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Effect of Muscle Energy Technique and Stabilization Exercise on Forward Neck and Rounded Shoulder for Elite Swimmers

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Abstract

Forward Neck and Rounded Shoulder is one of an incorrect posture. Craniovertebral angle, rounded shoulder posture measurement and posture screen mobile are the types of outcome measures to assess the conditions. To find the effect of the Muscle Energy Technique and Stabilization Exercise on the forward neck and rounded shoulder for elite swimmers. Study Design: Experimental study. Method: The study design was an experimental study, 30 male elite swimmers were selected from Pondicherry Swimming Pool Academy, They were allocated divided into two groups, Group A (n=15) Muscle Energy Technique and Stabilization Exercise Group B (n=15) Conventional treatment, 3 sessions in a week for 6week, The outcome measure (Craniovertebral angle, Rounded Shoulder Posture Measurement and posture screen mobile) were measured in pre and post-test for 6 week period. Results: Data analysis was done by unpaired 't' test and paired 't' test for the between group and within the group analysis respectively, The statistic analysis done with unpaired 't' test within the Group A and Group B analyses is shown significance ($p<0.01$). Which shows that Group A must be significant than Group B, it have been concluded that Group A shows improvement in rounded shoulder and forward neck posture in elite swimmer with the outcome measures than Group B. Conclusion: This study concludes that the Muscle Energy Technique and Stabilization Exercise (Group-A) shows more significant improvement in rounded shoulder and forward neck posture in elite swimmers when compared with conventional treatment (Group–B)

Key Words: Craniovertebral Angle, Muscle Energy Technique, Stabilization Exercise, Rounded Shoulder Posture, Forward Head Posture.

Introduction

Swimming is an individual or group sport that requires the use of the whole body to walk on water. Swimming requires a variety of shoulder movements in rotation with anti-clock directions and clock direction with various levels of internal rotation and external rotation. Advanced swimming and retrieval consists of four different strokes of different distances, including freestyle, butterfly, backstroke, and breaststroke.

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The FREESTYLE STROKE is to exhale, the body slowly bends to the side during the arm's recovery, and the head turns to the side until the mouth is above the water surface. The BUTTERFLY STROKE has a movement as both arms are moving in the same motion at the same time rather than alternating. The BACKSTROKE or crawling back uses opposite arm movements and the shoulder of the arm that is currently pulling back into the water is lower than the shoulder of the arm that recovers forward above the water, The BREAST STROKE movement begins with a full flexion with internal rotation.[13]

Forward head position is the anterior position of the cervical spine that occurs when the lower cervical spine is bent and there is an extension of the upper cervical bone and head.[1,2,3]. Changes in curvature of the neck bone causes upper crossed syndrome due to imbalance of muscle pattern leading to rounded shoulder posture (RSP)[1,2]

Muscle Energy Technique is a therapeutic intervention in which the patient actively contacts the targeted muscles against an exact point, clinically controlled counter force, followed by rest and stretching. This technique is widely used to strengthen and enlarge muscles, reduce edema, improve circulation, and mobilize limited articulation. Several groups have shown positive effects of using MET. [11,12]

Stabilization training is an effective form of physical therapy designed to strengthen the muscles to support the spine and helps prevent low back pain. Current practices to aid in prevention and treating forward shoulder posture focus on stretching the anterior shoulder muscle and strengthen the elongated posterior scapular stabilizers.[13,14]

Posture Screen Mobile accurately measures angles and exact distances of posture displacement and clinical examination documents. Using a posturescreen with Structure Sensor on supported phones, allows real 3D full body scanning. Imagine being able to visualize your client's image in real 3D, and then visualize it in any perspective. Easily deploy 3D client models in supported software.[9]

This study focus that the forward neck and rounded shoulder posture is not uncommon for professional swimmers. The posture and the biomechanical approach along with regular exercise should be implicated. Hence this study analyzes the effect of METs and Stabilization Exercise on forward neck posture and rounded shoulders on elite shoulders.

Materials and Methodology

The study was an experimental study designed with pre and post type. This was conducted in the Pondicherry swimming pool academy, Pondicherry, for a duration of 2 months. This study includes 30 swimmers. Group A received Muscle Energy Technique and Stabilization Exercise, whereas Group B received usual conventional exercise for 2 months in alternate days. The pre and post-test were evaluated by craniovertebral angle rounded shoulder posture measurement and posturescreen mobile.

Inclusion Criteria	Exclusion Criteria
Age Group between 20 -25	Any Shoulder Pathology
EliteSwimmers.	Recent History ofSurgery
Rounded Shoulder (Distance between Posterior Aspect Of Acromiom Process And The Examining Table Is More Than 1 Inch Or 2.5cm)	Beginner Swimmers and untrained
Forward Neck Posture (More Than 55°)	Any other associated postural malalignment

PROCEDURE

The study included 30 subjects of competitive swimmers. They were divided into two Group A (n=15) Muscle Energy Technique along with Stabilization Exercise–15 swimmers and Group B (n=15) conventional treatment by random allocution method. After signing an informed consent sheet they were admitted to the study.

PROPRIOCEPTIVEASSESMENT:

CRANIOVERTEBRAL ANGLE:

Using a goniometer, the following two angular measurements were taken.

The angle is formed by the line connecting C7 to the posterior aspect of the Tragus of the ear and a horizontal line.

The angle is formed by the line connecting the Tagus of the ear with the lateral corner of the eye and a horizontal line.

POSTURESCREEN MOBILE (PSM)

Capture of the lateral side was taken with 10 feet distance. PSM wants it to select 17specific anatomical landmarks. Twelve landmarks were placed on the anterior side and five terrestrial markers were placed on the lateral view image in the following areas: 1) external auditory meatus, 2) shoulder center at cervicothoracic junction, 3) greater trochanter, 4) tibiofemoral joint center, and 5) center of the malleolus. PSM then calculates the following 5points of data used using related algorithms: head shift (lateral), head shift (longitudinal), head tilt shoulder shift (lateral), shoulder shift (longitudinal). The result was displayed and marked inched by inches.

GROUP–A CONTROL GROUP (Stabilization Exercise and Muscle Energy Technique)

STABILIZATION EXERCISE

Warm-up exercises are provided before stability exercises like walking and pushups. Each exercise was performed for 15 repetitions. Stretching exercises are performed with the aim of increasing the flexibility of the pectoralis muscles and cervical neck extensor muscles. The Y-W exercise (fig 1) is done by placing the swimmer in a prone lying elbow flexed and shoulder abducted to120°, thumb pointed up, arms 4-5 in, raised while keeping the reaction of the scapula. Then elbow flexed and the shoulder moved in a position of extension and the L-Y exercise is done by placing the swimmer in standing Shoulder abducted to 90° and elbows flexed to 90° with retracted the scapula and arms externally rotated. Arms raised above Shoulder abducted to 90°and elbows flexed to 90°with retracted scapula and arms externally rotated. Arms raised above the head and fully extended the elbows so that formed the letter Y.

Fig 1: W-Y EXERCISE and L–W EXERCISEMUSCLE ENERGY TECHNIQUE

Muscle Energy Technique (Fig. 2) is given after the Stabilization Exercise for 3 muscle groups.

Suboccipitalis muscle

The therapist had to move neck into flexion just short of craniocervical flexion and the subject was asked to gently push back into craniocervical extension with mild effort for 7-10 seconds.

Upper Trapezius

In this technique the therapist should stabilize one side shoulder of the swimmer, and then the ear area of the same side was held by the opposite hand. The subject then shrugged the stabilize shoulder towards the ear at a sub maximal pain free effort.

Pectoralis Major

The subject arm was abducted to 90° and 140° and externally rotated. Grasp the subject arm above the elbow then subject was asked to slowly push the arm towards the ceiling for 7 to 10 seconds and arm was moved into barrier.

Fig 2: Muscle Energy Technique for Sub occipitalis Muscle, Muscle Energy Technique for Pectoralis Major Muscle And Muscle Energy Technique for Upper Trapezius Muscle

GROUP–B CONTROL GROUP (Conventional treatment)

The regular warm up exercise including Chin tuck exercise, Pushup exercises, Chest doorway stretch, Reverse shoulder stretch for 30 minutes.

STATISTICAL ANALYSIS

THE BETWEEN GROUP ANALYSIS OF CRANIOVERTEBRAL ANGLE,

GROUP ANALYSIS OF ROUNDED SHOULDER POSTURE MEASUREMENT and

GROUP ANALYSIS OF POSTURESCREEN MOBILE

Table . 1: THE BETWEEN GROUP ANALYSIS

GROUP A and B	MEAN	SD	t- value	p- value
CRANIOVERTEBRAL ANGLE				
PRE TEST	43.99	2.62963	11.51	0.001
POST TEST	47.13	1.83		
PRE TEST	42.9	2.30	9.87	0.001
POST TEST	44.4	2.30		
ROUNDED SHOULDER POSTURE MEASUREMENT				
PRE TEST	4.48	0.42	18.57	0.001
POST TEST	2.79	0.28		
PRE TEST	2.66	0.24	17.53	0.001
POST TEST	1.87	0.35		
POSTURESCREEN MOBILE				
PRE TEST	4.26	3.24	16.63	0.001
POST TEST	0.413	0.32		
PRE TEST	2.65	2.28	65.73	0.001
POST TEST	1.45	0.24		

Results

Within the Group analysis of A (Experimental group), The mean and SD of CVA for the pre and post values are 43.99 ± 2.629 and 47.13 ± 1.83 and "t" value is 11.51. The mean and SD of RSP measurement for the pre and post values are 4.48 ± 0.42 and 2.79 ± 0.28 and "t" value is 18.57. The mean and SD of posturescreen mobile pre and post values are 2.65±2.28 and 1.45±0.24 and "t" value is 65.73. The statistical analysis is done with paired "t" test within the experimental group analysis shows the significance of ($p<0.001$). Within the Group analysis of B (control group), the mean and SD of CVA for the pre and post values are 42.9±2.30 and 44.4±2.30 and "t" value is 9.87. The mean and SD of RSP measurement for the pre and post values are 4.26 ± 3.24 and 0.413 ± 0.32and "t" value is 16.63. The mean and SD of posturescreen mobile pre and post values are 2.66 ± 0.24 and 1.87 ± 0.35 and "t" value is 17.53. The statistical analysis is done with paired "t" test within the experimental group analysis shows the significance of($p<0.001$).

Between the group A and B the mean and SD for the CVA angle are 47.13 ± 1.836 and 44.46± 2.3026, "t" value is 3.88 and "p" value is 0.001.

Between the group A and B the mean and SD for the RSP measurement are 1.45 ± 0.24 and 1.87 ± 0.35, "t" value is 4.35 and "p" value is 0.001.

Between the group A and B the mean and SD for the posturescreen mobile are 1.45± 0.24 and 1.87 ±0.35, "t" value is 4.35 and "p" value is 0.001.

The statistical analysis done using unpaired t-test with the values of experimental and control group shows significance of ($p<0.001$). After the statistical analysis, it shows that there is improvement to normal rounded shoulder and forward head posture the experimental group A.

Discussion

The present study is the experimental study conducted to find out the "Effectiveness of Muscle Energy Technique and Stabilization Exercise on forward neck and rounded shoulder for elite swimmers". This study was selected for the purpose to correct the forward neck and rounded shoulder posture in elite swimmers.

Kevin g. laudner et al, (2015) studied data for treating forward shoulder posture supports stretching the anterior shoulder musculature for 40 collegiate swimmers, where 20 were in experimental group and 20 were in control group. The result reveals that 6 weeks of MET treatment applied to pectoralis minor of asymptomatic female swimmers provided improvement in forward shoulder posture.

Kiana ft hollahnejad et al, (2019) studied the effect of manual therapy and stabilizing exercise on 60 women categorized into 3 groups with forward head and rounded shoulder posture, were Group 1 performed Stabilization Exercise and manual therapy and Group 2 performed Stabilization Exercise and the Group 3 receives home exercise. Significant improvement was seen in posture and pain among Group1as compared to Group 2 and thus indicated that cervical and shoulder angles significantly decreased. It is thought to improve FHP and RSP. **Lynch et al.(2010)** reported that the exercise intervention (stretching of the anterior shoulder muscles and strengthening of the posterior shoulder muscles) considerably improved FHP in elite swimmers.

In this study, 30 subjects were taken and are divided into two groups Group–A **(**n=15; Muscle Energy Technique And Stabilization Exercise) and Group B (n=15; conventional therapy). The subjects were selected on the basis of inclusion criteria and they were assessed using the outcome measures such as craniovertebral angle**,** rounded shoulder posture measurement and posture screen mobile. The outcome measures a showed the significant improvement in correcting the forward head and rounded shoulder posture of elite swimmers after treatment when compare to before treatment values.

Conclusion

This study concludes that the Muscle Energy Technique and Stabilization Exercise along with the regular training (GROUP A) shows significant improvement on rounded shoulder and forward neck posture when compared with regular training alone (GROUP B) after 6 weeks of intervention on elite swimmers.

CONFLICT OF INTEREST: There is no Conflict of interest declared in this study.

ETHICAL CLEARANCE: This study was cleared by the Institutional Ethical Committee (IEC) of Sri Venkateshwaraa College of physiotherapy, Puducherry.

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Review Article

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Effects of Taping on Lower Limb Function in Stroke Patients: A Literature Review

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Abstract

BACKGROUND: Stroke is one of the leading causes of morbidity and mortality globally and is caused due to defective blood supply to an area of the brain, resulting from a hemorrhage or an infarction, leading to severe brain damage. Depending upon the area involved, the patient may exhibit loss of sensory or motor function, affecting balance and gait; impaired cognition; visual and verbal deficits; and social problems. A stroke can occur at any age, but the majority of the affected patients are above 60 years of age, which further contributes to impaired balance and difficulty in performing activities of daily living. Rehabilitative measures include exercises along with adjuncts, such as taping, to promote function in the affected extremity. Thereby, this literature review assesses the effect of taping on lower-limb function in stroke patients.

METHODS: A thorough search was carried out through online databases such as PEDro, PUBMED, and Google Scholar for the purpose of this literature review. Relevant articles were studied thoroughly, and the observations have been presented in this paper.

CONCLUSION: Taping is an effective rehabilitative approach for improving lower extremity function in patients with stroke. Further studies can increase the magnitude of this intervention.

KEYWORD: balance, lower extremity, stroke, taping

Introduction

Balance is a broad term that indicates the ability of an individual to stay upright while weight bearing without falling. It has three major components, namely, steadiness, symmetry, and dynamic stability. Postural control is another component that contributes to balance. Loss of any of these components may lead to secondary consequences, such as falls. Fear of falling may also lead to a number of disturbances in activities of daily living (ADLs), leading to a decrease in the individual's participation in society[1,2,3]. Therefore, balance retraining forms an essential component of rehabilitation. Therapists emphasize on a number of techniques for the same, which include practice of standing balance, group therapy, electromyographic (EMG) biofeedback, traditional ankle foot orthosis, force feedback and body weight-supported training [2,3,4].

Recent evidence has indicated that taping is a useful adjunct for the management of musculoskeletal

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conditions[1-4]. Taping consists of the application of adhesive strapping tape using different techniques for the treatment of a number of conditions. Therapeutic taping acts by increasing muscle activation along with improving joint position sense, reduction of stress and strain on the involved joint, passive stabilization, and correcting the biomechanics at the joint[5]. Loss of postural control along with muscle imbalance often leads to impaired standing balance which can be corrected by taping. The same principles can also be applicable in certain neurological conditions, such as stroke[6].

Stroke is a major cause of impairment and disability in individuals above 65 years of age. Its effects range from minor loss of sensation at a small area to severe motor deficits as observed in hemi-neglect[3]. The majority of stroke patients show lasting effects of motor dysfunction, including loss of joint proprioception and asymmetric weight shifting, which are causes of static and dynamic imbalance [7,8]. As taping helps in improving proprioception and joint stability, it contributes to balance training and may be of immense value in rehabilitation[4, 8].

This study focuses on the effectiveness of three types of lower limb taping, namely, Kinesio, Mulligan, and Non-elastic taping in improving balance in stroke patients. Kinesio taping (KT) is a type of taping in which the tape is applied to the muscles along the direction of the muscle fibers[8]. Mulligan taping consists of diagonal taping across the lower leg and around the knee joint and can be done alone or in conjunction with non-elastic taping [4]. Non elastic taping considered in this study is applied from the anterior inferior iliac spine (AIIS) to the patella[6].

Therefore, taping as a rehabilitation technique specific to balance in stroke patients is of utmost importance to improve their performance of ADLs, decrease the risk of falls, and avoid the development of compensatory strategies, hence proving the need for the study[8].

Materials And Methods

Data were collected from PEDro, PubMed, Google Scholar, and JGateplus. Articles published between the years **1992** to **2022** have been considered for this review. Only English articles concerned with taping, lower limb function, and stroke were included in this study. Articles involving upper extremity and pelvic taping. The those of other languages were excluded.

Procedure

A thorough search was carried out through PEDro, PubMed, Google Scholar, Science Direct, and JGateplus for the purpose of this literature review. The keywords used were *Taping, Lower limb function, Stroke.* The Boolean search term AND was used.

Discussion

Stroke is the leading cause of long-term disability all over the world. Hemiparesis is an impairment following stroke characterized by the loss of voluntary motor and sensory control to varying degrees. Lower extremity control plays a vital role in performing activities of daily living, and its impairment can result in loss of balance and abnormal gait patterns[1,2]. Different types of taping are used in the treatment of a large number of motor deficits, such as loss of proprioception, joint instability, and muscle inhibition, which contribute to balance and are also observed in stroke patients[5]. Therefore, this study aims to explore the effects of lower limb taping in improving balance in stroke patients.

Out of the different types of taping, KT is one of the most common types of taping that is used to correct body balance and improve proprioception. Multiple studies have been performed to assess the effectiveness of KT on lower limb function in stroke [7,8]. The results of these studies showed that KT not only improved balance in stroke patients, increased muscle activation, and improved gait symmetry and velocity, but also decreased the amount of weight bearing on the unaffected side.[7,8]

Apart from demonstrating positive effects on muscle facilitation, postural alignment, and foot balance following KT, KT at the joint too proved its efficacy in improving joint stability, gait speed, step length, single support time, walking deviation, balance, and proprioception[9-11]. A study comparing KT with other methods of intervention such as ankle foot orthoses (AFOs) in patients with foot drop have also been performed; they demonstrated a more positive effect on the muscle activity, joint angle, and

gait ability in patients who underwent KT as compared to those who used an AFO[12]. Some study results also showed that KT had a better effect on muscle activity, joint angle, static and dynamic balance, and gait ability in patients with stroke suffering foot drop[10-12]. Kinesio tape can be applied to joints as well as muscles for muscle facilitation as seen in a study on hip abductor taping in hemiplegics. Results showed an increase in hip abductor activity and gait speed due to the taping[13]. Another study assessing the effects of gluteal taping using KT demonstrated increased hip extension along with an increase in step length on the unaffected side compared with either the control or placebo conditions [14].

