of the human body hamstring have a greater tendency to shorten. Tightness of hamstrings produces decreased range of motion and reduce flexibility of the pelvis, hip and knee joints which can lead to musculoskeletal injuries. Muscle energy technique (MET) also known as active muscular relaxation technique is effective for lengthening a shortened muscles and increasing the range of motion. It is found that neuro dynamic tension technique also affects muscle flexibility and stretch tolerance. The purpose of this study is to evaluate the immediate effect of muscle energy technique versus non ballistic active knee extension in neural slump position on hamstring flexibility in young adults.

Materials and Method : 60 healthy individuals between the age group of 18-35 years with bilateral hamstring tightness without any previous musculoskeletal injuries were allocated into 2 groups by means of quasi random sampling. Hamstring tightness was measured using active knee extension (AKE) test. Group A was given neural slump stretch and group B was given muscle energy technique.

Results: For within group data analysis Wilcoxon test was applied where Group A and Group B showed statistically significant difference ($p < 0.001$) in pre and post hamstring flexibility. Mann Whitney U test was used for between group analysis in which Group A (mean rank 35.22) showed a greater improvement than Group B (mean rank 25.78).

Conclusion: Both the techniques showed statistical as well as clinical significance in improving hamstring flexibility, however non ballistic active knee extension in neural slump position showed greater improvement than MET.

Keywords : MET, hamstring flexibility , neural slump position, active knee extension (AKE) test , non ballistic active knee extension

Introduction

Tightness is the adaptive shortening of the contractile and non contractile elements of the muscles which usually occurs in muscle groups in set pattern, with the

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biarticular muscles showing the greater tendency to shorten . The hamstring are the group of muscles that have a tendency to shorten even among young, healthy individuals and in recreational athletes.^[1] Hamstring tightness leads to high risk of recurrent injury, decreases the performance in athletes, lead to post-exercise soreness and decreases coordination among athletes. The hamstring muscles are commonly linked with movement dysfunction at the lumbar spine, pelvis and lower limbs, and have been coupled with low back

pain and gait abnormality. Limited flexibility causes neuro-musculoskeletal symptoms. Decreased hamstring flexibility is a risk factor for the development of patella tendinopathy and patellofemoral pain hamstring injury and symptoms of muscle damage following eccentric exercise. Hamstring tightness are associated with a posterior rotation of the pelvis in standing due to attachment of hamstring muscle is on ischial tuberosity. Tightness in hamstring muscle causes posterior pelvic tilt which lead to decrease in lumbar lordosis result in low back pain.^[2] Worrell and Perrin (1992) proposed a theoretical model for hamstring strains, suggesting that they result from a complex interaction of four etiologic factors: warm-up, strength, fatigue, and flexibility.⁽³⁾ Apart from the musculoskeletal causes, hamstring has also been shown to get tight due to increased tension in the neural structures. Gajdosik, pointed out that along with the hamstrings, the deep fascia of the lower limb and the soft tissues of the pelvis, including neurological tissues, can limit a straight leg raise test. In the same way these noncontractile tissues can come under tension during passive or active movements of hip flexion or knee extension.^[1] Techniques previously investigated for hamstring flexibility include static stretching exercise, heat, and proprioceptive neuromuscular facilitation (PNF). Each of these interventions has demonstrated clinical and experimental success; no agreement has been reached on a standard protocol for treatment. Choice for a hamstring lengthening technique is typically based on provider specialty or preference. Muscle energy technique (MET) is a manual procedure that uses controlled, voluntary isometric contractions of a target muscle group. MET is claimed to be useful for lengthening a shortened muscle, improving range of motion at a joint and increasing drainage of fluid from peripheral regions. This approach which targets primarily the soft tissue is also known as active muscular relaxation ^[4]. Although abnormal muscle and tendon stiffness has been thought to be a cause of poor hamstring extensibility, several authors emphasised that abnormal mechanosensitivity due to sciatic nerve adhesion could potentially result in decreased hamstring extensibility and stretch tolerance^[5] Studies have shown that incorporating neural mobilisation technique such as slump mobilisation into the treatment program can be an effective method of restoring normal neural tension and

mechanics of the nervous system^[1]. Therefore the need of this study is to compare the immediate effect of non ballistic active knee extension in neural slump position versus muscle energy technique on hamstring flexibility in young adults.

Materials and Method

In this interventional study after obtaining ethical clearance a total of 60 subjects were included by screening according to the inclusion and exclusion criteria after obtaining an informed consent from the subjects. The subjects were divided into two groups with 30 subjects in each group. The criteria was as follows..

Inclusion criteria

1. Age group between 18-35 years.
2. Both males and females
3. Bilateral hamstring tightness (knee flexion angle greater than 15 degrees for active knee extension test)

Exclusion criteria

1. Subjects with any present or previous musculoskeletal injuries.
2. Individuals engaged in regular physical activity.

Procedure

The subjects were divided into 2 groups by quasi random sampling method after a consent was provided by the subjects . Where **Group A** was given non ballistic active knee extension in neural slump position and **Group B** was given MET.

Group A

Group A Patients were then instructed to perform 30 repetitions of active knee extension maintaining the full dorsiflexion, upto the point where the firm resistance or stretch was felt at the posterior thigh, knee or calf and position was held for the self count of one, two, three, four by the patient The position was held for 6 seconds and 30 repetitions were done.^[1]



Group B

While the subject was lying in supine position, the subject's hip was passively flexed and the leg extended until tension was sensed by the researcher and the subject reported a moderate stretching sensation. The subject provided a moderate knee flexion isometric contraction (approximately 50% of maximal contraction), by pressing his ankle joint against the top of the researcher's

shoulder for 7–10 s. This was followed by 2–3 s of relaxation, and then the leg was passively stretched by the researcher to the palpated barrier and/or tolerance to stretch and held for 30 s. The leg was then lowered to the table for a short resting period (approximately 10 s). This procedure was repeated two more times. ^[4]



(a) isometric contraction



(b) stretching post isometric contraction.

