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Comparative effectiveness of mulligan's mobilization in weight bearing and non-weight bearing in the treatment of ankle sprains- a randomized clinical trial

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Abstract

Purpose of study: To compare the effectiveness of Mulligan's mobilization in weight bearing and non-weight bearing in the treatment of ankle sprains.

Material and Methods: 30 subjects with the clinical diagnosis of ankle sprains were randomly allocated to two study groups. Group A subjects were treated with the RICE protocol (Rest, Ice, Compression and Elevation) and Mulligan's mobilization in weight bearing. Group B received RICE protocol and Mulligan's mobilization in non-weight bearing. The treatment was given for 10 consecutive days. The outcome was measured in terms of visual analogue score, range of motion at the ankle and the Foot and Ankle Disability Index.

Results: There was significant difference between the subjects treated with movement with mobilization (MWM) in weight bearing (WB) and subjects treated with MWM in non-weight bearing (NWB) in terms of pain relief measured by VAS score (p=0.0265), active plantarflexion range (p=0.0294) and the functional ability as per the Foot and Ankle Disability Index (p=0.0326). However there was no significant change (p=0.3586) in active dorsiflexion range.

Conclusion: Weight bearing mobilizations are more effective than non-weight bearing mobilizations in the treatment of ankle sprains.

Key words: Ankle sprain, Mulligan's mobilization, Foot and ankle Disability Index

Introduction

Ankle injuries are a common and recurrent problem around the world. International figures report that ankle sprains which are basically weight-bearing injuries represent 15-20% of all sporting injuries, and about 10% presentations to accident and emergency departments[1]. According to Brookes et al (1981), the incidence of lateral ankle sprains is approximately 1 per 10,000 people per day[2].

Ankle sprains can be classified according to the severity, the level of injury, the ligaments involved and time duration since the incidence of the injury[3]. As per the severity they are classified into grade 1(ligaments not actually torn), grade 2 (partially torn) and grade 3 (fully torn). As per the level of injury, there are two types of ankle sprains; the high and the low level sprains[4]. Depending upon the ligaments involved Type 1 sprain involves partially torn ATFL, type 2 involves torn ATFL and intact CFL and in type 3 there is tearing of the ATFL and CFL[5].

According to the time duration there are three stages of ankle sprains. First or acute stage involves traumatic reaction immediately following the trauma; the first 24-48 hours. Second or sub-acute stage is from the second day to 6 weeks and is the period of repair. Third or chronic stage lasts after 6 weeks to 2 months in which there is adherent scar tissue[6].

Treatment varies according to the grades and duration of the injury. It is generally accepted that grades 1 and 2 ankle sprains are best managed with rest, ice, compression and elevation (RICE). Protected weight bearing or non-steroidal anti-inflammatory and various types of soft bracing and or taping may also be used in early phase of management [6]. Surgery is generally agreed upon in Grade 3 ankle sprains.

Functional treatment appears to be the treatment of choice for all grades of soft tissue ankle injuries. This involves using rigid or semi-rigid bracing, taping and elastic bandage to facilitate early weight bearing and mobilization. Other interventions are used to facilitate the healing process and to regain mobility, strength and coordination[1].

Physiotherapists frequently use manipulative therapy techniques to heal dysfunction and pain resulting from ankle sprains[7]. Clinicians frequently use Mulligans technique treatment to improve range of motion and alleviate pain. The mobilization with movement (MWM) treatment approach for improving dorsiflexion post ankle sprain combine a relative postero-anterior glide of the tibia on talus with active dorsiflexion movement preferably in weight bearing (Mulligan, 1999). Chance of rapid restoration of pain free movement are generally associated with MWM techniques (Mulligan's, 1993, 1999, Exelby, 1996)[7].

Hence this study was undertaken to compare the effectiveness of two Mulligan's mobilization technique that is weight bearing and non-weight bearing after an ankle sprain.

Methodology

Source of data

The source of data for this study was the Physiotherapy

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department of K.L.E.S. Prabhakar Kore Hospital and Research Center, Belgaum.

Study design

It was a randomized clinical trial study for which the ethical clearance was granted by the institutional ethical committee.

Subjects

Thirty male and female subjects referred to the physiotherapy department with a clinical diagnosis of unilateral ankle sprain with a symptom duration for more than 7 days.

Inclussion criteria

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

a. Aged between 15-45 years of age.
b. Sub acute ankle sprains.
c. Grade 2 ankle sprains.
d. Those who are willing to participate in the study.

Exclusion criteria

a. Subjects with previous injury to the back, hip, knee or major injury to the ankle in previous two years[8].
b. Subjects with previous experience of Mulligan's mobilization were also excluded in order to facilitate blinding[8].

Procedure

After the informed consent the demographic data, pain intensity in terms of visual analog scale (VAS), available range of motion at the ankle joint in terms of goniometry and functional assessment based on Foot and Ankle Disability Index were noted prior to the intervention on the first day. After this the subjects were randomly allocated to either group A (MWM in WB) or group B (MWM in NWB).

Mulligan's MWM in weight bearing for ankle sprains

Mulligan's mobilization in weight bearing (Figure 1) was applied in standing with the therapist stabilizing the foot. A non-elastic belt which passed around both the distal leg of the subject and the waist of the therapist, was used to apply a posteroanterior glide of the tibia by a backward lean of the therapists body. Then the subject was actively asked to do the movement. This was sustained for 10 seconds. This process was repeated 4 times in succession followed by a 20 second rest period for each treatment set.

Figure 1: MWM IN WB

Mulligan's MWM in non-weight bearing for ankle sprains:

Mulligan's mobilization in non-weight bearing (Figure 2) applied in supine with the tibia resting on the treatment bench and the ankle and foot unsupported off the edge of the table. Mobilizations were applied the same way as in above technique. The process was repeated 4 times in succession.

Figure 2: MWM IN NWB

Treatment was continued for ten days in the similar manner. VAS scores, range of dorsiflexion and plantarflexion and FADI scores were obtained on the first day and the tenth day and were compared.

Results

The results of this study were analyzed in terms of pain relief by VAS, Range of motion at the ankle joint and the functional ability by Foot and Ankle Disability Index.

Statistical analysis

Statistical analysis was done by the Graph Pad Prism software. Statistical measures such as unpaired 't' tests and paired 't' tests were used to analyze the data. The results were concluded to be statistically significant with $p< 0.05$.

Paired 't' tests were used to compare the differences of scores on day 1 and day 10 within a single group. Unpaired 't' tests were used to compare differences between the two groups, WB group and the NWB group.

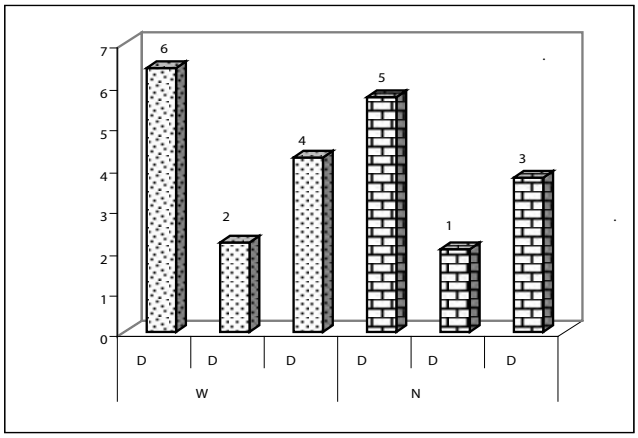
Demographic profile

Thirty subjects were studied out of which 16 were females and 14 were males. Weight bearing group consisted of 8 females and 7 males. Non-weight bearing group consisted of 8 females and 7 males as well. Age of the subjects participated in this study was between 15 years to 45 years. The mean age of WB group was 26.07 years with SD $\pm$ 7.11, the mean age of NWB group was 24.20 years with SD $\pm$6.82. WB Group subjects were having mean weight 63.53 kgs with SD $\pm$13.24. NWB Group subjects mean weight was 63.67 kgs with SD of $\pm$11.20.Mean height of WB group was 160.80 cms with SD of $\pm$11.46. In NWB Group the mean height was 156.60 cms with SD $\pm$ 11.86. Mean BMI of WB group was 24.33 with SD of $\pm$ 3.02. In NWB Group the mean BMI was 25.19 with SD $\pm$ 3.10.

Pain relief

The average pain relief in terms of VAS score for MWM in WB was 4.25 ± 0.73 and in MWM in NWB was 3.72 ± 0.48. There was statistically significant difference (p=0.026) in pain relief (Graph 1) obtained due to MWMin WB and MWM in NWB.

Graph 1: Pain profile of subjects



Ankle joint mobility

The average increase in active plantarflexion was 10.67 ± 3.72 with MWM in MB. The average increase in active plantarflexion was 8.00 ± 2.54 with MWM in NWB. There was a statistically significant difference (p=0.0294) in the active range of plantarflexion in subjects treated with MWM in WB and NWB positions.

The average increase in active dorsiflexion was 6.33 ± 3.52 with MWM in MB. The average increase in active dorsiflexion was 5.13 ± 3.52 with MWM in NWB. There was no statistical significant difference (p=0.3586) in the active range of dorsiflexion in subjects treated with MWM in WB and NWB positions.

Foot and ankle disability index

The average increase in the FADI score was 17.13 ± 5.97 with MWM in MB. The average increase in the FADI score was 12.67 ± 4.85 with MWM in NWB. There was a statistically significant difference (p=0.0326) in the FADI score (Graph 2) in subjects treated with MWM in WB and NWB positions.

Graph 2: Mean fadi score

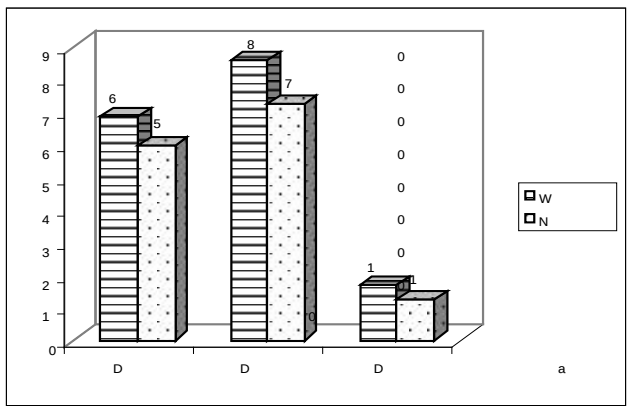


TABLE NO. 1: Clinical outcome

Study Group	Mean pain relief in Vas (cm s)	Mean Dorsiflexion (Degrees)	Mean Plantarflexion (Degrees)	Mean Fadi
MWM IN WB	4.25 ± 0.73	6.33 ± 3.52	10.67 ± 3.72	17.13 ± 5.97
MWM IN NWB	3.72 ± 0.48	5.13 ± 3.52	8.00 ± 2.54	12.67 ± 4.83

Discussion

The results of this study showed that movement with mobilization in weight bearing position is clinically better mobilization option than movement with mobilization in non-weight bearing position (Table 1).

This could be due to the fact that movement with mobilization in weight bearing position resembles more like the functional movements performed during the activities of daily living such as standing, walking, jogging and running. In addition to this weight bearing probably allows correction of underlying pathology such as malposition.

The results of this study are in accordance with the study done by B.Vicenzino, I Prangly and D. Martin at the University of Queensland in Australia. However in their study they used only the range of motion measured in weight bearing and non-weight bearing as the outcome measure.

In the present study besides the range of motion, the pain relief in terms of VAS and the FADI was used as an outcome measure. The FADI is designed to assess functional limitations related to the foot and the ankle conditions and is believed to be a global measure of foot ankle disability as it is reliable and sensitive measure[9].

Few limitations of this study included small sample size, no long term follow up due to time constraints and the study population involved both athletic and non-athletic subjects unevenly in both the groups which could have given varying results. Also the active range of inversion and eversion was not considered to be an outcome measure.

Hence it is recommended that similar study be performed with larger sample size with a long term follow up and also with homogenous study populations.

We also recommend to include active range of inversion and eversion should also be measured as an outcome measure.

Conclusion

On the basis of present study it can be concluded that movement with mobilization in weight bearing is a better treatment option than movement with mobilization in non-weight bearing in the treatment of ankle sprain.

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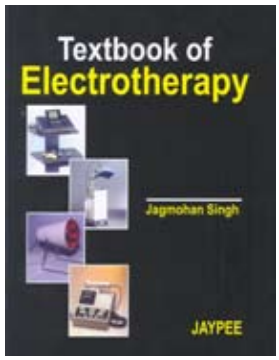
BOOK REVIEW

by Editor, IJPOT



Text book of Electrotherapy by Jagmohan Singh published by Jaypee Brothers Medical Publishers(P) Ltd New Delhi First Edition 2005 ISBN 81-8061-384-4 Price Rs 275/ pages301

This book has been designed to cater long pending demands of students of BPT. Besides, this book is also useful for practicing physiotherapists, doctors, teachers, rehabilitation professionals and public. The book has been prepared as per curriculum of BPT.the book gives a complete coverage of subject describing the most common modalities employed by physiotherapists.

The book has been divided into eleven chapters like basic electricity, low frequency currents, medium frequency currents, high frequency currents, radiation therapy, laser therapy, superficial heating modalities, ultrasound therapy, cryotherapy, bio feedback and electromyography. The book gives latest therapy and their descriptions.

The book is well written and is in simple language to understand. The printing and quality of the book layout is good. It is well supported by diagrams and flow charts. In nut shell a good book for physiotherapist which is reasonably priced.

Effect of Unilateral Visual Neglect on Activities of Daily Living in patients with stroke

Suvarna Ganvir

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Abstract

Purpose of the study: Physical impairment in stroke patients is related to poor outcome. UVN is a common deficit found in patients who have had right hemisphere stroke. It has been found to be among the factors predicting the poor functional recovery. It is measured usually in terms of strength, coordination, voluntary control, balance. But none of the studies have been found to correlate UVN with the functional activities. Now the focus of rehabilitation changed from attending the recovery in terms of strength power coordination to improving the quality of life. Hence it is necessary to evaluate quality of life which can be done in terms Activities of Daily living. Therefore this study is taken up to measure the effect of UVN on ADLs in patients with stroke.

Methodology: The study consisted of two groups, A with UVN & B without UVN. There were 30 patients in each group. In each group there were 26 RBD Stroke patients.The subjects were excluded if they could not give an informed consent & had clinically significant fluctuations in the mental status in 48 hours before the enrollment. Also the patients were assessed for Activities of Daily living with the help of Barthel Index. The demographic variables along with side of lesion, severity of stroke, cognition, proprioception, visual impairment were also recorded.

Result: There was significant correlation between UVN & ADLs in patients with stroke even though it was the non dominant side extremity that was affected as assessed with spearman correlation analysis(r_s=0.825, $p<0.01$)The baseline factors associated with UVN having significant effect were found to be age, side affected, severity of the stroke, & cognition by univariate logistic regression analysis.

Conclusion: There is a strong correlation between unilateral visual neglect & activities of daily living in patients with stroke.

Key words: stroke, unilateral visual neglect, activities of daily living.

Introduction

Stroke is a disease with considerable physical & psychosocial impairments. The physical impairment is related to functional disability resulting in a poor outcome. UVN is a common deficit in patients who have had a right hemisphere stroke .It can disrupt many aspects of daily living. It has repeatedly been found to be among the factors predicting the poor functional recovery in stroke patients.[1]

The focus of rehabilitation has now changed from attending the recovery in terms of strength power coordination to improving the quality of life, applicable to stroke patients as well. The quality of life is measured in terms of functional improvement evaluated with various scales for activities of daily living .The gold standard test for measuring ADLs in stroke patients is Barthel Index whose reliability & validity is well proved[1].

There are various tests used for the measurement of UVN such as Cancellation test that includes star, alphabets structured & unstructured[3] , Line Bisection tests, Baking tray test, CBS etc[4] . Each one has its advantages & disadvantages. Though it is said that the commonly used test star cancellation test can not be used to differentiate between sensory neglectt & motor neglect as it requires both visual search &manual exploration, but still cancellation tests are believed to be have greatest test retest reliability & are often more sensitive for detecting UVN.[4]

Though UVN is said to have significant effect on functional outcome direct studies relating UVN & ADLs [5,6] which is one of the important aspects of functional outcome, are rare.

Hence this study is taken up to investigate the effect of UVN on functional abilities of patients' with stroke using star cancellation test & Barthel Index respectively.

Methodology: 100 patients with stroke in the acute phase i.e. within one month of the onset of the condition according to the stroke & Heart Foundation of the Canada were included in the study. The severity of the stroke was assessed with the help of NIHSS scale to maintain the uniformity of the patients that were included in the study. Patients with both RBD as well as LBD were included. Other inclusion criteria being

1. An ischemic or hemorrhagic stroke (with or without confirmatory neuroimaging) within 30 days of admission to inpatient rehabilitation.
2. Evidence of preserved cognitive function intact abi;oity to follow commands
3. no major deficit in the upper limb on the non paretic limb

Subjects were excluded if they-

1. Could not give informed consent.
2. Had clinically significant fluctuations in mental status in the 48 hours before enrollment.

Patients were explained about the procedure of SCT .It is a pen & paper test for the detection of the Unilateral Visual Neglect .On A4 sheet 52 large stars, 10 short words, &13 letters randomly positioned with 56 small stars interspersed

among them. The small stars are the target items whereas the other symbol acts as the distracters. The words & letters acting as the distracters were in the patients native language .The patients were instructed to cross out all eh small stars across the page. The procedure was demonstrated to the patients by crossing out two middle stars & so the score was calculated from out of 54. The numbers of stars crossed were noted & a cut off score of 44 was decided to label the patient having UVN. Scanning pattern was also recorded during the test by tracing the sequence in which the patient cancels the stars. This was done by giving different colored pens for every 10 cancellations. The order of the colors used was maintained the same for all the patients. The activities of daily living were assessed with the help of Barthel Index. The Barthel Index has a good reliability & validity & is widely used in the research studies.

Result: 100 patients in the medicine ward were assessed for UVN. 30 patients were found to have UVN when tested with SCT. The mean duration between onset of stroke & assessment was 15 days.

Univariate Analysis of the factors associated with UVN

Socio demographic variables		With UVN	Without UVN	P	O.R.	95%C.I.
		30(30%)	70(70%)			
Age	51-60 yrs	20	42	<0.05	2.03	
	61-70yrs	10	28	<0.01	6.09	2.42,15
Gender	Male	24	56	NS	0.52	0.20,1.45
	Female	06	14	NS	1.00	
Brain Damage	RBD	25	59	0.05	1.88	1.04,3.13
	LBD	05	11	NS	0.66	0.20,2.45
Side affected	Dominant	06	11			
	Non Dominant	24	59	NS	15.7	1.89,13.9
Clinical Variables						
NIHSS	Mild	14	19			
	Moderate	16	26	<0.01	2.96	1.57,2.38
	Severe	10	15	<0.05	7.10	2.66,3.46
Cognition	Affected	20	45		1.68	
	Un affected	10	25	NS	1.00	0.87,1.23
Proprioception	Affected	21	58		0.84	0.47,1.25
	Unaffected	09	22	NS	1.00	
Visual Impairment	Present	22	58		1.00	0.50,3.2
	Absent	08	22	NS	1.28	

Out of 30 patients 25 were right brain damage accounting to 80% of the prevalence of UVN in RBD patients. A step wise multiple regression analysis was under taken with Barthel Index as a dependent variable and age, sex, side affected, strength, balance, proprioception, cognition & neglect as an independent variable. Of all these only neglect showed a significant association with the Barthel Index score. Also comparison was done between RBD & LBD patients with UVN. The dominant side in 5 LBD patients was right. The parameters like age, sex, side affected, strength, balance, proprioception, cognition were comparable in both groups. It was found that there is no significant correlation between barthel index & the side affected .Also comparison was done in RBD & LBD patients without UVN based on the scores of Barthel Index . It was found that side affected does not affect the Barthel Index score given that the other parameters mentioned above were comparable & there was no significant difference between the two groups.

Discussion

The present study shows significant correlation between UVN & Activities of daily living irrespective of the side affected. This shows that the UVN has a added negative effect if the dominant side is affected leading to greater disability.

In the present study it was found that 30% of the patients were suffering from Unilateral Visual Neglect. In the literature there are varying rates of occurrence of UVN the contributory factors being different sampling techniques that area used ,improper definition of the lesion site, duration of the condition i.e. the time at which the USN/UVN was assessed, use of different methods of assessment [7]

The author of this study has taken care of the maximum factors so the 30% prevalence rate can be accepted. The author of this study has tried to explore the factors associated with UVN so that while selecting the patients for the research purpose these can be taken into account.

Age had an important bearing in the presence of UVN. It was more frequently seen in the elder age group i.e. between 61-70 yrs. This may be due to the fact that as age progresses, more degenerative changes are expected to occur at the CNS level [8]

Gender did not have a significant effect on the prevalence of UVN.

RBD patients showed more prevalence of UVN as compared to LBD in accordance with the previous studies.

The reason being right brain plays an important role in the spatial processing [9].

Severity of the stroke greatly affected UVN. More severe the stroke more was the prevalence of UVN. It was measured with NIHSS which has shown to have good correlation with the exact extent of the lesion as shown by sensitive investigations such as CT, MRI. [10]

Cognition also plays an important role in sensory perception of the stimuli. in the present study cognition was assessed with the help of MMS .UV N was more closely associated in patient with cognitive impairment than without it. This suggests that along with techniques to improve neglect due emphasis should be given on cognitive assessment & treatment.[8]

Visual impairment was present in maximum no of patients included in the study. But that did not affect presence of UVN. The visual impairment was more because of age related changes.

Limitations of this study can be in the form of unavailability of the investigations to know the extent of the lesion. But this in part is replaced by the use of the NIHSS which closely relates with the severity of the disease. Another limitation of the study is that impact of apraxia is not taken into consideration which might have an additional effect on UVN. Also SCT recognizes USN in near extra personal space which can not detect all the difficulties that can be encountered in activities of daily living . So results can be more convincing if other test are used for the detection of UVN which eliminate this deficiency.

In the study I found that there is a strong correlation between UVN & ADLs .The contributory factors off the factors affecting UVN being age, cognition,& proprioception.

Improving QOL of stroke patients has received increasing attention in the development of therapeutic strategies. The QOL depends on the ability of the person to do the activities of daily living.

The strong correlation between UVN & ADLs suggests that quality of life will be compromised in the presence of UVN . Hence the rehabilitation of these patients needs to concentrate on cognitive therapy & proprioceptive training in these patients.

Conclusion

Taking into consideration that UVN is affected by the factors such as age , RBD severity of the disease & cognition . UVN is strongly correlated with Barthel Index.

These factors should be given a due cognisancewhile treating patients with UVN.

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The effect of play therapy over conventional therapy in improving the hand function of spastic diplegic cerebral palsy children

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Abstract

Background and objective: Play therapy has become an important part of physiotherapy treatment program to improve functional outcome in children with cerebral palsy. This study is to examine the effectiveness of play therapy together with conventional therapy to improve the hand function ability in children with spastic diplegic cerebral palsy.

Methods: 30 spastic diplegic cerebral palsy children were divided into two groups, Group-I received conventional physiotherapy alone where as Group-II received play therapy and conventional therapy (n=15) both. The treatment was given 3 days a week for 6 weeks continuously for both the groups.

Results: After the treatment period Group II who received play therapy in addition to conventional therapy scored significantly higher on the Box and block test and Nine hole peg test for grasp and release showing $p<0.05$.

Conclusion: Play therapy along with conventional physiotherapy was found to be much effective in improving the hand function in children with spastic diplegic cerebral palsy. This study may help the physiotherapist to utilize and evaluate the functional outcomes using play therapy in cerebral palsy children.

Key words: Spastic diplegic cerebral palsy; Play therapy; Conventional physiotherapy; Box and block test; Nine hole peg test.

Introduction

Cerebral palsy is caused by static lesion to the developing nervous system, resulting in motor and possibly sensory abnormalities, former estimated 85% and latter in 15% of the cases[1]. The definition of cerebral palsy cited by Christensen and Melchior (1967) "as a persistent but not unchanging disorder of movement and posture" is as appropriate today as it was over 25 years ago[2]. The incidence and prevalence of CP is considered to be 2/1000 live births. In addition to motor deficit, other associated handicaps are frequently present. These include abnormalities of vision, hearing and speech, seizure disorders, mental retardation, learning disabilities and frequent social, emotional and interfamily problems[3]. The range of severity may be from total dependency and immobility to abilities of talking, independent self-care, walking& running and other skills although with some clumsy actions[4].