One study did not support the use of KT as the only intervention and rather promoted its use as an adjunct in rehabilitation[15]. A study that assessed the effectiveness of KT on the reduction of plantar flexor spasticity in stroke patients concluded that it was ineffective[11], whereas other studies found that tibialis anterior taping helped improve walking ability, motor recovery, spasticity, speed, forward reach, displacement of the center of pressure, and ambulation and aerobic capacity in patients with stroke[16,17,18]. Another study assessed the effectiveness of proprioceptive neuromuscular facilitation along with KT and found it effective in improving walking and balance ability in stroke[19]. The major limitations noted among these studies were a small sample size, thus leading to a lack of generalizability, and a short study duration[10-19].

Despite these limitations, KT showed its effectiveness in a large number of functional areas that are affected in stroke patients. Majority of its effects are due to increased recruitment of muscle fibers and activation of the golgi tendon organ, which contributes to improvement in proprioception and balance. It also helps in maintaining postural control and contributes to gait symmetry and velocity, which in turn helps in performing ADLs far more efficiently[7-19].

Apart from Kinesio taping, other types of taping techniques that use non-elastic tape, such as Mulligan, McConnel, and talus-stabilization taping, are also used in clinical practice. They act by providing dynamic stabilization to joints during active movement. Studies showed that the application of non-elastic tape in patients with stroke stabilized the joints of the lower extremities, thereby improving balance and gait [6,20,21].

A study performed to assess the effectiveness of Mulligan taping on the lower limb in stroke patients showed that dynamic standing balance, gait, and asymmetric body alignment improved in these patients after taping intervention[4]; however, further studies are warranted. Mulligan taping may be an effective tool for the management of orthopedic and neurological conditions provided there are sufficient number of clinical trials to prove its efficacy in a larger sample size.

Patellar taping (McConnel taping), which uses rigid, non-elastic tape, was also used as an intervention for improving balance in stroke patients by some researchers. Studies assessing its effectiveness showed improved dynamic balance ability along with improvement in gait abilities, including velocity, cadence, paretic and non-paretic step length, and double support period [22,23]. A study also compared the effectiveness of KT versus McConnel taping along with PNF techniques in stroke patients and observed that KT was comparatively more effective in improving the stance phase, balance and walking speed than McConnel taping [24].

There are many other types of taping that were not included in the scope of this study. Taping may prove to be an effective intervention provided it is performed using the correct technique and for an adequate duration. Its effects, in general, range from improving balance and proprioception to increasing gait velocity and dynamic stability, which are common impairments seen in hemiplegics. Further studies regarding the effectiveness of taping in a larger sample size without any geographical limitation and for adequate duration could pave the way for increased usage of this intervention in the clinical setting. Thus, from the above literature, it is evident that taping is effective in the management of stroke.

Conclusion

From this study, it can be concluded that different types of taping are effective in improving

lower limb function in stroke patients. It is a known fact that taping as an intervention helps in increasing proprioception and joint stability leading to an overall improvement in lower limb function. It is therefore recommended that taping be used more frequently in the clinical setting for stroke rehabilitation.

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Effectiveness of Hyperbaric Oxygen Therapy and High Intensity Interval Training for Post Covid Patients: A Literature Review

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Abstract

Objective: The study was aimed to find out whether the two interventions,(1) Hyperbaric Oxygen.

Therapy(HBOT) and (2) High Intensity Interval Training (HIIT) are beneficial in in improving the respiratory functions of the individuals who has been affected with post covid syndromes.

Methods: Articles with the keywords 'post-covid', 'hyperbaric Oxygen Therapy', 'High Intensity Interval Training' were screened through the search engines such as Google Scholar and pubmed, out of which 20 articles were selected which met the selection criteria.

Results: The literature study showed that patients who suffered from impaired respiratory functions after being affected with covid-19 showed significant improvements after undergoing either one of the modes of therapy.

Conclusion: HBOT and HIIT had a conspicuous effect in regaining the respiratory functions 3back to normal, decreased anxiety stress and also minimized the use of mechanical ventilator.

Keywords: COVID-19, HIIT, HBOT, RESPIRATORY IMPAIRMENTS, ARDS

Introduction

In a Hubei province of China called Wuhan, a sudden increase in the number of pneumonias was noted on December, 2019. The number of cases spiked very quickly in the next two months and spread to different parts of the world and later in march the WHO declared the outbreak of coronavirus as a pandemic and named it as COVID-19[1]. The transmission of virus through either directly by the droplets or touching the infected surfaces made all those who had a contact with infected person prone to be affected.

The virus having an average of 6 days of incubation period made the affected person as a source to spread the virus till the affected person starts showing symptoms[2]. The most frequent symptoms being fever, dry cough shortness of breath, anosmia and ageusia, but may vary from person to person[3]. The WHO recommendation for COVID-19 treatment includes all kinds of atmospheric oxygen therapy except for hyperbaric oxygen therapy which has been in use since a long time for treating acute and chronic hypoxemia[4]. Similarly, the lockdown and home quarantines, all have led to a more of sedentary

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lifestyle which further declines the cardiorespiratory health, increases the stress and anxiety level of people. Therefore, there is a decline in respiratory and cardiac functioning of the body and mental health as well.

The main aim of this literature study is to find out whether hyperbaric oxygen therapy and high intensity interval is use full in improving the cardiac and respiratory function of post covid-19 patients for early return to normal healthy life.

Methodolgy

Design: we thoroughly searched and found the relevant articles using the keywords on the online search engines like PubMed and Google scholar published between the years 2020 to 2022. The articles received between these dates had undergone a two-step screening process, the first being screening the article title or abstract, and second one was screening examination of the full text. All irrelevant articles were excluded.

Search strategy: A thorough search was done on the search engines like google scholar and PubMed using the key words "hyperbaric oxygen therapy", "high intensity interval training", "post covid" "COVID-19",

Inclusion and Exclusion criteria: All articles were included, articles like literature review, clinical trials, meta-analysis, RCT were also included. The excluded articles were those which was published before 2020, paid articles or unavailability of full texts and abstracts.

Results

We analysed the search engines as mentioned above and that search produced a total of 72 results for hyperbaric oxygen therapy and 46 results for HIIT and total of 118 results. Out of which 26 were duplicate records. The remaining 92 underwent the first screening and 55 records were eliminated, and after the second screening 25 articles were selected, of which 17 articles were finally selected which met all the inclusion and exclusion criteria.

All the studies were supporting the use of HBOT for covid-19 infected patients, because the study results showed an improved blood oxygen saturation, reduce the use of mechanical ventilator and showed an overall improvement after receiving HBOT treatment. Few studies make it evident that HBOT is very much helpful in preventing systemic hypoxemia due to covid-19. There was few to no adverse reactions to treatment, some being claustrophobia and ear pain.

There was lack of studies which showed the effect of HIIT for covid-19 patients. The studies which were found showed that HIIT helped in reducing the stress, anxiety and depression that was seen during the covid-19 quarantine. In another study, HIIT for inspiratory muscles showed marked improvement in their functioning in patients mild COPD which led to reduction in the dyspnoea and fatigue they faced.

Discussion

Maintaining oxygen saturation is the main struggle in treating covid-19 patients. The hypoxemia which follows the decreased blood oxygen saturation is one of the main clinical manifestations of covid-19, and high flow oxygen delivery is the recommended mode of treatment for covid patients by WHO. Though HBOT is one of the oldest and most powerful oxygen therapy known and with enough studies and articles pointing out the effectiveness of hyperbaric oxygen therapy on respiratory improvement, it is still not being added in the guidelines.

In Hyperbaric oxygen therapy the patient isagiven0100% concentrated oxygen at a high pressure, this helps the cells to assist oxygenation through out every level of perfusion ranging from pulmonary function to alveolar oxygen exchange[5]. This helps to prevent the lack of oxygen even at the tissue level (hypoxemia) by increasing the tissue oxygen intake by delivering oxygen at high pressure. The factor which makes HBOT stand out is the ability of HBOT to improve tissue perfusion exchange capability because of the increased oxygen diffusion rate. All investigations like ABG analysis, liver function test, CBC showed improvement.

HBOT is thought to be a safe and low risk procedure with no other main contraindications apart from untreated pneumothorax and respiratory failure which require mechanical ventilation[6]. One of the biggest challenges for HBOT is the accessibility

because of the existing limitation in regular oxygen distribution therefore it is less likely to be accessible in most rehab centre.

The recent studies have shown that covid-19 affected patients are at a higher risk for cardiopulmonary complications and physical disability. The physical inactivity and bed rest during the time of hospital admission for COVID-19 treatment is first step which leads to these complications. Only a few weeks of bed rest and physical inactivity can lead to decreased cardiopulmonary fitness and muscle wasting. In addition to these physiological impairments patients also suffer from stress, anxiety and depression due to confinement in the isolation rooms[7].

Here exercise training plays a vital role as a powerful stimulator for fitness improvement. Exercise training aids in preventing muscle wasting, promoting a strong anti-inflammatory response and reduce the stress and anxiety due to isolation. Importantly HIIT was able to improve the resilience.

There is a mounting body of evidence backing up that HIIT is both efficient and safe for the cardiopulmonary rehabilitation of post covid patients. HIIT is a type of exercise which includes interspersing short bursts of intense exercise with rest periods. The main advantage is it requires no equipment so people can do it whenever or wherever they are comfortable. It had a marked effect in covid affected people by increasing the cardiovascular function, vasculature and reducing blood pressure. Other changes noted where lower resting heart rate, improved exercise tolerance, oxygen supply to the muscles, improved mental health, and reduced levels of depression and social avoidance. Due to the short duration of the exercise, people with less motivation or who procrastinate found it was helpful to overcome those.

Conclusion

Overall, HBOT is seen to be an efficient and safe way to treat COVID-19 patients. The limitations for HBOT cannot also be neglected, HBOT chambers being big size and space occupying cannot be fit in every setup and the cost to setup the chamber is high therefore making it very difficult for small centres to acquire it. There is still limited information and evidence on the effect of HBOT for covid-19 patients, further studies which include a larger sample size is required to access the outcomes of this modality and compare it other modalities.

This study has demonstrated that HIIT brings a meaningful improvement in the dyspnoea during normal activities of day-to-day life, improves cardiorespiratory fitness, improve mental health and reduce anxiety, stress and depression. There are very few studies that directly link HIIT for covid-19 patients. Hence more studies are required to establish that HIIT has a direct effect on post covid patients.

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Effects of Lumbar Manipulation Spinal in Patients with Pain Caused by a Lumbar Disc Herniation: A Systematic Review

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Abstract

Background: herniated disc usually presents pain accompanied with paresthesia and loss of muscle strength, causing limitations in the activities of daily life. Among the therapeutic strategies aimed at obtaining an improvement in the symptomatology, highlights the Osteopathic manipulation.

Methods: 11 computerized databases were consulted. Regarding the eligibility criteria, only articles of the randomized controlled clinical trial type were included. The tool for assessing the risk of bias was the one proposed by Cochrane.

Results: A total of 3 randomized controlled clinical trials were selected and considered low risk of bias. The results showed an improvement in all the variables measured in the experimental group of osteopathic manipulation. However, the improvement was greater in the study group that was underwent surgery.

Conclusions: lumbar manipulation spinal is an effective technique to improve the symptomatology of pain originating from a herniated lumbar disc. None of the participants had adverse reactions and their outcome improved significantly in the short and long term. Nevertheless, the studies obtained were limited in number.

Key words: Manipulation Osteopathic, Manipulation Chiropractic, Low Back Pain, Radiculopathy, Sciatica.

Introduction

A herniated disc is known to be a pathology in which the peripheral fibers of the annulus fibrosus rupture, causing the nucleus to protrude into the spinal canal or foramen of conjunction. The most common clinical presentation is low back pain that increases with severity and with increasing intra-abdominal pressure. It may also present paresthesias or loss of muscle strength in the sufferer, leading to disability[1]. If the nucleus comes into contact with the spinal root, it can cause radiating pain along the path of the sciatic nerve.

Research has found that the 1-year incidence of first ever low back pain episode ranges from 6.3% to 15.4%, while the 1-year incidence of recurrent low back pain episodes ranges from 24% to 80%[2]. The prevalence of low back pain during a person's life has been established at around 70-80%[3,4]. It is known

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that 10% of low back pain is caused by a herniated disc in that area[5], reaching a prevalence of 1-3% of the population with a herniated disc[6]. A lumbar disc herniation can cause radiculopathy towards the lower limb, due to the pathway of the sciatic nerve. This lumbar radicular syndrome does not exceed 5% of the population in terms of prevalence[7]. All these data show that we are dealing with a pathology that is well established in society and that presents numerous cases.

As for the triggering cause of a herniated disc, the literature is not clear, and it can be of various kinds. It is suspected to have a mechanical component produced by compression of the herniated disc, due to falls, lifting heavy weights, rotations or even produced spontaneously by a genetic predisposition[8] and it is also reported to have an inflammatory component, due to radicular edema.

There are numerous therapeutic strategies for treatment of lumbar disc herniation, both surgical and non-surgical, with variable evidence regarding their respective efficacy[9, 10]. Osteopathic manipulation has been the result of numerous studies regarding its applicability to herniated discs, low back pain and sciatica[11-13], in which its efficacy has been high and there has been an improvement in the symptoms of the subjects in the studies. In this type of techniques, there has also been controversy regarding the complications that their use may present, such as the provocation of paresthesias or cauda equina syndrome, among others[14], although the evidence is scarce in these cases.

There is controversy regarding the biological mechanisms underlying the effects of spinal manipulation. The latest studies show that spinal manipulation can have an effect on the primary afferent neurons of the paraspinal tissues, on the motor control system and on pain processing[15].

The objective of this study is to carry out a systematic review to analyze the existing evidence in the literature regarding lumbar osteopathic manipulation in people suffering from low back pain caused by a herniated disc. The existence of the possible risks involved in spinal manipulation in a subject with a herniated disc will also be verified, as well as the short and long term evolution of the participants who undergo this type of treatment.

Subjects and Methods

STUDY DESIGN

A systematic review was conducted following the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) recommendations.

DOCUMENTARY SOURCES CONSULTED

Eleven computerized databases were consulted. Within the virtual platform Pubmed the Medline database, in the Virtual Health Library (VHL) the IBECS and LILACS databases, Cochrane Library was also consulted, and in the virtual platform EBSCO Host the databases CICINAHL Complete, Academic Search Complete, Food Science Complete, Health Source Nursing, and SPORT Discus. Lastly, on the Web of Science (Wos) platform, the Web of Science Core Collection and Scielo databases.

To search for articles, the keywords: Osteopathic Manipulation, Chiropractic Manipulation, Spinal Manipulation, High-Velocity Low-Amplitude Spinal Manipulation, Intervertebral Disc Displacement, Lumbar Herniated Disk, Disc Protrusion, Lumbar Sciatica, Low Back Pain, Pain, Sciatica and Radiculopathy.

The dates on which the documentation search was carried out were in the period established between December 2018 and September 2021.

INCLUSION CRITERIA

Subjects with low back pain radiating to the lower limb caused by previously diagnosed lumbar disc herniation were included.

The intervention required in one of the groups was high-velocity, low-amplitude (HVLA) techniques. Articles that included other techniques in the experimental group were also accepted, as long as the control group received them in the same way. The control group to be compared had to use another hernia treatment technique in order to be compared.

The studies included in this systematic review are randomized controlled clinical trials published in international peer-reviewed journals.

EXCLUSION CRITERIA

Participants who presented hernias of the sequestered type were excluded.

In terms of intervention type, those studies that included a drug that could intervene in the results were excluded.

In terms of language, Chinese was established as the language of publication as a limit.

Results

PROCESS OF IDENTIFICATION AND SELECTION OF STUDIES

A total of 206 results were obtained in the literature search. Of these, 103 were duplicates, so they were eliminated. Of the other 103, with our inclusion criteria, a selection was made after reading their titles and abstracts, resulting in a total of 60 studies. Of these 60 studies, exclusion criteria were applied, leaving a total of 16 items.

Finally, after reading the 16 full-text articles, it was decided to select only articles of the randomized controlled clinical trial type, leaving a total of 3 articles to analyze, all of them were published in this century, from the year 2000 to 2010.

RISK OF BIAS OF INCLUDED STUDIES

Risk of bias assessment was performed at the level of individual studies. The tool used for this assessment was the one proposed by the Cochrane Collaboration.

Table 1 shows the risks of bias for each article in a structured manner

Table 1. Risk of bias of included studies

Author	Sequence generation	Sequence concealment	Blinding of participants and staff	Blinding of performance evaluators	Incomplete results data	Selective notification of results	Other sources of bias
Burton et al.[16]	LR	LR	HR	LR	HR	LR	LR
Santilli et al.[17]	LR	LR	HR	LR	LR	UR	LR
McMorland et al.[18]	LR	LR	HR	LR	LR	UR	LR

Note: LR: Low Risk. HR: High Risk. UR: Unclear Risk

GENERAL CHARACTERISTICS OF THE INTERVENTION

Table 2 shows the type of treatment, time, duration and dose of both the control group and the experimental group of the included articles.

Table 2. General characteristics of the intervention

Author	Gruops	Treatment	Time	Duration	Dose
Burton et al.[16]	EG	Osteopathic Manipulation	15 min/sess	6-18 sessions	–
	CG	Chemonucleolysis	–	1 day	1 (2ml of Chimopapain and 10ml of 0.25% Bupivacaine)
Santilli et al.[17]	EG	Osteopathic Manipulation	5min/sess 5 sess/wk	Max 20 sessions	–
	CG	Simulated manipulation	5min/sess 5 sess/wk	Max 20 sessions	–

Author	Gruops	Treatment	Time	Duration	Dose
McMorland et al.[18]	EG	Osteopathic Manipulation and Supervised Rehabilitation	2-3sess/4wk 1-2sess/4wk	Average 21 sessions	–
	CG	Microdistectomy and Supervised Rehabilitation	–	1 day and 1-2 days of hospitalisation	–

Note: EG: Experimental Group. CG: Control Group. Min: Minute. Sess: Sessions. Wk: week.

Specifically with regard to pain, evaluated by the 7 point score in the study by Burton et al.[16], they demonstrated how the experimental group reduced pain radiating to the leg by 20% in the second week, reaching 46.75% at 12 months post-treatment, while lumbar pain decreased by 16.62% in the second week and decreased by 40% one year post-treatment. It was also observed that in all the assessments, the experimental group improved more than the control group, which included chemionucleolysis treatment. The pain assessed by VAS in the study by Santilli et al.[17], showed how many people completely improved in terms of their pain, with a total of 15 out of 48 (28%) in back pain and 29 out of 48 (55%) with regard to pain radiating to the leg, who had a full recovery at 6 months. The improvements in pain were also clear during all the evaluations made with the McGill Pain Questionnaire and the Aberdeen Back Pain Scale in the study by McMorland et al.[18] to the osteopathic manipulation group, reaching decreases of more than 9 points in both scales 3 months after starting therapy.