Outcome Measure : Active Knee Extension Test (. ICC values 0.87 – 0.94)

Hamstring tightness was measured before the treatment at baseline by active knee extension test (AKE) and immediately after the treatment. The AKE consists in an active extension movement at the knee joint (with the hip flexed at 90°), in which the subject is instructed to stop when he feels strong resistance to the movement.^{16]}

**Active knee extension test****Statistical Method**

After the collection of data , analysis of data was done in SPSS VERSION 20. Shapiro-wilk test was used to check normal distribution of data. The data did not follow a normal distribution therefore non parametric tests were used. For a within group analysis WILCOXON SIGNED RANK TEST. For a between group analysis MANN WHITNEY U TEST. P value less than 0.05 is taken as significant level.

Results**TABLE 1 : AGE AND GENDER DISTRIBUTION IN BOTH THE GROUPS.**

GROUP	Gender distributiom	AGE (YEARS) MEAN±SD
GROUP A (NEURAL SLUMP)	Male : 14 Female : 16	24.56 ±4.19
GROUP B (MET)	Male : 17 Female :13	24.53±4.27

TABLE 2 : SHOWS THE WITHIN GROUP ANALYSIS BY WILCOXON SIGNED RANK TEST FOR THE PRE AND POST VALUES OF AKE TEST

Group	Pre Mean±SD (in degrees)	Post Mean±SD (in degrees)	P value
A (neural slump)	102.48±3.7	120.31±8.5	0.0001
B (MET)	105.18±3.9	115.33±6.9	0.0001

- As bilateral hamstring tightness was considered with regard to statistics a mean value of both the sides was taken as the final value per each subject.

TABLE 3 : SHOWS BETWEEN GROUP ANALYSIS OF THE POSTVALUES OF AKE BY MANN WHITNEY U TEST.

GROUP	P VALUE
BETWEEN A AND B	0.03

Discussion

Results of this study showed that both MET and slump stretch showed a clinically (**Minimal detectable change is 7–8°for AKE**)¹⁶ as well as statistically ($P < 0.05$) significant difference in improving hamstring flexibility however slump stretch showed a greater improvement. As MET showed a significant improvement in muscle flexibility which is supported by a similar study conducted by Adel Rashad Ahmed that compared the effect of Muscle Energy Technique and Dynamic Stretching on Hamstring Flexibility in Healthy Adults. It was reported that the application of post-isometric stretching technique, such as MET, produce greater changes in range of motion and muscle extensibility than static or ballistic stretching^{14,17}. It was concluded that 30 seconds as the optimal duration for an effective stretch, MET may produce an increase in muscle length by a combination of creep and plastic change in the connective tissue²². The probably mechanism of increasing muscle extensibility involves both neurophysiological (including changes to stretch

tolerance) and mechanical factors (such as viscoelastic and plastic changes in the connective tissue elements of the muscle). Also, the effectiveness MET was attributed to the inhibitory Golgi tendon reflex. This reflex is believed to be activated during isometric contraction of muscle, which is claimed to produce stretch on the golgi tendon organs and a reflex relaxation of the muscle¹⁴. This was further supported by a study carried out to examine Efficacy of Muscle Energy Technique on hamstring muscles flexibility in normal Indian collegiate males. By Wassim M et al which also attributed the improvement in hamstring flexibility to combination of creep and plastic change in the connective tissue, an increase in flexibility after muscle energy technique (MET) occurred due to biomechanical or neuro-physiological changes or due to an increase in tolerance to stretching¹⁷.

Also neural slump stretch showed a clinical as well as statically significant difference on hamstring flexibility when compared with MET. Supporting this finding a study done by Gadpal Pratiksha, Asgaonkar Bharati showed immediate effect on hamstring flexibility

by comparing non ballistic active knee extension in neural slump position and static stretch technique and found slump stretch to give better results. According to shacklock ,damaged or inflamed nerves leads to increase in mechanosensitivity which is a direct response to mechanical loading of the neural structures. This can lead to increased knee flexion angle in AKE. The possible mechanism of reduced knee flexion angle post neural stretch can be attributed to the improved physiological functions of nervous system, including improved axoplasmic flow, vascular perfusion and reduced neuromeningeal mechanosensitivity (perceptions of stretch or pain were altered). Thus there are many proposed mechanism of improvement of hamstring flexibility by neural slump position. But reduced mechanosensitivity is the chief mechanism by which the nervous system becomes more tolerant to source of pain with movements and postures^[1] A similar study , examining the immediate effect of neurodynamic sliding technique verses mulligan's bent leg raise technique on hamstring flexibility in a symptomatic individuals by vinod babu et. Al found that , In NDST group, who received Neurodynamic sliding technique showed that there is a statistically significant change in means of passive SLR ROM, when means were analysed from pre intervention to post intervention measurements within the group with positive percentage of change showing there is increase in post means. There is a clinical significant effect with large effect size. This could be due to neurodynamics sliding technique, when tension is applied to the nervous system while applying neurodynamics, it causes reduction in cross-sectional area and increase in pressure in the nerve that results in extension and movement of the sciatic nerve together with the hamstring and this compliance of the nerve, results in increased flexibility. When applying neurodynamics, tension that occurs in the nervous system and pressure within the nerve increases due to the decrease in cross-sectional area, and the axonal transport system lengthens the sciatic nerve after shortening because of the influence of the surrounding related structures and hamstring flexibility. The observed changes may have been secondary to decreasing neuromeningeal sensitivity or may be that the neurodynamic sliders led to a modification of sensation such that the individual's perceptions of stretch or pain were altered ^[8] Further this mechanisms which improved the hamstring flexibility