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Besides neuromuscular components the motor dysfunction has musculoskeletal components. The clinical signs associated with cerebral palsy vary in type as well as topography and hence has two means of classification, by type and by topography. Classification by type is neither uniform nor clear-cut, and a mixture of types is often found in the child. The commonly accepted categories are spastic, athetoid and ataxic. Topographical classifications are an attempt to desirable what is seen clinically according to the part or parts of the body involved[4].

A small percentage of children who show signs of neuromotor developmental delay in infancy outgrow their impairments and become completely normal gradually. Others are left with neurological impairments ranging from mild to severe. There is no permanent treatment for cerebral palsy, hence early intervention programs are necessary in children where impairment exists. It is easier to predict a functional prognosis once the clinical picture is established[5&6].

Treatment should begin as early as possible. A major part of treatment is aimed at encouraging muscles to grow in accordance with lengthening bones, and limbs to grow symmetrically. Treatment should at least continue throughout the growth years[4]. Many treatments techniques are used nowadays, not only to improve hand function but to improvise the children in a globalize view. The physical therapy treatments plan includes conventional as well as the recent trends like Neurodelopmental therapy, Vojta's technique, conductive education, and many more to name[7]. Conventional methods like icing and stretching are usually applied to the children with cerebral palsy.

Icing is preferred in spastic type of cerebral palsy with a main aim of relaxing the spastic muscles and therby reducing the tone. **Semenova KA, *et al* (1986)** performed a study on cryotherapy in the complex restorative treatment of children with spastic diplegic, hemiparetic, hyperkinetic infantile cerebral palsy children. Cryo applications were given to the hands. Results showed reduction in muscle tone and increased functional possibilities[8]. Research findings indicate that children with cerebral palsy have hyper tonus or hypotonic muscle weakness. However, weakness has long been recognized as a clinical characteristic in spastic cerebral palsy[9].

Apart from the techniques mentioned above, play therapy is among one of the recent advances in physical therapy.

Play therapy requires the knowledge of development as well as an understanding of play as means of treatment. It facilitates the motor performance to be learned. **Reilly (1974)** described play along a continuum leading to work and leisure. Children learn skills and develop interest through play that affects the latter choices and success in work. Play is the arena for development of sensory integration, physical abilities, cognitive and language skills, and interpersonal relationships. In their play, children practice adult and cultural roles and learn to become productive member of society[10].

Recently the emphasis has been more on play as an experience or state of mind and also for the treatment purpose. This seems to be more helpful when considering a balanced life.

By integrating therapy sessions with play, the therapist promotes interaction with the environment and mastery of new skills, and develops risk-taking, problem-solving, and decision-making abilities. A child absorbed in play is not focused on the specific motor demands of the activity, and can be stimulated to use appropriate movement to improve head, trunk and extremity control during play[10].In a study by **Couch (1996)**, pediatric therapists were asked if they felt play was important in a treatment and how they used play. 97% of the therapist rated play as a very important tool of treatment. In treatment, 95% used play as modality, primarily to elicit motor, sensory, or psychosocial outcomes. Whereas only 2% used play as outcome by itself[11].

Play therapy can be used for many purposes in the cerebral palsy children. But in this study has precisely concentrated on the hand function. Impaired hand function is a major disability in spastic cerebral palsy children. As a result, children with cerebral palsy often fail to use the upper extremities and learn to perform most tasks.

Skilled hand movements, involving independent finger movements, usually develop poorly in children with cerebral palsy. Such children typically learn to grasp with the whole hand, slowly and with excessive force for the. Impairments were found particularly in reciprocal and rapid alternating movement, in actions acquiring fractionation of movements and in bimanual actions[12].

Deficits in grasping are common and seem to reflect difficulty timing grasp and release, coordinating wrist extensor and long finger flexor muscles for grasping manipulation , and adapting muscle force to load. **Jeannerod (1986)** filmed two children with hemiplegia as they reached to grasp a prong from a pegboard. In the child aged 23 months, while contact of the normal hand with the object was followed immediately by grasp, the fingers of the affected hand remained extended and a clumsy grasp occurred after the contact with the object. The other child aged 5 years, showed a different pattern of grip formation in the affected hand when compared to the normal, with abnormal finger posturing and a clumsy grasp. Interestingly, he reports that the first child did not use the affected hand until the other hand was immobilized, and then only with difficulty[13].

There was also a study performed to analyze the load forces of the grip affected in cerebral palsy. **Elisson and colleagues (1991)** found with a group of 12 children, aged between 6 and 8 years of age with hemiplegia or diplegia, that they lacked the coordination or coupling between grip force and load force normally achieved by the second year of life. Force generation was excessive in amplitude and the children generated grip force n advance of load force in similar manner to young children. The authors suggested that the children lacked the ability to use both anticipatory control and sensory feedback. They also suggested that the high grip forces generated might be adaptive- a compensatory mechanism providing a wide safety margin in order to prevent the object from slipping. The authors found that the grip coordination of the diplegic children was better than that of the children with hemiplegia. This view is supported by the studies of different pathological mechanism of these two types of CP. Although impaired sensory mechanism may have caused deficits in motor performance, it seemed unlikely that an impaired sensory mechanism would have been the main cause of the poor coordination between grip and load force. In a subsequent study of the same children, it was found that they were able to adapt their grip force to the actual weight of the object. This suggests that the timing of the force output could be modified to some extent, by the feedback mechanism[14].

Control of the path of the hand in reaching is often difficult, due to control deficit and lack of extensibility in soft tissues. **Forsstorm and Von Hofsten (1982)** investigated reaching to catch a moving target in a group of children aged between 4 and 11 years with a diagnosis of minimal brain dysfunction. They found that the approach path were more devious than those of normal controls. However, by aiming at a point further ahead of the target, the children seemed to take into account their lack of efficiency, and by this strategy caught the ball on most attempts. This gives enough understanding of the importance of the hand function and how it cam be manipulated in spastic diplegic cerebral palsy children with use of various techniques[15].

Thus with all the support acquired from various literatures, attempts have been made in the present study to analyze the effects of conventional methods with Play therapy to improve the hand function in children with spastic diplegic cerebral palsy. The purpose of this study is to investigate more extensively the use of play therapy in enhancing hand function along with conventional therapy and thus providing a better outcome functionally. This provided the focus for the present research.

Material & method

Study design

Experimental study with same subject design in nature involving the comparative analysis of play therapy along with conventional therapy with conservative treatment to improve hand function in spastic diplegic cerebral palsy children.

Study setting

This study was conducted in the following centers:

1. Goutham Physiotherapy & Rehabilitation Centre, Bangalore
2. Arun Chetna - School for Children with Special Needs,

Bangalore
3. St. Joseph Nivas- School for special children, Bangalore.

Sample selection

30 subjects (both boys and girls) aged between 3-7 years were selected based on selection criteria by means of convenient (purposive) sampling and divided randomly into 2 groups, namely Group I and Group II with fifteen subjects each. All these subjects participated in the study voluntarily, after signing a consent form by their respective guardians or parents. The demographic data was collected from each subject and the purpose of the study was explained to the attenders of the subjects.

The selection criteria are listed below:

Inclusion criteria
- Children diagnosed medically as spastic cerebral palsy falling under grade I spasticity according to Modified Ashworth scale.
- Both boys and girls
- All children who have achieved up to the fine motor milestone of extended reach and grasp.
- Age group of 3 to 7years.

Exclusion criteria
- Recent trauma in upper limb
- Children with any other neurological disorder.
- Children with cardio vascular disorder.
- Children below 3 years and above 7 years.
- Children with other type of Cerebral Palsy.

Materials used
1. Treatment Couch
2. Treatment Table
3. Chair
4. Ice pack
5. Velcro straps
6. Pair of Scissors
7. Small plastic toys
8. Water tub
9. Wooden puzzles
10. Clay
11. Blocks
12. Peg board frames
13. Sand
14. Sponge
15. Papers
16. Box and blocks
17. Nine hole peg board
18. Stop watch

Measurement tools

Functional Test - Hand function will be used as a parameter for the study and it will be analyzed using the following functional tests for hand.

- Box and Block Test: A box is placed lengthwise at the edge of the table with 150 blocks. Subject is given 15 seconds trial and then the testing period of 60 seconds to move the block from one side of the partition to the other.
- Nine Hole Peg Test: This test involves the subject placing nine dowels in nine holes. Subjects are scored on the amount of time it takes to place and remove all the nine pegs.

Procedure

Thirty spastic cerebral palsy children (both males and females) were selected based on inclusion and exclusion criteria and were divided into 2 groups namely Group-I and Group-II. The Subjects will be selected by convenient sampling method for both the groups.

All of these subjects were assessed using a general pediatric neurological proforma (Annexure I) and the pre test measurements of the Box and block test and Nine hole peg test, were recorded. The Group-I subjects were given conventional therapy alone and Group-II were treated with play therapy along with conventional physiotherapy.

Conventional therapy

(for both the groups I & II)

GROUP I will be taken as the control group where subject will be treated with routine conventional physiotherapy methods like:

Conventional therapy (for both the groups)
1. Icing on long flexors of forearm.
2. Stretching of long flexors of forearm.
3. Sponge ball exercises for hand.

All the subjects of Group **I** & Group **II** were treated with cryotherapy (Ice packs) for 3-4 minutes followed by gentle passive stretching for 30 seconds. Preceding these active assisted movements was given to each joint for 10 repetitions. The patient was positioned in supine with adequate pillow support for maximal comfort.

Following this, ice pack wrapped in a towel fastened in position by means of velcro strap was applied in close approximation to the skin overlying the muscle belly of long flexors of hand for 3-4 minutes. Following this icepack application gentle passive stretching was given to the muscle of long flexors of hand and the stretch was maintained for 30 seconds. Active assisted movement of wrist flexion and extension was then given for 10 repetitions.

Cryo applications were also given to the elbow flexors (belly of biceps brachii muscle) for 3-4 minutes followed by their gentle passive stretching. The stretch was maintained for 30 seconds and active assisted movement of elbow flexion and extension was then given for 10 repetitions[8, 16].

After the cryotherapy and stretching, sponge ball exercise is given to the subject for around 5-7 minutes. Subject was seated on the chair with a tub of luke warm water and sponge immersed in it, which was placed on a stool. The subjects were instructed to perform squeezing of the sponge with the hand immersed within the tub of water.

Play therapy

(only for group II)

GROUP II considered to be the experimental group will be given the above mentioned routine physiotherapy along with following play therapy exercises:

1. Make hand impressions in play dough: The subjects were seated on the chair with the table in the front. Playing dough was placed on the table. The subjects were instructed to put impressions of their hand on the dough. 10 repetitions were performed by the subjects.
2. Roll play dough to ball and snakes: With the subject in sitting position and table in the front with dough on top, the subjects were asked to mould the dough in shapes of balls and snakes. Ball shape was made by rolling the piece of dough between the surfaces of the palms of the subject. And the snake shape was made by rolling the piece of dough between the surface of the palm and the table top. 5 balls shapes and 5 snake shapes were made by the subjects.
3. Cut with scissors: The subjects were given sheets of old newspapers and a pair of scissors. Then they were instructed to cut those newspapers in different shapes like, thin strips, broad strips, zigzag shape and curved lines. 10 of each shape were cut.
4. Play in water with toys in sink or tub: Subject in sitting position with the tub filled with water placed in front on the stool. Within the tub small toys were kept. The subjects were instructed to toss and turn the toys making whirlpool with the hand. This activity was performed for around 5-7 minutes.
5. Play with wooden puzzles: Wooden puzzles of different sizes, shapes and colors were given to the children. They were instructed to sort the puzzles into the respective sockets according to the size, shapes and colors.
6. Play with clay, blocks and pegboard frames: Clay was given to the children an instructed to make simple objects with it. Different sizes of blocks were given and children were asked to make tower of those blocks. Using the pegboard frames the children were asked to place the pegs into their respective sockets on the board.
7. Play in sand: A small tub filled with sand was given to the children and were instructed to play with sand making hand impressions, mountains of sand and ball of sand.
8. Pick up and sort small and clay objects: In the tub many different sizes, shapes and colors of objects made out of clay were kept. The children were instructed to sort out each object according to the sizes, shapes and colors.

The Participants are given play therapy for 15-20 minutes daily 3 times per week for 6 weeks.

For both the groups to assess the hand function, the child was asked to perform the Box and Block test and Nine hole peg test. The procedure was repeated twice for reliability factor.

The reading of Box and block test and Nine hole peg test were measured before the treatment and at the end of six weeks respectively for both the groups.

Data analysis

The software used for the data analysis was, SPSS (11.0) and Systat (8.0). In this study, the two groups were compared for the significant difference to infer the effectiveness of Play therapy along with conventional therapy over Conventional therapy alone for spastic diplegic cerebral palsy children.

The statistical tool used in this analysis was independent't' test. The differences between the value of pre test and posttest were found. It was done for the values taken before and at the end of six weeks respectively. The mean difference of the Box and block test and Nine hole peg test of Group I were compared to Group II and the actual pattern of variations in all the categories were observed.

With the acquired't' values from the pre tests and posttests, the accurate level of significance was analyzed and interpreted. An alpha level of $P<0.001$ was the level of significance of the test.

Also a dependent't' test was performed to analyze the efficacy of treatment within the groups.

Results & interpretation

Thirty Spastic diplegic cerebral palsy subjects with a mean age of 5.23 years were selected for the study. The mean, variance and standard deviation values of the age groups according to the distribution of the sex are shown in Table-1.1 & 1.2

TABLE- 1.1 Mean, variance & standard deviation values of age in group-i

SEX	N	MEAN	VARIANCE	SD
Boys	9	5.22	1.94	1.39
Girls	6	5.33	2.66	1.63
Total	15	5.26	2.06	1.43

FIG- 1

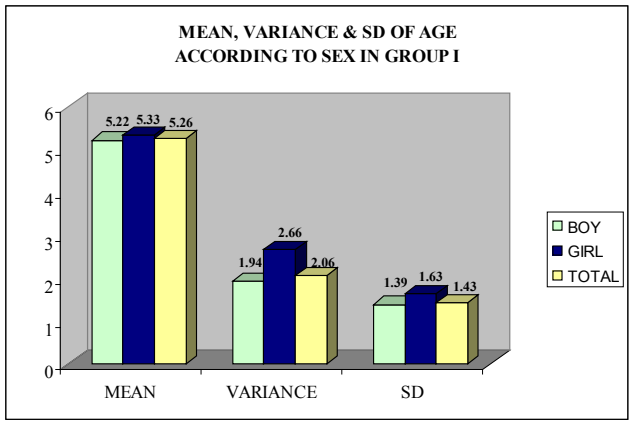
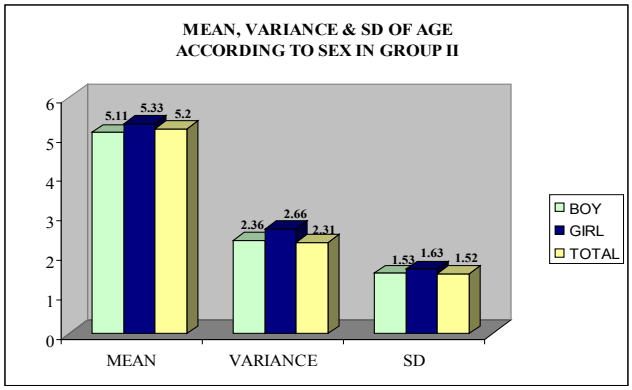


Table- 1.2 Mean, variance & standard deviation values of age in group-ii

SEX	N	MEAN	VARIANCE	SD
Boys	9	5.11	2.36	1.53
Girls	6	5.33	2.66	1.63
Total	15	5.2	2.31	1.52

Fig- 2



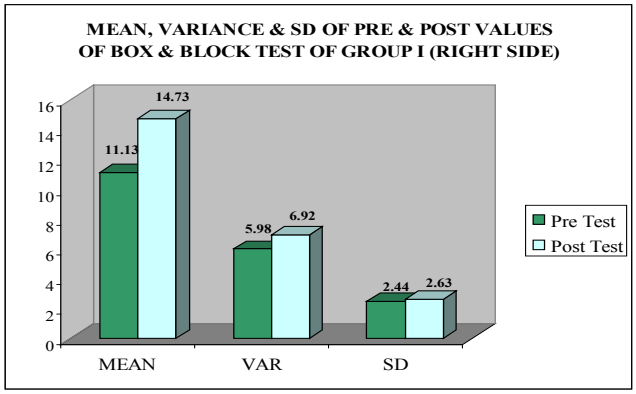
Descriptive statistics

The following tables & graphs illustrates the mean, variance & SD values of the different parameters individually, thereby showing the improvement within the group by the respective training procedures.

Table- 2.1 Mean, variance & sd values of pre & post tests for box & block test of group i (right side)

Test	Mean	Variance	Standard Deviation
Pre Test	**11.13**	**5.98**	**2.44**
Post Test	**14.73**	**6.92**	**2.63**

Fig- 3



Table– 2.2 Mean, variance & sd values of pre & post tests for Box & block test of group ii (right side)

Test	Mean	Variance	Standard Deviation
Pre Test	**10.86**	**4.83**	**2.19**
Post Test	**15.13**	**8.12**	**2.85**

Fig- 4

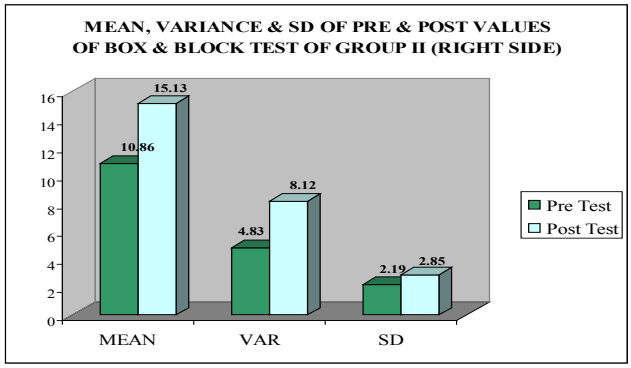


Table -2.3 Mean, variance & sd values of pre & post tests for box & block test of group i (left side)

Test	Mean	Variance	Standard Deviation
Pre Test	10.86	5.98	2.44
Post Test	14.46	5.69	2.38

Fig- 5

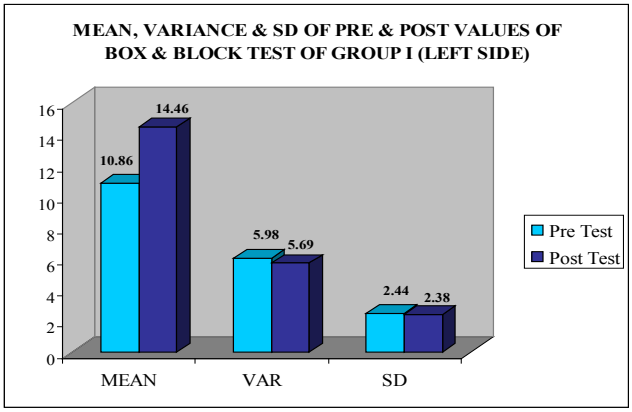


Table- 2.4 Mean, variance & sd values of pre & post tests for box & block test of group ii (left side)

Test	Mean	Variance	Standard Deviation
Pre Test	11	5	2.23
Post Test	15.4	7.82	2.79

Fig- 6

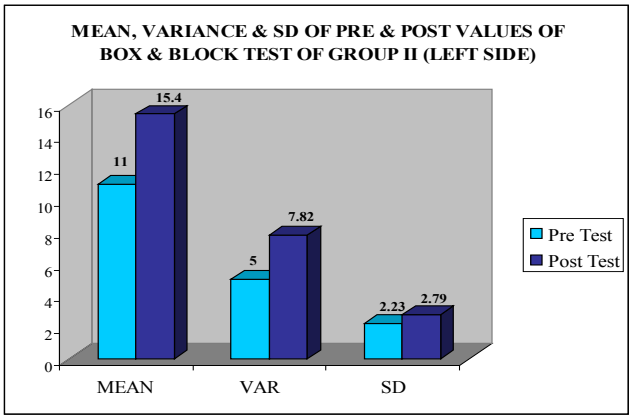


Table -2.5 Mean, variance & sd values of pre & post tests for nine hole peg test of group i (right side)

Test	Mean	Variance	Standard Deviation
Pre Test	41.33	56.95	7.54
Post Test	34.2	54.03	7.35

Fig- 7

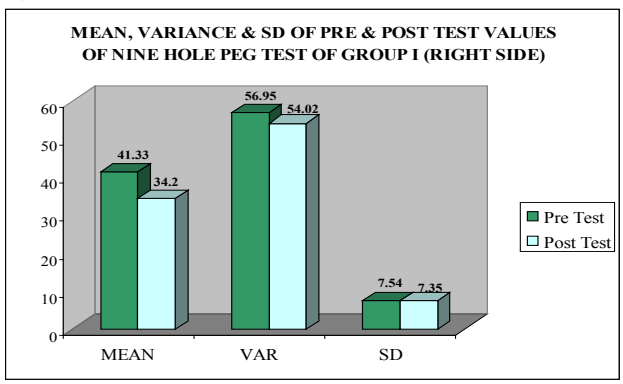
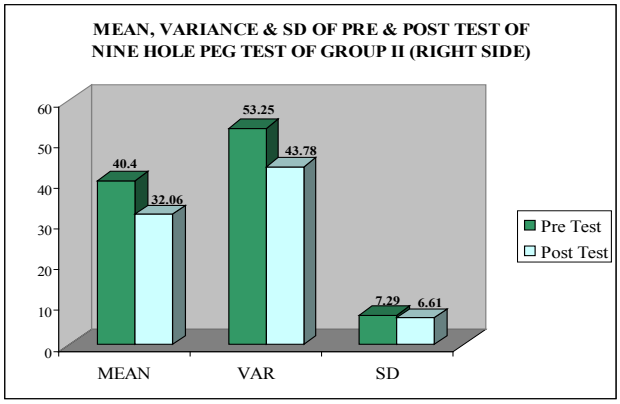


Table- 2.6 Mean, variance & sd values of pre & post tests fornine hole peg test of group ii (right side)

Test	Mean	Variance	Standard Deviation
Pre Test	40.4	53.25	7.29
Post Test	32.06	43.78	6.61

Fig- 8



Table– 2.7 Mean, variance & sd values of pre & post tests for nine hole peg test of group i (left side)

Test	**Mean**	**Variance**	**Standard Deviation**
Pre Test	**41.6**	**55.68**	**7.46**
Post Test	**34.46**	**53.55**	**7.31**

Fig- 9

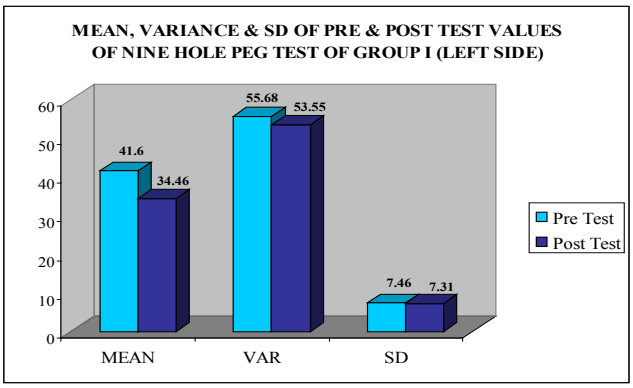


Table- 2.8 Mean, variance & sd values of pre & post tests for nine hole peg test of group ii (left side)

Test	Mean	Variance	Standard Deviation
Pre Test	40.66	57.66	7.59
Post Test	32.2	49.45	7.03

Fig- 10

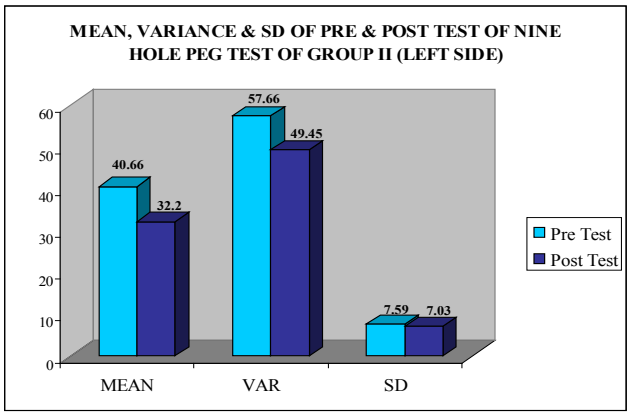
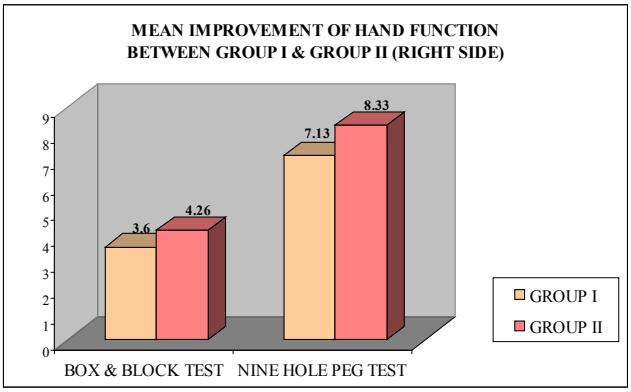


TABLE- 3.1 Mean improvement in the hand function between group i & group ii (right side)

Parameters	Group I	Group II
Box & block test (No. of Blocks/minute)	3.6	4.26
Nine hole peg test (in seconds)	7.13	8.33

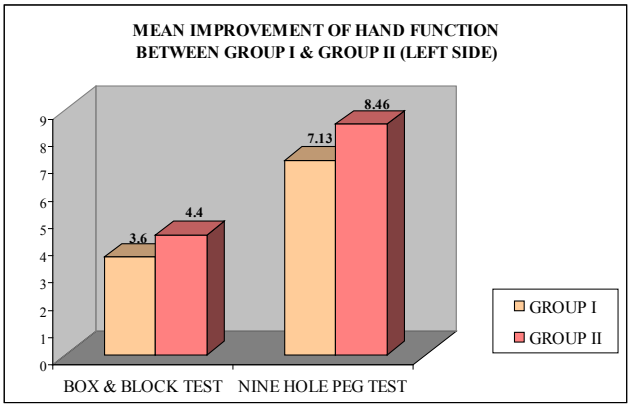
Fig- 11



TABLE– 3.2 Mean improvement in the hand function between group i & group ii (left side)

Parameters	GROUP I	GROUP II
Box & block test (No. of Blocks/minute)	3.6	4.4
Nine hole peg test (in seconds)	7.13	8.46

Fig- 12



Interpretation of statistical results

This study was done with 30 subjects allotted into two groups namely Group I and Group II consisting of 15 each, to know the effectiveness of Play therapy in improving the hand function of spastic diplegic cerebral palsy children.