In reference to the improvements in physical disability in the experimental group, assessed by the RDQ in the studies of Burton et al.[16] and McMorland et al.[18], improvements were seen which oscillated around 13% in the first 2-3 weeks and which reached 25% at 3 months and even 50% at 12 months.

Regarding the SF-36 Questionnaire to assess quality of life in the studies of Santilli et al.[17] and McMorland et al.[18], it was observed that at 3 weeks the osteopathic manipulation group improved their scores in this test by 12.37% and even reached an improvement of 27% at 3 months.

Finally, the article by Santilli et al.[17] used the Symptom Questionnaire (SQ) to assess the psychological profile of the osteopathic manipulation group versus the sham manipulation group at 6 weeks after treatment, the results showed clear improvements in psychological aspects in the experimental group versus the control group.

Discussion

In general, in the articles analysed in this review, short-term data (2-3 weeks) showed significant decreases in low back pain scale scores by more than 15% and pain radiating to the leg by 20%. Whereas in the long term (1 year) the subjects' low back pain and radiating pain decreased by more than half from the first assessment, 40% and 46% respectively.

In terms of the treatments against which the manipulation groups were compared, the evidence shows that chemonucleolysis is an effective treatment for lumbar disc herniation[19]. Several authors have also shown that microdistectomy is effective for lumbar disc herniation[20, 21]. There is between 80 and 95% good results with these interventions[22]. However, microdistectomy is a surgical operation in which the interruption of the anatomical planes can be a more technically complicated operation, leading to possible secondary complications[23]. Reviews show that patients undergoing surgery required a new operation in 6% of cases, as well as lumbar pain 2 years later between 15% and 25% of subjects[24].

It should be taken into account that the application of the spinal manipulative technique at lumbar level is painless, without side effects for the patient and with costs that can be considerably reduced. Burton et al.[16] established calculations indicating that manipulative treatment saves the patient £300 per year compared to chemionucleolysis treatment. This is why osteopathic manipulation can be considered as a first choice resource for the

population with symptomatic lumbar disc herniation. In cases where there is no improvement inoutcome, other more invasive but also effective techniques should be considered as a second option, such as chemionucleolysis or microdistectomy.

According to the analysis of the results provided by the studies included in this study, an adequate manipulative treatment for a herniated disc with lumbar symptomatology and/or radiating to the lower limb, a consultation should last around 10 minutes, 3 sessions spaced per week, with an average duration of 13 to 20 sessions in total.

LIMITATIONS OF THE STUDY

This work has several limitations. One of them is the limited number of studies to be analysed. When choosing the selection of these articles, we opted for randomised controlled clinical trials, which are those with the highest scientific quality, leaving other types of studies by the wayside which, despite being able to report useful information to the study, could reduce the overall validity of this work.

Another limitation is that the sample sizes of the included studies were small, none of them barely reaching 100 participants. This means that the conclusions obtained may be less robust and less extrapolable to the general population.

A final limitation found in the included studies was the lack of precision with which the application of the manipulative technique was described.

Conclusions

Osteopathic manipulation at the lumbar level is an effective technique and improves the clinical outcome of people with pain caused by lumbar disc herniation. However, due to the lack of a correct explanation of how the manipulative techniques are performed, as well as the times used in the treatment, future studies are needed to present concise data on these aspects.

According to the data provided by the studies analysed, none of the participants had adverse reactions to osteopathic manipulation and none dropped out of the study due to worsening symptoms. It should be pointed out that the sample that participated in the studies was small, but nevertheless relevant to rule out the side effects that are wrongly assumed to be associated with these techniques.

The clinical outcome of people with lumbar disc herniation improves significantly in the short and long term. This is why it is considered an effective and safe technique for these patients; however, it would be advisable to extend the follow-up of the subjects to more than one year in order to evaluate possible modifications.

CONFLICT OF INTEREST: Authors state no conflict of interest.

DISCLOSURE STATEMENT: No author has any financial interest or received any financial benefit from this research.

ETHICAL CLEARANCE: Taken from The Ethics Committee for Research related to Human Beings of the centers where the investigations were conducted. Ethical and deontological principles in relation to the people taking part in the study and handling the data obtained were complied.

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Original Article

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To Determine the Effect of Iliopsoas MET along with the Conventional Therapy on Pain, Functional Disability and lumbar lordosis in the Patients with Non-Specific Low Back Pain

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Abstract

Background: Low back pain is one of most frequent causes of disability. Non-specific low back pain is the low back pain not attributable to a recognizable, known specific pathology (e.g. infection, tumour, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, cauda equina syndrome, etc.) Iliopsoas MET helps to improve pain, functional disability and hyper Lordotic curve. Combination of Iliopsoas MET and conventional therapy may have positive effects on non- specific low back pain.

Method: 40 female subjects with non-specific low back pain participated in the experimental study, underwent treatment for duration of 4 weeks after receiving informed consent. They were evaluated and randomized into 2 groups' i.e. experimental group receiving Iliopsoas MET along with conventional therapy and control group receiving conventional therapy only. . The Pre and Post values of NPRS, MODI and lumbar lordosis were recorded at the start of the treatment and consecutively after the end of the treatment.

Conclusion: Iliopsoas MET along with the conventional therapy was found to be more effective in decreasing pain and disability in patients with non – specific low back pain. Iliopsoas MET shows better results in reducing hyperlordotic curve and hence decreasing low back pain.

Keywords: Non- specific Low back pain (LBP), Iliopsoas Muscle Energy Technique (MET), Interferential therapy (IFT), Numerical Pain Rating Scale (NPRS), Modified Oswestry Disability Index (MODI)

Introduction

Low back pain (LBP) is one of the most frequent causes of disability. Low back pain (LBP) is the pain, muscle tension or stiffness localized below the costal margin and above the inferior gluteal folds, with or without leg pain. It is the pain arising from the posterior region of the trunk, covered by the lateral borders of the erector spinae muscles, a horizontal plane through the T12 spinous process superiorly and through the posterior iliac spines inferiorly.[1]

LBP can be classified as mechanical, non-mechanical, and psychogenic. Mechanical LBP may

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be specific or nonspecific. According to its duration, LBP can be acute (less than 6 weeks), subacute (6 - 12 weeks), chronic (more than 12 weeks).[2]

Non-specific low back pain is the low back pain not attributable to a recognizable, known specific pathology (e.g. infection, tumour, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, cauda equina syndrome, etc.) Nonspecific - LBP is the most commonly reported problem by the population. Human body has a centre of gravity, which keeps the balance between muscles and bones to maintain the integrity of structures and protect them against injury. In non-specific LBP, imbalance typically occurs between the functional load and ability. Only 10% of LBP has a specific cause due to a particular disease. Despite, the lack of structural changes in nonspecific LBP, it can limit daily activities and cause temporary or permanent inability to perform any work.[2]

The features of nonspecific LBP are heavy pain, worsening with exertion especially in the afternoon, relieved with rest, absence of neurological and muscle contraction, antalgic posture, associated with inactivity and poor posture.[2]

Support and stability to low back arise from the muscles mainly Iliopsoas and Quadratus Lumborum. Biggest factor in low back pain is involvement of these muscles. When these muscles become contracted or shortened due to injuries, poor posture, prolong sitting or stress, it can alter normal biomechanics of pelvis, lumbar, thoracic and even cervical vertebra leading to back pain.[3]

Tightness of Iliopsoas muscle closely correlates with low back pain as it's the major compressor of the lumbar spine and contributes to the spine's stability because of its comprehensive nature. The Psoas' compression causes segmental stiffness, and increased forces can hinder the spinal health, and ultimately, this increased tightness of the hip flexor leads to low back pain.[4]

Common symptoms originating from Iliopsoas tightness are: pain in low back and hips, discomfort or pain while driving with extended or flexed legs, pain upon twisting the spine.[5]

The functional evaluation of muscle imbalance includes the patient's history and current complaints, orthopaedic procedures, and, most importantly, visual and palpatory observations. Patients are observed in three views: posterior, anterior, and lateral. Postural observation always begins at the pelvis regardless of the area of the primary complaint because most chronic musculoskeletal pain is first evident in postural asymmetries. Modified Thomas Test for Hip Flexor tightness is done.[6]

There are several treatments options available for LBP, such as medications (anti-inflammatory corticosteroids, paracetamol, opioids, muscle relaxants, antidepressants, and anticonvulsants), electrotherapeutic measures such as short wave, ultrasound, transcutaneous electrical stimulation, laser and acupuncture.[2]

Nonsurgical management of low back pain may include manual passive mobilization of joints and soft tissue, neuromuscular reactivation, exercise prescription, sensorimotor training, posture correction, movement or ergonomic re-education, and conditioning exercises. The traditional treatment approach also used to reduce pain and dysfunction of the musculoskeletal system through various modalities such as icing, applying heat, taping, external bracing, and joint or soft-tissue mobilization.[6]

Interferential current therapy is the medium frequency current that crosses different intermediate frequency currents of around 4000 Hz, allowing currents to penetrate deeper tissues by reducing skin resistance. By stimulating sensory nerve fibers, IFT treatment not only reduces pain but also promotes muscle relaxation and blood circulation.[7]

Muscle Energy Technique (MET) is a gentle form of manipulative therapy which is effective for treating movement restrictions of both the spine and extremities. The dysfunctional joint is placed at the end range of its limited motion and the patient is asked to lightly contract for approximately five seconds against the specific counterforce offered by the practitioner. After relaxation, the restrictive barrier is often felt to yield, and the procedure is repeated for several repetitions.[8]

Material and Method

Subjects were recruited from MYH department of physiotherapy after obtaining informed consent. A total of 55 patients were selected in this study by purposive sampling technique at sampling stage one. Female gender were only included with age group from 25 – 50 years as per inclusion criteria.

Inclusion criteria - Non- specific low back pain of 3 – 6 months, Age group – 25 – 50 years, Female population, Individual with Lordotic curve equals to and more than 60^{o}, Bilateral Iliopsoas tightness, Positive Modified Thomas test, NPRS value 6 – 10.

Exclusion criteria - Constant or severe back pain judged on clinical grounds due to nerve root irritation, Major surgery within past year, Motor weakness, absent or diminished muscle strength and reflexes, Any medical condition contra indicatory to physical activity, Conditions like Spondylolisthesis, Spondylosis and Lumbar disc herniation, Any Structural deformity, Systemic disease or inflammatory condition of spine, Hip joint pathology or fractures.

After 1^{st} stage sampling, 15 subjects were excluded, as 8 were unable to come OPD daily and 7 subjects were not interested to sign the consent. In sampling stage two, simple random allocation of 20 subjects each to group A and B, i.e. experimental and control group were done respectively and specific physiotherapy protocols were given to the subjects. Assessment values of pain, functional disability and lumbar lordosis were taken before the intervention and after the treatment.

The group A, (experimental group) received the Iliopsoas MET along with the conventional therapy while the group B, (control group) only received the conventional exercises therapy.

Procedure:

Group A – Experimental group

- Iliopsosas MET (5 repetitions/10 secs hold/ 2 sets/once a day/5 times a week.
- Interferential therapy – bipolar method for 10 minutes *Lower Back
- Pelvic Bridging
- Cat and Camel pose
- Prone gluteal squeezes
- Double knee to chest
- Curls – up

FITT – 10 Repetitions / 10 secs hold/ 2 sets/ twice a day/ 5 sessions per week for 4 weeks.

Group B – Control Group

- Interferential therapy – bipolar method for 10 minutes *Lower Back
- Pelvic Bridging
- Cat and Camel pose
- Prone gluteal squeezes
- Double knee to chest
- Curls – up

FITT – 10 Repetitions / 10 secs hold/ 2 sets/ twice a day/ 5 sessions per week for 4 weeks.

Statistical Analysis

Descriptive and inferential statistics were implemented as statistical tools to analyse the gathered data statistically. Baseline demographic and clinical characteristics were analysed using Mean ± Standard Deviation (Min-Max). Therefore, a parametric test, paired t-test was used to identify the significance of mean difference of score of NPRS, Functional disability and lumbar lordosis in non-specific low back pain patients between pre and post intervention of exercises in groups (group A and group B). Independent sample t-test was used to observe the significance of mean difference of score of pain, functional disability and lumbar lordosis in patients with non- specific low back pain patients of group A and group B.

Results

Table 1: Comparison between effect of conventional therapy and Iliopsoas MET along with conventional therapy on Numerical Pain Scale (NPRS) of patient having nonspecific back pain.

Variable	Condition	N	Mean	SD	t-value	p-value
NPRS	Control (Post)	20	3.90	1.12	2.37*	<0.05
	Experimental (Post)	20	3.05	1.15		

Significant *, not significant **, Abbreviations: SD – Standard deviation

Table 2: Comparison between effect of conventional therapy and Iliopsoas MET along with conventional therapy on MODI of patient having nonspecific low back pain.

Variable	Condition	N	Mean	SD	t-value	p-value
MODI	Control (Post)	20	19.8	5.81	4.06*	<0.05
	Experimental (Post)	20	13.30	4.18		

Significant *, not significant **, Abbreviations: SD – Standard deviation

Table 3: Comparison between effect of conventional therapy and Iliopsoas MET along with conventional therapy on Lumbar lordosis of patient having nonspecific back pain.

Variable	Condition	N	Mean	SD	t-value	p-value
Lumbar Lordosis	Control (Post)	20	67.75	5.80	2.65*	<0.05
	Experimental (Post)	20	63.80	4.16		

Significant *, not significant **, Abbreviations: SD – Standard deviation

Discussion

The purpose of the present study was to determine the effectiveness of Iliopsoas MET along with the conventional therapy in management of patients with non – specific low back pain. A total of 55 female subjects, age group between 25 – 50 years were purposively selected and 40 patients who had fulfilled the inclusion and exclusion criteria were included in the study. The subjects were randomly divided into two groups, of 20 subjects each. The Group A, Experimental group received the Iliopsoas MET along with the conventional therapy and Group B received the conventional therapy. The patients were treated for 5 sessions per week for 4 weeks and changes in NPRS, MODI and lumbar lordosis values were recorded before and after the interventions.

All the female subjects were selected for the study because the female spine manifested a greater curvature, a caudally located Lordotic peak, and greater cranial peak height.

The study result shows significant effect of Iliopsoas MET in reducing the pain, improving the functional abilities and lumbar lordosis curve after the 4 week exercise program. Along with the conventional therapy, the iliopsoas MET was helpful in reducing low back pain, thereby improving the quality of life. There is subsequent reduction in the tone of agonist muscle after isometric contraction, it occurs due to Golgi tendon organ stretch receptors located in the tendon of the agonist muscle. These stretch receptors react to overstretching of muscle by inhibiting further muscle contraction. Increasing the length of shortened muscles relieves tenderness and pain.

Priyanka Rishi et al (2018), in their study, Impact of muscle energy technique along with supervised exercise program over muscle energy technique on quadratus lumborum and iliopsoas on pain and functional disability in chronic non- specific low back pain, suggested that MET has got additional beneficial effect for decreasing disability and improving function in patients with chronic non- specific low back pain along with supervised exercise compared to the subjects who were exposed to MET only.

Kyoung-Sim Jung et al (2020), in their study, Effects of Interferential Current Treatment on Pain, Disability, and Balance in Patients with Chronic

Low Back Pain: A Randomized Controlled Study, concluded that IFT treatment can improve pain, disability, and postural sway, thus, highlighting the benefits of somatosensory stimulation from IFT.

Hence, significant changes were seen in both the groups but the group receiving the Iliopsoas MET along with the conventional therapy showed better and more significant results in NPRS, MODI as well as the lumbar lordosis values.

Conclusion

This study concluded that there was significant effect of Iliopsoas MET along with the conventional therapy on Pain, Functional disability and Lumbar lordosis in patients with non- specific low back pain. The statistical analysis suggested that the measurement values of Numerical pain rating scale, Modified Oswestry disability index and lumbar lordosis were significantly improved when the Iliopsoas Muscle energy technique was combined along with the conventional therapy

Conflict of interest – Nil

Source of Funding: None

Ethical Clearance: Ethical committee of The Mahatma Gandhi Memorial Medical Allied Health Sciences Institute (MAHSI) Indore, Madhya Pradesh, India.

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Retrospective Study

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Effectiveness of a Single Session Prehabilitation Group Therapy on Post-Operative Complications in Resectable Lung Cancer: A Retrospective Study

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Abstract

Background: Lung cancer is the most common cancer worldwide and the leading cause of cancer death among men and women. Surgical resection with minimal perioperative complication is most desirable for the treatment of stage 1 and 2 non-small cell lung cancer (NSCLC). The standard PR duration recommended in most studies ranged from 4-6 weeks. However, the major challenge is the short duration of time available from the time of diagnosis to the time of lung surgery. This prompted us to start the Prehabilitation Group Therapy session for patients undergoing major surgical resections for lung cancer in our large tertiary cancer institute.

Aim: This study aimed to evaluate the effectiveness of single-session prehabilitation group therapy on post-operative complications and length of hospital stay following lung cancer surgeries.

Methods: We conducted a retrospective chart review of lung cancer patients from a single tertiary cancer institute for the period from January 2016 to July 2017. Data from 201patients who underwent lung surgeries were collected, using the predesigned data extraction form. Data analysis was performed using the SPSS 22 statistical package.

Result: Out of the 201 patients with lung cancer, 117 attended the Prehabilitation Group Therapy session. There was no statistically significant difference found in the post-operative complications between the groups that attended the Prehabilitation Group Therapy session and the group that did not attend the session ($p = 0.52$). The medians of ICU stay days ($p = 0.911$) and ward stay days ($p = 0.805$) were the same across categories of PR status.

Conclusion: This study showed that a single session of prehabilitation group therapy did not reduce post-operative complication following lung cancer surgeries.

Keywords: Lung Cancer, Prehabilitation, postoperative complications

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Introduction

According to GLOBOCAN 2018, Lung cancer is the leading cause of cancer death (18.4% of total cancer deaths) among all cancers. According to American Lung Association (2017), tobacco smoking is the leading cause of developing lung cancer; other causative factors are second-hand smoke, Radon and hazardous chemical exposure, pollution, and genetic predisposition[1]. For early stage (stage I and II), surgery is the main treatment while advanced stages (stage III and IV) are treated with chemotherapy and radiation[2,3]. Early-stage tumors are treated either by video-assisted thoracoscopic surgery (VATS) or by open surgery.[4.] Lung cancer surgeries usually need thoracotomy and complex oncological resections and may result in postoperative complications such as pneumonia, air leak, atelectasis, respiratory failure requiring prolonged ventilation, increased hospital stay, and mortality [5.] Video-assisted surgeries require minimum invasion resulting in fewer post-operative complications and lesser hospital stays [6,7]

Postoperative pulmonary complications are associated with morbidity and mortality that ultimately increases health care costs [2.] The risk factors for developing postoperative pulmonary complications are associated with age, smoking history, obesity, general health, and underlying chronic lung conditions, such as COPD and cardiovascular co-morbidity [8]. Chest physiotherapy maneuvers like vibrations, clapping and positioning help to prevent postoperative pulmonary complications and reduction in mortality rates in intensive care [9].In lung cancer surgeries, general anesthesia, post-surgical pain, and reduced mobility affect the cough reflex and reduce the mucociliary clearance leading to retention of secretions and infection [10]. European Society of Thoracic Surgeons, European Respiratory Society, and American College of Chest Physicians have recommended post-operative pulmonary rehabilitation as an essential component of Enhanced Recovery Protocols (ERP) [11,12]

Cancer pre-habilitation is one of the important key for post treatment outcome of patients into their survivorship journey[13]. Prehabilitation in lung cancer optimizes physical fitness, reduces postoperative morbidity, and improves health related QoL to some extent [14]. Recent systematic review and meta-analysis of Randomized Controlled trials on pre-operative physical exercise interventions in patients with NSCLC done by Rosero et al in 2019 [15], which included 10 RCTs with a total of 676 patients showed that preoperative rehabilitation helps to reduce post-operative pulmonary complications and improves aerobic capacity, VO2 peak,6MWD,dyspnea and mental wellness.