were supported by a the following study , A Randomised, Placebo-Controlled Trial of Neurodynamic Sliders on Hamstring Responses in Footballers with Hamstring Tightness by Pattanasin Areeudomwong et al. This study demonstrated that a 4-week Neurodynamic sliding (NS) technique improved knee extension angle, which reflected apparent hamstring extensibility without causing any significant changes in th hamstring activity in footballers with hamstringtightness. There were three proposed mechanisms to explain the greater knee extension angle after NS. First, increased knee extension angle may be due to changes in the individual's tolerance of the stretch , and the strong afferent input from the acute stretch may reduce firing rates of mechanoreceptors and proprioceptors that may also affect sensory adaptation and allow increased joint ROM . Second, NS may provide more excursions of the neural structures at the vertebral canal, the buttock, and especially the sciatic nerve in the posterior thigh. It may also decrease the neural mechanosensitivity that may play a factor in determining an increase in apparent hamstring extensibility . Third, NS may induce sliding of the sciatic nerve at the thigh relative to its nerve beds by performing joint movements that elongate the nerve beds and the fascial system, including the hamstring muscles . This may allow increased joint ROM. ^[5]

Conclusion

From this study it is concluded that both the techniques showed statistical as well as clinical significance in improving hamstring flexibility, however non ballistic active knee extension in neural slump position showed greater improvement than MET.

Limitations and Scope of Further Research: Long term follow up was not done it is not known how long the observed increase in hamstring flexibility might have lasted. Subjects with musculoskeletal disorders were not included therefore the scope of further research is that this techniques could be applied in musculoskeletal disorders.

Conflict of Interest : none

Source of Funding: self

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Correlation of Cognition and Fall Risk in Elderly

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Abstract

Introduction: Cognition declines with age which is one of the key factor of fall risk. Falls in advanced age have serious impact on physical, mental, and socioeconomic consequences. As age increases there is affection of executive function, attention, problem solving, concentration and memory.

Aims: The purpose of this present study is to investigate the correlation of cognition and fall risk in elderly.

Method: It was correlational, cross sectional study carried out for a period of 6 months on 60 elderly. Cognitive status assessed using by Montreal Cognitive Assessment (MoCA) scale and fall risk assessment done by using Fullerton Advanced Balance Scale.

Results: Total numbers of participants were 60. After adjusting age and gender they from a linear regression it shows that one unit increase in MoCA there is increase in FAB value by 0.28 and vice versa. 95% confidence interval is 0.12 _ 0.43, p value < 0.01. Result shows positive correlation between FAB and MoCA (r = 0.498, p= 0.0001).

Conclusion: There is a positive correlation between, MoCA (cognition) and FAB (fall risk) thus as cognition declines, the fall risk in elderly increases.

Key words: cognition, fall risk, elderly, ageing

Introduction

According to WHO aging is a progressive, generalized impairment of function resulting in a loss of adaptive response to stress and in a growing risk of age associated disease.¹ Aging causes a gradual decrease in physical and mental capacity, a growing risk of disease, and ultimately death. Out of the many problems that are associated with aging, fall is one of the important ones. Fall is one of the main causes of injury-related disability, morbidity and mortality in geriatric people.²⁻⁷ About 1/3rd of the community living elderly fall in a year.⁸ About half of world's elderly population lives in Asia.⁹

In India elderly population successively increasing from 6.7% in 1991 to 10% in 2021.⁹ The prevalence of

falls among Indian older adults with age above 60 years is 14% to 53%.¹⁰⁻¹³

According to WHO, fall depend upon biological, environmental, behavioral and socioeconomic factor. Biological risk factors consists of age-related declines in strength, vision, cognition¹⁴, balance, sex, race, chronic diseases¹⁵, dementia¹⁶, and depression¹⁷⁻¹⁸, Sedentary lifestyle, anxious behavior or on multiple medications comprises of behavioral risk factors. The Socioeconomic risk factors include low education, income, inadequate housing, and limited access to health care services. Environmental (extrinsic) risk factors include slippery or uneven surfaces, poor building design steps or any physical environmental features in the home or community that may cause hazards.¹⁹

Cognition includes any process by which a person becomes aware of his or her situation, needs, goals, and required actions, and uses this information to implement

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problem-solving strategies for optimal living.

Cognitive function play an important role in the regulation of routine walking, particularly in older adults. Attention is an important cognitive resource for maintaining normal walking. There is evidence which shows that cognitive and attention deficits are independently associated with postural instability, impairment in performing daily living activities, and future falls.²⁰

Cognition declines with age, which is one of the factors of fall risk, as there is affection of executive function, attention, problem solving, concentration and memory. During walking, all these cognitive domains work together to maintain balance and prevent fall.²¹ Fall risk associated with poor cognition is not related with one specific domain, but are influenced by more than one domain of cognition.²¹ So the purpose of this study is to investigate the correlation of cognition and fall risk in elderly.

Aims and Objectives

Aim was to find correlation of cognition and fall risk in elderly. Objectives were to assess cognition in elderly, to assess fall risk in elderly, to assess correlation of cognition and fall risk in elderly.