The parameter used was Box and block test and Nine hole peg test for hand function. It was taken before the therapy and at the end of sixth week.

The data were analyzed using dependent‘t’ test to find the significance of the interventions used within the groups and then an independent ‘t’ test was used for the above mentioned parameter to find the significance between the groups.

The dependent‘t’ test showed significance for both the groups stating Play therapy and Conventional therapy, both were improving the hand function in spastic diplegic cerebral palsy children.

The results were found to be significant with independent't' test at $p<0.05$ with the calculated't' values as 1.799 & 2.0876 (right side) and 2.0856 & 2.6091 (left side) being more than the table values (1.701) for Box & block test and Nine hole peg test scores for the hand function of grasp and release. It stated that there was a significant effect when Play therapy was given along with Conventional therapy than Conventional therapy alone in improving the hand function (grasp & release) in spastic diplegic cerebral palsy children.

DISCUSSION

In this study, totally 30 subjects were selected and assigned conveniently into 2 groups of 15 subjects each, Group-I (Control Group) and Group-II (Experimental Group). Both the groups received conventional physiotherapy and Group-II subjects received Play therapy additionally.

These two groups were analyzed with improvement of hand function as measured with the Box and block test and Nine hole peg test. The mean was calculated and the statistical analysis of the values showed considerable increase in mean improvement for Group-II than the Group-I, which proved that subjects who received Play therapy along with conventional therapy had better outcome than the group who received only conventional therapy.

The natural study on patients did provide a proven insight into distinctions about which mode of treatment between both the groups was better and Play therapy was proven for improving the hand function as measured by the Box and block test and Nine hole peg test. The improvement in the functional parameter in this population provides further evidence that even in a diverse group of people; hand function can be increased through training thereby producing measurable clinical improvement. However there was significant result when an independent't' test was performed to find out the results statistically.

The toys and objects which were chose and the games played actively encourage the action with which the child has difficulty. If a child is offered toys which can be grasped in many different ways, the child will reflect the options provided by the lesion system, thereby stimulating the response[17].

In an experiment, it showed that when a subject holds the ball and lets it drop into a cup held in the other hand, the grip force of the cupped hand increased in the anticipation of the ball's impact. Practice of games like this, it improved the visual, tactile and motor processing and also the ongoing adjustment of the grip force[18].

These results strongly support the studies done by **Smith J et al (2000) & Schaff RC (1990)** which states that play therapy enhances the fine motor outcomes in spastic cerebral palsy. This study was done with boys and girls and all the patients found a considerable improvement in the fine motor activities[19, 20].

The result of the present study indicates that Play therapy along with conventional therapy improves the hand function in children with spastic diplegic cerebral palsy.

Conclusion

This study had shown that in the spastic diplegic cerebral palsy children, the group given Play therapy for 20min thrice a week for 6 weeks along with conventional therapy (icing, passive stretching and Sponge ball exercises to the hand) showed a better outcome than the group receiving only conventional therapy. Experimental group showed a considerable increase in the hand function as measured by the Box and block test and Nine hole peg test.

The study was done by concentrating on the hand function in a generalized way. The findings of the study support the evidence for the effective use of Play therapy in children with spastic diplegic cerebral palsy. This short term play therapy program demonstrates a positive functional outcome for children with spastic cerebral palsy across diagnostic categories and a wide spectrum of involvement in the population.

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Functional capabilities in tetraplegic patients

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Tetraplegia is defined in the International Standards for Spinal Cord Injury (SCI) classification as the "impairment or loss of motor and/or sensory function in the cervical segments of the spinal cord due to damage of neural elements within the spinal canal. Tetraplegia results in impairment of function in the arms as well as in the trunk, legs and pelvic organs. It does not include brachial plexus lesions or injury to peripheral nerves outside the neural canal".[1]

Whether tetraplegics are able to maintain or further improve their levels of physical capacity and functional performance over time might be dependent on several factors, like physical activity, the occurrence of illness and injury, and the level of the lesion. Motor recovery of the upper limbs typically correlates with self-care function. [2]

Functional capabilities include motor capacities that correspond to the abilities of a patient to perform basic and functional tasks regardless of contextual factors (environmental and personal factors) in relation with activities that should be accomplished on a daily basis (nutrition, fitness, personal care, communication, mobility, etc). Life habits presenting a significant level of disruption can create handicap situations. [3]

Individuals with cervical SCI can move their hand through a much smaller workspace, restricting their ability to perform normal activities of daily living. Motor impairments of the upper limb due to SCI significantly limit the workspace where individuals can maintain stable hand positions and, hence, restrict their ability to perform normal activities of daily living. [4]

Loss of hand function is one of the most important disabilities for patients with a cervical spinal cord injury (SCI). Impaired motor and sensory functions in arms and hands result in a loss of joint mobility, grip strength, coordination of motion, proprioception and protective sensitivity. In addition, muscle spasm may occur. Owing to these motor impairments, these patients use grips other than those with normal hand function. [5]

It is widely recognized that individuals with lesions at the C4 and C5 spinal cord levels require assistance for many self-care tasks, whereas those with lesions at C8 and below should be capable of achieving independence in nearly all daily activities. However, individuals at the critical functional levels of C6 and C7 tetraplegia are on the borderline of achieving independence in self-care tasks. C5 tetraplegic patients are independent only in eating and with indoor wheelchair locomotion, while C7 tetraplegics are almost independent with self-care items, transfer and wheelchair locomotion. Subjects with C5 and C7 neurological level injuries generally tend to have consistent functional abilities which are determined by their neurological level. However, some patients with spinal cord lesions at C6 can achieve total independence in self-care and transfer tasks while others cannot. The degree of disability varies widely among C6 complete tetraplegic patients in comparison with that in other levels of injuries.[6]

Spinal cord injured subjects at the C5 level are expected to retain voluntary control of the shoulder abductors, flexors, and rotators and elbow flexors. A person with a level of C5 could use shoulder abduction and external rotation to bring about elbow extension by gravity. Control of elbow extension occurs through the use of gravity and eccentric contraction of the elbow flexors. There is also variable control of forearm supination and pronation. Muscles generating motion at the wrist, fingers, and thumb, however, are no longer under voluntary control. Consequently, a seated subject with C5 SCI is able to control forearm/hand placement and movements against gravity but is unable to grasp, hold, and release, thereby limiting the functional use of the upper limbs.[7]

The degree of functional independence that a person with tetraplegia can achieve is influenced by shoulder musculoskeletal integrity. [8,9] The total shoulder strength score reflects the strengths of serratus anterior muscle, upper part of pectoralis major muscle and latissimus dorsi muscle. The ASIA motor score includes only the strength of the deltoid muscle among the shoulder girdle muscles. In transfer and push-up motions, tetraplegic patients need to lift and move their bodies by the upper extremities. It is supposed that the muscles in the shoulder girdle, especially the serratus anterior muscle, upper part of pectoralis major muscle and latissimus dorsi muscle, play a key role in those motions. The serratus anterior muscle is innervated from C5 to C7, the upper part of pectoralis major from C5 to C7, and the latissimus dorsi muscle from C6 to C8. Therefore, these muscles are partially innervated among C6 tetraplegics according to neurological anatomy. Shoulder muscle strength could reflect the degree of disability among C6 complete tetraplegics, and functional variation depends on the degree of strength in these muscles. The degree of disability varies widely among C6 complete tetraplegic patients in comparison with injuries at other neurological levels. [6]

A paralyzed muscle that crosses two joints can be tightened by motion at one joint, bringing about motion at the second

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joint. For example, wrist extension by a person with a level of C6 can passively tighten the finger flexors, producing palmar grasp (tenodesis). A person with C6 tetraplegia could use the anterior deltoid and pectoralis major for elbow extension .C6 and C7 tetraplegics have paralysis of finger and thumb flexor muscles but retain voluntary control of wrist extensor and sometimes wrist flexor and finger extensor muscles. Despite such extensive paralysis these patients are generally able to hold and manipulate objects. An ability to effectively use the hand is critical to independence and quality of life. [10,11]

To produce effective pronation, an individual with a high-level cervical spinal cord injury with paralyzed pronator muscles will often need to use substitution patterns of movement. Such substitution patterns include large shoulder abductions. It is likely that, in many cases, these substitution patterns will be undesirable and inefficient to the user. Examples might occur in the case of the user needing to maintain his personal space within a confined area, such as when dining in a restaurant or driving a car. Additionally, such movements (substitution patterns) will betray the disabilities of the user to the public and draw attention, which is undesirable. [12]

Persons with cervical lesions have a reduced trunk control due to the paralysis of the trunk muscles. They sit back onto his sacrum with pelvis rotated posteriorly. It has been hypothesised that the poor trunk stability of the individual with a mid- to high level of tetraplegia may limit upper extremity function.[13]

Functional outcomes for the incomplete population are impossible to predict because they depend on such factors as extent of incompleteness, timing of return of function, level of spasticity and so on.

To assess the actual performed activities in daily life, a scale or questionnaires are suitable and frequently used tools. The quadriplegia index of function has been specifically developed to document functional gains as a result of treatment in tetraplegic SCI. [5] The Functional Independence Measure (FIM) is one approach to functional assessment that has become widely utilized in the U.S. and is gaining acceptance internationally. The FIM focuses on six areas of functioning: self-care, sphincter control, mobility, locomotion, communication and social cognition. Within each area, two or more specific activities /items are evaluated, with a total of 18 items. For example, six activity items (eating, grooming, bathing, dressing-upper body, dressing-lower body, and toileting) comprise the self-care area. [16]

Many interventions, such as orthoses, tendon transfers, functional electrostimulation (FES) and the creation of a functional hand with a tenodesis, have been developed to modify or strengthen the grip of tetraplegic patients.[5]

In more recent years surgery has been widely advocated as the treatment of choice. An approach of combined surgical reconstruction and implantation of an FES system (also known as a neuroprosthesis) has been shown to improve the grasp, hold, and release capabilities of selected individuals with C5 and C6 tetraplegia.[7] Neuroprostheses are also occasionally used to enhance the hand function of this group of patients, though less commonly in C7 tetraplegics.[10] Electrical stimulation of the upper extremity is being applied to those with greater disability, such as those with tetraplegia in the C4 region of the spinal cord who are likely to have reduced shoulder function. [12] The benefits of reconstructive surgery, although widely advocated, have still not been supported by good-quality, randomized controlled trials. The hand function depends on its mobility and its sensibility. If by means of muscle transfer the mobility is restored but there is no sensibility, the hand is blind, requires the aid of the vision, and consequently its function is poor. [14,15]

Disabled individuals have become more autonomous is through the use of assistive technology devices (AT), which is in essence any device that facilitates or aides a person (disabled or non-disabled) in performing a functional task in a particular environment. The discipline of AT services encompasses access to computers. This particular realm of AT has proliferated with the advent of the personal computer, and omnipresence of these devices for work, education, leisure, and daily tasks in our society. Manual wheelchair users (MWUs) with cervical- level spinal cord injury (SCI; tetraplegia) often find it difficult to independently complete certain activities of daily living (ADLs). This difficulty can be attributed to reduced physical capacity, upper-extremity muscle weakness, pain, injuries, or fatigue due to overexertion from propelling a manual wheelchair throughout the day. Because of decreased physical capacity and impaired upper extremities, MWUs with tetraplegia are typically less efficient than MWUs with paraplegia. When propelling a wheelchair under controlled conditions, people with tetraplegia travel less distance with a higher oxygen consumption rate than those with paraplegia. A more efficient manual mobility device may enable people with tetraplegia to travel further distances while exerting less energy. [16]

However, the technology must correspond to the individual's needs. Therefore, a comprehensive assessment of the person's function is required, particularly in persons with severe and multiple disabilities. The assessment phase for assistive technology mandates a trans-disciplinary assemblage of competent Rehabilitation team members. AT should be better integrated into the daily needs of the individual through the advocacy of others such as the family, and all involved persons should have a stake in whether or not AT interventions are a success. The assessment of the user needs to be honest, accurate, and meticulous. Areas addressed in an assessment when selecting a switch device are as follows: 1. Does the user have sufficient endurance to repeat the motion consecutively? 2. Do reflexes exist that will interfere with the motion the user needs to hit a target? 3. Is tone present that will interfere or enhance the user getting to a target? 4. What is the available range at each site and which is less restricting? 5. Are the available movements the user controls able to hit a target and release in a timely manner? 6. How can the technologist position the switch for optimal activation? 7. What kind of isolated or gross finger movement is available for a fine-motor switch? 8. Can the user activate a switch if it is in the hand secured with a strap or splint? 9. Can the user control a pointing device? 10. What kind of arm placement is available for a gross motor switch site? 11. Does the user still have a visual contact with the device with switch activation?

Loss of independence may have a detrimental psychologic effect and financial consequences (eg, the need to employ

caregivers and/or to purchase additional equipment).Finally, what the patient can do does not always indicate what the patient actually will do in daily life. In particular, the self-care skills achieved in therapy are often not utilised at home due to the help of others. Secondly, dexterity tests do not reveal the subtle and important changes in the activity pattern in the daily life of the patients.

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Table . Functional capabilities in tetraplegics according to neurological level of injury.

LEVEL	C3-C4	C5	C6	C7	C8-T1
Pressure relief	dependent in bed	Most require assistance	Independent	Independent	Independent
Wheelchair transfers	Total dependence	Assistance of one person- tranfer board	Potentially idependent –transfer board	Independent	Independent
Wheelchair propulsion	Independent in chin control driven power wheelchair	Independent in powered wheelchair	Independent moderate distances manual wheelchair	Independent manual wheelchair	Independent manual wheelchair
ambulation	Not applicable	Not applicable	Not applicable	Not applicable	exercise
Orthotic devices	Upper extremity externally powered orthosis	Upper extremity externally powered orthosis	Wrist driven orthosis	none	none
transportation	Dependent on others	Driving?	Driving specially adapted van	Driving specially adapted car	Driving specially adapted car
communication	Independent with adapted equipment	Independent with adapted equipment	Independent with adapted equipment	Independent with adapted equipment	Independent
Pulmonary hygiene	Totally assisted cough	Assisted cough	Assistance-supine Independent-sitting	Assistance-supine Independent-sitting	Assistance-supine Independent-sitting
feeding	May be unable to feed self	Independent with adapted equipment	Independent with adapted equipment	Independent	Independent
grooming	Total dependence	Independent with adapted equipment	Independent with adapted equipment	Independent	Independent
Dressing	Total dependence	Assistant-lower Independent upper	Assistant-lower Independent upper	Independent (potential) with equipment	Independent
bathing	Total dependence	Total dependence	Independent with adapted equipment	Independent with adapted equipment	Independent
Bowel and bladder routine	Total dependence	Total dependence	Assistant-bladder Independent -bowel	Independent	Independent
Bed mobility	Total dependence	Assisted by others	Independent with adapted equipment	Independent	Independent

Effectiveness of Prorioceptive training over strength training in improving the balance of geriatrics subject with impaired balance.

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Study design: This is an experimental study with same subject design.

Background and Objectives: Proprioceptive training and strengthening exercises is a promising therapy to improve the balance in geriatrics subjects with impaired balance.The study intended to find out the effectiveness of Proprioceptive training and strength training exercises on balance of the geriatrics subjects and which of them is more effective.

Methods: 30 elderly subjects with impaired balance were selected and randomly divided in two groups. Group A was treated with Proprioceptive training, Group B was treated with strengthening training for 13 week .Both group were assessed with Timed up and Go scale and Berg balance scale at the end of 13 week .The result was statically analyzed using dependent t –test for significance between the two groups.

Results: After a 13-week training period, the 't' test values were found significant with values 2.3565 & 2.3748 for TUG&BBS score respectively stating that there is significant effect when using Proprioceptive training than giving strength training for improving balance in geriatric subject with impaired balance

Conclusions: Improving balance of geriatric subjects by Proprioceptive training showed better improvements in balance than strength training

Key words: Balance, fall prevention, Strength training, Proprioceptive training.

Introduction

Aging is a continuous and cumulative process taking place in human from conception to death. It is generally agreed that first two decades of human form the phase of the productive aging process and that the degenerative aging process commence in 3rd decades of life.[1] As a person aged, the ability to maintain balance becomes more difficult. Loss of balance is the primary factor in falls, which results in serious injuries. Balance can be defined as a complex process revolving the reception and integration of sensory input, and the planning and execution of movement, to achieve a goal required in upright posture. The control of balance requires the integration of information from multiple sensory and motor systems by the Central nervous system (CNS). Balance receptors in the inner ear (vestibular system) provide information to CNS about the head and body movements. The eye (Visual system) provides input regarding the body's orientation and motion within the environment. The position and motion sensory of the muscle and joints, and the touch receptors of the extremities (proprioceptive system) send signals regarding bodily position particularly in relation to the supporting surface.[2]

Proprioception is a sense produced by the sensory receptors that are sensitive to pressure in the tissues that surround them. They are also present in the bones of the legs, arms or other parts of the body and these receptors response to stretches of the muscle surrounding them and send impulse through the sensory nerve fibers to the brain. Decline in dynamic position sense is associated with decrease in the balance of elderly and this decline in proprioception can be prevented or improved by Proprioceptive training in a study Edward R Laskowski et al (1997) shown that proprioception based rehabilitation programs improved objectives measurements of functional status, independent of changes in joint laxity and proprioception can be improved through proprioceptive training.[3]

Muscle strength is another factor that plays an important role in balance and mobility. As human ages, the force generating capacity (strength) of their muscle is reduced, leading to difficulties in their activities of daily living. Their musculoskeletal system deteriorates with great deal of muscle strength and bone loss. During normal aging, there is associated reduction in physical activity, intake of energy and loss of lean body mass (skeletal muscle mass), which is accompanied by loss of strength due to decrease in size of muscle fibers. Decreased use of skeletal muscle leads to conversion of slow (type 1) fibers to fast (type 2) fibers which fatigue fast. [4] Nelson et al (1997) in their study on home base exercise training in frail elderly had an effect on their physical performance. The subjects who showed age related loss of strength, muscle mass and bone density could be lessened by strength training exercises.[5]

Many studies have been conducted to show the individual effect of proprioceptive training and strength training to improve the balance of geriatrics subjects. Hence this studies aims to analyze the effectiveness of both treatment technique and prove the better effectiveness by comparing proprioceptive training and strength training.

Methodology

Sample selection

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The selection criteria are listed below

Inclusion Criteria

1. Elderly subjects with age group between 60 –75 years.
2. Both male and female geriatric subjects.
3. Elderly subjects who had fall at least twice during the recent 1 year.
4. Subjects who scored greater than 20 seconds in Timed up and go test.

Exclusion Criteria

1. Elderly subjects with age group below 60 years and above 75 years.
2. Subjects with any neurological impairment.
3. Subjects with any musculoskeletal impairment (apart from age- related changes).

Measurement tools

Timed up and go scale

Timed up and go scale provides a reliable quick screening measure. Many researches indicate that most adult can complete the test in 10 seconds. A score of 11 to 20 seconds are considered within normal limit for frail elderly or individual with a disability whereas score over 20 seconds are indicative of impaired functional mobility. To perform this, the subject is in sitting position and a visible object is placed 3 meter away from the patient. The subject is instructed to get up and walk down till the object and return to the seat. During this task timing is maintained with a stopwatch and the time taken for it is recorded. A score greater than 20 seconds is associated with high risk in community dwelling older adults.[6]

Berg Balance Scale

This balance scale developed by Berg is an objective measure of static and dynamic balance abilities. It is used to assess balance and mobility which has 14 functional tasks commonly performed in everyday life with scores ranging from 0-4, with a maximum score of 56. [6]

Procedure

Thirty elderly subjects are randomly assigned to two experimental groups of fifteen each named as Group A & Group B. All the subjects were assessed using a general assessment Performa prior to the study and a demographic data was collected. Then, the subjects were explained about the procedure to be done to gain their co-operation and confidence. All the subjects were given proper warm up for 5-10 minutes before starting the treatment in the form of simple stretching of quadriceps and hamstrings and free exercises like knee flexion & extension in side lying and high sitting.

GROUP A: (Proprioceptive Training)

Subjects in GROUP A were given proper warm up for 5-10 minutes before starting the treatment in the form of simple stretching (Quadriceps and hamstring stretch) and free exercises (knee flexion and extension in side lying and high sitting). [7]

The proprioceptive training included the following exercises

1. Stair climbing up and down (a regular 3 steps staircase).
2. Standing with feet approximately shoulder-width apart and arms extended out slightly forward lower than the shoulder, then lifting both heel off the floor and to hold the position for 10 seconds, followed by climbing regular 3 steps staircase. This procedure was performed with eyes closed also.
3. Standing with feet side by side & holding the arms in same position as described above, one foot is placed on the inside of the opposing ankle and to hold the position for 10 seconds. Followed by climbing regular 3 steps staircase. This procedure was performed with eyes closed also.
4. To perform one leg standing with one foot raised to the back and to maintain the position for minimum 3 seconds. This procedure was performed with eyes closed also.
5. Same exercise as above performed but with one foot raised to the front. This procedure was then performed with eyes closed.
6. Walking heel to toes.
7. Rising from a standard chair (4 times) without arm support.

All the above exercises were performed for duration of 30 minutes per session; with 5 minutes rest period in between for three days a week for 13 weeks.

GROUP B (Strength Training)

All the subjects were treated with lower extremity strengthening exercises using weight cuff. A standardized weight of one repetition maximum (1RM) was considered for the subjects. 1RM was determined before the training for all the subjects. The following exercises were then given and it was ensured that the position of subjects in all form of exercises were comfortable:

1. Side leg rising

Subjects were made to lie in side lying position and instructed to abduct the upper leg tied with weight cuffs slightly about 6-12 inches. This position was held for sometime and then the leg was lowered. Same exercise was repeated with the other leg.

2. Knee flexion exercise

Subjects were made to sit on high chair or table, the knee was bent slowly as far as possible, so that the foot with the weight cuff was bent behind. The subject was asked to hold the position and then the foot was lowered slowly all the way back down. The same procedure was repeated with the other leg.

3. Hip Extension Exercise

Subjects were made to lie on prone position and one leg with weight cuff was lifted slowly straight upwards. The

subject was asked to hold the position and then the leg was lowered. The same procedure was repeated with the other leg.

4. Knee Extension Exercise

Sitting on the chair with back support, the subject was asked to rest the balls of the feet & toes on the floor. The hands were kept on the thigh or on the side of the chair, and then the right leg with the weight cuff was extended slowly in front, parallel to the floor for a period of 3 seconds. With right leg in that position, the foot was flexed so that the toes were pointing towards head; the foot was held in that position for 1-2 seconds. Duration of 3 seconds was taken to lower the leg back to the starting position, so that the balls of the foot rested on the floor again. The same procedure was repeated with the other leg.

5. Ankle Dorsiflexion

Sitting on the chair with back support, the subject was asked to lift the foot tied with a weight cuff so that the toes were pointing towards the head. Then the subject was asked to hold and slowly return to the original position. The same procedure was repeated with the other leg.