However, the major challenge is the limited time available from the time of diagnosis to lung surgery. Standard duration for pulmonary rehabilitation is generally 4 to 6weeks, which could delay the surgical treatment in lung cancer. These limitations can be overcome by home based exercise training, which has shown to improve effort tolerance and reduce post-operative complications. Preoperative physical rehabilitation studies in operable lung cancer varies in duration, intensity, and type of exercise and the period varies between 4-6 weeks of exercise [16,17,18] to a minimum 1 week of rehabilitation [19] before surgery.

Considering the lack of time available before lung surgery and the high volume of patients, Prehabilitation session was started for operable lung cancer patients on OPD basis. Trained Physiotherapists from the Physiotherapy Department counseled and trained the patients for different breathing exercises, mobility exercises, forced expiratory techniques, spirometer exercises, coughing and huffing techniques, walking programs, and post-operative suture care.

Aim:

This study aimed to evaluate the effectiveness of single-session prehabilitation group therapy on post-operative complications and length of hospital stay following lung cancer surgeries.

Method:

This retrospective chart review was conducted from September 2016 to August 2017 after obtaining ethics clearance. (Project no. 3025/TMH/IEC)

Participants aged 18 years and above and operated for lung cancer within the above-mentioned period were included. Patient who underwent chemotherapy and radiotherapy as a main line of treatment and

metastatic lung resection were excluded from the study. Moreover, patients with incomplete data were excluded from the study. The following data were extracted from the electronic medical records: participant demographic data, Eastern Cooperative Oncology Group (ECOG) performance status, exercise tolerance, smoking habits, co-morbidities, type of surgery, date of admission and surgery, number of days in ICU and Ward, date of discharge and Clavein-Dindo classification score, which is a valid and widely used complication grade [20]. (Table 1). Details regarding attendance to the Prehabilitation session were collected from the Prehabilitation records kept in the Physiotherapy Department. A total 201 patient's data was collected.

In the Physiotherapy Department Prehabilitaion Group Therapy session was conducted on daily basis for one hour and the patients undergoing lung surgery should attend PR session at least once before undergoing surgery. Prehabilitation Group Therapy session includes information about postoperative pulmonary complications, the importance of exercises, different types of breathing exercises, spirometer exercises, and forced expiration techniques like coughing and huffing exercises, mobility exercises for upper limb, lower limb, and trunk, and brisk walking for 20 to 30 minutes. Patients were advised to perform 8 to 10 repetitions, three sets in a day for all days in a week till surgery and to continue postoperatively for three months after discharge from hospital. A printed leaflet with all the above information and exercises was handed over to the patient at the end of the session for home reference.

Breathing exercises- Diaphragmatic and segmental breathing exercises helps in re-training the respiratory muscles. Relaxed, slow and deep breathing exercises help to facilitate effective ventilation and help to maintain the control of breathing and reduce dyspnea.

Incentive spirometer- It helps to improve lung function and reduce mucus buildup. It helps to keep small airways open and provides visual feedback to measure the lung capacity pre- and post-operatively. The spirometer used was Voldyne of capacity either 2500 or 5000 ml according to capacity of patients.

Thoracic mobility exercises- These helps to improve posture and chest wall mobility.

Upper and lower limb mobility exercises- These exercises help to maintain mobility and flexibility of the joints and prevent post-operative edema.

Coughing and huffing- These are forced expiratory maneuvers that help to move the secretions from smaller airways towards centrally. These maneuvers help to clear out the secretions from the chest.

Brisk walking- Brisk walking helps to improve cardiopulmonary fitness, improve muscular endurance, and improves aerobic capacity.

Statistical analysis:

Data was analyzed using the SPSS statistical software version 22. Association between the Complication grades and Prehabilitation status in the study was evaluated using Chi square test. Categorical type of data was presented in percentages and age, ICU days and ward days duration were summarized using median value and minimum and maximum value. Statistical significance was considered for $p<0.05$.

Result

201 patient's data for the period from September 2016 to August 2017 were extracted through electronic medical record and the Prehabilitation Group Therapy records kept in the Physiotherapy Department. Ten patient's data was incomplete, so they were excluded from the study. 191 patient's data for the period from September 2016 to August 2017was analysed.72.8% of the study population were male (n=139), and 27.2% were female (n=52) with a median age of 57 (18, 80). 65.8% of patients were non-small cell lung carcinoma (n=125) and 34.2% (n=65) were neuroendocrine and other tumors. 79.6% (n=152) underwent open surgery while 20.4% (n=39) underwent VATS / Robotic surgery. The Prehabilitation Group Therapy status analysis showed that 61.3% (n=117) attended Prehabilitation Group Therapy session while 38.7% (n=74) did not attend the session. (Table 2).

Median ICU stay was 1(1, 48) day and the median ward stay was 3(1, 28) days for both the Prehabilitation Group Therapy attended and not attended groups.182 patient's data was analyzed to evaluate the association between the complication score and Prehabilitation Group Therapy status. 9 patients (7 in Prehabilitation Group Therapy attended group, 2 in not attended group) data did not record the Clavien-Dindo complication score. The complication rate in the Prehabilitation Group Therapy attended group (n = 23) was 21%, whereas in the not attended group (n = 18) was 25%. 79% of the Prehabilitation Group Therapy attended group (n = 87) did not show any complications as compared to the 75% in the not attended group (n = 54). (Table 3/ Table 4).

There was no statistically significant difference found in the post-operative complications between the groups that attended the Prehabilitation Group Therapy session and the group that did not attend the session (p = 0.52). The medians of ICU stay days (p = 0.911) and ward stay days (p = 0.805) were the same across categories of Prehabilitation status.

Table 1: Clavian-Dindo classification

Grade	Definition
I	Any deviation from normal post-operative course without the need for pharmacological treatment or surgical,endoscopic,or radiological interventions Permitted theraputic regimes are: drugs as antiemetics, antipyretics, diuretics, electrolytes, and physiotherapy. The grade also includes wound infection opened at the bedside
II	Requiring pharmacological treatment with drugs other than those permitted for grade I complications Blood transfusions and total parental nutrition are also included
III	Requiring surgical,endoscopic,or radiological intervention
IIIa	Intervention not under general anesthesia
IIIb	Interventions under general anesthesia
IV	Life-threatening complication(including complications of the central nervous system) that requiresmanagement in a high dependency or intensive therapy unit
IVa	Single organ dysfunction (including dialysis)
IVb	Multiorgan dysfunction
V	Death
Suffix 'd' if the patient suffers from a complication at the time of discharge the suffix 'd'(for "disability") is added to the respective grade of complication.it indicates the need for follow-up fully evaluate the complication	
Brain haemorrhage,ischaemic stroke,subarchnoid bleeding,but excluding trasient ischemic attacks	

Table 2: Demographics

Data	Number	Percent%
Male	139	72.8
Female	52	27.2
NSCLC (diagnosis)	126	65.9
Neuroendocrine and Other lung ca (diagnosis)	65	34.1
Open Surgery	152	79.6
VATS / Robotic	39	20.4
PR attended	117	61.3
PR not attended	74	38.7

Table 3: Age, ICU stay and Ward stay distribution

	Age	ICU stay in days	Ward stay in days
Mean	53.26	2.64	4.51
Median	57.00	1.00	3.00
Std Deviation	13.747	4.308	3.987
Minimum	18	1	1
Maximum	80	48	28

Table 4: Complication score and PR status Association

	PR attended	Percent %	PR not attended	Percent %
No complications	87	79	54	75
Complications	23	21	18	25
Total	110		72	

Discussion

This retrospective study was conducted to find out whether single session of Prehabilitation Group Therapy offered any benefit to the operable lung cancer patient in terms of post-operative complications and length of hospital stay. There are enough evidences to support that for optimum benefit, Prehabilitation program is recommended for anything between 4 to 6 weeks. There is also one study, which has demonstrated feasibility of prehabilitation and shown physical and psychological benefit of one-week Prehabilitation pre operatively in Lung cancer (19). Standard Prehabilitation program was not very feasible due to the large volume of patients. Additionally, majority of patients were outstation and could not stay back for standard supervised Prehabilitation protocol, so a single Prehabilitation Group Therapy session was started pre-operatively for lung cancer patients. The trained physiotherapist who counseled and trained the patients for different breathing exercises, mobility exercises, spirometer, and walking conducted this single session. A leaflet containing information about Prehabilitation and the different exercises was given to the patient at the end of the session for reference at home.

Majority of patients (75%) did not report any complications in both the Prehabilitation Group Therapy attended and not attended groups. Although a single Prehabilitation group therapy session did not have any significance in reducing post-operative complications following lung cancer surgeries, it is still delivered as a standard of care in our hospital in order to cater to the large volume of patients visiting the hospital. Prehabilitation group therapy session is feasible, less time consuming and may have an added benefit of giving positive encouragement to patients with similar diagnosis and facing similar problems.

The reason for the non-significant result may be the non-adherence or the non-compliance to home exercises. In addition, the length of hospital stay was the same across both the groups of Prehabilitation and the reason could be the reduced incidence of complications (25%) in both the categories of Prehabilitation status.

Limitations and strengths:

Our study only compared the benefit of one single session of Prehabilitation group therapy against the post-operative complications and length of hospital stay. It did not measure the adherence or compliance rate for home exercises. It also did not study other benefits of Prehabilitation like improved functional capacity or effort tolerance nor was any association between habits and co-morbidities in categories of Prehabilitation status and post-operative complications recorded.

The strength of our study is that it is the only one of its kind to study the benefit of a single session of Prehabilitation group therapy in operable lung cancer. As our study was focused on a single institution; it is possible that the results reflect local culture limiting generalizability.

Conclusion

Single session of Prehabilitation group therapy did not have any significance in reducing post-operative complications following lung cancer surgeries. In addition to the single session, maintaining an exercise log or dairy at home or a tele consultation may be beneficial in measuring adherence or compliance. More research in terms of intensity, mode and type of Prehabilitation exercises and comparing more data that are objective may be necessary for broader implementation of Prehabilitation group therapy session across hospitals and institutions.

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Original Study

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A Study to Evaluate Correlation between Respiratory Function Measures – MVV, FEV1, FVC and FEV1/FVC Ratio to Pain, Disability Index and Craniocervical Angle in Persons with and without Chronic Neck Pain

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Abstract

Back ground: Chronic neck pain is one of the most common musculoskeletal pain conditions experienced by many people during their lives. Due to increased use of Tech devices & modern life style, forward head posture & resultant neck pain becomes quiet common. Although patients with neck pain are managed predominantly as musculoskeletal patients, there are indications that they also have poor pulmonary function as limited movement of the neck muscles can result in impaired chest movements. The aim of this study was to examine whether patients with chronic neck pain have impaired pulmonary measures.

Methodology: A cross sectional observational study was conducted to evaluate pulmonary function measures in patients with chronic neck pain.100 subjects included dividing them into 2 groups. Group A: Patients with Chronic Neck Pain. Group B: Age & sex matched healthy individuals. Written Consent was taken from the subjects and the subjects were made to understand the purpose of the study. Spirometry was performed for all the subjects. Forced vital capacities (FVC), forced expiratory volume in the first second of FVC (FEV1), ratio of FEV1/FVC and maximum voluntary ventilation (MVV) were recorded. Neck Disability Index (NDI), Numeric Pain Rating Scale (NPRS) for pain & Craniocervical Angle (CCA) had also been considered for both the groups.

Results: Data analysis was done using Microsoft office Excel. The results showed that patients with chronic neck pain yielded significantly reduced FVC, FEV1 and maximum voluntary ventilation ($P < 0.005$), but FEV1/FVC ratio were not affected significantly ($P > 0.5$). Craniocervical Angle & Pain Intensity was found to be significantly correlated with respiratory function.

Conclusion: Patients with chronic neck pain do not have optimal pulmonary function. Cervical spine muscle dysfunction in parallel with pain intensity and kinesiophobia are factors that are associated mainly with this respiratory dysfunction.

Key words: Chronic Neck Pain, Pulmonary Function Tests, Neck Disability Index, Numeric Pain Rating Scale, Craniocervical Angle

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Introduction

Musculoskeletal Neck pain is considered common worldwide with a prevalence ranging from 0.4% to 86.8%. It is considered to be one of the most costly musculoskeletal problems as it is associated with disability and tremendous social, psychological and economical impact on health and quality of life of the individual and on society as a whole.[21]

The close anatomical, physiological, neurological and musculoskeletal connection between the cervical and thoracic regions has received considerable clinical research attention, this has led researchers to propose that many patients presenting with chronic neck pain are supposed to have a predisposition towards respiratory dysfunction due to associated changes in rib cage and thoracic spine. This disclosure presents a totally different and previously unreported feature of chronic neck pain syndrome1[22,13].

In recent times especially after COVID scenario, there have been lots of changes in work nature, increased use of motor vehicles and the advancement and increased use of computers in certain occupations as well work in static sedentary postures for long hours in order to perform the tasks required of them. This all can cause continuous muscle contraction in the neck and shoulders, which subsequently leads most people to adopt a forward head posture (FHP) in which their chins stick out[2].

It has shown that 84% of patients with chronic neck pain present faulty breathing patterns. In normal breathing pattern, breathing should initiate with abdominal breathing rather than chest breathing and the chest should expand horizontal rather than vertical[3].

Although patients with neck pain are managed predominantly as musculoskeletal patients, weakness and fatigue of cervical muscles, reduced cervical mobility, impaired proprioception, postural abnormalities, and psychological compromise have been argued to be factors that are associated with poor pulmonary functions[1, 22].

Perry et al. examined the existence of a correlation between faulty breathing and musculoskeletal pain patterns. Abdominal and chest breathing was assessed by observation only, and results showed that 83% of patients with neck pain, in a population of different chronic musculoskeletal pain syndromes, experienced a changed breathing pattern indicating a relationship between neck pain and respiration[3]. No other research has examined this relationship, and urgent research is required to explore same.

Although FHP is thought to be one of the confounding factors for respiratory dysfunction, there are a limited number of head-to-head comparison studies.

Spirometry is a common test of pulmonary function that provides information regarding the presence of obstruction or possible restriction in people with suspected pulmonary dysfunction.[4] Pulmonary restriction is a term used to describe a group of respiratory disorders related to an impaired filling of the lungs with air.[5] Although a reduction in lung volume is a sign that is characteristic of restrictive disorders, respiratory flows and maximum voluntary ventilation (MVV) may also be affected.[5-7] This is particularly apparent in cases of neuromuscular weakness, as the respiratory muscles have a reduced ability to generate optimal levels of pressure and flow.[6] Neuromuscular weakness is also a physical sign in musculoskeletal pain conditions. However, musculoskeletal pain and pulmonary function are rarely considered together in clinical practice.

Despite mechanistic evidence suggesting that pulmonary function may be affected in those experiencing neck pains, [1] little is known of the actual respiratory function in this group[1].

Therefore, the aim of this study was to investigate the effects of chronic neck pain on respiratory function. In particular, consideration was given to spirometric measures and assessment of respiratory muscle strength in these patients. A further aim was to examine whether an alteration of normal cervical posture such as FHP, commonly found in chronic neck patients, can correlate with respiratory dysfunction.

Aims and Objectives

- The aim of the present work was to study the correlation between chronic neck pain & respiratory dysfunction.
- To evaluate intensity of chronic neck pain & disability index amongst individuals.
- To compare spirometric measures and assessment of respiratory muscle strength in patients with chronic neck pain with age & sex matched healthy controls.
- A further aim was to examine whether an alteration of normal cervical posture such as Forward head posture (FHP) can affect respiratory functions or not.

Methodology

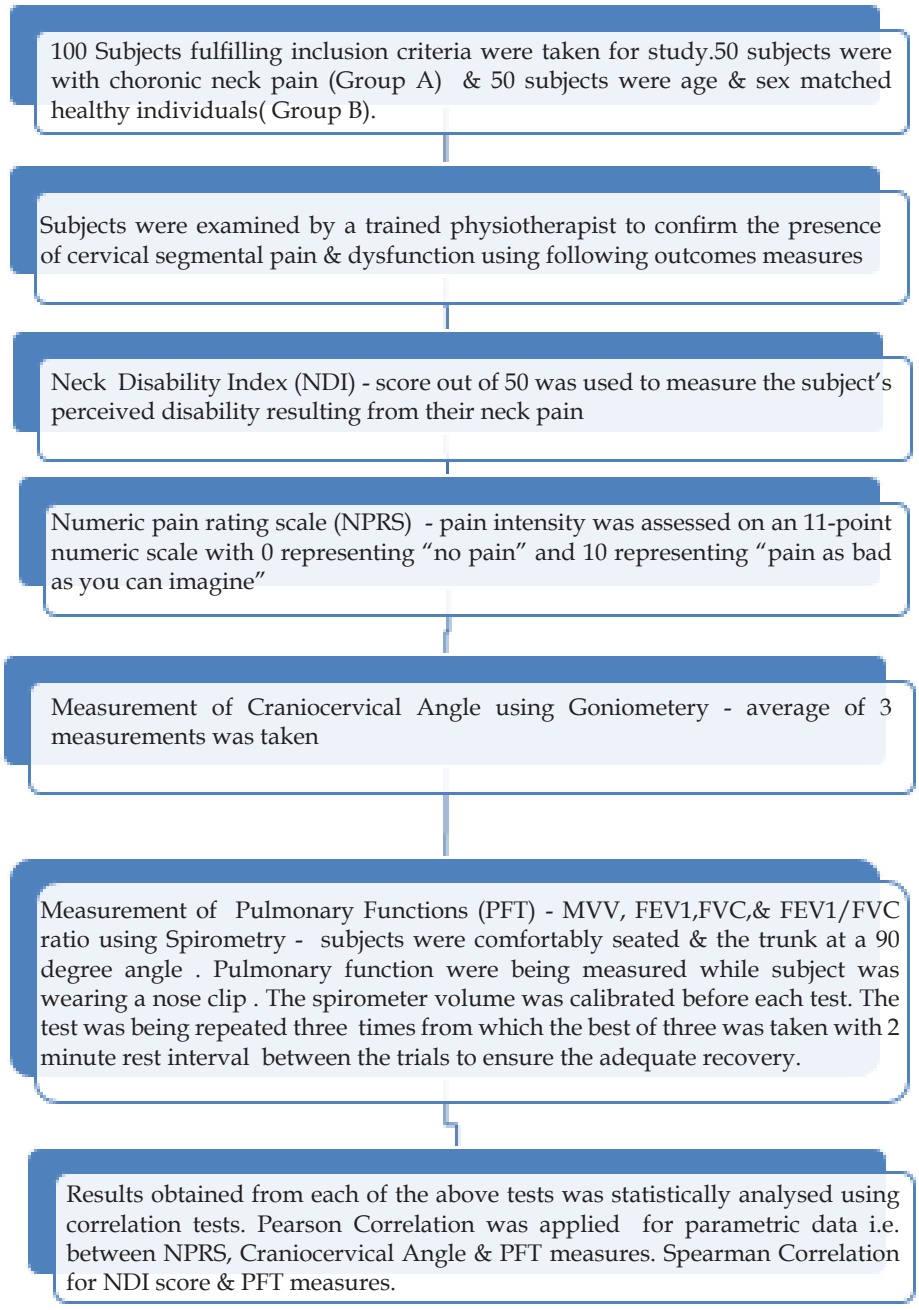
Inclusion Criteria

- Both Genders Patients were included if they had a history of neck pain with or without headache at least for 6 months or more that is associated and experienced incidence of pain at least once a week.
- Age group: 18 years to 50 years.
- Gender: Male & Female, both genders were included in study.