Material and Method

The study was conducted in the physiotherapy outpatient department of a KEM hospital. Study included 60 healthy adult participants with age of 60 years and above. Prior permission was obtained from the local Institutional Ethics Committee. Permission for using GDS, MoCA and FAB were obtain from author. It's a cross-sectional, correlational, single-center study which was carried out for a period of 6 months.

Inclusion criteria contains elderly with age 60 or above. Both genders were included. Participant who can stand independently, can understand Hindi, English or Marathi, osteoarthritis knee if present then VAS less than 4 Subjects were included. Exclusion criteria contains individuals with associated symptomatic cardiovascular, musculoskeletal or neurological condition causing imbalance, any surgical procedure for lower extremity, uncorrected visual impairments, vestibular impairments, uncontrolled diabetes mellitus, hypertension, subjects

on psychotropic drugs, sedatives, antiepileptic, antihistaminic, subjects with GDS Score more than 9.

The study materials included Stopwatch, pen, pencil, 6" Bench, mobile for Metronome App and foam. A written informed consent document in a language best understood by the subject (English/Hindi/Marathi) was obtained. All the participants underwent a subjective evaluation, in which their histories were taken in order to gather health-related data, consisting of demographic data including age, gender, occupation, occurrence of falls in the last 12 months. Subjects was evaluated by using following scales- The Screening for depression by Geriatric Depression Scale (GDS) was done first followed by cognitive status by Montreal Cognitive Assessment (MoCA). Further assessed for fall risk by Fullerton Advanced Balance Scale.

Outcome Measures

Geriatric Depression Scale

Screening for depression was done by Geriatric Depression Scale. It has a 30 yes / no questions, rated 1/0 on response. GDS is widely used as a quick screening tool for Depression. The grade sets a range of 0-9 as normal, 10-19 as mildly depressed, and 20-30 as severely depressed.

It was found to have 92% sensitivity and 89% specificity when evaluated against diagnostic criteria.²² Individuals having score less than 9 were included in the study. Individuals with score 10 and above were excluded.

Montreal Cognitive Assessment (MoCA)

Assessment of cognitive status was done by MoCA. A score of < 26 is generally accepted cut off for cognitive impairment. The MoCA has a sensitivity of 90% and a specificity of 78% for detecting MCI.^{23, 24}

Fullerton Advanced Balance Scale

It consists of 10 functional tasks which assess both static and dynamic balance under varying sensory conditions. This performance based activities are scored on a 5-point ordinal scale (0-4) with a maximum score of 40. FAB scale has an excellent inter-rater (ICC = 0.955 - 0.999) and test retest (r = 0.96) reliability.²⁵ It also has an excellent correlation with BBS (r = 0.75) suggesting

excellent construct and concurrent validity.²⁵ Score of FAB scale < 25/40 indicate fall risk in elderly due to balance impairment.

DATA Findings

Data were analyzed using Stata Version 13. We calculated the means and standard deviations for the linear variables, and proportions for the categorical variables. The normality was assessed using the Shapiro-Wilk test. We estimated the Pearson's correlation coefficient between two linear variables. A p value of less than 0.05 was considered to be statistically significant.

Results

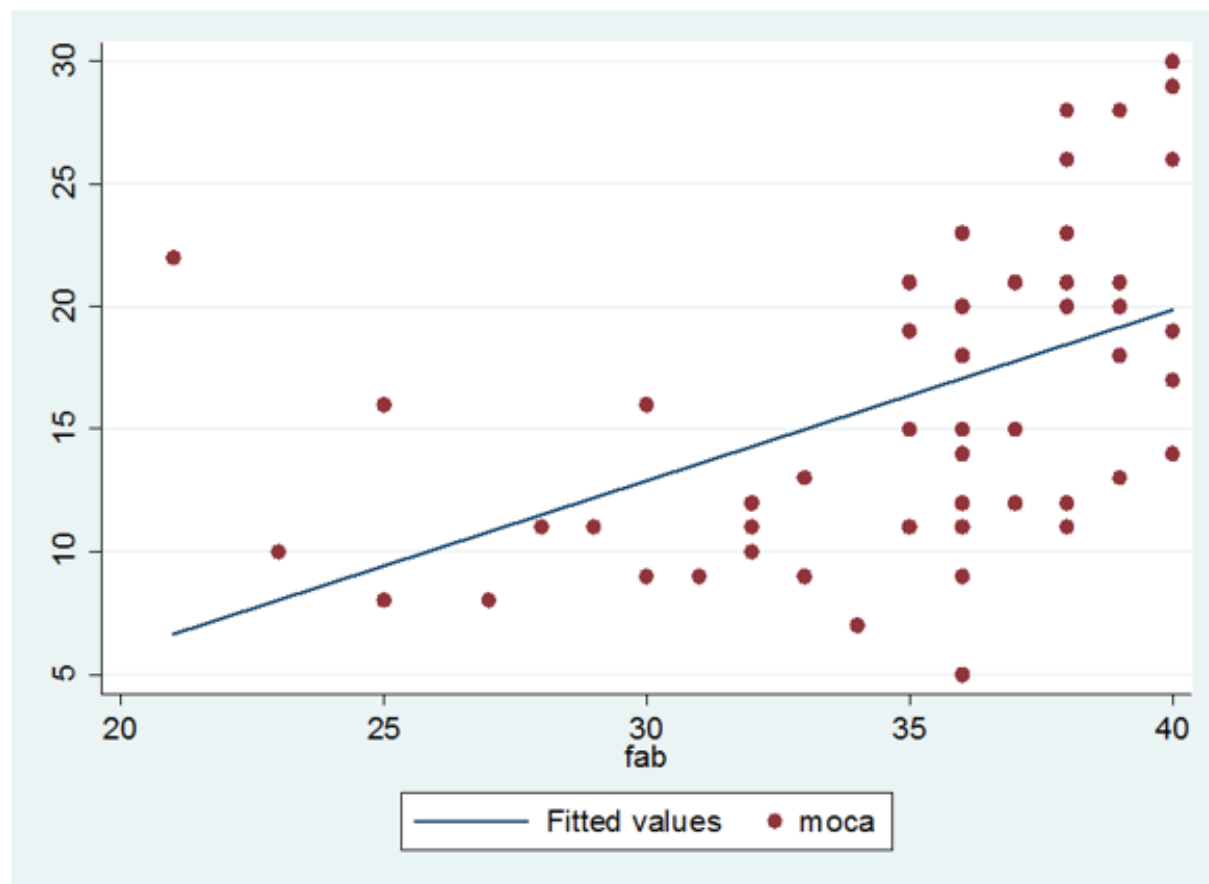
60 participants were recruited in this study. The minimum age of the subject participated in the study was 60 and maximum 78 with mean age of 64.42 ± 4.66 (Table 1) After adjusting age and gender they from a linear regression shows one unit increase in MoCA and there was increase in FAB value by 0.28 and vice versa. (Table 2). Result shows positive correlation between FAB and MoCA ($r = 0.498$, $p = 0.0001$) respectively (Table 3) were 95% confidence interval is 0.12 - 0.43, p value < 0.01. The score of MoCA decreases the score of FAB decreases, which means that as cognition declines the risk of fall increases in elderly individuals.