A repetition of 8 to 15 times was done for all the above exercises for duration of 30 minutes per session; with 5 minutes rest period in between for five days a week, for 13 weeks.

All the subjects were measured for functional balance using timed up & go test and Berg balance scale before the start of the training period and at the end of thirteen weeks of training.

Data analysis

The statistical software SPSS 11.0 systat 8.0 were used for study. The mean differences of the Timed Up and Go Test & Berg Balance Scores of Group A were compared with Group B and the actual pattern of variation in all the categories was observed.

With the acquired 't' value from the pretest and post test, the accurate level of significance was analysed and interpreted.

Also a dependent 't' test was performed to analyse the efficacy of treatment within the groups.

Results & interpretation

Fifteen Geriatric subjects of impaired balance with a mean age of 64.2years were selected for Group A and fifteen more with a mean age of 64.33years were selected for Group B of this study. The mean, variance and standard deviation values of the age groups according to the distribution of the sex are shown in Table-1.1 &

Table- 1.1 Mean, variance & standard deviation values of age in group-a

Sex	N	Mean	Variance	SD
Male Subjects	5	64	7	2.65
Female Subjects	10	64.3	12.01	3.46
Total Subjects	15	64.2	9.74	3.12

Table- 1.2 Mean, variance & standard deviation values of age in group-b

Sex	N	Mean	Variance	SD
Male Subjects	5	64.6	7.3	2.7
Female Subjects	10	64.2	11.2	3.35
Total Subjects	15	64.33	9.38	3.06

Fig-3

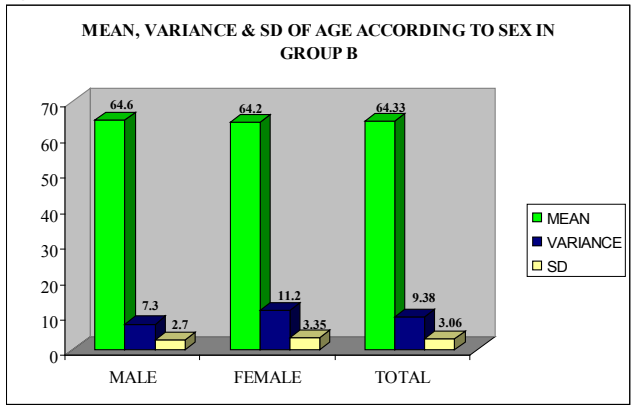
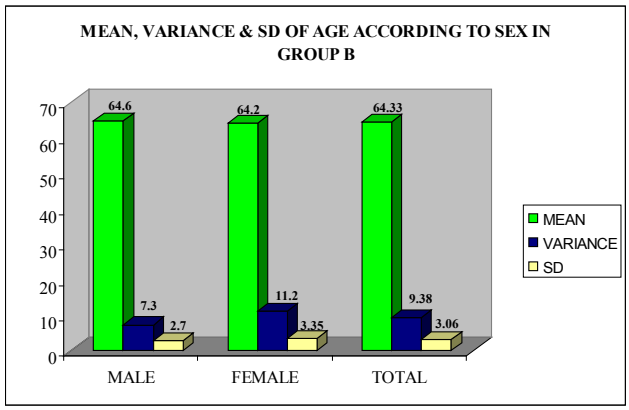


Fig-4



Descriptive statistics

The following tables & graphs illustrates the mean, variance & SD values of the different parameters individually, thereby showing the improvement within the group by the respective training procedures.

Table- 3.1 Mean, variance & sd values of pre & post tests for timed up and go test of group a

Test	Mean	Variance	Standard Deviation
Pre Test	25.53	5.83	2.41
Post Test	15.6	6.68	2.58

Table- 3 Mean, variance & sd values of pre & post tests for timed up and go test of group b

Test	Mean	Variance	Standard Deviation
Pre Test	25	5.14	2.26
Post Test	16.8	6.88	2.62

Fig- 5

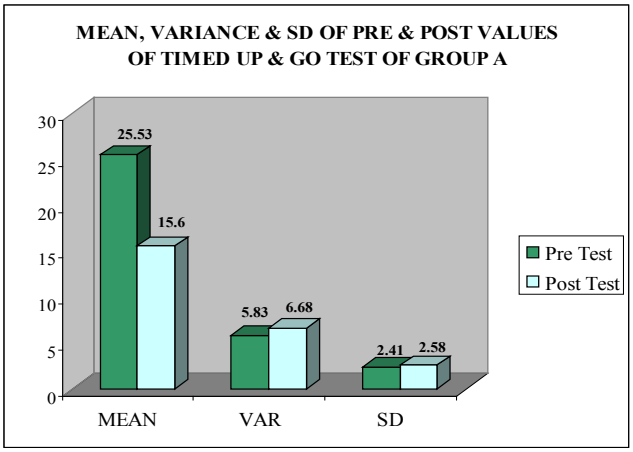


Fig-6

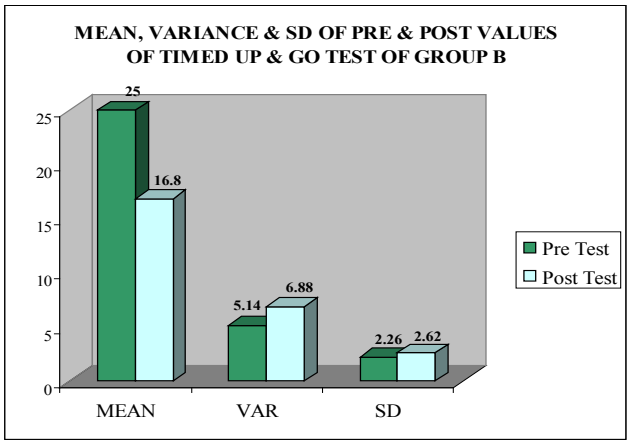


Table- 3.3 Mean, variance & sd values of pre & post tests for berg balance score of group a

Test	Mean	Variance	Standard Deviation
Pre Test	35	16.57	4.07
Post Test	45.8	16.45	4.05

Table- 3.4 Mean, variance & sd values of pre & post tests for berg balance score of group b

Test	Mean	Variance	Standard Deviation
Pre Test	36.93	39.21	6.26
Post Test	44.2	41.6	6.44

Fig-7

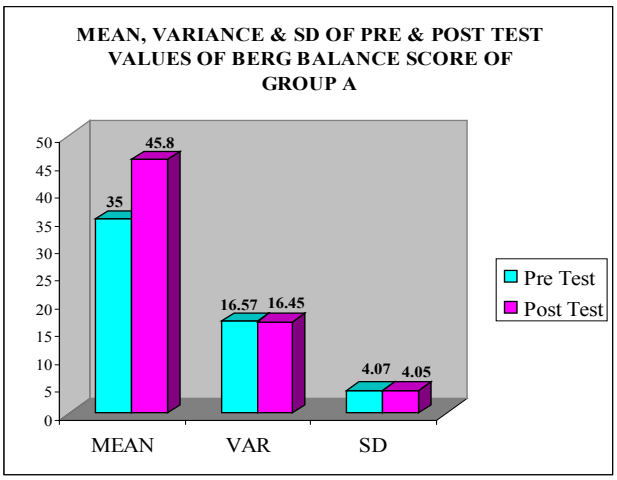


Fig-8

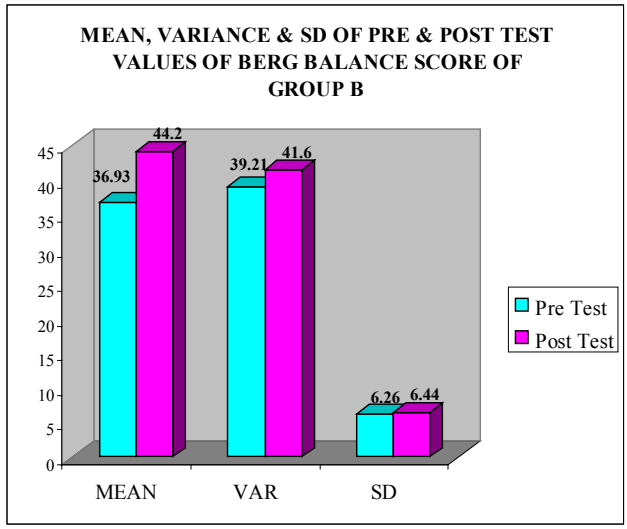
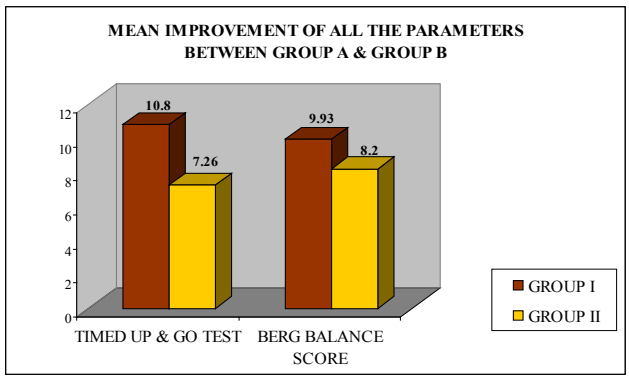


Table- 6 mean improvement in all the parameters between group a & group b

Parameters	Group B	Group B
Timed up & go test	10.8	7.26
Bergbalance score	9.93	8.2

FIG-9



Interpretation of statistical results

This study was done with 30 Geriatric subjects with impaired balance allotted into two groups namely Group A and Group B consisting of 15 each, to know the effectiveness of Proprioceptive Training over Strength Training in improving their balance.

The parameter used was balance assessed using Timed up & Go Test and Berg Balance Scale. Outcome measure of balance were assessed using two testing tool before training and at the end of thirteenth week.

The data were analyzed using dependent 't' test to find the significance of the interventions used within the groups and then an independent 't' test was used for the above mentioned parameters to find the significance between the groups.

The dependent 't' test showed significance for both the groups stating Proprioceptive Training and Strength Training, both were improving the impaired balance of Geriatric subjects.

The results were found to be significant with independent 't' test at $p<0.05$ with the calculated 't' values as 2.3565 & 2.3748 being more than the table values for Timed Up & Go Test and Berg Balance Scale respectively stating that there is a significant effect when using Proprioceptive Training than giving Strength Training for improving balance in the Geriatric subjects.

Discussion

In this study, better improvements in balance outcome were analyzed using proprioceptive training and strength training. This study was done on 30 geriatric subjects with impaired balance who were divided in to experimental Group-A treated with proprioceptive training and Group-B with strength training.

The balance was taken as the dependant variable which was measured using Timed up & go test (TUG) (ICC=.95-.97) and Berg balance scale (BBS).8&9 Both this tool are standard tools to analyze balance. Proprioceptive training exercises were given to improve the balance by improving the decreased sense of proprioception in older age group where as Strength training was given to improve the balance by improving the strength of lower extremity muscles.

The data collected was analyzed using dependent and independent 't' test to find the significance within and between the groups respectively. The 't' test value showed that there were significant improvements in balance in both the treatment groups but the group treated with proprioceptive training showed higher improvements.

The improvements in functional balance due to proprioceptive training may be attributed to the improvement of mechanoreceptor activation. Structural changes in the muscle, bone and joints during old age accounts for the decreased efficiency of the proprioceptors.10 Researchers reason that proprioceptive training can improve the joint and kinesthetic sensation to a greater extent that the falls and risk of fall can be reduced among the elderly subjects. At the same time strength training can reduce the symptoms of degenerative conditions of old age as the strong muscles act as shock absorbers for the joints. If the muscles are able to take pressure off the joints during activities such as walking, there is less joint related pressure and pain preventing the fall census.

These results were in accord with Gauchard GC et al (1999) 11 to improve balance by proprioceptive training. Also studies done by Pierre Gangloff et al (2003)12 supports our results, which prove that proprioceptive training exercises, improve balance in geriatric subjects with impaired balance. This supports the experimental hypothesis hence the null hypothesis was rejected.

The result of the present study indicates that effect of proprioceptive training had a proven effect over strength training. All participants in the proprioceptive training group declared that their balance had improved and most of them were motivated to continue with the training. Hence proprioceptive training should be emphasized in the daily exercise regime of geriatric subjects to improve their mobility and functional status.

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Inter-judge comparision of the anthropometric measurements of competitive body builders

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Abstract

Background: Bodybuilding, like other sports judged by human observation continues to use old model of officiating and judging and there is always been a search for better ways to judge sports.

Purpose of the study: To compare judges score of the Anthropometric measurements of competitive body builders and to see if there is any correlation between judges' score.

Design and methodology: 50 male bodybuilders participated in light, middle and heavy weight classes each in the National Interuniversity Bodybuilding Competition held at Guru Nanak Dev University, Amritsar. There were two judges to evaluate the body builders. Height, weight, skin folds, muscle girth, biepicondylar diameter of the bodybuilders were measured to compute fat mass, fat percent, fat free mass. Judges' scores (muscularity and symmetry) were given on the basis of these Anthropometric variables.

Results: Highly significant positive correlations were found between judges' total score (muscularity and symmetry) and height, weight and fat free mass. Highly significant negative correlation were found between judges' total score (muscularity and symmetry) and fat percentage. A significant positive correlation is found between judges' scores.

Conclusion: Judges' score correlate with anthropometric measurements of competitive bodybuilders. Judges scores are helpful for confirming and justification of bodybuilding ranking.

Keywords: Bodybuilders, Two Judge, Judges' scores, Anthropometric measurements.

Introduction

Kinanthropometry is an emerging scientific specialization concerned with the application of measurement to appraise human size, shape, proportion, composition, maturation and gross function. It is a basic discipline for problem-solving in matters related to growth, exercise, performance and nutrition[1]. Kinanthropometry is a medium to contribute basic research and application in human biology, physical anthropology, sports sciences, auxiology, gerontology, ergometry, home science, sports medicine and physiotherapy and many fields related to the knowledge.

Society has associated anabolic steroid use with anyone who claimed to be bodybuilders, and that has prevented the sport of body building from becoming a part of the Olympics. In the early 1980's drug free body building surfaced, and the World Natural Body Building Federation emerged to give natural athletes a chance to compete professionally. Some body builders have become more marketable than others, and judging the sport became prone to bias. Back in Sandow's time they used to judge physiques by physical measurements, but this has long term discontinued. Bodybuilding, like other sports judged by human observation, is subject to the basis of the panel of judges selected to evaluate the event. Competition judges are influenced by a number of outside factors, such as social/psychological influences, political affiliation, personal biases, and expectations [2].

Bodybuilding is a male-dominated sport, and more research is needed to be performed on males [3]. Bodybuilding competitions are often judged by former competitors or promoters, and there is no formal training required. This study improves on the methods of [4], since it will test the correlation to experienced judges with new judges.

Many of the classical ideals of how body builders were judged have carried over to today's judging of the sport. Earlier athletes were judged on athletic prowess, and as late as 1973 the **Amateur Athletic Union (AAU)** America required body builders to show intelligence by being scored on how they responded a question.

There have been several studies investigating the judging criteria in sports, and searching for better ways to judge sports [3,4,5]. Body building currently uses only a ranked system for judging physiques, and judges give not justification for their rankings. There is a need for a more formalized system. At this time, in most judged sports, there are limited criteria for judging, and there are very few measures for confirming judges' scores. If physical anthropometric measurements are correlated with judges' scores, could be a method of help with confirmation. This study compared anthropometric scores of natural competitive bodybuilders to judges' scores.

Materials and methods

The study was a descriptive and correlational study examining the anthropometric measurements of bodybuilding athletes and judges' rankings.

A National Interuniversity Bodybuilding Competition was held in January 2006 at Guru Nanak Dev University, Amritsar. The anthropometric scores of natural competing bodybuilders were compared to judges' scores. There were

150 male bodybuilders who participated in three classes, light weight, middle weight and heavyweight classes, 50 bodybuilders in each class. The judge was an official judge appointed by the National Natural Bodybuilding and Fitness Organization.

There were two judges scoring the performance of the bodybuilders. Off those one judge was experienced and another was new inexperienced. The experienced judge was official judge appointed by the National Natural Bodybuilding and Fitness Organization. The judge has over 5 years of experience in the sport of bodybuilding, and has judged prior competitions. Inexperienced judge was recruited from the population of faculty.

Both Judges were required to report the school auditorium 30 minutes prior to the start of the prejudging. Both judging sheets were collected after the prejudging and finals. The judges were instructed not to communicate with each other, and not to look at another judges" scoring sheet. Judges were briefed on the order of the show, and they were also, at that time, given the order of events for the finals.

Kinanthropometric variables viz. Height, Weight, skinfolds, girth and diameters were taken and from these kinanthropometric measurements body composition parameters were analyzed and those being Fat percent, Total Body Fat and fat free Body Mass. The judge gave the muscularity and symmetry score based on these variables.

Statistical Analysis

All data were analyzed the Excel Graduate Pack 10.1 for Windows. Descriptive statistics were conducted on all bodybuilder's weight, height, body fat mass, fat %, fat free weight. Karl Pearson correlation coefficient was used to analyze the data with the p value taken as ≤0.05.

Results and discussion

Table 1: Correlation coefficient analysis between muscularity score given by the judge and the 5 variables in light, middle and heavy weight classes.

S.No	Variables	Light Weight(n=50)	Middle Weight(n=50)	Heavy
1	Height(cm)	0.19	0.72	0.58
2	Weight(kg)	0.69	0.88	0.70
3	Fat percent (%)	-0.90	-0.79	-0.85
4	Fat free mass(kg)	0.90	0.90	0.73
5	Fat mass(kg)	-0.46	-0.40	-0.8

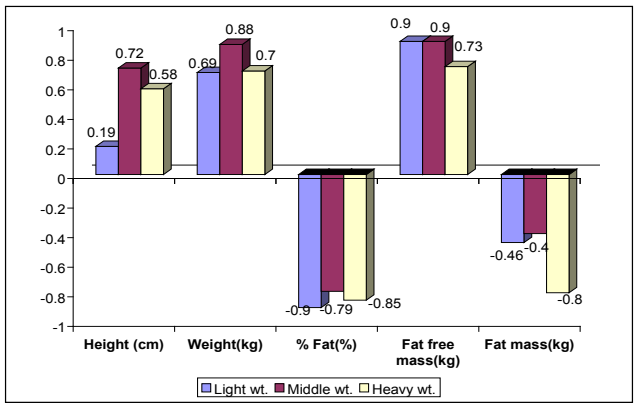

Table 1 shows the correlation coefficient analysis between muscularity score given by the judge and the 5 variables in light, middle and heavy weight classes. Highly significant positive correlation were found for Fat free mass (kg) [r = 0.90, r = 0.90, r = 0.73] and Weight (kg) [r = 0.69, r = 0.88, r = 0.70] in all the three classes respectively whereas significant positive correlation were found for Height (cm) [r = 0.72, r = 0.58] in middle and heavy weight classes respectively. Highly significant negative Correlation were found for Fat percent (%)[r = -0.90, r = -0.79, r = -0.85] in all the three classes and Fat mass(kg) [r = -0.80] in heavy weight class.

Table 2: Correlation coefficient analysis between symmetry score given by judge and the 5 variables in light, middle and heavyweight classes.

S.No	Variables	Light Weight (n=50)	Middle Weight(n=50)	Heavy Weight(n=50)
1	Height(cm)	0.78	0.62	0.61
2	Weight(kg)	0.35	0.58	0.50
3	Fat percent (%)	-0.36	-0.41	-0.50
4	Fat free mass(kg)	0.34	0.58	0.51
5	Fat mass(kg)	-0.10	-0.12	-0.41

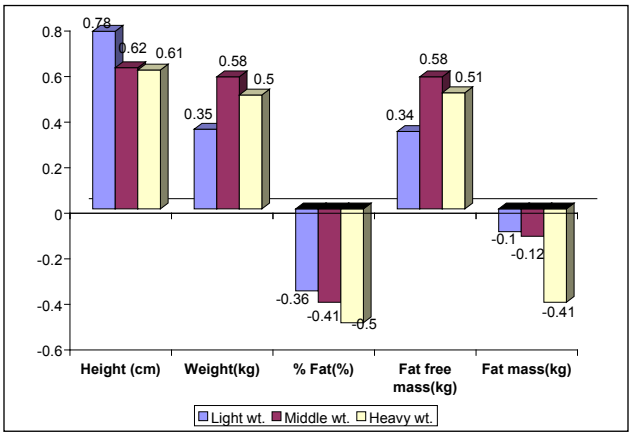

Table 2 shows the correlation coefficient analysis between symmetry score given by judge and the 5 variables in light, middle and heavyweight classes. Significant positive Correlation were found for Fat free mass (kg) [r = 0.58, r = 0.51] and Weight (kg) [r = 0.58, r = 0.50] in middle and heavy weight classes respectively and for Height (cm) [r = 0.78, r = 0.62, r = 0.61] in all the three classes respectively with no Correlation for Fat mass (kg) in all the three classes.

Table 3: Correlation coefficient analysis between total score given by judge and the 5 variables in light, middle and heavyweight classes.

S.No	Variables	Light Weight (n=50)	Middle Weight (n=50)	Heavy Weight (n=50)
1	Height(cm)	0.57	0.74	0.66
2	Weight(kg)	0.75	0.81	0.68
3	Fat percent (%)	-0.76	-0.65	-0.77
4	Fat free mass(kg)	0.75	0.82	0.71
5	Fat mass(kg)	-0.34	-0.27	-0.7

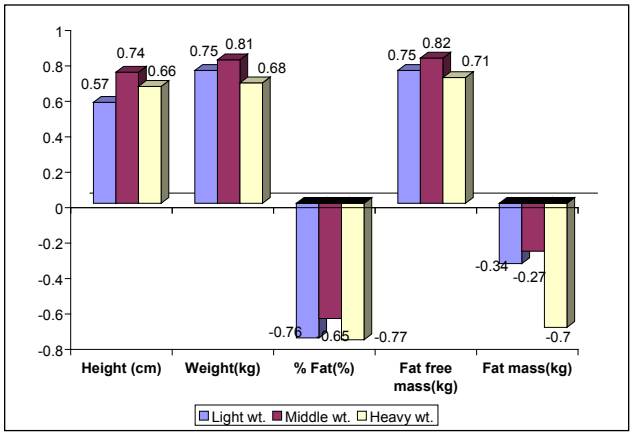

Table 3 shows the correlation coefficient analysis between total score given by judge and the 5 variables in light, middle and heavyweight classes. Highly significant positive Correlation were found for Fat free mass(kg) [r = 0.75, r = 0.82, r = 0.71] , Weight(kg) [r = 0.75, r = 0.81, r = 0.68] and Height(cm) [r = 0.57, r = 0.74, r = 0.66] with highly significant negative correlation were found for Fat percent(%)[r = -0.76, r = -0.65, r = -0.77] in all the three classes and for Fat mass(kg) [r = -0.70] in heavy weight class.

Table 4: Correlation coefficient analysis between muscularity score given by judge 2 and the 5 variables in light, middle and heavyweight classes.

S.No	Variables	Light Weight (n=50)	Middle Weight (n=50)	Heavy Weight (n=50)
1	Height(cm)	0.20	0.59	0.51
2	Weight(kg)	0.58	0.74	0.59
3	Fat percent (%)	-0.74	-0.64	-0.75
4	Fat free mass(kg)	0.61	0.75	0.62
5	Fat mass(kg)	-0.49	-0.32	-0.71

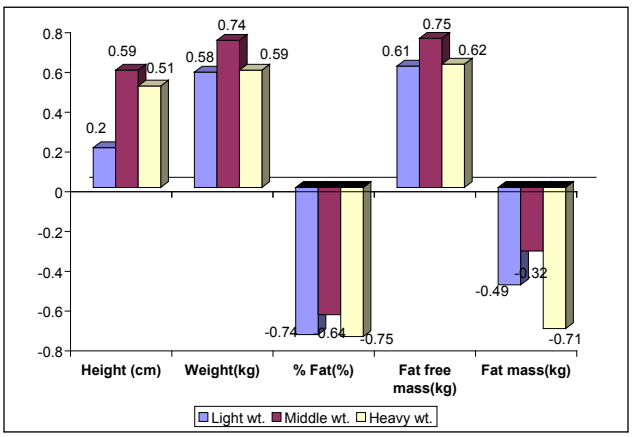

Table 4 shows correlation coefficient analysis between muscularity score given by judge 2 and the 5 variables in light, middle and heavyweight classes. Significant positive correlation were found for fat free mass(kg) [r = 0.61, r = 0.75, r = 0.62] and weight (kg) [r = 0.58, r = 0.74, r = 0.59] in all the three classes respectively whereas and for height(cm) [r = 0.59, r = 0.51] in middle and heavy weight classes respectively with significant negative correlations were found for fat percent (%) [r = -0.74, r = -0.64, r = -0.75] in all the three classes and fat mass(kg) [r = -0.71] in heavy weight class.