Exclusion Criteria

- Subjects were excluded,
- If they had undergone cervical spine, abdominal or chest surgery
- If they had taken neck exercise program in past 12 months
- If they were cigarette smokers or tobacco chewers
- If they had any occupational industrial exposure
- If they were obese (body mass index > 40)
- If they had clinical abnormalities of the vertebral column or thoracic cage
- Neuromuscular Diseases
- K/C/O of gross Anemia, Diabetes Mellitus
- Respiratory Pathologies - Pulmonary Tuberculosis, Bronchial Asthma, Chronic Bronchitis, Bronchiectasis, Emphysema or Malignancy.

Procedure:

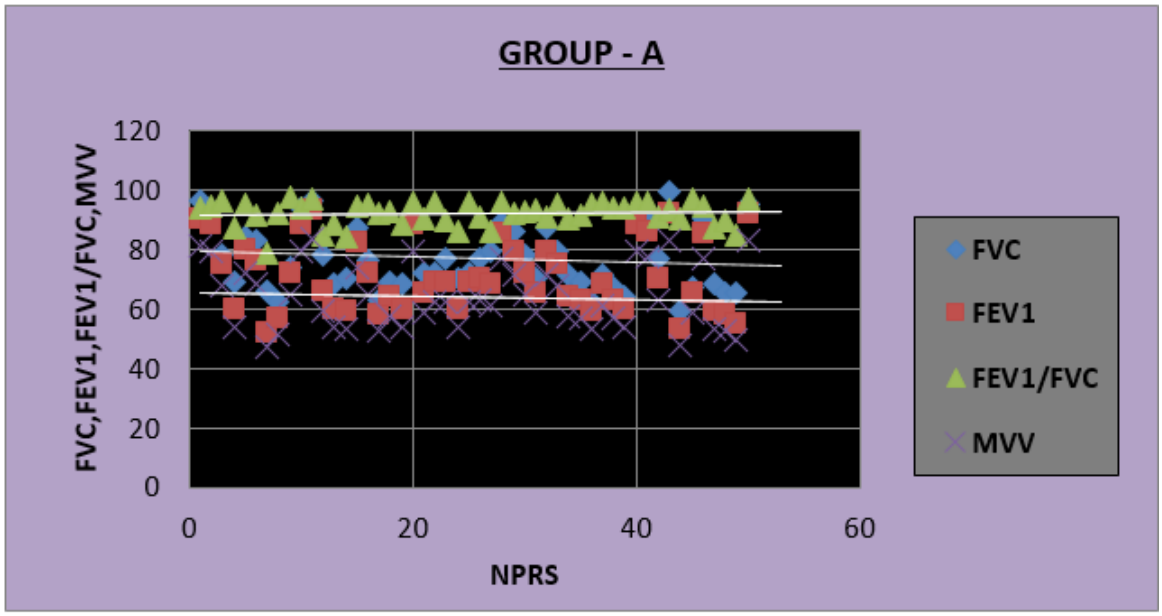


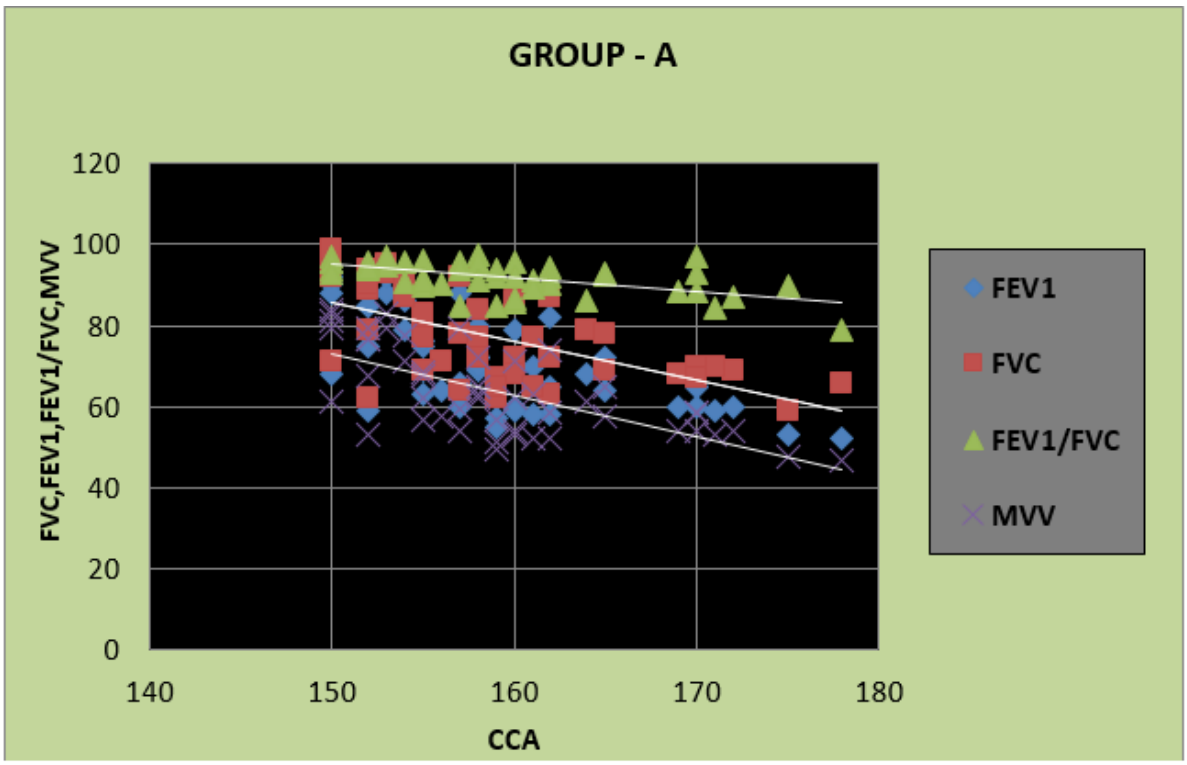
Results

Results obtained from each of the outcome measures were statistically analyzed using correlation tests. Pearson Correlation was applied for parametric data i.e. between NPRS, Craniocervical Angle & PFT measures. Spearman Correlation between NDI score & PFT measures.

Below is the graphical presentation of the results obtained with their r values.

Group – A: Patients With Chronic Neck Pain





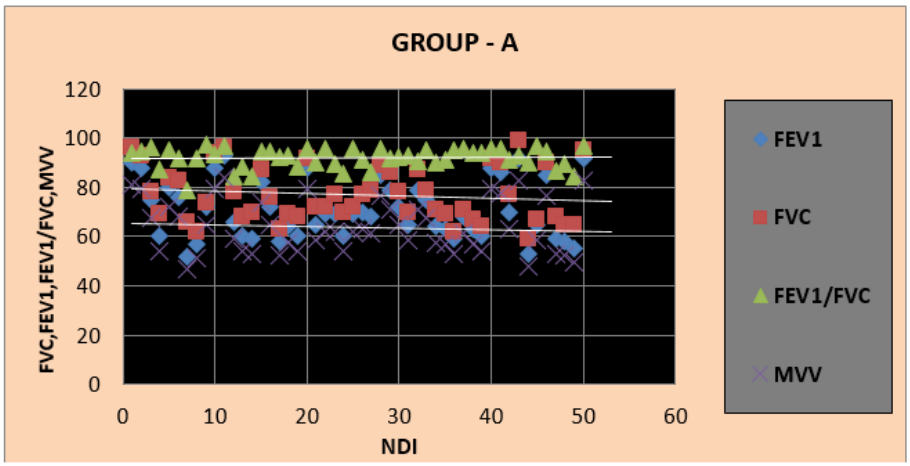


Table 1: Group – A: Patients With Chronic Neck Pain

CORRELATION PARAMETERS	r - value	SIGNIFICANCE
NPRS – FEV1	-0.72	Strong –Ve association
NPRS - FVC	-0.69	Strong –Ve association
NPRS – FEV1/FVC	-0.56	Moderate –Ve association
NPRS - MVV	-0.74	Strong –Ve association
NDI – FEV1	-0.67	Strong –Ve association
NDI – FVC	-0.66	Strong –Ve association
NDI – FEV1/FVC	-0.36	Weak –Ve association
NDI - MVV	-0.67	Strong –Ve association
CCA – FEV1	-0.66	Strong –Ve association
CCA – FVC	-0.60	Strong –Ve association
CCA- FEV1/FVC	-0.56	Moderate –Ve association
CCA - MVV	- 0.66	Strong –Ve association

Group – B: Healthy Individuals

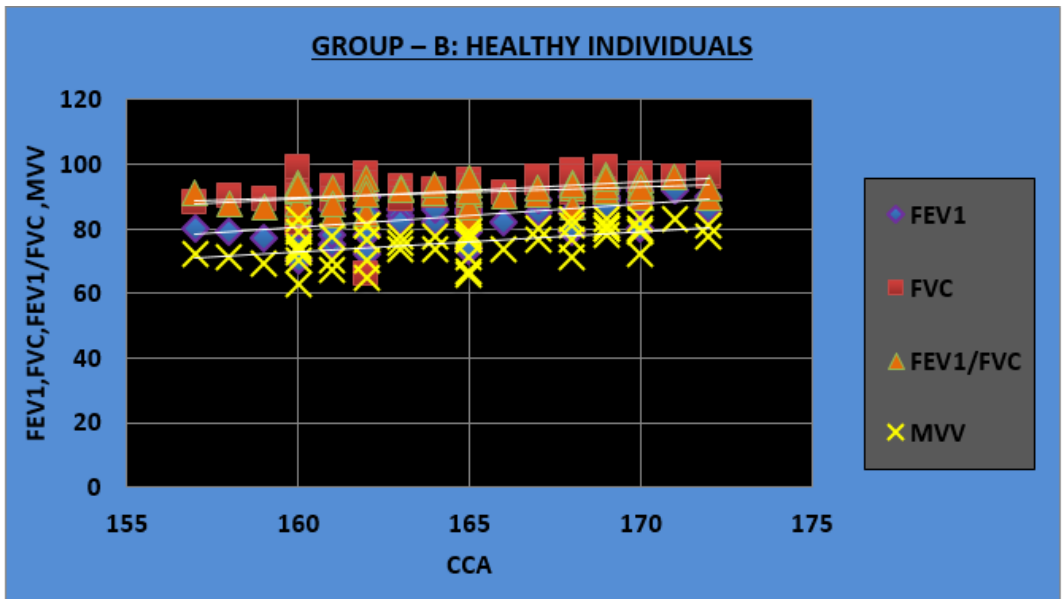


Table 2: Group – B: Healthy Individuals

CORRELATION PARAMETERS	r - value	SIGNIFICANCE
CCA – FEV1	0.49	Moderate +Ve association
CCA – FVC	0.50	Moderate +Ve association
CCA- FEV1/FVC	0.36	Weak +Ve association
CCA - MVV	0.50	Moderate +Ve association

Abbrevations

- FEV1 – Forced Expiratory Volume in 1 sec
- FVC – Forced Vital Capacity
- FEV1/FVC – Ratio of Forced Expiratory Volume in 1 sec to Forced Vital Capacity
- NPRS – Numeric pain rating scale
- NDI – Neck Disability Index
- CCA – Cranio-Cervical Angle

Table 2: General Characteristic of Participants

Variables	Chronic Neck Pain Group	Age & Sex Matched Healthy Individuals
Age(Years)	35.14	35.24
Gender	24(M)+26(F)	23(M)+27(F)
NDI	24.6	-
NPRS	7.26	-

Table 3: Pulmonary Function Tests

Variables	Chronic Neck Pain Group	Age & Sex Matched Healthy Individuals	Mean Difference	"t"	Significance
FEV1	70.9	84.12	13.22	1.684	<0.001
FVC	76.9	91.78	14.88	9.654	<0.001
FEV1/FVC	91.95687	91.69227	-0.26	0.742	>0.5
MVV	63.81	75.708	11.89	1.684	<0.001
CCA	159.1	164.72	5.62	3.276	<0.001

Discussion

According to the present results, chronic neck patients present with a respiration dysfunction attributed to decreased FEV1, FVC & MVV. Furthermore, the current study has demonstrated a moderate association between increased FHP and decreased respiratory muscle strength in neck pain patients. These findings seem to support the hypothesis that a common disorder like chronic neck pain syndrome can present with problems beyond the musculoskeletal. It seems that this kind of pathology has further implications, closely correlated with the respiratory system[1].

The study showed strong negative correlation of NPRS, NDI & CCA with PFT measures FEV1, FVC & MVV in chronic neck pain patients. While the correlation of NPRS, NDI & CCA with FEV1/FVC was moderately negative.

As per described in Table 2, there was a significant decrease in pulmonary function parameters like FEV1, FVC and MVV in patients with chronic neck pain compare to age and sex matched healthy individuals, and non significant decrease of FEV1/ FVC. Similarly, Kapreli *et al*.[1] reported significantly reduced pulmonary functions (MVV, VC, FVC, FEV1, and PEFR) in patients with chronic neck pain. While the values of FEV1/ FVC were lower in those with neck pain, the difference was nonsignificant.[1]

Thus present results showed, chronic neck pain patients present with a respiration dysfunction attributed to decreased pulmonary function measures. Furthermore, the study demonstrated association of increased forward head posture and decreased pulmonary function in neck pain patients.

In the literature, Han et al.[17]found that the FVC, FEV1, FEV1/FVC%, and MVV in FHP patients tended

to decrease more than that of normal individuals, while Kang et al.[18] found a relationship between FHP and FVC in healthy population.

When FHP is maintained for prolonged periods the neck flexors and the erector spinae (ES) muscles in the upper thoracic region are weakened due to their lengthening, and the scapula is elevated due to tension in the levator scapula, sternocleidomastoid (SCM), splenius muscles, and the suboccipitalis, which also causes tension in the upper trapezius (UT)[8]. Therefore, because of an imbalance in the muscles, such as the shortening or lengthening, or straining or loosening of the muscles around the neck, a rounded shoulder posture is exhibited, in which the upper thoracic region is slightly bent while in a sitting posture[9], and chronic neck pain results due to mechanical stress[2]. These changes in muscle activity result from changes in motor strategies to minimize the activities of muscles that are sensing pain and to compensate for these suppressed muscles[10].

The SCM, scalene muscles, UT, pectoralis major (PM), and thoracolumbar ES muscles are important accessory respiratory muscles involved in inspiration[11, 12] and prolonged FHP weakens these muscles, thereby affecting their respiratory function[11]. Because of this, patients with FHP accompanied by chronic neck pain have been shown to have altered respiratory muscle strength than normal individuals[13] and their accessory respiratory muscles are shortened, which largely affects their respiratory function[14]. In addition, a study reported that FHP changes the alignment of the thoracic spine and rib cage due to a slightly bent posture, thereby causing respiratory dysfunction[1].

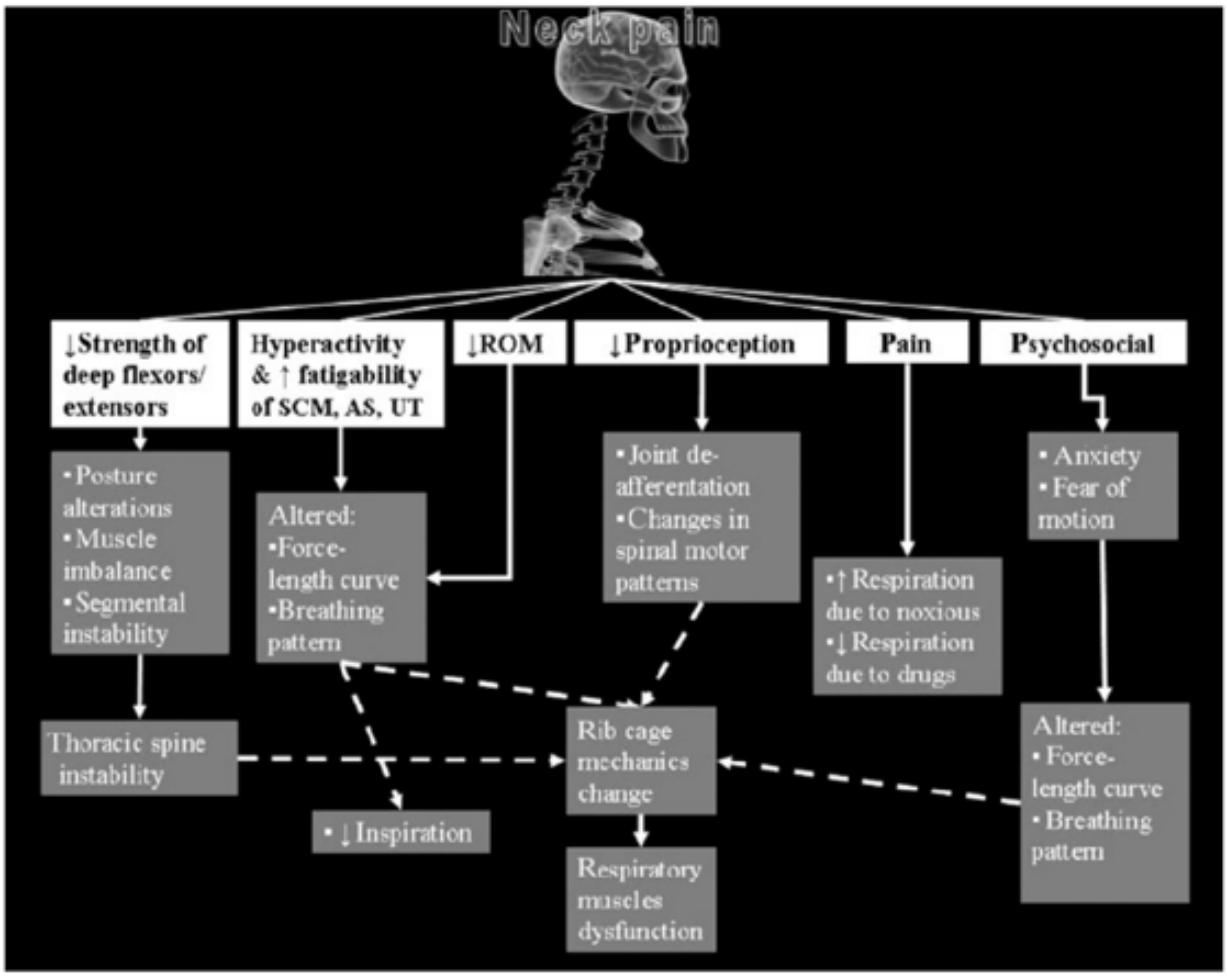
In the faulty upper chest breathing pattern, clavicles are lifted upward by over activity of sternocleidomastoid (SCM), trapezius, and scalene muscles, contributing to the muscle imbalance.[3]Muscle imbalance has an important role in forward head posture (FHP). As Janda[15] refers in upper crossed syndrome, superficial neck flexors (SCM and anterior scalene muscles) become tight; however, deep neck flexor and extensor muscles tend to be lengthened and incapable. Also, upper trapezius, levator scapulae, and pectoralis muscles which play a role in forced inspiration become tight and shortened, while the rhomboid and serratus anterior muscles become loose and weak.[15,16] These imbalances result in rib cage dysfunctions, leading to respiratory dysfunction.