Table 1: Age description

Variables	Observation	Mean	Stand dev	Min.	Max.
Age	60	64.42	4.66	60	78

Table 2: Linear regression between MoCA and FAB

	Estimate	95% Confidence intervals		p value
Moca	0.28	0.12	0.43	<0.01
Age	-0.38	-0.59	-0.16	<0.01
Sex				
Male	1.05	-0.83	2.93	0.27
Female	Reference			
Constant	54.33	39.55	69.11	<0.01

Table 3: Relation of MoCA and FAB

Discussion

The present study was done to find out the correlation between cognition and risk of fall in elderly individuals. The results of study show that there is positive correlation between cognition (MoCA) and risk of fall (FAB) ($r = 0.498$, $p = 0.0001$). This showed that as the score of MoCA decreases the score of FAB decreases, which means that as cognition declines the risk of fall increases in elderly individuals.

Postural stability is a complex skill, it depends upon the coordination of motor system and sensory systems to perceive various environmental stimuli and respond to perturbations to control body movement. The motor and sensory systems are linked with higher order neurological system and cognition, which are necessary for planning movements, divided attention and responding to changes within the environment.

Many studies have demonstrated cognition has a key role in the regulation of gait and balance in older adults. Such as, Wilson et al., 2006 in his Prospective study demonstrated that cognitive status can predict falls and related injuries. Colón-Emeric et al., 2002 also in his prospective study mentioned that, cognitively impaired older adults have a 120% greater chance of developing fall related injury during a 6- to 10-year period following cognitive status assessment compared with those cognitively intact older adults.

Executive function also plays an important role in gait control and the regulation of gait speed and variability.²⁶ Van Iersel et al., 2008; Martin et al., 2013 in their study proved that while performing dual tasks with affected executive functions associated with gait and balance impairments resulted in reduced gait speed and length and increased body sway. The reduced executive functions of elderly lower their judgment

in motor planning, balance confidence, and decision-making while walking.²⁷

Aron Buchman et al 2011 mentioned that in ambulatory elders, cognition is associated with the incident of mobility impairment and mobility decline. Mobility is associated with complex interaction of neural systems which control gait initiation, planning, execution and the adaptation of these movements to fulfill motivational and environmental demands.²⁸

Also in this study we used, FAB scale to assess balance. Which is a performance-based measure that comprehensively addresses the multiple dimensions of balance.^{29,30} According to, Klein PJ et.al. The FAB Scale is a reliable and valid tool to assess balance function in higher-functioning older adults.³¹

As the age advances, there is significant loss in gray and white matter, mainly in the frontal and parietal lobes.³² Loss of white matter affects various cognitive tasks.^{33, 34} Loss of white matter in frontal lobe leads to reduced processing speed and working memory.³⁵ Due to loss of fronto-parietal white matter individuals face difficulty in switching the task. Loss of gray matter in frontal lobe is associated with attention and executive function deficits. As the age advances, motor automaticity reduces; automatic tasks, become more difficult or require greater conscious control So, in elderly there is a shift from unconscious to increasingly conscious information processing, dependence on frontal functions becomes greater, which is characterized by an increase in their pre-frontal processing.³⁶ But as age advances there is loss of fronto parietal white and gray matter which declines frontal functions which can greatly contribute to the increased risk of falling in older adults, who mainly depend upon conscious motor control due to brain aging. So brain aging is strongly associated with an increased incidence of falling.

Conclusion

Our study concludes that, there is a positive correlation between, MoCA (cognition) and FAB (fall risk) thus as the cognition declines fall risk in elderly increases. A clinical implication of our results is that fall risk screening and prevention should be a key component in the clinical management of older adults with cognitive impairment

Conflict of Interest: There is no conflict of interest as study contains normal healthy elderly.