Table 5: Correlation coefficient analysis between symmetry score given by judge 2 and the 5 variables in light, middle and heavyweight classes

S. No.	Variables	Light Weight (n=50)	Middle Weight (n=50)	Heavy Weight (n=50)
1	Height(cm)	0.64	0.70	0.42
2	Weight(kg)	0.36	0.61	0.28
3	Fat percent (%)	-0.34	-0.41	-0.35
4	Fat free mass(kg)	0.35	0.61	0.29
5	Fat mass(kg)	-0.11	-0.12	-0.34

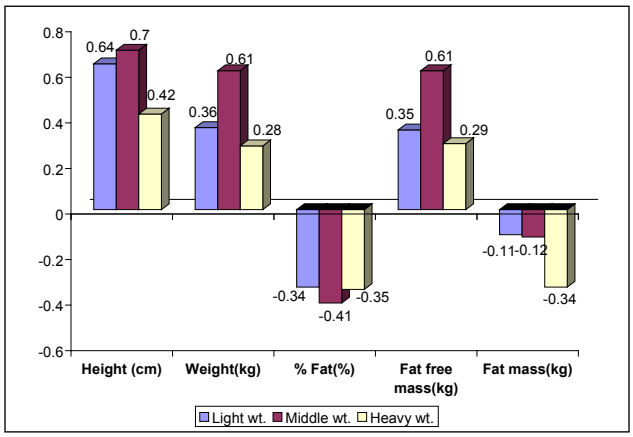

Table 5 shows correlation coefficient analysis between symmetry score given by judge 2 and the 5 variables in light, middle and heavyweight classes .Significant positive correlations were found for height (cm) [r = 0.70], weight(kg) [r = 0.61] and fat free mass(kg) [r = 0.61] in middle weight class and for height (cm) [r = 0.64] in light weight class with no correlation for fat percent (%) and fat mass(kg) in all the three classes.

Table 6: Correlation coefficient analysis between total score given by judge 2 and the 5 variables in light, middle and heavyweight classes.

S.No	Variables	Light Weight (n=50)	Middle Weight (n=50)	Heavy Weight (n=50)
1	Height(cm)	0.50	0.67	0.54
2	Weight(kg)	0.56	0.73	0.52
3	Fat percent (%)	-0.65	-0.62	-0.66
4	Fat free mass(kg)	0.58	0.74	0.55
5	Fat mass(kg)	-0.36	-0.31	-0.63

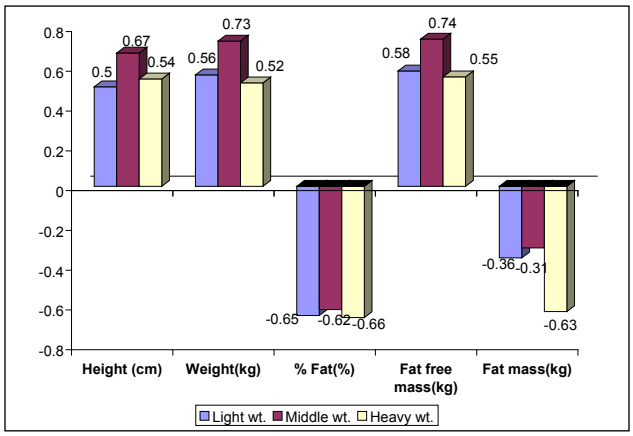

Table 6 shows correlation coefficient analysis between total score given by judge 2 and the 5 variables in light, middle and heavyweight classes. Significant positive correlations were found for fat free mass(kg) [r = 0.58, r = 0.74, r = 0.55] , weight(kg) [r = 0.56, r = 0.73, r = 0.52] and height(cm) [r = 0.50, r = 0.67, r = 0.54] with significant negative correlations were found for fat percent(%)[r = -0.65, r = -0.62, r = -0.66] in all the three classes and significant negative correlations were found for fat mass(kg) [r = -0.63] in heavy weight class.

Table 7: Correlation coefficient analysis between final score given by judge 1 and Judge 2 and the 5 variables in light, middle and heavyweight classes.

S.No	Variables	Light Weight (n=50)	Middle Weight (n=50)	Heavy Weight (n=50)
1	Height(cm)	0.58	0.73	0.62
2	Weight(kg)	0.68	0.8	0.62
3	Fat percent (%)	-0.73	-0.66	-0.73
4	Fat free mass(kg)	0.69	0.81	0.65
5	Fat mass(kg)	-0.36	-0.30	-0.68

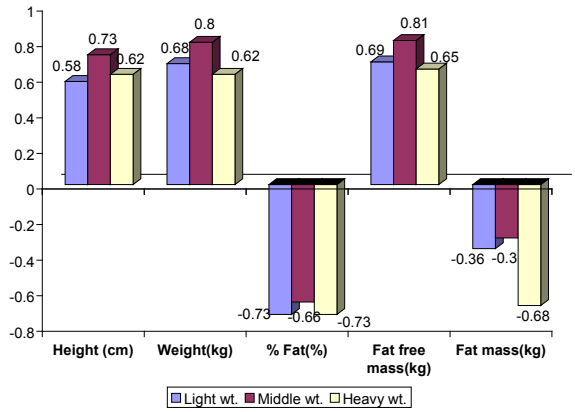

Table 7 shows correlation coefficient analysis between final score given by judge 1 and judge 2 and the 5 variables in light, middle and heavyweight classes. Highly significant positive correlations were found for fat free mass(kg) [r = 0.58, r = 0.74, r = 0.55] , weight(kg) [r = 0.68, r = 0.80, r = 0.62] and height(cm) [r = 0.58, r = 0.73, r = 0.62] with highly significant negative correlations were found for fat percent(%)[r = -0.73, r = -0.66, r = -0.73] in all the three classes and for fat mass(kg) [r = -0.68] in heavy weight class.

Official criteria of physique judgement

1. Basis of judgement

The judging of physique in NBF-certified competitions shall be based solely on the appearance and presentation of contestants on stage during the prejudging and final show.

2. Dimensions of judgement

The judgment of physique in NBF-certified competitions shall include three related dimensions, as described below:

a. Muscularity: Muscularity refers to the size of the muscles, their shape, definition and hardness. Muscularity is determined, In part, by the extent of the development in relation to the size of the skeletal structure. It also Includes the shape/contour of the developed muscles and muscle groups, and separation (i.e., the lines of demarcation between adjacent muscles) and striations delineating sections or fibers within the same muscle group, and the degree of firmness and muscle tone (lack of fat or water under the skin).

b. Symmetry: Symmetry refers to the structural harmony of the physique - the relative size of the various body parts and their shape. There must be a balance and proportion between different components (upper body and lower body, upper and lower parts and front and back of extremities, as well as between same body parts from each side view, etc.). Symmetry refers not only to balance in size of these elements, but also the degree of definition and detail. The presence of muscularity and definition must also be included when determining symmetrical balance, as a tight, defined physique that is properly shaped is the ideal of this judging maker. Symmetry is a measurement of evenness of development and how well all parts of the physique fit together.

c. Presentation: The element of presentation covers everything not included In muscularity and symmetry. This includes the effectiveness of the display of the contestant's assets, and includes posture, carriage, projection and posing ability. Skin quality, evenness of skin tone and skin color, choice of posing outfit and grooming are considered. The finesse in assuming mandatory poses, as well as the strict following of instructions when asked to hit the poses, is factors included in presentation.

Fat-free weight is important, but consideration must be given to the amount of weight and the proportionality of muscle. A bodybuilder may have a great deal of fat-free weight, but may lack proportionality based on physique size.

Conclusion

There was highly significant positive correlation between judge score and body fat free mass, height and weight measures of competitive bodybuilders in all the three categories.

There was highly significant negative correlation between judge score and body fat mass and body fat % measures of competitive bodybuilders in all the three categories. There was highly significant correlation between judge 1 and judge 2 rankings of the competitive body builders in all the three categories.

Measuring the anthropometric variables can prove to be a more formalized system for judging competitions. These anthropometric measurements are helpful for confirming judges' score and justification of their rankings.

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Efficacy of eccentric training versus static stretching, in improving gastrocnemius muscle flexibility in male students

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Abstract

Objectives and background- To find out the efficacy of eccentric training verses static stretching, in improving gastrocnemius muscle flexibility in male students.

Few studies have evaluated that static stretching and eccentric training have equal effect on improving flexibility in hamstring muscle since the gastrocnemius is also a important muscle for athletic and daily activities so eccentric training may have effect to improve flexibility in gastrocnemius muscle.

Methodology- This study included thirty subjects of gastrocnemius shortening with lunge test positive between the age group of 15-17, they are divided into three groups (control and experimental groups- eccentric and static stretching group) randomly. Experimental group were treated with eccentric training and static stretching and control group were treated without any stretching.

Each subject was treated 30 second treatment of each session for 3 sessions in week. Each subject received treatment for six weeks.

Results- The experimental groups were shown statistically significant improvement in gastrocnemius flexibility when compared with control group, whereas eccentric training is highly significant at $p<0.001$**. When compared with static stretching group.

Conclusion-This study shows that static stretching and eccentric training both are effective but the eccentric training is highly effective and statistically significant in increasing gastrocnemius flexibility in male school students.

Key words- Eccentric training; Static stretching; Gastrocnemius flexibility

Introduction

Flexibility of the soft tissue that surround a joint that is muscle connective tissue and skin, in conjunction with adequate joint mobility are necessary for normal range of motion; unrestricted pain free range of motion is often require to perform many functional living task as well as occupational or recreational activities.[1] Flexibility is an ability to move single joint or series of the joints through an unrestricted range of motion depends upon the extensibility of the muscle, which allow muscle that cross the joint to relax, lengthening and yield to a stretch force.[1, 2] Flexibility training is generally accepted as an important aspect of conditioning for athletic and occupational Performa and is widely used as an effective method in the treatment and prevention of injury.[3, 4]

Some research show that significantly higher stiffness values at 10 degree of dorsi flexion in male subject compare to female.[5]

Tightness is a non-specific term referring to mild shortening. A muscle that is tight can be lengthen to all but till the outer limits of its range. Normal individuals who do not regularly participate in a flexibility program can develop mild myocytic tightness particularly joint muscle such as hamstring rectus femoris gastrocnemius.[1, 6]

Gastrocnemius is a large powerful muscle it has two heads, medial and lateral. The medial head is larger than the lateral; it arises by a broad flat tendon from the postero-superior depression on the medial condyle of the femur behind the adductor tubercle and also from the adjoining raised area on the poplitial surface of the femur and from the capsule of the knee joint. The lateral head arises by the broad flat tendon from the lateral surface of the lateral condyle of the femur and the lateral surpracondylar line .it inserted into middle 1/3 of the posterior surface of the calcane

The gastrocnemius is very important in walking and running. In walking when movement is under way the quicker acting gastrocnemius increases the speed.[7]

Stretching is important for reducing injury and improving performance in sport and for over all physical fitness athletes are often given stretching protocol to improve their flexibility.[8]

Stretching is a general term used to describe any therapeutic manner to lengthen pathological shorten soft tissue structure and thereby increasing range of motion.[9]

Three type of stretching have been traditionally defined in the literature in an effort to increase flexibility; ballistic stretching, proprioceptive neuromuscular facilitation and static stretching.

Ballistic stretching is a technique involving a rhythmic bouncing motion. The bouncing uses the momentum of the extremity to lengthen the muscle. Proprioceptive neuromuscular facilitations involve the use of brief isometric contraction of the muscle to be stretched before statically stretching of the muscle.

Static stretching considered the gold standard for measuring flexibility is elongating muscle to tolerance and sustaining the position for a length of time.[9, 10]

The literature reflects some interesting difference opinion

commonly held believes regarding flexibility training and consideration of static stretching as the gold standard.[11, 12]

Murphy suggested a better option to maintain or increase flexibility of a muscle is through contraction using dynamic range of motion there by adding forth type of stretching.

Dynamic range of motion that allows muscle to elongate naturally and in its relax state. This elongation is achieved by having the subject concentrically contract the antagonist muscle to move the joint through full available range of motion be in the slow controlled manure to stretch the agonist group of muscle. [13]

Eccentrically training a muscle through a full range of motion theoretically could reduce injury rates and improve athletic performance and flexibility. During eccentric training or contraction of the muscle is lengthen under active tension, concentric contraction are frequently used to resist gravity the muscle being used as a brake. Tension developed during eccentric training is greater than those of concentric or isometric contraction.[14]

The objective of the study to compare the efficacy of eccentric program and static stretching on gastrocnemius muscle flexibility that occurred after a 6-week program of eccentric training compared with static stretching and with a control group (no stretching).

Methodology

This study design was a purposive controlled trial Pre test and post test experimental design. Ethical clearance was obtained from the institutions ethical commencement of the study. There were thirty Subjects with gastrocnemius muscle shortening between 15-18 years of high school males.

Inclusion criteria

Subject with shortening of gastrocnemius muscle (using lunge test). The ages of subjects between 15-18 years of high school males

Exclusion criteria

Subjects with History of impairment of knee, hip, thigh. Recent fracture to lower limb.Subject has any injury to lower limb, inflammatory condition to leg, previous surgery to lower limb, hyper mobility to ankle and knee joint, rheumatoid arthritis, any neurological problem affecting lower limb.

Materials- Incline board ,Three inches wooden square box, Inch tape,

Outcome measures

Lunge test- All the subjects are evaluated by lunge test before treatment of each session. All the subjects are evaluated by lunge test after the treatment

Procedure

All Subjects was selected randomly by using random number table for two experimental and one control group after screening them for inclusion and exclusion criteria.

Informed consent was taken from each subjects before starting the treatment, the subject was positioned comfortably and assessed thoroughly about his or her condition. Pre treatment assessment includes lunge test positive in them.

All the subjects evaluated by lunge test before and after the intervention.

The lunge test procedure

Subjects stand 3-4 feet apart from a wall with feet together. Subjects ask to put out stretched hands on the wall. Subject takes a lunge step forward until the front knee bends to 90 degree.Front foot should be flat on the floor with knee above ankle.Subjects ask to keep the heel of the back leg on the ground.The front knee goes well Forward and touch the wall.Keep your Balance; stay tall in this upright position. Lean forward until the stretch is felt on the straight back leg. range of right weight bearing ankle dorsiflexion was measured, taking distance from right foot to the wall (in centimeters) in standing lunge using inch tape. If rising in heel of back leg, show insufficient gastrocnemius flexibility.

The experimental group-1 was treated with static stretching with help of incline board in standing position with wall support for single repetitions of 30 second for 3 sessions per week.

Training the static stretching of gastrocnemius in standing

Place an incline board with support of wall.

Subject performs the gastrocnemius stretch by standing erect on incline board with knee extended position.

Once this position is achieved subject maintain this position for 30 seconds.

Perform same procedure for six weeks 3 sessions per week.

Figure 1 Experimental Group-static stretching

Figure 2 Subject using incline board performing static stretching

The experimental group-II was treated with eccentric training with help of square box in standing position with wall support for 6 repetitions of 5 second without taking rest, 3 sessions per week for six week

Training the eccentric training of gastrocnemius in standing.

- Perform full range of motion eccentric training for gastrocnemius muscle.
- Subject stands erect on 3 inches square box
- Subject was instructed to maintain one side heel contact on box
- Simultaneously lowering another heel to the floor.
- This exercise is progressed by increasing the step height.
- This position held for five seconds and repeated 6 time with no rest between the repetition, 3 days per week for 6 weeks

Control group

The control group was treated without any exercise as the experimental group.

After 6 weeks all these three groups were re evaluated by lunge test for post test and data stored and compared with pre test to find significant improvement.

Figure - 3 Experimental-Group-eccentric training

Figure 4 Subject using 3 inches square board performing eccentric training

Data analysis

Study Design: A comparative evaluation study consisting of 30 subjects randomized into three groups, 10 subjects in Control, 10 subjects in static stretching group (which received static stretching for gastrocnemius muscle to improve flexibility) and another 10 subject in eccentric training group (which received eccentric training in full range of motion for gastrocnemius muscle to improve flexibility) was undertaken to investigate the efficacy of the treatment in an experimental group.

Statistical Methods

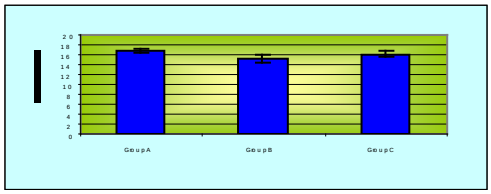
Student t test (Two-tailed, paired) was used to find the significance of range of motion between pre and post-analysis of variance was used to find the significant of outcome between the three-dentin groups. The Post hoc Tukey test was used to find the pair wise significance of outcome between the groups.

Results

Table 1 Age distribution

Groups	Range	Mean ± SD
Group A	16-17	16.70 ± 0.43
Group B	15-17	15.30 ± 0.74
Group C	15-17	16.10 ± 0.57

Figure 5 Age distribution

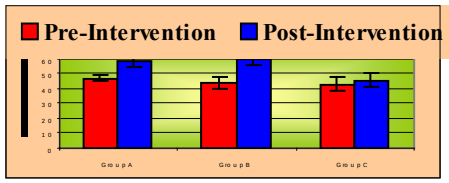


Thirty male subjects with a mean age of 16.23±0.68 Years completed all requirements for this study. The Table - I shows ten subjects, with a mean age 16.10±0.57 years served as the control group. The static group consisted of 10 subjects with a mean age of 16.70±0.43 years. Ten subjects comprised the eccentric group and had a mean age of 15.30±0.74 years. This graph (Figure-5) shows the distribution of age in years in all three groups.

Table 2 Comparison of effects three types of treatment on flexibility improvement Results are presented in Mean ± SD (Min-Max)

Groups	Flexibility improvement		p value
	Pre Intervention	Post Intervention	
Group A	46.70±2.31 (43-51)	57.50±3.21 (53-62)	t=14.548 p<0.001**
Group B	43.10±3.84 (34-48)	59.80±4.26 (52-63)	t=16.691 p<0.001**
Group C	42.80±4.52 (36-48)	45.00±4.55 (38-50)	t=8.820 p<0.001**

Figure 6: Comparison of effects of three types of treatment on flexibility improvement in cm using tape measurement



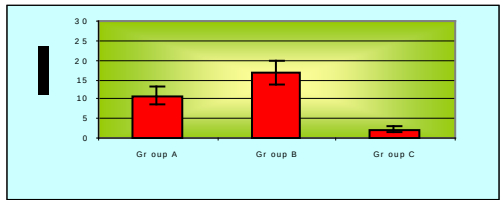
The Table - 2 presents the means mean values before intervention and after intervention of the static stretching group for gastrocnemius flexibility were 46.70±2.31 (43-51) and 57.50±3.21 (53-62), eccentric training 43.10±3.84 (34-48) and 59.80±4.26 (52-63), control group 42.80±4.52 (36-48) and 45.00±4.55 (38-50), respectively gain scores for each group. 3 dependent *t* tests were calculated on the pretest to posttest change for each group. The *t* tests indicated increases in gastrocnemius flexibility in all groups. The p values for the eccentric group t=16.691, p<0.001 and the static stretching group t=14.548, p<0, the control group t=8.820, p<0.001.

And this graph (Figure-6) shows comparison of effects of three types of treatment on flexibility improvement before intervention and after intervention in all three groups and it represent that all three groups has improved in gastrocnemius flexibility.

Table 3 Comparison of outcome between three different groups Results are presented in Mean±SD(Min-Max Comparison of outcome between three different groups

Groups	Outcome (Difference of Pre and Post)		
	Range	Mean ± SD	% Outcome
Group A	7-15	10.80±2.35	23.13
Group B	10-22	16.70±3.16	38.75
Group C	1-4	2.20±0.79	5.14
Significance	F=98.801, P<0.001**		

Figure 7: Comparison of outcome between three different groups



We calculated all the three groups improve in gastrocnemius flexibility. The table no. 3 shows comparison of outcome between three different groups. Group 1 static stretching has minimum and maximum improvement in flexibility respectively 7-15 cm Mean±SD 10.80±2.35 and shows improvement 23.13%. Group II eccentric training has minimum and maximum improvement in flexibility respectively 10-22 cm Mean ± SD 16.70±3.16 and shows improvement 38.75%. Group III control group has minimum and maximum improvement in flexibility respectively 1-4 cm Mean ± SD 2.20±0.79 and shows improvement 5.14%. Here we calculated both the experimental group significantly improved in compare to control group. Finally we calculated a one-way ANOVA to assess whether any significant differences existed in post intervention scores across the groups and found revealing a significant difference F=98.801, p<0.001**.

Finally, in an attempt to summarize the data, Posthoc analysis with a Tukey Honestly Significant Difference test indicated a significant difference between the gains in the static stretching group and eccentric training group in improving in gastrocnemius flexibility. But significantly higher improvement 38.75%. Found with eccentric training group (Figure 7).

Discussion

We rejected the null hypothesis that no difference would be seen in gastrocnemius flexibility after 6 weeks of static stretching and eccentric training as compared with a control group (no exercise). The groups that performed static gastrocnemius stretching and eccentric training for 6 weeks showed significantly greater gains in flexibility than the control group. Given the significant difference in gastrocnemius flexibility between the exercise groups, eccentric training appears to be more effective in increasing gastrocnemius flexibility. To date, this study is the first objective investigation of the effects of eccentric training on changes in muscle flexibility. The results support the theory that eccentric training through a full range of motion increases muscle flexibility. The gains gastrocnemius flexibility obtained in static-stretching group are quite similar to the 3 previous longitudinal studies on the effects of duration of static stretching.[11, 31,39]

Bandy et al1,[31] examined the effects of statically stretching the hamstrings for a variety of durations, including 30 seconds. The gains in knee-extension range of motion after 6 weeks of statically stretching the hamstring muscle for

30 seconds were very similar to the gains by the static-stretching groups in our study but not in eccentric training group.

Author Laroche et al [15] proved that after eccentric exercise they had greater range of motion we have also proved in our study that after eccentric training there is greater improvement in gastrocnemius flexibility.

Scott et al[19] that an incline board is no more effective at increasing active ankle dorsi flexion range of motion but in our study we have proved that incline board is effective at increasing gastrocnemius muscle flexibility.

Nobrega et al[18] says that resistance training alone did not increase flexibility, but resistance training did not interfere with the increase in joint range of motion during flexibility training. These results support the concept that specific training should be employed in order to increase either muscle strength or flexibility where as eccentric training increase strength of muscle and in our study we proved that it also increase flexibility.

The mechanism for the increased flexibility with eccentric gastrocnemius activity through the full range of motion is unclear. One explanation may be found in examining the possible neurologic mechanisms that occur with stretching. Static stretching may be effective in increasing the length of muscle due to the prolonged stretching, which may allow the muscle spindle to adapt over time and cease firing.[11,39]

The result of this adaptation/relaxation of the muscle spindle is an increased length in the muscle. Given that eccentric exercise through the full range of motion is a continual movement lasting only 5 seconds, the muscle spindle does not appear to have time to adapt, and this explanation does not appear to be appropriate for explaining the change in flexibility due to the eccentric activity. Although eccentric training of the hamstring muscles achieves the same flexibility gains as static stretching, the eccentric training offers a more functional option for flexibility training. Individuals training a muscle eccentrically may reduce the chance of injury by training the muscle in a more functional type of activity. [41,42]

Russell et al[21] has studied on hamstring muscle flexibility by using both eccentric training and static stretching for six week program and after six weeks they concluded the gains achieved in range of motion of knee Extension with eccentric training were equal to those made by statically stretching of the hamstring muscles and in our study on gastrocnemius we concluded the gains achieved in range of motion of dorsi flexion with eccentric training for 6 weeks were more significant in compare to those made by statically stretching.

Therefore, other research is now needed to determine if gains are made in strength, injury reduction, and performance improvement through an eccentric-training exercise program similar to the program used in the present study.

Limitation of the study

Our study was limited to the effects of eccentric training and static stretching on the flexibility of the gastrocnemius muscles.

Another limitation to this study is that the subjects were a sample of convenience of injury-free high school students.[21] Therefore, our findings are most applicable to a similar age group.

Our study has limited to one outcome measure other outcome measure can also be used.

In this study no follow up was given after one week, every week follow up was needed.

A larger sample size is required to make the study more reliable.

Further suggestion for research

Further studies are needed to determine if eccentric training and static stretching are equally effective in improving flexibility in other muscle groups, such as the quadriceps.

Further studies are needed to determine if other outcome measure can also be used (e.g., inclinometer).

Further research is needed to determine if an even older sample (e.g., elderly subjects) is able to achieve similar range-of motion gains.

In addition, incorporating this exercise technique into a rehabilitation program for an injured athlete should be investigated.