The deep flexors and extensors of the cervical spine, although they do not play a direct role in respiration, are important dynamic elements for correct posture, muscle balance and segmental stability. Known as 'active ligaments'[19], these muscles could have an impact on kinetic control, not only on the specific area but also on within the cervical and thoracic spine in order for the muscles to act in moving the ribs up or down. Poor cervical muscle control and restricted range of motion could present with mechanical adjustments and adapted contraction patterns, due to the alteration in the muscles' force– length curve relationship, thereby altering movement of the rib cage. This could lead to insufficient respiratory function, including all muscles involved as diaphragmatic, intercostals or abdominals.[1]

Dimitriadis et al. reported that maximal inspiratory and expiratory pressure showed statistically significant decreases for complex reasons, such as weaknesses of the SCM, scalene muscles, and the trapezius, which are accessory respiratory muscles and a reduction in kinetic control of the cervical area[13]. In addition, Wirth et al. reported that weaknesses of the neck muscles and accessory respiratory muscles in patients with neck pain resulted in a decline in thoracic mobility, thereby decreasing maximal voluntary ventilation, maximal inspiratory pressure, and maximal expiratory pressure, and that these effects were closely related to FHP[20].

Chronic Neck Pain patients present with decreased strength of deep cervical flexors & extensors, hyperactivity & increased fatigability of superficial neck flexors, limitation of cervical ROM. These functional alterations causes biomechanical modifications of thoracic spine & consequently on respiratory muscle function.

These findings seem to support the hypothesis that a common disorder like chronic neck pain syndrome can present with problems beyond the musculoskeletal.



Conclusion

In conclusion, Neck Pain & associated postural disorder mainly affecting the biomechanics of the neck and upper extremities, as well as respiration. It is recommended evaluating respiratory functions in addition to posture examination given the fact that most of the patients with neck pain have a faulty breathing pattern. So that finding out respiratory dysfunction in patients with neck pain is important to tailor the treatment protocol. It is also recommend to researchers to examine the effects of respiration training on FHP and neck pain in further studies. Expiratory muscle strengthening exercises may be useful, as well as re-education of breathing pattern and posture exercises. We recommend examining chest expansion testing to patients with chronic neck pain. In case of faulty breathing pattern, chest expands vertically rather than horizontally, leading to decreased chest expansion. It may help to determine respiratory dysfunction and revise the treatment protocol.

The study thus is suggestive that chronic neck pain patients have altered pulmonary functions. These findings support the hypothesis previously published by Kapreli et al. that a common musculoskeletal disorder like chronic neck pain syndrome may cause respiratory dysfunction. The connection of neck pain and respiratory operation could have a great impact on various clinical aspects, notably patient assessment, rehabilitation and consumption of pharmacological agents, and further research should therefore be performed.

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Conflict of interest: None.

Ethical Clearance: Approved.

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Original Article

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Kinesthetic Learners During the COVID-19 Pandemic in School going Students: A Perspective on E-learning

Editor's Note: This article has been retracted as of January 2026 as it is out of scope

Abstract

Background: During the pandemic, because of the sudden transition in content delivery methods, students needed to quickly adapt to e-learning. Depending on their learning styles, student adaptation may have been challenging. The way a person learns is defined by their perceptions, processes, and preferences. To date, only a limited amount of research has been done on the relationship between attitudes toward e-learning and learning styles. Because kinesthetic learners prefer hands-on learning, students may have found the transition to e-learning difficult. Therefore, the purpose of this study was to screen and gain the perspective of kinesthetic learners in the online learning environment.

Aim: This study aimed to screen and gain the perspective of kinesthetic learners among school-going students in an online learning environment.

Procedure: This study included 100 school-going students from South Delhi, participants were sent google forms, and an online link to fill VARK questionnaire after being informed of the study's objectives and signing an informed consent form.

Results: After screening using VARK 18% of subjects were categorized as kinesthetic learners whose mean age was 15.39 years $\pm$ 2.062, however, the range remained the same as 6 with a minimum ranging from 12 years to a maximum of 18 years of age. Six open-ended questions were then given to 18 participants to collect qualitative data.

Conclusion: The results of this study suggested that Kinesthetic learners' perspective

on e-learning is that they revealed decreased levels of confidence in the content learned during e-learning during the pandemic. The evidence from our study gave a call for attention to the teachers during the pandemic for the kinesthetic learners in the online learning environment.

Key Words: Kinesthetic learners, E-learning, COVID-19, Occupational Therapy

Source of funding: Self

References

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Efficacy of Muscle Energy Technique (MET) for Hand Function in Rheumatoid Arthritis

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Abstract

Background: Rheumatoid Arthritis is a rare condition which affects only 1% population in India. It is an autoimmune and chronic inflammatory condition which affects joints and organ system. And as it is also a progressive disease so medication and physiotherapy is must for stopping from further worsening of condition. This research aims to find out efficacy of Muscle Energy Technique for hand function in rheumatoid arthritis.

Methods: 50 Rheumatoid arthritis patients were chosen considering the inclusion and exclusion criteria. The purpose and nature of study was explained to the participants, a consent form being filled by the participants. The study was carried out by taking assessment of range of motion and VAS and then the treatment regime was started and after completing the treatment protocol assessment was taken again. The assessment which was collected was entered into a database on Microsoft excel and word.

Conclusion: Based upon the pre-post treatment assessment done and its data collection, the RA patients are prone to get their Range of Motion and Muscle Strength to get affected which also hampers their daily activities. The awareness regarding the condition, preventive methods and even exercise protocol are very helpful in avoiding further risk factors.

Keywords: Rheumatoid Arthritis, Muscle Energy Technique, Range of Motion, Muscle Strength.

Introduction

Rheumatoid Arthritis (RA) is an autoimmune and chronic inflammatory disorder which affects joints and organ systems. RA is also a progressive disease. It most commonly affects the small joints but can also affect to large joints and major organs in severe cases[1]. In severe cases this spreads from small joints till skin and lungs also. Now as RA is autoimmune process in this the immune system attacks bodies own cells. It is triggered by genetic as well as environmental factors. When RA is triggered due to genetic factor it is due to the gene HLA-DR4. The individuals who have these genes are more likely to develop RA[2]. Sometimes it can also triggered by some environmental factors such as smoking, alcohol intake, obesity and poor diet. But when compared

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the genetic factor is more severe than environmental factors[3]. RA affects about 1% population in India. It is mostly seen in 30-50 years of age groups and women are likely to get affects than men[4]. As, said earlier that RA is progressive disease, so if it is left untreated it can cause severe damage to joints and also to major organs which will affect your quality of life and also your daily activities will be hampered[5]. In RA the subjects usually have morning stiffness which usually lasts for more than an hour. This morning stiffness is also seen in OA but this usually goes off within 15-30 minutes but that's not the case in RA. The swelling of joints and pain at joints in night is also seen[6]. Individuals with RA of hand usually have polyarthritis i.e. more than 5 joints are affected and usually small joints of hand are affected[7]. It affects symmetrically to both hands. In this wrist and MCP is commonly affected and also the PIP joint which is also very commonly affected but for the DIP joint it is very rarely affected[8].

In RA of hand the individuals experience reduced range of motion and reduced muscle strength which affects their daily activities. When there is reduced range of motion there occurs spasticity, rigidity, hypertonicity or hypotonicity. Hypertonicity often follows overuse and can result in altered joint position, increased irritability and decreased elasticity and if it is left untreated the condition may get very severe affecting the joints causing joint deformity[9]. The joint deformities which are caused due to RA of hand are radial deviation of wrist and ulnar deviation of MCP joint, swan neck deformity and sometimes boutonniere's deformity is also seen. And for RA when coming to treatment approach medications and physiotherapy is given which is very effective because it can lower the severity and suppress the symptoms. The medication can be used to for relieving pain and inflammation but to increase strength and improve range and correction of deformity physiotherapy is given[10].

Muscle Energy Technique (MET) has been defined as a form of osteopathic manipulation treatment in which patients muscles are actively used on request, from a previously controlled position in a specific direction and is against the distinctly executed counter force. Thus MET is muscle relaxation technique in which manual resistance is applied against the active contraction of muscle in the form of isometric or isotonic contraction which may be followed by gentle stretch[11].

MET is used to mobilize joints in which movement is restricted, stretch the tight muscles and fascia, to improve local circulation and strengthening of muscles. MET thus improves musculoskeletal function through mobilizing joints and stretching of tight muscle and fascia to reduce pain and to improve circulation. So if there is severe pain because of severe muscle spasm or trigger points or any restriction in joints then MET is the best treatment which should be administered. This results in reducing edema, muscle relaxation, lengthening of shortened muscle and also increasing ROM[12]. But in unco-operative or unresponsive patients MET is not given[13].

MET is a manual therapy technique where muscle uses its own energy in the form of isometric contraction to relax the muscle using its two methods i.e. autogenic or reciprocal inhibition which is used to lengthen the muscle. MET is an active technique in which patients actively use their muscle on request for the sake of treatment. MET is based on the concept of autogenic inhibition and reciprocal inhibition. When there is contraction followed by stretching of same group then it is autogenic inhibition MET. But when there is contraction of muscle group and stretching of other muscle group then it is a reciprocal inhibition MET[14].

As the primary function of MET is to reduce pain and increase range of motion. In this the therapist will resist the desired muscle while the subject will contract it and push against the therapist. This contraction is held for 5-10 seconds and this is repeated for a several times with short rest periods. So in those patients who have spastic muscle or chronic tightness or post-surgery stiffness this technique will help reduce tone and regain the normal range. This technique can be applied to any joints. And when we aim to improve range patients effort should be 10-20% of available strength[15].

Reciprocal inhibition is an indirect manual therapy technique. This muscle energy activation utilizes the reflex mechanism of reciprocal inhibition when antagonistic muscles are contracted. In this the agonist muscle which are shortened or tensed

are not allowed to contract because pain prevents against muscle to contract. Therefore opposite group of muscle (antagonist) are allowed to contract isometrically or isotonically against resistance which causes reciprocal inhibition or relaxation of shortened muscle[16].

Post-isometric inhibition is also called as lewit's PIR. In this immediately following an isometric contraction the NM apparatus is in refractory state during which passive stretching may be performed without encountering strong myostatic reflex. The subject is asked to do is resist the contraction and then take up the slack in fascia during relaxed refractory period. With muscle contraction there also maybe increased tension in golgi organ proprioceptors in the tendons which inhibits active muscle contraction. As the name suggests that "physiological relaxation of muscle after isometric contraction". It is the types of hold relax exercise in which the contracted or tensed muscle is allowed ton contract against the manual resistance. And patient is allowed to use 10-20% of his/her available strength[17]. Post-facilitation stretch technique or Janda's post-facilitation stretch method is generally used to elongate muscle length as well as to relax the muscle[18]. As the name suggests a stretch is given to the muscle just after the contraction. In this also 10-20% patient effort available strength is used[19].

Methodology

A cross-sectional study was carried out from in a rural tertiary care hospital in karad. This study included rheumatoid arthritis patients with reduced mobility and strength of hand. An assessment was made for this purpose. Patients who were co-operative, patients who were willing to participate considering the inclusion and exclusion criteria were included in the study. A consent form was signed by the participants before taking their assessment and all the details explained in Marathi. The respondents were informed about the aim of the study as well as the fact that participation in the study was totally voluntary .The data collection sheet consisted of assessment in which range of motion and VAS was assessed in patients with RA in karad. The assessment was validated by the experts from Institutional Ethics Committee. An Assessment was performed using ROM and VAS. An assessment of ROM was performed with the measurement of subjects Wrists, MCP ranges. Similarly, for VAS, subjects were asked about their pain scoring at rest and on activity and the score was documented. All the data were entered in database on the Microsoft excel. Microsoft excel and Microsoft word have been used to generate the graphs. The treatment session was started after the complete assessment was taken.

Treatment

- Hot Moist Pack for 10 minutes
- Muscle Energy Technique –

1. Autogenic Inhibition- Post Isometric Relaxation (PIR)

   Post Facilitation Stretching (PFS)

2. Reciprocal Inhibition

❖ Post-Isometric Relaxation (PIR) :

- ➢ The tensed or spasmed muscle was lengthened into restricted ROM. Then the limb was held firmly but comfortably and patient was allowed to use his muscle against the manual resistance applied by therapist and also allowed taking deep breath during contraction.
- ➢ The contraction was allowed for 5-10 sec.
- ➢ Then the patient was instructed to relax the muscle and exhales then muscle was again stretched into restricted ROM just short of pain and again the same was repeated after 20sec rest and this procedure was repeated for 3-5 times.
- ➢ And also patient was asked to use their 10-20% of strength in order to improve range.

❖ Post-Facilitation Stretching (PFS) :

- ➢ The tensed muscle was placed between a fully relaxed and fully stretched state.
- ➢ Limb was held firmly but comfortably and patient was instructed to contract the tensed or shortened muscle for 5-10sec and then allowed to relax the muscle

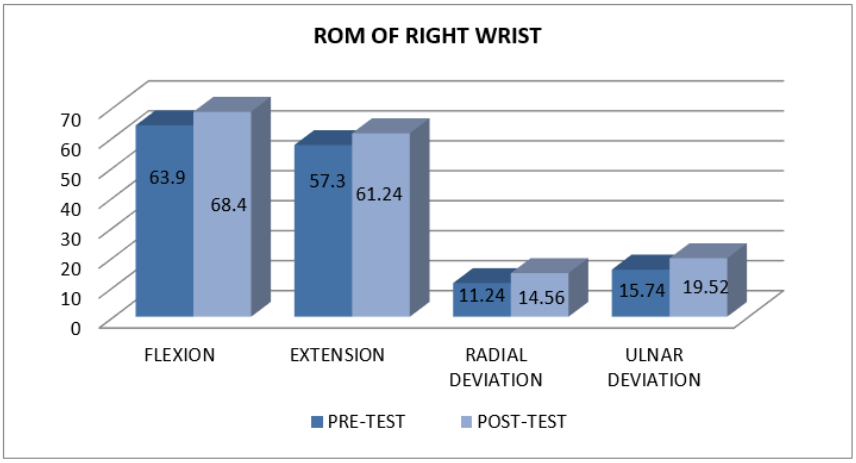
- And now as the muscle is relaxed a rapid stretch was given to tensed or relaxed muscle into restricted ROM (new position) held for 10 sec after which 20 sec rest was given.
- This procedure was repeated for 3-5 times.
- And also patient was asked to use their 10-20% of strength in order to improve range.

❖ Reciprocal Inhibition :

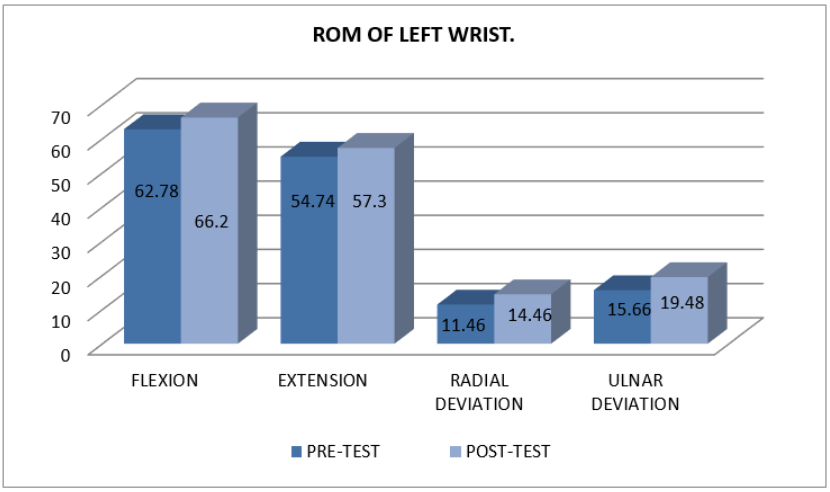
- The shortened muscle was placed between a fully stretched or fully relaxed state.
- The limb was held firmly but comfortably
- The patient was instructed to contract muscle (which is opposite to shortened or tensed muscle) isometrically or isotonically against manual resistance for 6-10sec
- This technique allows agonist muscle to relax without contacting them.

- This all techniques was being repeated 3-5 times and for 10 seconds of hold with 20 seconds of relaxation.
- This whole procedure consists of 30 minutes with 10 minutes of HMP and 20 minutes of MET with short breaks in between.