Source of Funding: Nil

Limitations

MoCA test does not specify grades of cognitive impairment so severity of cognition impairment and fall risk associated with it can't predict.

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Prevalence of Upper Trapezius Myofascial Pain and Brasserie Groove Deformity Due to Tight Inner Wear in Women: The Correlational Study

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Abstract

Objective: To evaluate the effect of tight bra strap on upper trapezius and brasserie groove deformity due to tight inner wear

Sample: A total number of 100 women aged 20-40 years were randomly recruited from rural area as well as from urban area

Design: Correlational and observational study

Method: 100 subjects fulfilling selection criteria participated in the study. All of them were told about the procedure of study. All their queries were answered satisfactorily and informed consent was taken from them. They were asked to fill these questionnaires which consists of 32 items. Participants were asked to state their bra size immediately after completion of the questionnaire (i.e. reported bra size) and then measure their bra size by tape method. Brasserie groove deformity is checked by palpation and observation of taught muscle band. The participants were selected for the inclusion and exclusion criteria of the study. The patient consent was taken to be comfortable and relaxed.

Conclusion: Study suggests the there is highly positive correlation between measured breast size and trapezius myofascial pain as with increase in bra size, trapezius myofascial pain also increases, and the positive correlation of measured bra size and VAS scale .

Key Words: Myofascial pain, upper trapezius, brasserie groove deformity and brasserie

Introduction

A trapezius is a muscle which connects your back to your upper limb. It is having a three fibers upper trapezius, middle trapezius, lower trapezius. Upper trapezius elevates scapula ^[1]. Myofascial dysfunction is the collection of sensory, motor and autonomic symptoms. It includes referred pain as well as localized pain, decreased range of motion and weakness[[]

^{8]}Myofascial pain is caused by a tight clothing ,structural inadequacies, systemic, alcohol toxicity, inflammatory diseases and relative growth hormones deficiency ^[13].A brasserie having two components -two cups like structure for support a breast and two straps attached to a cup which lift your breast against the gravity ^[3]. It leads to increases bra strap pressure on a upper fibers of trapezius .The wearing a wrong size bra can cause a serious musculoskeletal and neurological problem. The developing problems are-^[3]

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- Deep bra furrow
- Back pain
- Pectoral girdle myalgia

- Exercise inducing breast discomfort
- Upper limb neural symptoms

. A main part which creates a symptoms and discomfort is bra straps^[6]. Due to prolonged wearing of incorrect bra size and tight strap the chronic contraction is occurs within the trapezius muscles can having a compressive effect and narrowing of arteries leads to ischemia of that area.^[3] .Due to the tight bra strap the musculoskeletal symptoms could be the pain, soreness, pectoral girdle myalgia etc. They all restrict a scapular movement and effect on posture also^[5,3]. A depression occurs at the junction of neck and shoulder due to a tight bra strap is called brassiere groove deformity.

Purpose and Significance

The purpose of this study was to compare a upper trapezius myofascial pain and deformity in heavy breast size and small breast size

Aim And Objective

To evaluate the effect of tight bra strap on upper trapezius and brasserie groove deformity due to tight inner wear

Null Hypothesis

Tight inner wear in women does not produce upper trapezius myofascial pain and brasserie groove deformity

Alternative Hypothesis

Tight inner wear in women is significantly cause to produce upper trapezius myofascial pain and brasserie groove deformity

METHODOLOGY

SAMPLE SIZE

A total number of 100 women aged 20-40 years

Sample Population

A sample size were randomly recruited from rural area as well as from urban area Data were collected from college students, working professionals and housewife

Inclusion Criteria

Women aged 20-40 years

No pathology and injury occurs from last 3 month in neck, shoulder, upper back and arms area

Exclusion Criteria

Women more than 40 years are not allowed

pathology and injury occurs from last 3 month in neck, shoulder, upper back and arms area

Study Design

Correlational and observational study

Instruments and Measurement Tools

Data collection of this study comprised of 3 steps-questionnaire, bra size measurement and presence of brasserie groove deformity.

Procedure

Questionnaire

A total number of 100 female aged 20-40 years were randomly taken from rural area as well as from urban area. Those female were college students, working professionals and housewife's in India. The questionnaire consists of 32 items which included^[2]

- Name
- Age
- Weight
- Height
- BMI
- Educational qualification
- Occupation
- Bra knowledge :- no formal education, primary education, secondary education, tertiary education
- Bra use :- the variable are duration of daily usage, reported bra size, bra method, congruent/ incongruent bra size after measurement
- Reported bra size
- Type of bra used and how it is worn
- Occurrence of pain:-Yes or no?

- Current history of pain
- Pain in last 12 months: - Yes or no?
- Visual analog scale
- Nature and type of pain: -Radiating pain, localized pain, dull aching pain
- Frequency of upper trapezius myofascial pain and requirement for treatment of pain :-None , self-medication and treated in a hospital
- Frequency of factor reported to affect upper trapezius myofascial pain :- the variable are factor that worsen the pain, factor that relieve the pain, and reported that bra fit can affect the pain
- Pain onset and duration

Bra Size Measurement

Participants were asked to state their bra size immediately after completion of the questionnaire (i.e. reported bra size).Following this, research then used the method describe by Lunarie in 2002 and white and Scurr in 2012 to measure a female bra’s size. A tape method is

used to determine a bra size. Bra sizing is traditionally done by determining two specific values: band size and cup size. Band size, typically expressed in inches in the United States, is conventionally determined first by measuring the circumference around the wearer’s torso immediately below the breasts (the “underbust” measurement) with a conventional tape measure then adding Several-typically five inches to arrive at the correct band size^[12,18]

Table 1. Cup size conversion table (Zheng et al. 2006).