Conclusions

Thirty male students' of age between 15 to 17 years participated in this study. The study length shows increase in gastrocnemius flexibility after six weeks in all three groups (static stretching, eccentric training and control group). But eccentric training group shows statistically significant improvement than other two groups. Henceforth, the gastrocnemius flexibility in male students shows significant improvement in eccentric training after six weeks than static stretching.

Summary

The study is design to find out the efficacy of eccentric training verses static stretching, in improving gastrocnemius muscle flexibility in male students This study included thirty subjects of gastrocnemius shortening with lunge test positive between the age group of 15-17, they are divided into three groups (control & experimental groups- eccentric and static stretching group) randomly. Experimental group were treated with eccentric training and static stretching and control group were treated without any stretching. Each subject was treated 30 second treatment of each session for 3 sessions in week. Each subject received treatment for six weeks. The experimental groups were shown statistically significant improvement in gastrocnemius flexibility when compared with control group, whereas eccentric training is highly significant at $p<0.001^{**}$. When compared with static stretching group.

This study shows that static stretching and eccentric training both are effective but the eccentric training is highly effective and statistically significant in increasing gastrocnemius flexibility in male school students.

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Effectiveness of artifical horse riding on postural control in spastic diplegics - RCT

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Abstract

Objective: To determine the effectiveness of artificial horse riding (AHR) on postural control in children with spastic diplegia.

Methods: A convenience sample of 30 children, with spastic diplegia participated, whose ages were between 5 to 12 years. Subjects were randomly grouped into group A (n=15), receiving AHR and conventional therapy, and group B (n=15) receiving only conventional therapy. Therapy was given 3 times in a week for 6 weeks. Outcome measures were compared pre and post therapy using gross motor functional measure (GMFM) and pediatric balance scale (PBS).

Results: Paired t test was significant ($p < 0.0001$) for both groups for GMFM and PBS. Unpaired t- test was significant for group receiving AHR ($p = 0.0494$) as compared to control group for GMFM. Improvement was also noted in PBS following AHR compared to control, but was not statistically significant ($p = 0.4516$).

Conclusion: The results of this study suggest that AHR has a positive effect on postural control which is the foundation for gross motor activities. AHR appears to be a viable treatment strategy for therapist as a means to improve postural control in spastic diplegics.

Key words: Spastic diplegia; Hippotherapy; Artifical horse riding; Postural control; Gross motor function; Functional balance; Anticipatory postural adjustments.

Introduction

Artificial horse riding (AHR) is a treatment strategy using three dimensional, rhythmic, repetitive movements of a mechanical horse. Administration of AHR is based on adopting the concept of hippotherapy. Hippotherapy has been used by therapist in Europe since 1960s.

Hippotherapy has shown to improve co-ordination, gross motor skills, midline postural control, head control and equilibrium reactions in the trunk.[1] Bertoti report, in 1988, provided the first objective data on the benefits of hippotherapy. Results showed that posture improved significantly in 8 of the 11 children; where as spastic diplegia demonstrated an overall improvement. Other improvements such as reduced spasticity and improved balance were also reported.[2]

Rationale for using a horse is that it provides multi-dimensional movements to achieve specific therapeutic functional outcomes. As the horse walks, his/her center of gravity is displaced with up-and-down, side-to-side and rotational components of movement, which is very similar to the normal trunk and pelvic patterns human experiences when walking. Also the movements are rhythmic and repetitive thus the child anticipates and adapts to the movement.[3]

However, this beneficial therapy is not often available for majority of the patients because of limited access to horses, bad weather and relatively high cost making it cumbersome; alternatively, a artificial horse may be used, provided that the movements are three dimensional, rhythmic and repetitive.

Quint and Toomey, in 1998, studied the influence of Brunel Active Balance Saddle (BABS) which imitates movements of a walking horse, on pelvic mobility as compared to a static saddle. Based on statistical analysis, a significant increase in pelvic mobility in subjects who used the BABS as compared to static saddle was noted. Results reasoned that facilitation of normal postural tone; more appropriate reciprocal innervations and possible increase in soft tissue extensibility are likely to have increased pelvic mobility.[3]A paper article by Kuczynski and Sonka, in 1999, verified the beneficial effect of artificial saddle riding, using BABS, on stability of posture in CPs, using an autoregressive model and the possible acceptance of artificial saddle riding as an alternative form to hippotherapy to improve postural stability in CPs.[4]

As evidenced in these studies, the goal of AHR is not that the child is able to do something better when on the horse, but that he or she is able to move better when off the horse. Any motor skill or active postural control achieved while on the horse has the potential to influence the child's activities required for daily living of the horse. It is hypothesized that the stretching, facilitation, mobilization, spatial orientation and tactile reactions the child receives while AHR will improve his postural control. Through the rhythmical movement of the horse, the child experiences and begins to anticipate movements. The child learns to produce compensatory movements that reduce the displacement of his/her center of gravity and keep him or herself on the moving artificial horse. Repetition leads to the modification and reorganization of the central nervous system.

Patients are active participants in AHR. They are continuously responding to changes that encourage adaptive behaviors or movement strategies to maintain postural control on a dynamic surface. Postural control is the ability to control the position of the body in space for the dual purpose of balance and orientation. The development of postural control is postulated to be the foundation for normal gross

motor activities, and acquisition of motor skills is proposed to be dependant on the development of postural control.[1] If AHR influences acquisition of postural control, it may also influence acquisition of motor skills in everyday functional activities.

In addition to the automatic postural reactions necessary for postural control, active postural adjustments occur just before a voluntary movement. These postural adjustments are considered feed-forward anticipatory strategies. In 1960s scientist began to explore the way we use posture in an anticipatory manner to steady execution of skilled movement.[5] Spastic diplegic cerebral palsy are unable to maintain adequate postural control due to abnormal muscle activation and ineffective movement strategies. Insufficient control leads to lack of stability on base of support and abnormal postural adjustments when performing functional activities. The responses of these spastic diplegics to external disturbances or perturbations are adversely affected. Subsequently there is a delay in or absence in the development of anticipatory postural control. Therefore treatment commonly includes improving a variety of movement patterns, developing more advanced movement skills and improving postural control.

Typically therapist uses handling and verbal cues to stimulate feedforward anticipatory control in a functional task. Therapy balls are commonly used as a dynamic surface to develop postural control. Similarly, the artificial horse can be used as a dynamic treatment surface.

Though there are numerous studies conducted proving the effectiveness of hippotherapy on postural control on a wide range of neurological disorders, including cerebral palsy, there are very few studies that have been conducted and documented that would prove the effectiveness of AHR on postural control in CPs. AHR is most cost effective and convenient in clinical practice as compared to hippotherapy, though it cannot be compared directly to hippotherapy especially in a developing country like India. Till date, to my knowledge, no studies have been conducted proving the effectiveness of AHR on a homogenous group of CPs. This study has chosen spastic diplegia as the study group as this group has the maximum potential for ambulation as compared to other types of CP, provided intervention is provided early.

Objective of the study

To establish the effectiveness of artificial horse riding (AHR) on postural control in spastic diplegics in terms of gross motor function and functional balance.

Materials and methods: This randomized control trial was conducted in K.L.E.'S Hospital and MRC, Belgaum from November 2005 to July 2006.In this study 30 children both male and female with a diagnosis of spastic diplegic cerebral palsy between 5 to 12 years who were referred to pediatric physiotherapy department and whose parents were willing to allow their children to take treatment for 6 weeks at K.L.E.S hospital and MRC, Belgaum were recruited by convenient sampling method and then randomly allotted into two groups that is group A(experimental) and group B(control) according to computer randomized table. The inclusion criteria's for the study were1) Sufficient hip abduction to sit astride the artificial hors,e2)Stand independently for a minimum of 4 seconds,3)Belong to either Level I, II, III on the GMFCS and4) Able to follow simple verbal commands. The exclusion criteria's were 1) Level IV and V of the GMFCS,2)Seizures uncontrolled by medications,3) surgical procedures or lower extremity casting prior to 12 months of the study4)Vision and hearing impairment not corrected and 5)Hip subluxation.Instrument used in the study was a wooden shell motorized horse made of mild steel mounted on a vertical shaft with a reduction gear box which provided rhythmic repetitive movements in all 3 planes; frontal-130mm, saggital-90 mm and vertical-60mm , fabricated by M/s. Sam Engineers and fabricators, Belgaum.

Procedure

The parents of all participants were informed the purpose and procedure of the study and an informed consent was taken from them prior to participation.

In Group A: Experimental group (AHR and conventional physiotherapy): Before administering AHR, the participants were given conventional physiotherapy which included stretching, NDT, MFR and functional activities for 30 minutes. A rest interval of 15 minutes was provided followed by 30 minutes of AHR. The participants began by lying prone for 5 to 8 minutes on the artificial horse, followed by sitting astride facing forwards without performing any activity for 5 minutes as a part of warm-up. Following which participants were given activities such as throwing the ball, reach outs, touching different parts of the horse for 5 minutes. Then the participants were made to side-sit on the horse, first 5 minutes with no activity followed by activities as mentioned above for the next 5 minutes. Last 5 minutes participants were made to sit astride with no activity as a part of cool down. During the riding session the therapist provided continuous verbal and tactile cues to maintain correct postural alignment. Care was taken to ensure safety and avoid falls at all times. AHR was given for a total of 30 minutes. Total duration of treatment for the experimental group was one hour, three times a week for 6 continuous weeks, total of 18 sessions.

Group B Control group (conventional physiotherapy therapy): The parents of participants in this group received prior instruction regarding the procedure. The therapy administered included stretching, NDT, MFR and functional activities. Conventional therapy was given for a total of 1 hour, three times a week for 6 continuous weeks, total of 18 sessions.

Data analysis

Statistical analysis was done using the statistical software "MedCalc" 8.2 version. Chi-square test was used to find association between age, sex and different levels of GMFCS (I, II, III) between experimental and control group. Students paired t test was used to measure the difference between GMFM and PBS scores pre and post intervention, for both. Unpaired t test was used to test for significance between the two groups. Probability values of less than 0.05 were considered significant.

Results

Table-1 represents the demographic data of the participants. Male and female participants distribution between the groups was found to be equal i.e. 7:8 in group A and 8:7 in group B. GMFCS levels distribution was also found to be the same between groups. Participants in group A showed a significant improvement in GMFM with pre- score of 70.65+12.93 and post score of 76.77+12.64 as compared to group B whose pre score was 65.98+13.87 and post score of 66.83+13.83 with p<0.0001. (Fig-1) PBS scores in group A were also higher as compared to group B with p<0.04. (Table-2)But this improvement was not found to be statistically significant.

Table 1. Demographic profile of the participants

Experimental group				Control group			
Sr No.	Age	Sex	GMFCS	Sr No.	Age	Sex	GMFCS
1	5.20	F	II	16	7.2	F	III
2	6.60	M	III	17	7.9	M	II
3	5.30	M	I	18	6.9	F	III
4	6.60	F	II	19	7.0	M	III
5	5.90	F	II	20	5.9	M	I
6	5.10	M	II	21	11.6	F	II
7	6.70	F	III	22	9.4	F	I
8	7.00	F	III	23	5.0	M	III
9	7.40	F	II	24	11.4	F	II
10	7.20	M	III	25	7.0	M	II
11	5.11	M	I	26	8.1	M	III
12	11.00	M	II	27	5.0	F	II
13	9.80	F	I	28	5.3	M	III
14	5.10	M	III	29	6.8	M	II
15	10.20	F	II	30	8.8	M	III

Fig. 1: Gross Motor Functional Measure pre and post hippotherapy

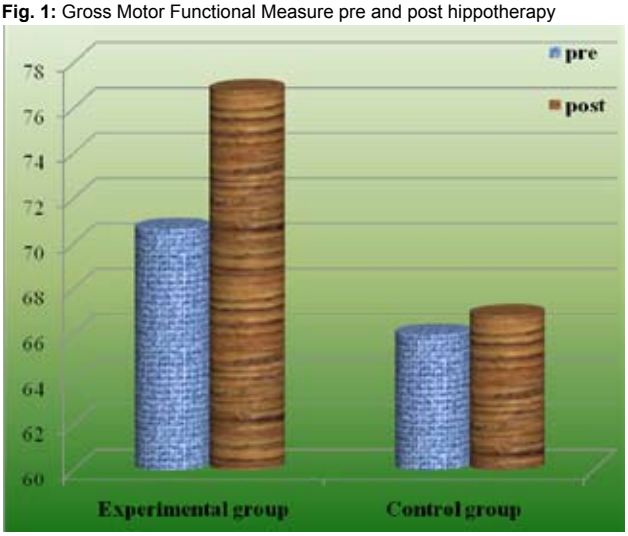

Table- 3 PBS score pre and post hippotherapy

	Experimental group	Control group	p value	Inference
PBS pre	31.67 ± 10.95	32.07 ± 9.75	0.7587	NS
PBS post	37.07 ± 10.36	33.47 ±9.76	0.4516	NS
p value	< 0.0001	< 0.0001		
Inference	HS	HS		

Discussion

The results of the study demonstrated a statistically significant improvement in GMFM total score for participants receiving AHR as compared to those participants who received only conventional physiotherapy treatment. Improvement in functional balance using the PBS was more in group A as compared to group B but the improvement was not statistically significant. The mean difference in GMFM total score, following intervention was 6.13% for group A and 0.85% for group B. The variation in GMFM total score change across time can be favorably compared with other studies that used GMFM as an outcome measure where there was 1% to 10% change following 10 weeks of hippotherapy.Magnitude of individual participant PBS score changed by 5.4 in group A and 1.4 in group B. More improvement was noted in the group receiving AHR along with conventional therapy compared to the group receiving only conventional therapy, but this improvement was not found to be statistically significant. This finding may be due to the small sample size and short duration of intervention. Positive results on balance have been found in a two case study by 5.6% and 12.5%, following 10 weeks, 3 times a week for 30 minutes of hippotherapy; but this study did not use a functional balance scale.[6]

AHR was administered using a mechanical horse, which provided 3-dimentional, rhythmic, repetitive movement. Fabrication of this artificial horse was based on the Brunel Active Balance Saddle (BABS). Studies conducted have shown BABS to faithfully reproduce the three-dimensional rotations of the horse at walk, as researched by Kunzle and Baumann (1979).[7] It accurately mimics the movement of the normal human ambulatory gait to stimulate able-bodied walking. This develops and improves physical and functional symmetry and control of the seat, torso and limbs. It stimulates the nervous and muscular system and encourages balance.[8] Therapy for 6 weeks duration was chosen to maintain patient continuity. Ferreira et al (2002) showed a positive influence on balance following 6 weeks, 3 times per week for 30 minute of hippotherapy. Since balance is a component of postural control, improvement in postural control was also expected.[6]

Spastic diplegics commonly present with impairments in postural control. In addition to automatic postural reactions, anticipatory postural adjustment (APA) occurs just before voluntary movements. Postural muscles are activated to provide a stable base to perform an activity. Dysfunctional motor recruitment and impaired co activation affects the quality of APR in spastic diplegics. Infants as young as 9 months show activation of their postural muscles of the trunk in advance to most of the reaching movements, and are mature by 4 to 6 years in a typically developing child. Riach and Hayes (1990) suggest that children as young as 4 years have already developed the ability to show APA during task performed in standing.[9] Liu et al (2007) in an observational study found that APA patterns may be present in CPs including spastic diplegics, but these adjustments are irregular and vary in amplitude and velocity. He stated that CPs showed more of an immature pattern of APA as compared to typically developing children.[10]

Postural adjustments made by the child during AHR, occur as a response to anticipated perturbations due to the

repetitive, rhythmic movement of the artificial horse and also during the functional activities such as ball throwing and reach outs which the child. APA is mediated by feed forward motor control processes generated by the CNS and are actively initiated movements to anticipate and counteract disturbances to balance. These APA are integral part of postural control. Repetition and practice makes these APR more appropriate and efficient. The three-dimensional movements produced by the artificial horse is correlated with the automatic physical reactions of the rider in the 3 components of movement of the human body i.e. static/ dynamic, weight shift and rotational component. The forward and backward movement of the artificial horse stimulates participants to develop control of the trunk via the flexors and extensors. Likewise, side-to-side movement's causes reciprocal activation of the participant's lateral flexors. The rotational component causes rotation in the trunk of the participants. This overall resulted in improvement of postural control.[11]

The concept of using AHR to improve postural control can be explained by adopting the concepts of hippotherapy. Hippotherapy can be explained using the dynamic systems theory along with theories of motor learning and sensory integration. Through the repetitive, rhythmical movement of the horse a child experiences and begins to anticipate movement with each step of the walking horse; the child learns to produce compensatory movements that reduce the displacement of his or her COG and keep him/her from falling off the horse. Practice and experience are believed to lead to the modification and reorganization of the CNS. By affecting multiple systems simultaneously such as the sensory, muscular, skeletal, limbic, vestibular, and ocular system. Hippotherapy may promote modification and reorganization of the CNS and increase the likelihood that the learning will be evidenced in movement patterns in other environment.[1]

There are numerous positions the therapist will have a child move into, and most often while the horse is moving. Different positions vary the sensory input, hip range of motion and pelvic tilt. Lying prone helps child to relax and reduces tone in spastic muscles, it also increases sensory input. Facing forwards increases the visual inputs, facing backwards provides a bigger stretch to the legs also a larger surface for upper extremity weight bearing. Side-sitting facilitates side to side weight shifts and increases balance challenges. Supine position provides total weight bearing to the body, facilitates equilibrium reactions and elongates rib cage.[12] Games like ring tossing and ball throwing are movement patterns used to promote normal functional movement patterns. Patients are active participants in hippo therapy. They are continually responding to a changing environment that encourages adaptive behaviors or movement strategies to maintain postural control on a dynamic surface. Similarly the artificial horse is also a dynamic surface, and with each movement of the artificial horse the child learns to anticipate movement and develops postural adjustments required to maintain postural alignment and balance. Also in this study we placed the child in prone, sitting astride and side-sitting because these positions will provide similar effect as that done on an actual horse. Along with this the child was also given activities like throwing the ball, tossing the ring, reaching activity all directed towards maintaining correct postural alignment and balance, which are the two main components of postural control.

GMFM was chosen as a primary outcome measure for this study to measure postural control. But prior to this participants had to be classified using GMFCS, which was developed to classify severity of functional limitation/ disability in children with CP, as children belonging to different level will have different maximum score attainable on the GMFM and different rate of progression to maximum score.[13] GMFM is a criterion-based observational measure. It samples motor skills that are typical of a normal developing milestone. All items can be accomplished by a 5 year old typically developing child. Postural control is required for gross motor skills. Acquisition of these skills depends on development of postural control, therefore assessments that analyses acquisition of gross motor skills can provide meaningful information about postural control.[14] similarly assessment that analysis functional balance can also provide meaningful information about the postural control as balance is a component of postural control. PBS which is a modified form of BBS used in elderly was used as a tool to measure functional balance in this study. PBS is also a criterion-based observational measure. Franjoine et al (2003) states that PBS is sensitive to changes in child's performance over time.[14]

The study however has a few limitations such as small sample size. Also, the duration of treatment in this study was much less as compared to other studies. Therefore further studies using a larger sample size and duration of intervention not less than 10 weeks I would provide more evidence as to the effectiveness of artificial horse riding in improving postural control.

Conclusion

AHR has shown to have positive effects on postural control. So it can be used as an alternative to hippo therapy as a treatment strategy for improving postural control in spastic diplegics in clinical setup.

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Single-nostril breathing to influence cognitive and autonomic functions.

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Abstract

Objectives: Analysis of the evidence for single nostril breathing as a therapeutic technique.

Data sources: Allied and Complementary Medicine database (AMED), British Nursing Index, Cumulative Index to Nursing & Allied Health Literature (CINAHL), Health Management Information Consortium (HMIC) and Ovid MEDLINE

Review methods: A literature search was conducted for articles with titles containing the words 'nostril' and 'breathing'. Experimental designs testing single nostril breathing with human subjects using dependant variables relevant to physiotherapy or occupational therapy were included (18). All others were excluded (6). Papers were analyzed for reliability and clinical validity.

Results: The age ranges of subjects were not specified in 6 papers. Those specified ranged from 15 to 78 years. The combined sample (579 subjects) was 50% male, 47% female and 3% of unspecified gender. Dependent variables researched included electroencephalogram (EEG) amplitudes, respiratory rate, heart rate, blood pressure and blink rate. Three papers confirmed their null hypothesis. The remaining 14 noted statistically significant changes. Clinical significance was only consistently noted for reductions of intra-ocular pressure with right nostril breathing.

Conclusions: Right nostril breathing may be useful for the symptomatic treatment of raised intra-ocular pressure or glaucoma. Confirmatory research is needed to determine whether single nostril breathing can be clinically effective for other autonomic markers.

Keywords: Nasal obstruction, heart rate, blood pressure, intraocular pressure, mood, cognition.

Introduction

Humans naturally breathe preferentially through one nostril at a time. The preferred nostril alternates in a simultaneous congestion-decongestion cycle. It is believed unilateral nostril breathing activates the contra-lateral brain hemisphere [1]. The right hemisphere is believed to play a greater role in parasympathetic nervous system activity than the left hemisphere [2, 3]. The nostril congestion-decongestion cycle is therefore believed to reflect the dynamic lateralisation of the autonomic nervous system. Breathing exercises have been advocated in physiotherapy literature to improve respiratory and bowel function [4] and in occupational therapy literature to facilitate spiritual emergence [5]. It has been assumed single nostril breathing can be used to therapeutically influence autonomic function [6] and may significantly affect other hemisphere-specific functions [7]. This article analyses the evidence to support the use of single nostril breathing for therapeutic purposes.

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Method

A literature search for English language articles with the two words 'nostril' and 'breathing' in their titles was conducted using the Allied and Complementary Medicine database (AMED), British Nursing Index, Cumulative Index to Nursing & Allied Health Literature (CINAHL), Health Management Information Consortium (HMIC) and Ovid MEDLINE. This search produced 24 hits. Six hits were disregarded. Two of these presented no original research, one used interventions of limited relevance to physiotherapy or occupational therapy and two studied alternate nostril breathing. One article was not about humans. The remaining 18 articles were grouped according to dependent variables and analysed for reliability and clinical relevance. The dependent variables identified include electroencephalogram (EEG) amplitudes, autonomic markers, blink rate as an indication of dopaminergic activity and measures of cognitive function.

Results

Autonomic function

Autonomic markers used in the literature included respiratory rate, heart rate, blood pressure, galvanic skin resistance and intra-ocular pressure. Sympathetic stimulation may be of use for the treatment of weakness or lethargy and parasympathetic stimulation may be of use for the treatment of anxiety or stress-related health problems.

Heart rate

Seven [8, **9**, 10, 11, 12, 13] research trials investigated the effect of single nostril breathing on heart rate. Two experiments with a combined number of 21 subjects revealed no significant effects from relaxed left or right nostril breathing for periods

of 20 minutes on heart rate [8, 12]. Three experiments with a total of 27 subjects showed association between 15 minutes of left nostril breathing and reduced heart rate [9, 13]. Two of these trials compared left nostril breathing to right nostril breathing at a rate of 6 breaths per minute [9]. Of these two, one utilised a repeated measurements design for control and experimental conditions with 4 male and 3 female subjects [9] (p=0.001). The other involved 16 repeated tests of the control and experimental conditions with one subject of unspecified gender (p=0.013, t=-2.831) [9]. Both of these trials were carried out by the same researchers and could possibly have been contaminated by researcher bias. The third trial [13], conducted by separate researchers utilised a repeated measurements design with 10 subjects of each gender. Heart rate reductions were evident after 15 minutes of left nostril breathing (P<0.01 males, P<0.05 females) and more pronounced after 8 weeks of daily 15-minute practice (P<0.001 males, P<0.05 females). While these differences were statistically significant the greatest mean heart rate difference noted in these trials was only 1.615 beats per minute. This technique is therefore unlikely to be clinically significant for heart rate.

The effects of left nostril breathing on heart rate while running for 10 minutes at 30% of maximum capability were tested on 88 male and 41 female right-handed sports and physical training students from Ataturk University aged 18 to 24. A same-subject controlled repeated measurements design was used. Results were analysed with t-tests using the Systat Statistical Package (http://www.systat.com/). Left nostril breathing significantly increased heart rate (mean increase = 6.03 beats per minute, t=3.36, p<0.001) but the same effect occurred with right nostril breathing (mean increase = 3.90 beats per minute, t=5.45, p<0.001) [11]. This may have simply been due to increased work of breathing.