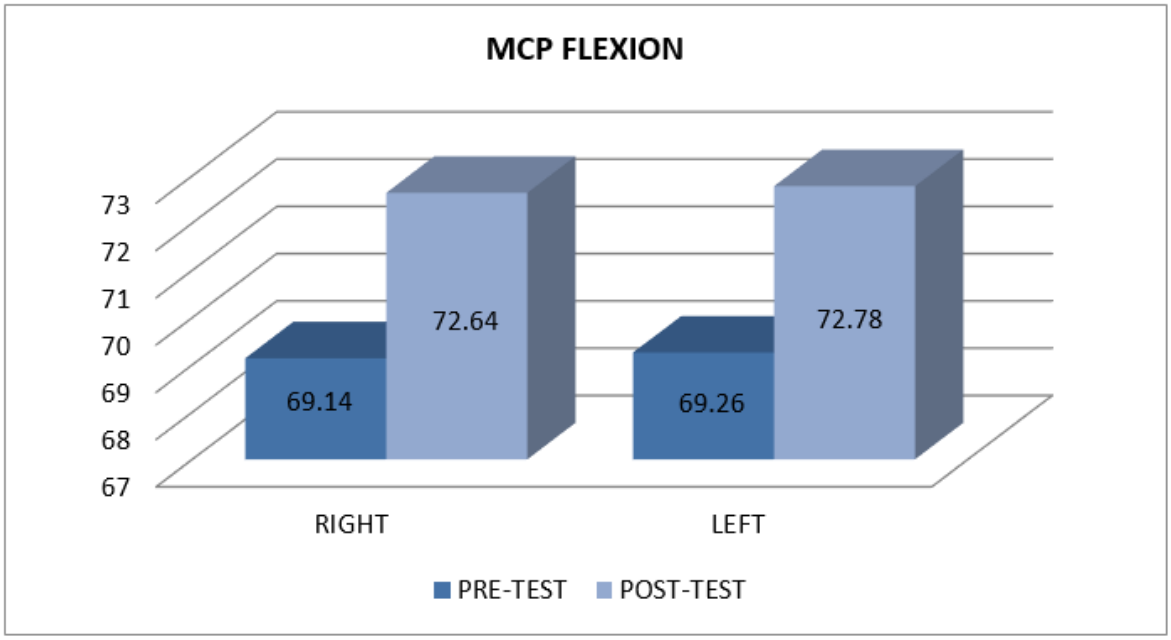
Results



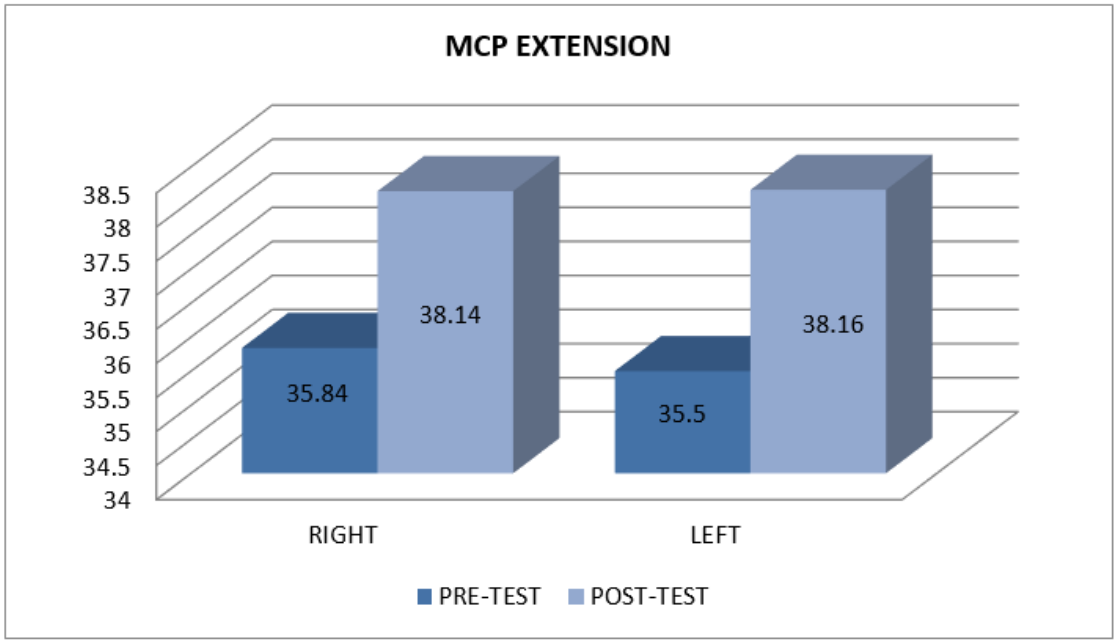
Graph 1: Comparison of pre-test and post-test of ROM of right wrist.



Graph 2: Comparison of pre-test and post-test of ROM of left wrist.

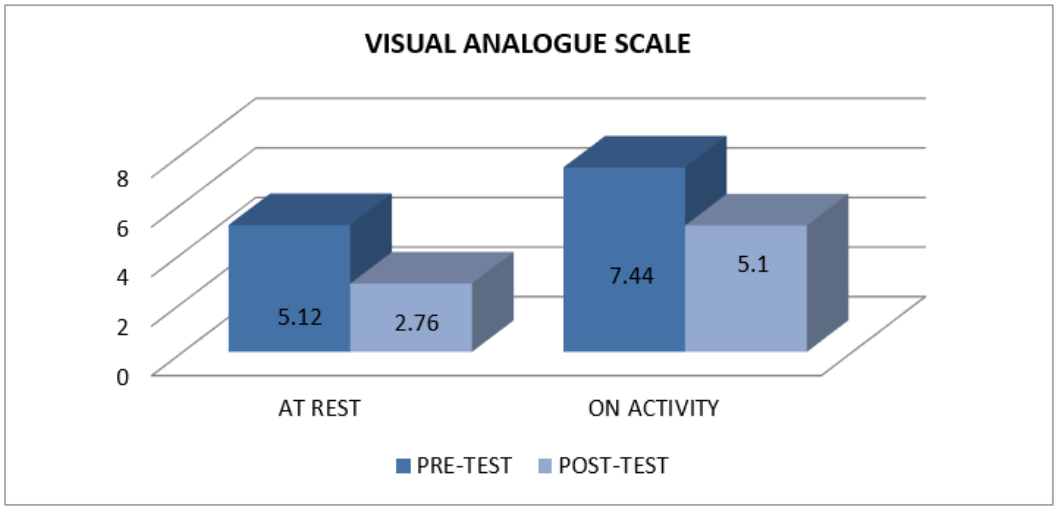


Graph 3: Comparison of pre-test and post-test values of ROM of MCP flexion.



Graph 4: comparison of pre-test and post-test values of ROM of MCP extension.

Interpretation: The above graphs shows the pre-test and post-test values of ROM score for patients with rheumatoid arthritis, for the wrist and mcp joint is extremely significant ($p<0.0001$). For wrist flexion, extension, radial deviation and ulnar deviation is extremely significant ($p<0.0001$) and MCP is also extremely significant with ($p<0.0001$). For flexion and extension is very extremely significant ($p<0.0001$).



Graph 5: Comparison of pre-test and post-test values of Visual Analogue Scale.

Interpretation: The above graph shows the post-test versus post-test values of Visual Analogue Scale (VAS) for patients with Rheumatoid Arthritis of hand. It is found to be statistically extremely significant ($p<0.0001$).

Discussion

In the present study we aimed toward assessing and applying the set treatment protocol to patients with RA who are residing in karad.

The study assessed the severity of rheumatoid arthritis in people whose range of motion and strength is affected. According to the pre-assessment taken groups were divided into mild moderate and severe. The result thus moves our attention towards educating the patients with Rheumatoid Arthritis about the condition and importance of physiotherapy in avoiding further worsening of the condition and also telling about importance of exercise protocol for them, this will help in building a more positive approach among the community dwelling RA patients towards the rehabilitation and seek a good quality of care. Along with increasing awareness among the RA patients, home based exercise protocol should be taught to patients. Proper implementation of this home based exercise protocol and the treatment protocol would ensure a subsequent decrease would stop further worsening of condition, reduction in hospital/rehab costs, and a significantly good quality of life.

Previous studies which have been conducted focuses on stretching and strengthening protocol as a general concept[20]; this study focuses on the Muscle Energy Technique (MET) for those RA patients who have decreased ROM and decreased muscle strength which is very crucial for rehabilitation and prevention of further worsening of condition. Many previous studies have been done on stretching, strengthening and using various physiotherapeutic modalities and using home protocol but the study focusing on MET has never been done. This project successfully developed a validated treatment protocol for treating the patients with RA of hand. Although the sample size was relatively small, a study with much larger population can demonstrate better outcomes.

Conclusion

According to responses collected, the study indicated very poor knowledge about the condition and preventive measures for same and about further risks if left untreated among the population in karad. This necessitates awareness regarding the knowledge and practice, if such awareness and importance of rehab is created then this will prove helpful in reducing the further risks. The treatment protocol will help in pain reduction and significantly increasing the ROM and muscle strength. This practice would thus lead to an improved quality of life.

Conflict Of Interest: Nil

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Original Article

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Effect of Iliopsoas Muscle Release on Running Speed in Recreational Runners

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Abstract

Background and Objective: Running has steadily gained worldwide popularity and is the primary mode of exercise for many. This, increase in activities have further observed a steady increase in the incidences of injuries. Recreational function and activities like running results in hip pain, limitation of motion or both. Iliopsoas, being the primary and the strongest hip flexor plays an important role in maintaining integrity and strength of hip joint. Iliopsoas muscle tightness occur as a result of overuse or strain in recreational runners. The primary aim of this study was to find the effect of iliopsoas release on running speed in recreational runners.

Materials and methodology: 40 recreational runners were included in the study. Static release and Dynamic release was given to the patients. A pre-test Assessment of Visual Analogue Scale (VAS) on rest, and on activity, Manual Muscle Testing (MMT), Range Of Motion (ROM) and Straight Line Sprint Test (SPT) was taken.

Result: Pain is significantly reduced during both, rest and VAS exercise. The mobility of the hip joint has significantly increased based on the ROM. There is a significant improvement on muscle strength evaluated by MMT.

Conclusion: There is significant increase in running speed of recreational runners, along with significant decrease in pain.

Keywords: iliopsoas muscle, recreational runners, running speed, muscle release

Introduction

Running is one of the most popular and accessible sport activities enjoyed by people worldwide.[12] It has become increasingly popular in the past 50 years. Running is an excellent form of exercise for people seeking to achieve physical fitness and healthy lifestyle as it is linked with longevity and reduction of risk factors for cardiovascular diseases.[10] Running is a form of both anaerobic exercise and aerobic exercise. It is a complex, coordinated process which involves the entire body.[10]

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Despite the health benefits, running related musculoskeletal injuries are very common. The incidence and prevalence of injuries among runners ranges between 3.2% and 84.9% respectively.[1] It has also been reported that 36% of the runners suffer from musculoskeletal injuries.[14]

In recreational runners, running related injuries are most commonly seen in the lower extremity. Some of the most frequently seen diagnosis among recreational runners are patellofemoral pain, iliotibial band syndrome, plantar fasciitis, with proportions in relation to all injuries ranging between 10-17%, 4-8% and 5-8% respectively.[8]

Clinically, one of the most important causes of running is muscle tightness. 92% of injured runners exhibits one or two muscle imbalances that may contribute to running injury.[8] A number of factors have been identified that contribute to flexibility, including gender, age, muscle size, and warm-up. Females are more flexible than males, with the differences in flexibility being accounted for by anatomic factors, such as the difference in pelvic anatomy that can result in females having a larger valgus angulation at the knee.

Compared to non-runners, runners tend to have tighter rectus femoris and iliopsoas muscles. The prevalence of iliopsoas tightness is 33.8% in runners. [2]

Iliopsoas muscle is a primary mover of the hip joint and also helps to stabilize the hip and lower back during activities such as walking, running and rising from a chair. Iliopsoas muscle activity occurs during swing phase for 30-60% of the running cycle. The tightness of iliopsoas muscle leads to reduced velocity while flexion of hip joint.[11] Reduced velocity of hip flexion leads to decreased running speed.

The iliopsoas muscle has the greatest influence on the running speed compared to other muscles. Stretching of tight muscles is a very common on-going physiotherapy practice. There are various types of stretches such as static, dynamic, and ballistic.[3]

In competitive sprinters, active dynamic stretching of the major muscle groups of the lower limb has been shown to be advantageous in terms of decreasing 50 meters sprint time. Dynamic stretching of the lower limbs in professional soccer players has produced faster 10- meter sprint times and greater maximal speed over 20 meters in comparison to no-stretch conditions. Static stretching of the calf and thigh musculature on 20-meter sprint performance and observed significantly slower times among post-stretch trials when compared to no-stretch trials.[7]

The main purpose of this study is to investigate the effects of iliopsoas muscle release on the running speed in recreational runners.

Material and Methodology

- Study Design: Observational Study
- Study Type: Experimental Study
- Study Setting: Krishna College of Physiotherapy, Karad
- Target Population: Recreational Runner
- Sample Size: 40

$$\left(\frac{4pq}{L^2} \right)$$

p= prevalence

q= (1-p)

L= allowance error

- Sampling Method: Convenient Sampling
- Study duration: 3 months
- Inclusion Criteria: Both male and female

  Age limit 18-30

  Recreational runners.

  Anterior hip pain on activity.

  Modified Thomas test positive.

- Exclusion Criteria: Runners who had experience in gymnastics, dance, yoga

  Patients who had history of surgeries.

  Trauma

  Recurrent ankle sprain.

  Hernia

- Outcome measures: Visual Analog Scale

  Range of motion of hip joint

  Modified Thomas test

  Straight line sprint test

Procedure

- This is a study to assess efficacy iliopsoas muscle release on running speed in recreational runners.
- This study was conducted in Krishna Institute of Medical Sciences 'Deemed to be' University, Karad.
- An ethical clearance certificate was obtained by Institutional Ethical Committee of Krishna Institute of Medical Sciences 'Deemed to-be' University, Karad.
- Subjects were selected according to the inclusion exclusion criteria.
- An informed written consent was obtained from the subjects.
- A pre-test Assessment of VAS on rest and on activity, MMT, ROM and SPT was taken.
- Patients were explained regarding the 3 weeks protocol which was divided in 2 phases
- Phase 1 is of 1.5 weeks, where only static release was given.
- In phase 2, static release was progressed to dynamic release.

Static release:

Subject lied in supine position with hip and knee flexed.

Patient was asked to breathe in and out.

While breathing out, therapist applied deep pressure just above the ASIS.

While maintaining the pressure, 10 oscillations were given for 10 minutes with 10 seconds hold in 3 sets

Dynamic release:

Subject lied in supine position and were asked to breathe in and out.

While breathing out, therapist applied deep pressure just above the ASIS.

The subject was asked to simultaneously perform hip flexion, hip extension + internal rotation.

Oscillations were given when the leg was in hip extension + internal rotation. 10 oscillations were given for 10 minutes with 10 seconds hold in 3 sets

Post 3 weeks of protocol a post assessment was taken for VAS on rest and on activity,

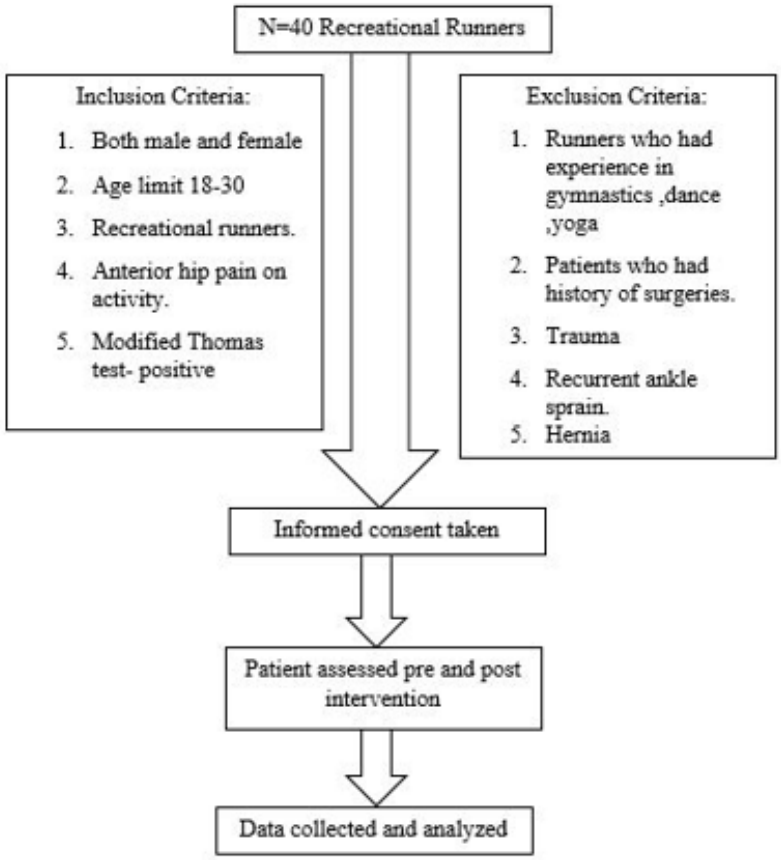
ROM, MMT and SPT.

Data was collected and analyzed statistically

Fig. 1: Static Iliopsoas Release

Fig. 2: Dynamic Iliopsoas Release

Fig. 3: Straight Line Sprit Test

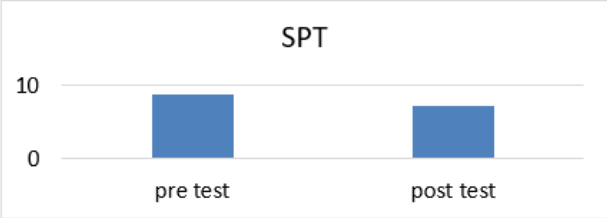


Result

- A total of 40 patients between the age of 18-30 years were included. The mean age of patients was 23.7±3.97 years. Out of 40 patients 14 were females and 26 were males.
- Patients treated with the given exercise program has shown decrease in pain VAS on rest mean score 2.68 to 1. 13. Statistically it shows that there was extremely significant difference (p<0.0001) between pre intervention assessment and post intervention assessment.
- Patients treated with the given exercise program has shown decrease in pain VAS on activity mean score 2.96 to 1.37. Statistically it shows that there was extremely significant difference (p<0.0001) between pre intervention assessment and post intervention assessment.
- Patients treated with the given exercise program has shown increase in hip range of motion with mean score of flexion from 113.1 to 118.9, extension from 8.45 to 13.6, abduction from 38.2 to 39.2 and adduction from 19.6 to 21.2. Statistically it shows that there was extremely significant difference (p<0.0001) between pre intervention assessment and post intervention assessment.
- Patients treated with the given exercise program has shown increase in muscle strength assessed using MMT with mean score of 4.72 TO 4.92. Statistically it shows that there was extremely significant difference (p<0.0001) between pre intervention assessment and post intervention assessment.
- Patients were assessed pre intervention and post intervention with SPT test. Patients treated with the given exercise program has shown increase in running speed with mean score 8.79 to 7.30. Statistically it shows that there was extremely significant difference (p<0.0001) between pre intervention assessment and post intervention assessment.