Bust girls-band size	-1"	0"	1"	2"	3"	4"	5"	6"	7"	8"
Cup size	AA	A	B	C	D	E	F	FF	G	GG

Cup Size, typically expressed as a letter size, is conventionally determined by first taking a measurement of circumference around the wearer’s torso at the “apex” or fullest part of the breasts (the “overbust” measurement) then calculating the difference between the apex or overbust measurement and the band size. By Standard practice, a difference of one inch corresponds to an A cup, two inches to a B cup, three inches to a C cup, and So on.

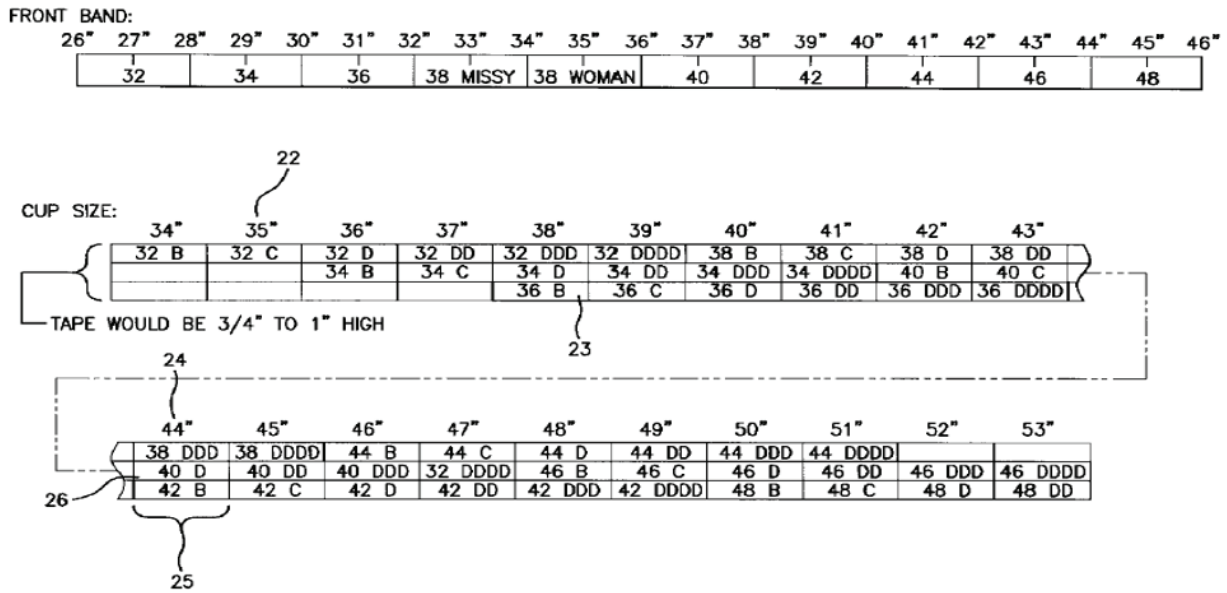


FIGURE 1 – Measurement Scale for bust size

BRASSERIE GROOVE DEFORMITY It was check by observation and taught band palpation [15]

bra size was different from measured bra size[2]

Data Analysis

Data was analysed with SPSS statistical package (version 12).

Pearson’s correlation co-efficient (r) were calculated to determine the strength and direction of linear relationships between pairs of numerical variables. Effect sizes were calculated as r². Consistent with Cohen’s conventions, correlations were interpreted according to size as well as direction [8]. Correlations of less than 0.3 are described as small or weak, between 0.3 and 0.5 are medium or moderate, and greater than 0.5 are large or strong[8].

A Pearson’s correlation co-efficient was used to determine the association between upper trapezius myofascial pain (point and 12-month prevalence) and measured bra size. UTMP was a binary variable of ‘yes’ (experienced Pain in the last 12 months) and ‘no’ (did not experience pain in the last 12 months) responses. Bra size was also binary variable: it was considered ‘congruent’ when the participant’s reported bra size was the same as her measured bra size and ‘incongruent’ when reported

Result

100 female participated in this study. Participants’ ages ranged from 20-40 years, the mean weight 85.4 ±38.6 kg body mass index is 26.1 ± 6.2 kg/m². Although the deformity is more likely observed in women with large and heavy breasts. Brassiere groove deformity due to direct reflection of the bra weight via bra straps to the skin[15]. In graph 1 shows that the comparison between the reported bra size and measured bra size and we find that 70% of females wearing incorrect bra size.

Mostly 70% of females with a large breast size were wearing a wrong bra size. There are several possibly explanations for why being large breasted is particularly associated with wearing a bra that is poorly fitted or the wrong size

Corelation

we were correlated the measured bra size and VAS. We were find that the correlation coefficient between the tape measured bra size and VAS is r=0.815 and it is positively correlated that heavy breast size having a more upper trapezius myofascial pain.