Two research trials showed 15 minutes of right nostril breathing to increase heart rates [9]. One utilised a repeated measurements design for control and experimental conditions with 4 male and 3 female subjects (p=0.001) [9]. The other involved 16 repeated tests of the control and experimental conditions with one subject of unspecified gender (p=0.013, t=-2.831) [9]. The same researchers conducted both trials, so agreement of findings could possibly have been influenced by experimenter bias. One research trial [13] showed no significant effect from 15 minutes of right nostril breathing in 10 male and 10 female subjects. After 8 weeks of daily 15-minute practice heart rates had significantly dropped in males (P<0.01) but not females. The mean decrease in males was 12 beats per minute. It is unclear why changes were seen in males but not females. There was no control group, so it is possible uncontrolled factors during the 8-week period affected the results.

One trial [10] tested right nostril breathing on 8 female and 4 male volunteer yoga students with a randomised crossed-over same-subject controlled trial. Normal breathing was the control. Experimental and control assessments were taken on two separate consecutive days. Heart rate was measured over 10 minutes using a 10-channel polygraph (http://www.medicare-india.com/). Digit pulse volume was measured with a photoplethysmograph on the volar surface of the distal phalanx of the left thumb. Baseline measures were taken as soon as the subjects woke. The experiment or control was then practiced for 45 minutes and then the measures were repeated. Data was analysed with the 2-factor analysis of variance, multiple comparison Tukey test and t-test for paired data. No significant effect on heart rate was noted.

Most of the research analysed here tested single practice sessions of single nostril breathing. Only one trial tested the effects of regular practice [13] and this was only effective for right nostril breathing in males. The evidence suggests that single sessions of single nostril breathing have no clinically significant effect on heart rate. More research on the effects of daily practice over long periods may prove useful.

Blood Pressure

Five [8, 10, 11, 12, 13] articles examined the effects of single nostril breathing on blood pressure. Two experiments with a combined number of 21 subjects revealed no significant effects from relaxed left or right nostril breathing for periods of 20 minutes on blood pressure [8, 12]. One trial [13] using 40 subjects (10 males and 10 females for each experimental condition) found 15 minutes of left or right single nostril breathing to significantly decrease systolic (mean change: -7mmHg for the left nostril and -3mmHg for the right nostril) and diastolic (mean change: -7mmHg for the left nostril, and -5mmHg for the right nostril) blood pressures in males (P<0.05). After 8 weeks of daily 15-minute practices the drop in blood pressure was sustained (right nostril mean changes: -6mmHg systolic, P<0.001, -5mmHg diastolic, P<0.05, left nostril mean changes: -9mmHg systolic, P<0.001, -7mmHg diastolic P<0.01). Eight weeks of daily practice of right nostril breathing produced a significant drop of diastolic blood pressures in females (mean: -5mmHg, P<0.01). Eight weeks of left nostril breathing produced significant drops in systolic (mean: -8mmHg, P<0.01) and diastolic (mean: -5mmHg, P<0.05) blood pressures in females. There was no control group, so it is possible uncontrolled factors during the 8-week period affected the results.

One experiment [10] looked at right nostril breathing only for 8 female and 4 male volunteer yoga students free of major illnesses with a randomised crossed-over same subject controlled trial. Normal breathing was the control. Experimental and control assessments were taken on two separate consecutive days. Blood pressure (BP) was recorded using the standard method with a stethoscope and mercury (Hg) sphygmomanometer. Baseline measures were taken as soon as the subjects woke. The experiment or control was then practiced for 45 minutes and then the measures were repeated. Data was analysed with the 2-factor analysis of variance, multiple comparison Tukey test and t-test for paired data. A 9.4mmHg average increase in systolic BP (P<0.05) was apparent in the experimental trials, but there were no significant changes in the control.

Testing of the effects of unilateral forced nostril breathing on blood pressure after exercise in 88 male and 41 female right-handed sports and physical training students from Ataturk University aged 18 to 24, showed both right (t=4.87, p<0.001) and left (t=3.52, p<0.001) single nostril breathing to

significantly increase systolic blood pressures in men (mean increases 11.64mmHg left and 10.09mmHg right) but have no effect on diastolic blood pressures [11]. No significant effects were observed in women. Systolic and diastolic blood pressures were first measured at rest, and then after running for 10 minutes at 30% of maximum capability. The next day, the subjects blocked their left nostrils with wet cotton and the running test was repeated. The following day, the test was repeated with the subjects' right nostril's blocked. All post-test blood pressure readings were taken at 10am and the results were analysed with t-tests using the Systat Statistical Package. The results from the five articles on single nostril breathing and blood pressure analysed in this paper were conflicting and inconclusive. This data does not therefore support the use of single nostril breathing to treat abnormal blood pressures.

Respiratory rate

The effects of right and left single-nostril breathing were studied with two groups of 20 healthy first year medical students, aged 17-22 years using a same-subject, repeated measurements design [13]. Each group contained 10 males and 10 females and was exposed to either right or left nostril breathing. Baseline measurements were taken of respiratory rates (from observed abdominal wall movements) and peak expiratory flow rates using a Wright peak flow meter. Subjects were then asked to close one nostril with their right hands for 15 minutes after which time measurements were repeated. Subjects then practiced 15 minutes of single-nostril breathing daily for 8 weeks before the measures were repeated. The results were analysed with the paired t-test.

Fifteen minutes of either right-nostril ($P<0.0001$ males, $P<0.05$ females) or left-nostril ($P<0.01$ males, $P<0.001$ females) breathing significantly lowered respiratory rates. After 8 weeks of daily left-nostril breathing practice respiratory rates fell significantly more for both genders ($P<0.0001$) and peak expiratory flow rates rose significantly ($P<0.05$) for females but showed no significant change in males [13]. No such effects were seen with right nostril breathing. These results suggest that regular practice of left nostril breathing may reduce resting respiratory rates.

Galvanic skin resistance

Jain *et al* [13] investigated effects of 8 weeks of either right or left single-nostril breathing on the galvanic skin resistance of two groups of 20 healthy first year medical students aged 17-22 years using a same-subject, repeated measurements design. Galvanic skin resistance was measured before and after, from electrodes on the index and ring fingers using a J&J T-68 electro-dermogram. No significant changes were found when the results were analysed with the paired t-test.

Intra-ocular pressure

Six experiments [12, 14, 15, 16, 17] with a combined total of 210 subjects examined the effects of single nostril breathing for periods varying from 10 to 20 minutes on intra-ocular pressure. One of these looked at right nostril breathing only [15]. One examined forced unilateral nostril breathing [16], another looked at unilateral nostril breathing whilst running at 30% of maximal effort [17]. Four examined the effects of relaxed single nostril breathing [12, 14, 15, 16]. The presentation of the results in one research paper is difficult to interpret [16]. Of the other papers, relaxed right nostril breathing produced average intra-ocular pressure drops ranging from 6.19% ($p=0.043$)[12] to 27% ($p<0.0040$)[15] and left nostril breathing produced changes ranging from insignificance [12] to +4.5% ($p<0.109$)[14]. Relaxed right nostril breathing produced greater decreases of intra-ocular pressure than relaxed left nostril breathing in all 4 experiments on this technique. Right nostril breathing was associated with statistically significant decreases of intra-ocular pressure in all 6 experiments. Greater effects were noted when right nostril breathing was used by left nostril dominant subjects (-13.74% $p < 0.01$) than when used by right nostril dominant subjects (-5.23% $p < 0.05$) in one trial [16]. The results for left nostril breathing were contradictory, insignificant and inconclusive.

The experiment that tested unilateral nostril breathing while running at 30% of maximal effort [17] compared left nostril breathing to right nostril breathing but had no control group. A same subject repeated measurements design was used. Both left (-8.74% $p<0.05$) and right (-7.39% $p<0.05$) single nostril breathing were associated with significant drops of intra-ocular pressure. The observed changes may have been due to physical exertion or other uncontrolled factors. When the results were broken down by gender (24 men and 26 women), both nostrils significantly decreased intraocular pressures ($t = 3.42$, $p < 0.05$) in men. There were no significant effects for women, except for left nostril breathing which significantly decreased intraocular pressure of the left eye only ($t = 2.47$, $p < 0.05$). The authors did not specify the apparatus used and their methodology did not account for order effects. Overall the results of the experiments on intra-ocular pressure suggest that right nostril breathing may stimulate reduction of intra-ocular pressures. This finding may be relevant for the treatment of glaucoma.

EEG

One trial [18] tested the effects of unilateral nostril breathing on EEG amplitudes in 5 untrained subjects recruited from an advertisement in the University of California newspaper. Thermisters were attached to each nostril to check nostril dominance, and a Grass Model 6 (http://www.grasstechnologies.com/) was used to record EEG from the occipital, parietal, frontal, and temporal lobes. Baseline measures were recorded for 15 minutes. Subjects then closed their dominant nostrils with the index fingers of their opposite hands, and force breathed through the non-dominant nostril for periods between 11 - 20 minutes. The duration of each trial depended on each subject's ability and tolerance. Recordings were then continued as subjects alternated their breathing between nostrils, remaining with each nostril for periods between 11 and 20 minutes as their individual tolerances allowed. Each subject continued with this protocol until fatigued. Final values for EEG activity and nostril dominance were then measured. Data was analysed using the non-parametric sign test. Breathing

through one nostril produced significant ($p<0.05$) relative increases in the EEG amplitudes in the contra-lateral hemisphere for all 5 subjects. Concordance between EEG trace and nostril ranged from 67% to 92%. This finding may have implications for the facilitation of lateralized brain functions such as language, spatial cognition or autonomic activity. Such extrapolations would however be more valid if those dependent variables were measured directly.

Verbal and Spatial Cognition

Four trials looked at the effects of unilateral nostril breathing on the performance of verbal and spatial tasks [19, 20, 21, 22]. Three of these used Vandenberg and Kuse's [23] mental rotation task to assess spatial cognition [19, 21, 22]. Of these three, two used 3 groups of gender-matched subjects (combined total of 156) to compare left nostril, right nostril and normal breathing, and revealed no significant effects [19, 22]. Breathing techniques were only practiced for 5 minutes [19] and 10 minutes [22] in these two experiments and this may not have been long enough for any significant physiological effect. The third experiment used a same-subject, repeated-measurements design with crossover assigned according to nostril dominance and each breathing technique practiced for 30 minutes [21]. Increased spatial abilities were significantly associated with left-nostril breathing [21]. A separate experiment conducted by the same researcher assessed the effects of unilateral forced nostril breathing on ratios of verbal:spatial performance in 23 right-handed males using Kohs Modified Block Design [24], and reading memory tests based on the SAT (http://www.collegeboard.com/student/testing/sat/about.html) [21]. Subjects were randomly assigned to natural breathing (n=6), left nostril breathing (n=7) or right nostril breathing (n=10) experimental conditions. Right nostril breathing evoked more verbally oriented scores while left nostril breathing evoked more spatially oriented scores. This difference was significant ($t=2.127021$, $p<0.05$) but neither of the experimental conditions varied significantly from the normal breathing condition.

Three other trials with a combined total of 87 subjects for each condition showed no relationships between single nostril breathing and verbal ability [19, 21, 22]. Tests utilised included consonant/vowel matching tasks [19, 22], the Klein and Armitage verbal test [25] and tests based on the Miller Analogies (http://harcourtassessment.com/)[21] and SAT [21]. Breathing exercise durations ranged between 5 minutes (n=20)[19] and 30 minutes (n=51)[21]. Overall, the results of these seven papers do not suggest single nostril breathing has clinically significant effects for verbal or spatial cognition.

Dichotic listening

Listening for words typically exhibits a left ear advantage, whereas listening for emotional tone typically exhibits a right ear advantage [26]. Saucier *et al* [26] tested the effects of single nostril breathing on dichotic listening for word- and emotional targets in 23 male and 37 female right-handed subjects with no known nasal or sinus congestion. Nostril dominance was assessed by unilateral breathing through each nostril to check which nostril provided the least resistance. Subjects were then randomly allocated to dominant or non-dominant nostril breathing groups. Each subject completed 144 trials listening for anger amongst happy, sad and neutral emotional tones and 144 trials listening for the word 'bower' amongst the words 'dower', 'power' and 'tower'. For each of the two above tests, 36 correct trials were presented to each ear. The numbers of correct responses for each ear were converted into lambda scores.

A $2\times2\times2$ repeated measurements analysis of variance for listening task, nostril dominance and nostril assignment was performed on the lambda scores and confirmed a significant three-way interaction between the variables $F(1,57) = 4.136$, $p = 0.047$. Tukey's test confirmed right ear advantage for emotional targets and left ear advantage for word targets except for the right-nostril-dominant subjects assigned to the right-nostril-breathing group. Eight out of the 18 subjects in this group exhibited right-ear-advantage for word recognition. Saucier *et al* [26] concluded that right-nostril-breathing during right-nostril dominance might increase left hemisphere advantage for all types of lateralised tasks. As this effect was only evident in the right-nostril-dominant group it is unlikely to be of any clinical use.

Mood

One trial [27] studied the effects of unilateral nostril breathing on emotion in 22 female and 18 male right handed first year psychology students (free from nasopharyngeal irregularities) from the University of Toronto using the Spielberger State Anxiety Self Evaluation Questionnaire [28] and a present mood evaluation in which subjects rated themselves on scales from +3 to –3 for depressed-elated, negative-positive, anxious-calm, unhappy-happy, and hostile-agreeable. Subjects were also shown a mood-ambiguous picture and asked to tell stories about it.

Baseline tests were performed and nostril dominance was determined by condensation patterns on a mirror. A moistened cotton bud was then placed in the non-dominant nostril. Twenty-two subjects (11 of each gender) were left nostril dominant and 18 were right nostril dominant. Subjects were asked to breathe with their mouths closed for 5 minutes but allowed to take occasional deep oral breaths if they felt they were not getting enough air. Subjects were then shown the picture and asked to tell the most dramatic story they could about it. After this, tests were repeated and the cotton plug removed. Two independent raters scored the subjects' stories as positive, negative or neutral in tone. They agreed for 85% of stories and disagreements were resolved by discussion.

Gender had no significant effect on any measure. Stories were analysed with 2×2 (nostril × gender) analysis of variance. Left nostril breathing produced significantly more negative stories ($F(1,36) = 9.15$, $p < 0.004$) and right nostril breathing produced significantly more neutral stories ($F(1,36) = 9.24$, $p < 0.004$). There was no significant difference of nostril on the number of positive stories. A 2×2×2 (nostril × gender × time) analysis of variance showed the left nostril breathers had significantly higher anxiety

than the right nostril breathers ($F(1,37) = 5.23$ $p<0.008$). Left sided breathing subjects consistently rated themselves as feeling less positive than right nostril breathing subjects. For each dimension of mood (depressed/elated: $F(1,36) = 5.16$ $p<0.02$, negative/positive: $F(1,36) = 5.78$ $p<0.02$, anxious/calm: $F(1,36) = 3.72$ $p<0.06$, unhappy/happy: $F(1,36) = 4.75$ $p<0.03$) except for hostile/agreeable left nostril breathing subjects were less positive than right nostril breathing subjects when data was analysed with 2×2 (nostril × gender) analysis of variance. These results suggest that right nostril breathing may be useful in the treatment of depression and left nostril breathing may be useful in the treatment of mania. Further research would be required to triangulate this hypothesis.

Blink rate

Backon and Kullok [29] used a two-channel electro-oculogram to measure the blink rates of a 37-year-old right handed male subject during right and left nostril breathing. An ABAB design with 11 reversals was used starting with the left nostril. Each phase consisted of 6.5 minutes of single nostril breathing with the contra-lateral nostril blocked by cotton wool. Blink rates were measured during the last 30 seconds of each phase. Left-nostril-breathing consistently decreased blink rate and right-nostril-breathing increased blink rate in 5 out of 6 phases. Left-nostril-breathing blinks ranged from 1 to 3 per test. Right-nostril-breathing blink rates ranged from 3 to 7 per test. The Wilcoxon rank sum test produced a p value < 0.015.

Blink rate is believed to depend on central nervous system dopaminergic activity [29]. If these results reflect changes in dopaminergic activity right-nostril-breathing could possibly used to treat Parkinson's disease or depression and left-nostril-breathing could be used to treat schizophrenia [29]. The subject had an abnormally low baseline blink rate. Most humans blink about 20 times per minute. This threatens the external validity of the experiment. The changes of blink rate during single nostril breathing may not be due to alterations of dopaminergic activity. Repetitions of this design with several subjects and a valid dependant variable would be needed for evidence-based practice.

Conclusions

The research analysed here showed no clinically significant effects of single nostril breathing on heart rates or of short-term practice on blood pressures. One trial associated two months of daily 15-minute practice of left nostril breathing with clinically significant reductions of systolic and diastolic blood pressures. If this finding is confirmed by further independent research, this technique may be useful for treating chronic hypertension. There is weak evidence to support the use left or right single nostril breathing for periods of 15 minutes or more to reduce respiratory rates. These techniques could be used to treat hyperventilation. There is strong evidence of a relationship between right nostril breathing and reduced intra-ocular pressure. Right nostril breathing may be applicable to the treatment of glaucoma. Weak evidence from one trial links right nostril breathing with mood elevation and left nostril breathing with depression. If this evidence is substantiated these techniques may be useful in the treatment of depression and mania. All of the research analysed here was on healthy subjects, and may not be valid for extrapolation to pathology. The effects of single nostril breathing techniques may be greater or lesser at physiological extremes caused by pathology. Further research is required to determine whether forced single nostril breathing has greater effects that relaxed single nostril breathing, and whether the effects are greater if applied when a nostril is in its non-dominant phase of the nasal cycle.

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Effectiveness of neural tissue mobilization over cervical lateral glide in cervico-brachial pain syndrome - A randomized clinical trial.

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Abstract

Cervico-brachial pain is a significant problem affecting many individuals. Neural tissue mobilization [NTM] and cervical lateral glide [CLG] are the suggested treatment protocols for cervico-brachial pain syndrome (CBPS). However, no clinical trials have been found studying the effectiveness of one over another. This study was conducted to determine the effectiveness of NTM over CLG. Thirty seven subjects were randomly allocated to one of the two groups- control (CLG) and experimental (NTM). The treatment lasted for a maximum of seven sessions and was combined with hot packs and home exercises. Both the groups were followed for a total of six weeks. The outcome measures were: pain (VAS), painless elbow extension range of motion (i.e. P1), and neck disability index (NDI). Patients were assessed before and on day 8, day 22, and day 43. Non-parametric analysis was done due to the nature of the outcome measures and results showed that both the groups improved significantly for all outcome measures at p = .001. A between group difference was observed for elbow range of motion and NDI at six weeks (p = .001), hence proving the effectiveness of NTM over CLG.

Introduction

Upper quarter pain includes pain perceived in neck, shoulder, and arm, upper back and/or upper chest region with or without associated headache (Donatelli, 1997; Allison et al., 2002). The term cervico-brachial pain syndrome (CBPS) has been coined to describe this upper quarter pain in which mechanosensitive neural tissue is the primary feature. However, it is unaccompanied by neurological deficit like altered deep tendon reflex, paraesthesia and motor weakness (Cowell and Philip, 2002).Enhanced mechanosensitivity of the upper limb peripheral nerve trunks may contribute to the pathology of CBPS. The clinical presentation includes pain in neck, shoulder girdle and upper extremity. Neck pain may be limited to posterior neck region or depending upon the level of the symptomatic joint, may radiate to the occiput, shoulder, arm, forearm and hand. Pain may be intensified by active or passive neck movements.

The movements and forces generated during body movement have direct effects also upon the physiological activity of nerve tissue such as intraneural microcirculation and axonal transport / flow (Butler, 1991; Lundborg, 1988). Changes in neural physiology and mobility may result in the development of the patient's symptoms and the limitation of motion confirmed with upper limb neural tension tests –ULNTT (Walsh, 2005; Butler and Gifford 1989).

If any part of nervous system, through trauma, wear and tear is denied of movement, then pain and other symptoms (local and referred) may occur resulting in 'Adverse Neural Tissue Tension'. This is defined as, abnormal physiological and mechanical responses produced from the nervous system when their range of motion and stretch capabilities are tested (Koes et al, 1992; Hurwitz et al, 1996).

Few studies demonstrate the efficacy of physiotherapeutic methods in this disorder with questions raised as to whether CBPS is best treated with mobilization or immobilization. Treatment modalities range from neural tissue self mobilization exercises, cervical manipulation, strength training routines etc and can be grouped as conventional and manual therapy procedures.

The conventional therapy for CBPS incorporates rest, neck and head immobilisation, cervical collar, cervical traction, moist heat, ultrasound therapy, neck strengthening exercise programme and postural correction (Tan and Nordin, 1992; Walsh, 2005). The effect of manual therapy in the treatment of CBPS has been studied in various clinical trials, but it is not widely used in therapy (Allison et al, 2002). Approaches like cervical lateral glides (CLG) and neural tissue mobilisation (NTM) have been proposed.[2, 3] Cervical lateral glide was proposed by Elvey in 1986 and then revised by Elvey & Hall in 1997 (Donatelli,1997; Cowell and Philip, 2002; Coppieters et al, 2003). Elvey recommended that a CLG technique would allow movement of structures within the inter-vertebral foramen without undue tension being applied to the neural tissues. Since its description, CLG has been used extensively as a technique to improve neural mobility. It involves the passive techniques where the anatomic tissues or structures surrounding the affected neural tissue are gently mobilized with controlled and gentle oscillatory movement. Treatment can be more progressive by using mobilizing techniques in a similar manner but involving movement of the surrounding anatomic structures and the affected neural tissue together in the oscillatory movement. Passive movement of the pathologic neural tissue without

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movement of its surrounding anatomic tissues should be avoided, and any stretching of the affected neural tissue is absolutely contraindicated. Its effectiveness has been proved in chronic CBPS by Elvey & Hall 1997 and in lateral elbow pain by Vicenzino 1996.

A specific form of treatment for CBPS proposed is based on the hypothesized mechanism of mechanosensitivity. It includes neural stretches and neural mobilization techniques, which are directed at the adjacent structures that might impede on neural tissue mobility. Two approaches suggested (Coppieters et al, 2003):

Facilitation of nerve gliding by controlled angular joint movement

1. Mobilization of the surrounding structures while keeping the nerve comparatively still.

Though this treatment approach has become increasingly popular in clinical practice, no clinical trials could be found which reported the effect of specific neural tissue mobilization on this particular condition.

Our primary objective was to study the effectiveness of neural tissue mobilization over cervical lateral glide in cervico-brachial pain syndrome.

Methodology

The study was conducted in the out patient section of the Department of Physiotherapy (PT), Kasturba Hospital, Manipal, during the years 2004-2006. Patients Referred to P.T. department with upper quarter pain were screened for CBPS through clinical examination and were included in the study after getting the informed consent. A total of 37 subjects participated in this study with 18 subjects in group A and 19 subjects in group B. Groups were assigned using permuted block randomization.

Group A: CLG (control)

Group B: NTM (experimental)

Inclusion criteria

1. History of cervico-brachial pain of 2 -12 weeks
2. Positive neural tissue provocation test (ULNTT2A)
3. Age between 18 - 45 years

Exclusion criteria

1. Any neurological deficits elicited during routine examination
2. Dysesthetic pain
3. Cervicogenic headache, dizziness
4. Soft tissue inflammatory conditions like tendonitis, tenosynovitis, capsulitis, & bursitis
5. Rheumatic conditions
6. Cervical instabilities
7. Irritable disorders
8. Injury to spinal cord
9. Tumour
10. Circulatory disturbances
11. General health problems

The Instruments used were pressure biofeedback stabilizer (Chattanooga Inc., Australia), universal goniometer, body chart, visual analogue scale (VAS) neck disability index (NDI).[25, 26, 27]

Procedure

The study protocol was reviewed and approved by the institutional research committee of Manipal College of Allied Health Sciences (MCOAHS), Manipal Academy of Higher Education (MAHE). A hot pack was applied to the neck region and treatment was given to both the groups by the main author, in the following way:

Group A

The subjects in this group received cervical lateral glide (CLG) which was performed as follows

- The subjects were positioned supine on the couch with their cervical spine in neutral, arm by the side, elbow in flexion and hand resting on the stomach.
- The therapist stood at the head end of the couch and applied a lateral glide away from the level(s) involved i.e. C5-C6, C6-C7.
- Slow oscillations (one / 2-3 seconds) were then performed giving due respect to pain and resistance.
- Two sets of ten oscillations each were performed per session.

Group B

The subjects in this group received neural tissue mobilization

(NTM) utilizing ULNTT2A

- The subjects were positioned supine with affected side at the side of couch, cervical spine in neutral.
- Constant shoulder depression was maintained throughout the treatment session by using an air filled pressure sensor which was inflated to a baseline of 40mm Hg and shoulder girdle depression being applied to increase the reading of pressure sensor to standard 60mm Hg (Sterling et al, 2002).
- ULNTT2A was then performed by adding the sensitizing components from proximal to distal with elbow extension being the last one.
- Graded NTM was then given based on irritability and severity of the condition.
- Two sets of 30 repetitions each were performed per session.
- In both the groups pre- & post-intervention parameters (pain, elbow ranges) were recorded by the therapist blinded to the study.

Both groups were given home program, which included:

- Posture correction
- Cervical exercises (as mentioned)

The subjects were advised to continue the above mentioned exercises for six weeks.

Treatment sessions

Intervention was done for a maximum of seven sittings on a daily basis. For those whose elbow extension range during ULNTT2A showed improvement to the extent nearing normality, the treatment was terminated, however subjects were advised to continue home exercise program. Subjects were then followed up for six weeks.

Outcome measures

1. **Pain:** This was measured using VAS where pain as perceived by the subject during the day (rest pain) and not what we provoked by performing ULNTT2A.
2. **Elbow ranges:** A standard goniometer was used for measuring the elbow extension range immediately after the intervention. The stationary arm of the instrument was held along the medial border of humerus and the movable arm was aligned along the medial border of ulna, points being marked in order to minimize the error due to mal-alignment of the goniometer. The range at which the patient reported the first pain (P1) while performing ULNTT2A, was considered as the elbow extension range.
3. **Neck disability:** NDI was used which is a modification of the well-established Oswestry low-back pain disability questionnaire (ODQ).

Pain and elbow extension ranges were recorded on day one, day eight, day 22 and day 43. Neck disability scores were recorded on day one and day 43.

Data Analysis

The data obtained was tabulated and statistically analyzed using SPSS (version 11) package. Due to the nature of the outcome measures non-parametric statistical tests were used. Baseline characteristics were compared between groups to assess for homogeneity. The groups were found to be homogenous. The following tests were used for different outcome measures:

- VAS: Friedman's test
- Range: Within group-Friedman's test Between group- Mann-Whitney
- Disability: Within group- Wilcoxon test Between groups - Mann-Whitney

Table 1. Comparison of pain scores within each group

Pain		Control(n=18)	Experimental (n=19)
Day1	Median	7.5	7
	IQR	6-8	6-8
Day8	Median	1.5	0
	IQR	1-3	0-0
Day 22	Median	2	0
	IQR	0-2.25	0-0
Day 43	Median	2	0
	IQR	0-2.25	0-0
λ2		50.65	.001
p		41.66	.001

Results

A total of 39 subjects were identified as potential participants for this study and were randomly allocated to the control and experimental groups. Two of them were lost during the follow-up. So we were finally left with 18 subjects in group A and 19 subjects in group B. The Friedman test for pain and elbow ROM for within group comparisons showed that both CLG and NTM groups had significant improvement at p value of .001 and this is further depicted in table and figure1 and table 2. The Wilcoxon test for the within group analysis of disability scores showed that both the groups had statistically significant improvement at p value of .001. The between group analysis was done for ROM at day 8 and day 43 and disability scores at day 43, by using Mann-Whitney test, which showed that NTM group was superior to the CLG group at p value .001.

Table 2. Comparison of elbow extension ranges (ROM) in both groups

ROM		Control (n=18)	Experimental (n=19)	Z	p
Day1	Median	123.50	143.00		NS
	IQR	108.50-150.00	107.50-145.50		
Day8	Median	165.50	175.50	-3.482	.001
	IQR	152.75-171.25	171.50-178.00		
Day22	Median	162.50	176.50		NS
	IQR	150.00-175.75	174.00-180.00		
Day43	Median	162.50	176.00	-3.158	.001
	IQR	151.75-175.75	174.00-180.00		
λ2		34.07	45.95		
p		.001	.001		

As can be clearly seen from the above table and graph, both the groups had significant improvement. On day eight, the experimental group had already attained 'zero level' pain whereas; control group showed VAS scores between the ranges of 1-3. The carry over effect of both interventions were equal at six weeks as in, group A showed VAS scores of two and group B showed VAS scores of 'zero'.

Figure 1. Trend of pain scores in both groups

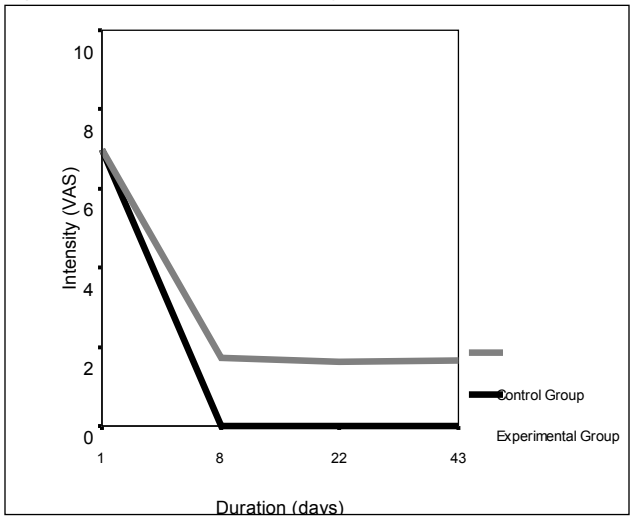

Figure 1 also demonstrates the similar trends in pain. There was a decline in both the groups in their pain scores from the initial baseline values. In group A, the pain values

plateaued at day 22 and day 43 without reaching 'zero' level. However, in group B, pain levels declined to 'zero' at day eight with the results maintained at the total follow-up of 43 days.

As depicted in table 2, elbow extension ranges improved for both the groups in the first week itself. The effects were well maintained in group B at day 22 and day 43, whereas, some subjects deteriorated in group A during the six weeks follow-up. Further, the between group analysis demonstrated that experimental group was superior to control group at day eight and day 43 (p value .001). However, no statistical significant difference was noted at day 22.

As can be clearly seen from table 3, both the groups improved with respect to their neck disability scores. The improvement was better in group B at day 43 as majority of the subjects reached the normal pain free functional status. Whereas, in group A though there was an improvement in functional scores, yet, most of the subjects were still not symptom free. Further, between-group analysis showed that improvement was better in group B and was statistically significant at p value .001.

Table 3. Comparison of neck disability scores in both groups

NDI		Control (n=18)	Experimental (n=19)	Z	p
Day1	Median	26	27		NS
	IQR	22-34.50	20-32		
Day43	Median	9.5	2	-3.17	.001
	IQR	6-13	0-4		
Z		-3.82	-3.72		
p		.001	.001		

Discussion

Although there are numerous studies that have addressed the issue of manual therapy in chronic neck pain, few studies have utilized mechanosensitivity of the neural structures as primary inclusion criteria for an intervention study in neck and /or shoulder pain (Allison et al, 2002). This study attempted to identify a specific subgroup of individuals with subacute neck pain using this diagnostic focus and to determine the efficacy of two active manual therapy techniques. One technique followed the principle of neural tissue stretching by utilizing ULNTT2A which is median nerve biased and the other technique focused more on the joint mobilization in the form of CLG. Positive benefits of NTM technique have been reported in two case studies of CBPS (Kaye and Mason, 1989) and mechanical allodynia of upper quarter following a hand injury. The current study suggests that each of the approaches (NTM and CLG) combined with traditional therapy consisting of cervical ROM and retraction exercises and application of hot packs resulted in an overall improvement in function, pain and elbow extension range of motion, as tested during ULNTT2A. This is also consistent with other studies that have individually demonstrated the efficacy of neural stretches and CLG (Allison et al, 2002). However, it is difficult to compare our results with other studies as their methods of intervention were vastly different as some studies have tested the immediate effects of a single manipulation and others have compared hands-on treatment with other conventional therapies (Coppieters et al, 2003). These techniques may not necessarily reflect the efficacy of manual therapy in the management of CBPS, in clinical practice.

The interventions in the current study, in comparison, were a more realistic representation of a pragmatic approach of the management of CBPS. Both interventions had components of a home exercise program and posture correction in addition to the intervention under study and it is acknowledged that this common component may account for some of the improvement in both the groups. The subjects chosen for this study fulfilled the symptomatic criteria for cervico-brachial pain and were found to have the physical signs implicating neural tissue as the dominant tissue of origin. The cause of the subjects' signs and symptoms was postulated to be neurogenic because of the distribution and behavior of pain, and the adverse responses to neural tissue provocation tests. The concept of the examination of the neural structures and their connective tissue coverings is based upon the premise that symptoms arising from pathology within the nervous system may be reproduced and differentiated by the application of manoeuvres that mechanically increase and decrease tension in these tissues while not influencing the non-neural structures. It is believed that an increase of tension will reproduce the symptoms and decrease of tension will reduce symptoms. The application of sensitivity tests help to confirm the diagnosis. This study clearly demonstrated significant improvement in pain (VAS), elbow extension range (ROM) and disability (NDI) following both manual therapy interventions. This improvement possibly may be attributed to the rapid hypoalgesic effects of mobilization-induced analgesia, a centrally mediated neurophysiological mechanism resulting from activation of a descending pain inhibitory system. The disability scores and elbow ROM shows better improvement in the NTM group. This may probably be due to the fact that in NTM group, neural structures were specifically targeted. Pain (VAS) was not compared between groups as this measure has a strong cognitive-behavioral component.

Both the groups demonstrated similar trends in their improvement. It is clearly seen from the results that significant improvement had occurred during the first week of intervention and the effects were carried over for upto six weeks, though no further improvement was observed. As depicted in the line diagram for pain, all the subjects showed marked reduction in VAS when compared to the baseline values. The improvement was better in the experimental group as most of the subjects reported their pain to be zero at day eight and during subsequent follow-up sessions. In the control group though there was improvement, some subjects showed slight increase in the VAS scores. This may be due to poor patient compliance towards home exercise program or because of certain abnormal work postures, but no definite reason could be stated for this trend in the pain scores. It is also notable that the number of treatment sessions required for NTM group were less when compared to CLG group. NTM group had significantly lower pain and disability scores and improved ROM by six weeks compared to CLG group. The magnitude of these differences however was clinically small. This study had a small sample size that may question the validity of interpreting the findings when comparing between the interventions. It is of interest to note that the majority of

subjects had a similar clinical presentation where in the onset was gradual, nature of pain was dull aching and side of affection was the dominant side of the individual. Postural abnormalities like forward head posture, protracted scapula and prolonged sustained postures were possible contributing factors to the symptoms.

Two forms of peripheral nerve pain have been identified following nerve injury: dysaesthetic pain and nerve trunk pain (Asbury and Field, 1984). Dysaesthetic pain mediated from damaged nociceptive afferent axon is characteristically felt in the peripheral sensory distribution of a sensory mixed nerve, where as nerve trunk pain is felt along the course of the nerve trunk. Nerve trunk pain is attributed to heightened activity in chemically or mechanically sensitized nociceptive sensory fibers that innervate the connective tissues of peripheral nerve trunks- the nervi nervorum (Cowell and Philip, 2002). The pain of subjects in this study appeared to be of a nerve trunk variety, in that most of them had dull aching sensation along the course of median nerve in the upper limb and they were clearly able to identify specific provocative activities such as writing and working on computer for more than thirty minutes, as these activities involve elbow extension and wrist extension, which are reported to increase tension on the median nerve (Lewis et al, 1998). However, it needs to be acknowledged that to distinguish between the two types of pain on purely subjective grounds can be difficult. Although we tried to select patients with predominantly peripheral neurogenic disorders, central processes are always involved to a certain extent. This was not assessed but could have acted as a confounder. However, there was equal representation of chronicity in both groups and this may have contributed to homogeneity between groups. But we acknowledge that the lack of controlling for this may be a limitation of this study. Also, it was not possible to control the use of analgesics and electrical modalities due to the ethical consideration. This may also have been a confounder.

The results of this study are in agreement with the findings that cervical mobilization reduces pain and disability scores and more specifically, with studies illustrating the benefits of a movement-based treatment approach for patients with peripheral neurogenic pain. Besides the capacity of the central nervous system to control the transmission of nociceptive impulses and the potential activation of descending pain inhibitory systems by joint mobilization, various definite hypotheses have been formulated that may explain the effects of treatment, like reducing mechanical forces on nerves, dispersing irritating chemicals and fluids in and around nerves and neurons, enhancing vascularity and stretching scar tissue. Most of these hypotheses still have to be examined in a systematic way. The sample size was small as some patients were lost during six week follow-up. Also, the inclusion criteria were stringent as only those with median nerve provocation tests positive, were included.

The consumption of NSAIDs by subjects was not controlled.

Use of electrical modalities even though it was to some other area, could have led to altered pain mediation by influencing the descending pain inhibitory pathways. Due to the relatively small sample size, it was not possible to infer patient characteristics corresponding with treatment outcome. Future research is essential to reduce the variability in patient selection in clinical trials and to further optimize clinical practice. Also, further studies may require more regular assessment during the intervention period to determine the timeframe of improvement and to investigate the delineation between the specific and non-specific elements of manual therapy and the rationale for adapting the specific intervention according to the repeated assessment findings.

Conclusion

This study investigated two forms of manual therapy interventions combined with home exercises in individuals with cervico-brachial pain. Both interventions demonstrated significant improvement in pain, elbow extension range and disability scores and therefore both interventions had significant therapeutic overlap. The effects of treatment in both the groups were maintained throughout the six week follow-up. It was noticed that NTM group required fewer sessions for the optimum benefit and had a better carry over effect as compared to the CLG group. Hence, the findings of this study suggests that Neural Tissue Mobilization utilizing ULNTT2A as a treatment technique is more effective than Cervical Lateral Glide.

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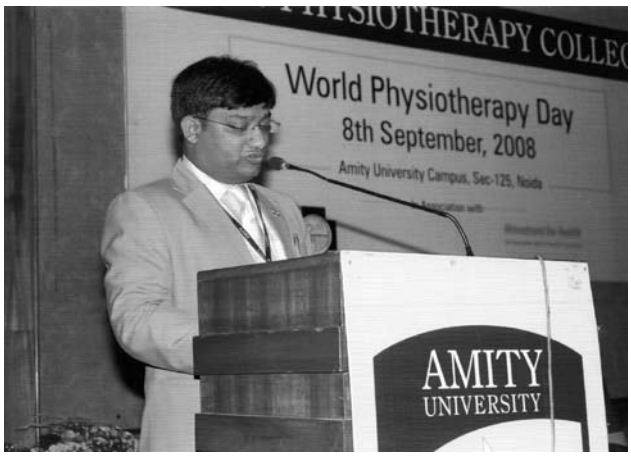
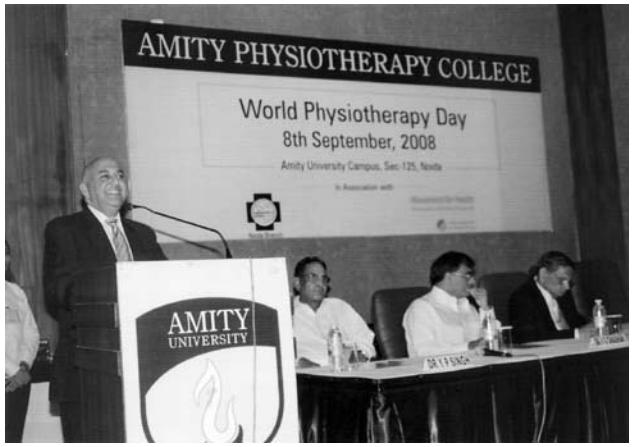
World Physiotherapy Day at Amity Physiotherapy College

With the origin of Physiotherapy, people world wide are living longer and busier lives. Every year physiotherapists help billions of people to manage the effects of ageing, illness, accidents, stresses and strains of lives. Today physiotherapy is an essential part of health services around the world and its contribution and importance is growing over the years.

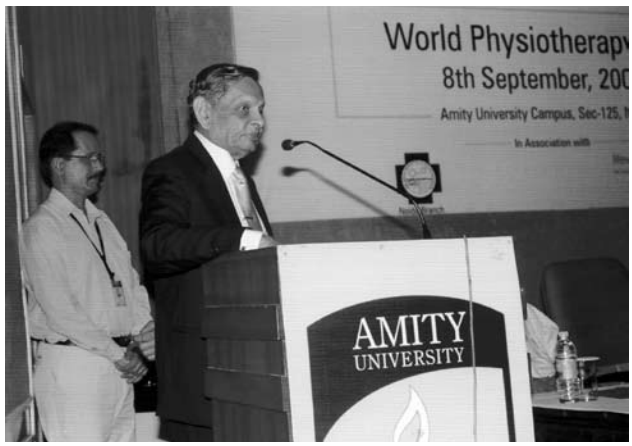
On the occasion of World Physiotherapy Day Amity Physiotherapy College, organized, one day seminar at Amity University Campus, Sector – 125, Noida, INDIA. **Dr. Ali Irani,** President, Indian Association of Physiotherapists, **Dr. V.S. Chauhan,** Head, Prakash Hospital, **Maj. Gen. K.J. Singh,** Vice Chancellor, Amity University, **Dr. Nitesh Bansal,** Director, Amity Physiotherapy College inaugurated the seminar with lighting of the lamp.

Welcoming the delegates **Dr.Nitesh Bansal** said World Confederation for Physical Therapy (WCPT) has designated 8th September, the date WCPT was founded in 1951, as World Physiotherapy Day. The profession specializes in human movement: that is why the theme of World Physiotherapy Day, on 8th September, is ***"Movement for Health".*** Physiotherapists identify physical impairments, limitations, and disabilities that prevent people from being as independent as they can be.





While addressing the students and participants, **Dr. Ali Irani,** President, Indian Association of Physiotherapists said that the physiotherapy today is an independent profession and encouraged students to come in this profession by saying his experience on how he had chosen this profession. One day while playing football and got injured and at that time there were no physiotherapists. This changed his mind and he chose physiotherapy and sports medicine as a specialization. Dr. Irani informed the audiences that there are 160 physiotherapy colleges in India which offer undergraduate courses, 80 colleges offer post graduate and 5 colleges offer research Ph.D in physiotherapy. Emphasizing on the scope of physiotherapy, Dr. Ali remarked that it has increased manifold and is now used in the pediatrics, orthopedics, cardiology, manual therapy, sports medicine, neurology, chest medicine, geriatrics etc. The services of physiotherapist are also used in disaster management, rural rehabilitation.



Maj Gen K.J. Singh, Vice Chancellor, Amity University said that with higher stress level ad sedentary lifestyle, ailments from neck to toe are increasing day by day. Some of which can be only cured through physiotherapy. Lauding the efforts of physiotherapeutic, Gen Singh remarked that a patient surrenders in front of the therapeutic healer thus the Practioners should also come to that level to ease the pain of patients like a friend.

During the occasion, prizes were given to the winners of All India Physio Gyan Examination which was held in March 2008. All India First rank prize was awarded to Saurabh Sharma, *(final Year Student of Amity Physiotherapy College),* Fourth rank awarded to Abha Sharma and Fifth rank winner was Rashi.

Dr. B. Shukla, Pro Vice Chancellor, Amity University, senior officials of Amity, more than 200 practicing physiotherapists, trainees, students were present to attend the seminar.

PRESS CLIPPINGS

IN COMMEMORATION

To commemorate World Physiotherapy Day on September 8, Amity Physiotherapy College had organised a one-day seminar at the Amity University Campus. Ali Irani, president, Indian Association of Physiotherapists, V S Chauhan, head, Prakash Hospital, Maj Gen K J Singh, vice chancellor, Amity University and Dr Nitesh Bansal, director, Amity Physiotherapy College inaugurated the seminar with the lighting of the lamp. During the occasion, prizes were given to winners of All India Physio Gyan Examination, which was held in March 2008. The All India First rank prize was awarded to Saurabh Sharma. B Shukla, pro-vice chancellor, Amity University, senior officials of Amity, practicing physiotherapists, trainees, students were present at the seminar.

IN BRIEF

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HAPPENINGS

localevents

Physiotherapy Day

On the occasion of World Physiotherapy Day, Amity Physiotherapy College organised a one-day seminar at the Amity University Campus, Sector 125. Dr. Ali Irani, president, Indian Association of Physiotherapists, and Dr. V. S. Chauhan, head, Prakash Hospital, were present on the occasion. Emphasising on the scope of physiotherapy, Dr. Ali remarked that it has increased manifold and is also used in pediatrics, orthopedics, cardiology, manual therapy, sports medicine, neurology, chest medicine, geriatrics, etc. On the occasion, prizes were given to the winners of All-India Physio Gyan Examination, held in March this year. The all-India first prize was given to Saurabh Sharma.

The Hindustan Times Noida - HT Live Noida / Page 05

फिजियोथेरेपी के इलाज से मिलती है पूर्ण संतुष्टि : डॉ. इरानी

नोएडा। पिछले कुछ वर्षों में चिकित्सा के क्षेत्र में फिजियोथेरेपी ने व्यापक परिवर्तन किया है। न केवल लोगों को रोगों से निदान दिलाया है, बल्कि चिकित्सा क्षेत्र को भी नई दिशा दी है। आधुनिक दवाईयां एक बार दर्द से निजात दिला देती हैं। यह बातें एमिटी विश्वविद्यालय में आयोजित सेमिनार का उद्घाटन करते हुए इंडियन एसोसिएशन ऑफ फिजियोथेरेपिस्ट के डॉ.अली इरानी ने कही।उन्होंने कहा कि कई बार लोग एक बीमारी से मुक्ति पाने के चक्कर में दूसरी बीमारी चपेट में आ जाते हैं। फिजियोथेरेपी द्वारा इलाज कराने पर व्यक्ति को पूर्ण रूप से संतुष्टि मिलती है। प्रकाश अस्पताल के निदेशक डॉ. वीएस चौहान ने कहा कि आज के भौतिकतावादी युग में व्यक्ति का खानपान, रहन-सहन के कारण विभिन्न व्याधियों के चक्कर में आ जाता है।

Amar Ujala - New Delhi Page 12

बीमारियों के इलाज में फिजियोथेरेपी बेहतर विकल्प

नोएडा, सं : बीमारियों के इलाज के लिए लोगों ने योग, ध्यान व फिजियोथेरेपी का सहारा लेना शुरू कर दिया है। इसका लाभ भी लोगों को मिल रहा है। उक्त बातें इंडियन एसोसिएशन ऑफ फिजियोथेरेपिस्ट के अध्यक्ष डॉ. अली इरानी ने सोमवार को एमिटी विवि में सेमिनार के दौरान कहीं। इससे पहले डॉ. इरानी ने विश्व फिजियोथेरेपी दिवस पर आयोजित सेमिनार का उद्घाटन दीप जलाकर किया। उन्होंने कहा कि दवाएं व ऑपरेशन दर्द से निजात तो दिला देती हैं, लेकिन इसके कई दुष्प्रभावों को जिंदगी भर झेलना पड़ता है। फिजियोथेरेपी से मरीजों का बेहतर इलाज के साथ ही संतुष्टि भी मिलती है। मांसपेशियों आदि की बीमारियों के लिए फिजियोथेरेपी एक बेहतर विकल्प है। प्रकाश अस्पताल के प्रबंध निदेशक डॉ. वीएस चौहान ने कहा कि भाग दौड़ भरी जिंदगी में लोगों के रहन सहन, खान पान अदि में लगातार परिवर्तन हो रहा है। ऐसे में शारीरिक गतिविधियों से लोग दूर होते जा रहे हैं। इससे कई बीमारियां लोगों को अपने चपेट में ले रही हैं। इससे बचाव के लिए फिजियोथेरेपी चिकित्सा कारगर साबित हो रही है। एमिटी विवि के उप कुलपति जय सिंह ने कहा कि फिजियोथेरेपी के जरिए हृदय रोग समेत अन्य रोगों के उपचार में भी मदद मिल रही है। इस मौके पर डॉ. दीपक कुमार, डॉ. वीपी गुप्ता, डॉ. एके भटनागर, डॉ. राजीव अग्रवाल, डॉ. हेमंत जुनेजा, बलविंदर शुक्ला, नीतिश

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फिजियोथैरेपी के इलाज से मिलती है संतुष्टि ■

फिजियोथैरेपी से इलाज कराने पर व्यक्ति को संतुष्टि मिलती है। यह कहना है इंडियन एसोसिएशन ऑफ फिजियोथैरेपिस्ट के अध्यक्ष डा. अली इरानी का। वह एमिटी विश्वविद्यालय में सोमवार को विश्व फिजियोथरेपी दिवस पर आयोजित सेमिनार में मुख्त अतिथि थे। विश्वविद्यालय के उप कुलपति जय सिंह मेजर जनरल ने कहा कि फिजियोथैरेपी के जरिए हृदय व अन्य रोगों के उपचार में काफी मदद मिलती है। इस अवसर पर प्रकाश अस्पताल के निदेशक डा. वीएस चौहान के अलावा छात्र मौजूद थे।

Rashtriya sahara - Noida - Page 03

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