TABLE 2- Correlation between tape measurement and VAS

		VAS	Tape
VAS	Pearson Correlation	1	.024
	Sig. (2-tailed)		.815
	N	100	100
tape	Pearson Correlation	.024	1
	Sig. (2-tailed)	.815	
	N	100	100

After the positive correlation of measured bra size and VAS scale .We were correlate the measured bra size and brasserie groove deformity .The correlation

coefficient between the tape measured size and deformity is r=0.232 and it is positively correlated that heavy breast size have a brasserie groove deformity

TABLE 3- Correlations between the measured bra size and deformity

		tape	Deformity
Tape measured bra size	Pearson Correlation	1	.121
	Sig. (2-tailed)		.232
	N	100	100
Deformity	Pearson Correlation	.121	1
	Sig. (2-tailed)	.232	
	N	100	100

Table 4- Bra knowledge and use (n=100)

Variable	n (%)
Duration of daily usage	
Working hours	18(18.75)
All day	52(54.16)
All day and all night	26(27.08)
No response	04(4.166)
Respondents who claimed to know their bra size	
Yes	78(78)
No	22(22)
Congruent/incongruent bra size after measurement	
Congruent	30(30)
Incongruent	70(70)

Table 5 Frequency of upper trapezius myofascial pain and requirement for treatment of pain (n=100)

Variable	n (%)
Prevalence	
Point prevalence	28(43.7)
12-month prevalence	34(54.8)
Treatment requirement (12-month prevalence)	
None	14(41.17)
Self-medication	12(35.29)
Treated in a hospital	08(23.53)
Highest level of educational attainment	
No formal education	12(12)
Primary education	18(18)
Secondary education	20(20)
Tertiary education	50(50)

TABLE 6- FACTORS THAT AFFECT THE UPPER TRAREZIUS MYOFASICAL PAIN (n=62)

Variables	n=%
FACTORS THAT WORSEN THE PAIN	
Wearing bra for than a few hours	13(20.96%)
Wearing a bra with thin bra strap	17(27.41%)
Wearing tight bra straps	32(51.61%)
FACTORS THAT REDUCES THE PAIN	
Take off bra	46(74.19%)
Loosen the strap	16(25.80%)

Discussion

The purpose of the study was to determine the corelational between breast size and upper trapezius myofasical pain and other corelational betwene the bust size and brasserie groove deformity .In this study we find that the comparison between the reported bra size and measured bra size and we find that 70% of females wearing incorrect bra size.

The finding that removing the bra gave most respondents relief from upper trapezius myofasical pain. In this study we were find that women with larger breasts, who have been reported to be more prone to myofasical pain. Less reliance on the bra shoulder straps for support may lead to less pressure on the areas of the upper trapezius muscle in contact with the bra strap, and may therefore reduce the possibility of developing upper trapezius myofasical pain

The contour deformity can develop in women with hypertrophied breasts due to pressure exerted by brassiere straps. However, an ill-fitting brassiere with narrow straps can cut into the trapezius muscle running along the top of the shoulder to the neck and cause the deformity to develop and it developing a upper trapezius pain. Though the deformity may be prevented by using wider and/or padded straps and wearing a correct bra size ^[15]

Wearing a brassiere disturbs the muscle equilibrium of the pectoral girdle. Upper trapezius is the main scapular elevator. The small breast is held in a stable

elevated position mainly by static friction between the brassiere structures and skin. As Brasserie groove deformity increases, static friction increases, elevating more strongly and also elevating skin and subcutaneous tissue posteriorly. The total downward forces on the shoulders are, posteriorly, friction plus posterior tissue weight, and anteriorly, friction plus breast weight. Therefore, upper trapezius was able to sustain this small load but with ischemia, which was below its pain threshold^[2,4]

Upper trapezius myofasical pain was common among the respondents, with a 12-month prevalence of 54.8% and a point prevalence of 43.7%

Bra sizing is traditionally done by determining two specific values: band size and cup size. The compressive effect of the bra straps can lead to narrowing of the arteries in the trapezius muscles. The pressure exerted on the trapezius muscles by the bra. Moreover, the majority of the respondents in the present study were younger women, who have been previously reported to experience more breast bounce than older women when walking.

Increased breast bounce is more pronounced in the vertical direction and may increase the compressive pressure exerted by the bra straps on the upper trapezius, thus increasing the possibility of precipitating ischemia in the blood vessels of the trapezius muscles^[15,17]

In this study the factor that actually affect the upper trapezius myofasical pain were noticed.20.96% female

were complaining a pain when they were wearing bra more than few hours. 27.41% were those who wearing a thin bra strap and 51.61% were those who complaining a pain because of tight bra straps.

Conclusion

This study was conducted to find the correlation between upper trapezius myofascial pain and measured breast size, and to find the correlation between the brassiere group deformity and measured breast size. There is highly positive correlation between measured breast size and trapezius myofascial pain as with increase in bra size, trapezius myofascial pain also increases, as we can see from the result written in chapter no. 5 that $r = 0.815$ which shows high degree of positive correlation between both upper trapezius myofascial pain and measured breast size. The wearing of a wrong-sized bra was common among the respondents, who largely depended on self-selection to determine bra size, rather than using professional bra-fitting criteria. Inadequate support as a result of wearing a wrongly sized bra may have increased the possibility of developing upper trapezius myofascial pain. As BSP increases, static friction

Increases, elevating more strongly and also elevating skin and subcutaneous tissue posteriorly. The total downward forces on the shoulders are, posteriorly, friction plus posterior tissue weight, and anteriorly, friction plus breast weight

After the positive correlation of measured bra size and VAS scale. We were correlate the measured bra size and brasserie groove deformity. The correlation coefficient between the tape measured size and deformity is $r=0.232$ and it is positively correlated that heavy breast size have a brasserie groove deformity. Due to tight bra straps and heavy breast size there is depression occurs between the neck and shoulder junction. The deformity is more likely observed in women with large, heavy breasts, it can affect anyone.

Ethical Clearance- Participants gave informed consent before taking part.

Source of Funding- Self

Conflict of Interest – Nil

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