Table 1: Mean, Standard Deviation and *P* Value for SPT Pre And Post Intervention

Outcome cmeasure	Pre test	Post test		interpretation
	Mean ± SD	Mean ± SD	p- value	Extremely significant
SPT	8.79±0.53	7.30 ± 0.46	< 0.0001	



Graph 1: Result for Straight Line Sprint Test (Pre and Post)

Discussion

The result of this study demonstrated that iliopsoas release is effective on increasing the running speed in recreational runners. The authors of a study measured the effects of stretching on a dynamic event immediately after stretching (0-60 seconds), whereas other studies investigated the effects of stretching on performance approximately 3-10 minutes following the performance of stretching.[5]

A study carried out by Winchester et al reported a 3% decrease in sprint performance for track and field athletes after participating in a static stretching protocol, which was conducted after a 30 minute dynamic warm-up.[4]

Prior studies reported an increase in 50-m sprint time (decrease in sprint performance) in a group of competitive track and field athletes after passive static stretching, despite being combined with active dynamic stretching. Conversely, they observed a decrease in 50-m sprint time (improvement in performance) after warm-ups involving static dynamic stretches combined with active dynamic stretches or with the active dynamic stretches alone. [6]

Little and Williams reported that a static-stretch protocol produced significantly faster runs than did the no-stretch protocol for the 20 m sprint.6 However, in their study, subjects performed further warm-up activity after the stretching, which may have affected the immediate adverse effects of static stretching that have been previously reported. Vetter reported no changes on a 30-m sprint after static stretching.[9]

A study showed significantly faster post 40-yard sprint times when compared to pre 40-yard sprint times only after the NS condition. One limitation of this study was the use of a small group of untrained, recreational, non-competitive runners instead of trained runners. Consequently, it becomes important not to generalize the findings to competitive runners. Yet, the results of this study may be more relevant for trained runners than recreational runners due, in part, to stringent training regimens, warm-up routines, and stretching protocols as well as potential differences in parameters such as height, weight, and BMI.[13] Future research can be carried out with increased number of sample size and also increased time duration for treatment protocol.

Conclusion

In this present study, there is significant increase in running speed of recreational runners, along with significant decrease in pain, improved strength and mobility of lower limb muscles. The structured exercise program designed, have been effective for other types of runners and different age group.

Future studies can include more exercises and can build a step-by-step protocol.

Conflict of Interest: The authors declare no conflict of interest.

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Observational Study

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Assessment of Stress and Sleep with Respect to Age in School Going Children Confined to Home During Covid-19: An Observational Study

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Abstract

In 2020 the World health organization declared the novel corona virus disease 2019 outbreak a pandemic. On March 2020, the government ordered a national lockdown to limit the viral transmission of COVID- 19 infection. The lockdown included such measures as home confinement, restriction on movement, encourage and arrangement to work from home. Aim of this study was to assess, stress and Sleep disturbances with respect to age. It was an observational survey study with sample size of 100 school students .students divided in 2 groups based on ages that was 8-11 yrs. And 14-15 yrs. Stress questionnaire (PSS) was given to students and sleep questionnaire (SDSC) was given to parents. Result showed that Mean score were 12.72 and 26.60 of students age 8-11 yrs and 14-15 yrs. Respectively. Mean difference was 13.88, and p value was 0.001which show that younger age (8-11 yrs) group had less stress than older age group (14-15 yrs) and sleep disturbance scale for children used for assessing the sleep disturbance the mean score were 37.38 and 44.48 in 8 to 11 yrs and 14-15 yrs respectively, and p value was 0.001 which show sleep disturbance was more in 14-15 year age group children. it is concluded that covid -19 had poor impact on children's mental aspect and sleep too and Occupational therapy can suggest various ways for reduction in stress and decrease the sleep disturbance by activity scheduling, time management, deep breathing exercise, Jacobson's relaxation techniques, meditation and yoga.

Key words: covid-19, stress, sleep disturbance, home confinement

Introduction

On March 11, 2020 the World health organization declared the novel corona virus disease 2019 outbreak a pandemic. On March 2020, the government ordered a national lockdown to limit the viral transmission of COVID- 19 infection. The lockdown included such measures as home confinement, restriction on movement, encourage and arrangement to work from home by telecommunicating and temporary closure of non essential business and school of every order and degree [1].

Children and adolescents face massive changes in their daily lives including school closures, home confinement, and social distancing rules[4]. The restriction of mobility can act as a psychosocial stressor due to prolonged confinement, difficulties in obtaining daily life necessary supplies, potential financial losses, and access to conflicting during

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and inadequate information on the internet .[6] The consequences of stress related to social isolation and anxiety generated by the pandemic on mental and physical health are collateral effects that are yet poorly investigated.[3].

The aim of study was to assess stress and sleep disturbance in school student who went to home confinement during pandemic. The sleep cycle was disturbed due to online gaming, web series, movies till late night, internet surfing, and waking up late makes everything late which leads to difficulty in managing activity of daily living, taking online classes and completing homework with online classes was tough which caused stress in children. Continue of covid -19 started to affect performance area and mental aspect of children that's why I felt, need to do study. The experimental hypothesis was, there would be high score in stress and sleep disturbance in children of age 14 to 15 yrs. than children of age eight to 11 yrs.

Materials and Method

Materials- pencil, pen, paper

Methods

Research design-survey

Sample size-100 school students and divided in two groups

Group A-:8 to 11 Yrs.

Group B-:14 to 15 yrs.

Sample design- convenient sampling

- **Age range**-8 to 15 yrs.
- **Proposed place for study**-community

Inclusion criteria

1. School going students.
2. Student's age 8-15 yrs.

Exclusion criteria–

1. Children never went to school.
2. Age Less than 8 yrs. and more than 15 yrs
3. Atypically developing children.
4. Having physical disability.

- **Withdrawal criteria-:**

Parents and students who wants to with draw at any point of time during.

OUTCOME MEASURES:

1. FOR STRESS-: **PERCEIVE STRESS SCALE (PSS).** The Perceived Stress Scale (PSS) is a classic stress assessment instrument. The tool, while originally developed in 1983, remains a popular choice for helping us understand how different situations affect our feelings and our perceived stress.
2. FOR SLEEP- **SLEEP DISTURBANCE SCALE FOR CHILDREN (SDSC).** This scale was used to assess sleep in children. The questionnaire is given to parents for fill this. The sleep disturbance scale for children (SDSC). The SDSC is a 26-item scale developed by Mr. Oliviero Bruni , full professor of Child Neurology and Psychiatry, Head of the Child Neuropsychiatry Unit. S. Andrea Hospital, Sapienza University, Rome Italy.

Results

1. **BASIC CHARACTERISTICS:**

(a) Information of subject's age: total number of 100 subjects was selected for the study whose mean and Standard Deviation value with respect to age were reflected in table 1.1.

Table 1 shows subjects' age and numbers.

Age	Number	Percentage
8-11 yrs	50	50%
14-15 yrs	50	50%

2. **Assessment of Stress score,**

While using perceives stress scale, the mean score were 12.72 and 26.60 of 8-11 yrs and 14-15 yrs. respectively. Mean difference were 13.88, which show that younger age group had less stress than older age group. Independent sample t test was applied, t value is 10.657 and p value is 0.00 which is highly significant.

Table 2: P value calculated by individual t test

Age	t test for equality of means		
	t	df	Significant value
8-11 yrs	10.657	98	0.00
14-15 yrs	10.657	95.205	0.00

3. **Assessment of Sleep disturbance**

When sleep disturbance scale for children used for assessing the sleep disturbance the mean score were 37.38 and 44.48 in 8 to 11 yrs and 14-15 yrs respectively. The mean difference in age was 7.10 and in gender 6.980 which shows that children aged 8 to 11 yrs had less sleep disturbance then 14 to 15 yrs. Independent sample t test was used, t value was 3.541 for age and for gender it was 3.474 and p value was same in both age i, e. 0.001 which reflects high significance.

Table 3: P value calculated by individual t test.

Independent sample test			
Age Group	t test for equality of means		
	T	df	Significant value
8-11 yrs.	3.541	98	.001
14-15 yrs.	3.541	78.549	.001

Discussion

The **Perceive stress scale** was used while assessing stress; the mean scores were 12.72 and 26.60 of 8-11 yrs and 14-15 yrs. respectively. Mean difference were 13.88, which show that younger age group had less stress than older age group. Independent sample t test was applied, t value is 10.657, and p value is 0.00, which is highly significant, which shows that our experimental hypothesis H_1 is proved. Meichun Mohler-Kuo [5] did study and took sample of young adults, as well as children, adolescents, and their parents in his study, result showed that the most perceived stresses during the first-lockdown due to covid-19, adults felt most stressed, and symptoms of mental health problems, which is in our study's support.

The **sleep disturbance scale in children** was used to check the sleep disturbance in children of 8 to 11 yrs and 14 to 15 yrs. When children were assessed on the sleep disturbance scale the mean score were 37.38 and 44.48 in 8 to 11 yrs and 14-15 yrs, respectively .Independent sample t test was used, t value is 3.54 and p value is 0.01, which reflects high significance. Our experimental hypothesis H_1 for sleep disturbance proved.

Nicola Cellini [1] et al ,SDSC showed that elder age group children faced more sleep disturbance than younger ones and study of Shuang-Jiang Zhou[2] et al, his cross-sectional study included Chinese adolescents and young adult 12-29 years of age during covid-19. The result revealed that a high prevalence of sleep problems among adolescents and young adults during the part of the COVID-19 epidemic, especially among young group[3].

Limitation Of Study

- Subjects for the study were selected based on convenience and availability.
- The study had small sample size.
- The samples were selected from one geographical location.

Future Recommendations

1. Subjects can be selected from nationwide.
2. Study can also be done in experimental form.

Conclusion

100 children were selected in this observational study of age group 8 to 11 yrs and 14-15 yrs for assessing Stress and Sleep disturbance. We found that Stress and Sleep disturbance were more in children of age between 14-15 yrs old during covid-19.

Occupational therapy can suggest various ways for reduction in stress and decrease the sleep disturbance to avoid or tackle these issues by activity scheduling, time management, deep breathing exercise, and Jacobson's relaxation techniques and meditation.

Conflict of interest – none

Source of funding- self

Ethical- I did not take ethical clearance because it was an observational study so i took consent of parents and children before doing the study also study was completed in community.

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Original Article

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Prevalence of Central Sensitization in Chronic Musculoskeletal Pain Disorders

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Abstract

Chronic musculoskeletal pain (CMP) is a leading cause of work absenteeism and increased costs for employers and the health care systems. It may emanate from activation of peripheral nociceptors due to tissue damage, but when the perception of pain persists beyond the expected time for tissue healing, it has become chronic. Central Sensitization (CS) is an important mechanism involved in chronic pain conditions causing amplified responses to noxious and innocuous inputs. Despite the association of CS in Chronic musculoskeletal pain disorders (CMPDs), the evidence regarding prevalence of CS in CMPDs is lacking.

Methodology: A descriptive study to document prevalence of CS in CMPDs was conducted among 190 participants with age group 18-65 years. The Central Sensitization Inventory (CSI) was used to determine severity of CS in chronic pain.

Results and Conclusions: The mean CSI score for the whole sample was 26.28±13.32 and the prevalence of CS was highest among participants with shoulder pain (28.6%) followed by leg pain (25%) and back pain (23.1%). In clinical practice, modification of life style factors and improving quality of life in patients with chronic musculoskeletal pain could be instrumental in mediating management strategies of CS in addition to pharmacological treatment.

Keywords: Central Sensitization, Inventory, Chronic Pain, Musculoskeletal Pain

Introduction

Musculoskeletal Disorders (MSD) are the leading cause of disability worldwide. Constant pain, reduced mobility and function, impaired quality of life and affliction of mental health are the common experiences associated with musculoskeletal conditions[1]. Most of the people experience one or more episodes of MSD once in their life, regardless of age, gender, or economic status. It affects approximately 47% of general population, out of which about 39-45% have long lasting problems necessitating intervention[2].

Pain that persists for a period longer than 3 months is classified as chronic pain, and this definition is consistent with several widely used epidemiological references[3]. Chronic musculoskeletal pain as per the proposed ICD-11 classification is defined as 'constant or recurrent pain that arises as part of a disease process directly affecting bones, joints, muscles or associated soft tissues[1]. According to World Health Organization (WHO), 20-33% of world's population has some form of CMP, translating to 1.75 people globally[4].

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Chronic pain is caused by not only physiological pathology but rather a complex interaction between biological, psychological and social factors[5]. There is strong evidence that chronic pain may be associated with physical disability, emotional disorders, and social difficulties. In addition, it has been recognized that emotional, cognitive, and social factors mediate the subjective experience of pain[6].

Chronic musculoskeletal pain disorders are the main contributors for components like years lived with disability and disability adjusted life years which significantly attributes to burden of disease worldwide[7].

As opposed to some symptoms which cannot be explained by scientific means highlights the importance of central sensitization in non organic or functional disorders. CS provides evidence based explanation for such cases and is defined as increased responsiveness of nociceptive neurons in the central nervous system which results in hypersensitivity to stimuli and an increased pain response[8]. It is oftenly associated with mechanical hyperalgesia and allodynia in patients with chronic pain conditions[9].

The scientific understanding of chronic pain where a clear origin for nociceptive input is lacking has been increased markedly in recent years. It is apparent that in most of the cases chronic pain results from traumatic or non traumatic injury which encompasses alterations in CNS processing. Such CNS dysfunctions alters the sensitivity of somatosensory system and results in increased brain activity. Once CS is established in such cases, it becomes plastic and any new injury will further results in an exaggerated CNS response[10, 11].

The signs of CS in chronic musculoskeletal pain can lead to lower quality of life and results in significant socioeconomic problems if they are not adequately managed. The prevalence of CS in low back pain and neck pain patients has been associated with high rates of disability[7]. This relationship has been understudied since most of the studies have been conducted in western countries except few studies in India[12]. Therefore the aim of the study was to document the prevalence CS in chronic musculoskeletal pain disorders.

Study Design and Methodology:

A cross sectional survey on subjects having any complaint of chronic musculoskeletal pain of more than 3 months duration aged between 18-65 years and having a score of at least 4 out of 10 on Numeric pain rating scale (NPRS) were recruited for the study. Subjects who had undergone any surgical intervention in the past 3 months, diseases of central nervous system, including cancer, brain or spinal cord injury, neurological disease or injury, primary diagnosis of neuropathic pain, any kind of infection and refusal to give informed consent for the study were excluded.

Sample Size determination:

The sample size was calculated by using the formula[7]:

$n = (Z^2 \times P (1 - P))/E^2$

n=163 (approximately)

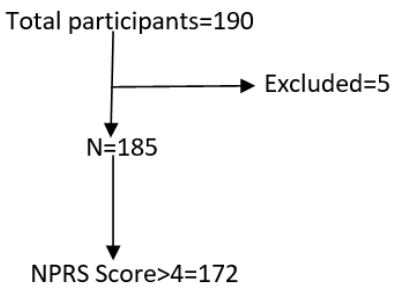
Where Z = value from standard normal distribution corresponding to desired confidence level

(Z=1.96 for 95% CI) P (.12) is expected true proportion E (.05) is desired precision.

Total sample size = 163

Procedure:

On the basis of selection criteria and on obtaining informed consent, a total of 190 subjects were interviewed out of which 172 were found to be eligible for the study. The demographic data including age, sex, weight, height and duration of symptoms was obtained and the prevalence of CS symptoms was assessed using the Spanish version of the CSI (CSI-Sp). The cut off score of greater than 40 was used for clinical relevance.



Statistical Methods

The statistical analysis was executed out using IBM SPSS version 20. All quantitative variables were evaluated using measures of central location (mean and median) and measures of dispersion (standard deviation). An analysis of variance (ANOVA with F and P values) was estimated out for the CSI variable i.e. cut off point and total score to determine the differences among BMI, age and gender. The chi-square test was carried out to test differences between categorical variables. The Kolmogorov–Smirnov test was used to check the normality of data.

Central Sensitization Inventory:

The Central Sensitization Inventory (CSI) is a screening instrument that helps identification of CS among subjects of CMP. It is a two-part questionnaire that contains a 25-item survey (Part A) that assesses the frequency of health-related symptoms associated with Central Sensitivity Syndromes (CSS) and a brief survey (Part B) for documentation of subjects that have been diagnosed with specific disorders. The participants were asked to rate each question on a 5-point scale with 0 meaning "never" and 4 meaning "always". The response will be summed up from a total possible score of 100. Higher CSI scores represent greater self proclaimed symptomatology. A cut off score of 40 or greater manifests acceptable psychometrics to recognize patients with central sensitivity syndromes[13, 14].

Results

A total of 190 participants were taken, out of which 185 completed the CSI questionnaire and 172 participants (43.41±13.32 years) were having NPRS score >=4. The majority of participants under study were females (61%) and from the age group of <=30 years. The most frequent diagnosis were back pain (45.3%) and neck pain (31.4%) followed by knee pain (19.2%), shoulder pain (12.2%), leg pain (9.3%), elbow pain (7.0%) and ankle or foot pain (6.4%). The details from demographic and anthropometric data are given in Table 1 and the frequencies of different areas of pain are given in Table 2.

Table 1: Demographic variables, CSI-Sp classification, and the most common diseases and diagnosis from the CSI-Sp part B

		N= 172
Avg age ± SD, years	43.41±15.15	
Avg weight ± SD, kgs	66.14±10.55	
Avg height ± SD, mts	1.63±.09	
Avg BMI ± SD, kg/m^2	25.24±4.14	
Gender, % (No.)	**Frequency**	**Percentage**
Men	67	39.0%
Women	105	61.0%
Condition		
Neck pain	54	31.4%
Shoulder pain	21	12.2%
Elbow pain	12	7.0%
Back pain	78	45.3%
Hip pain	1	.6%
Knee pain	33	19.2%
Leg pain	16	9.3%
Ankle/foot pain	11	6.4%
CSI part B classification		
Restless leg	14	8.1%
Chronic fatigue	11	6.4%
Fibromyalgia	19	11.0%
TMJ	3	1.7%
Migraine	20	11.6%
IBS	12	7.0%
MCS	1	.6%
Neck injury	2	1.2%
Anxiety	21	12.2%
Depression	17	9.9%

The cut off score of CSI<40 points was found among 144 participants and the remaining 28 participants had CSI score >=40. The mean CSI score for the whole sample was 26.28±13.32 whereas the CSI score >=40 was highest among participants with shoulder pain (28.6%) followed by leg pain (25%), back pain (23.1%) and neck pain (22.2%). The detailed values of CSI score has been mentioned in Table 3 and Table 4.

Table 2: Frequency of CSI<40, CSI >40 points and CSI total score in each CMPD

CMPD	CSI score				CSI Total Score, Mean±SD
	<40; (No., %)		>40; (No., %)		
Neck pain	42	77.8%	12	22.2%	26.65±13.74
Shoulder pain	15	71.4%	6	28.6%	31.14±15.45
Elbow pain	10	83.3%	2	16.7%	26.25±15.66
Back pain	60	76.9%	18	23.1%	30.13±13.95
Hip pain	1	100.0%	0	0.0%	17.00
Knee pain	27	81.8%	6	18.2%	25.94±13.97
Leg pain	12	75.0%	4	25.0%	27.63±16.03
Ankle/foot pain	11	100.0%	0	0.0%	21.82±8.59

Table 3: Frequency of CSI<40, CSI >40 points and CSI total score in BMI subgroup

BMI Subgroup	No. (%)	CSI <40, No. (%)	CSI>40, No. (%)	CSI Total Score, Mean±SD
Underweight	4 (2.3%)	4 (100.0%)	0 (0.0%)	20.50±9.43
Normal	89 (51.7%)	76 (85.4%)	13 (14.6%)	24.51±12.61
Overweight	57 (33.1%)	46 (80.7%)	11 (19.3%)	27.37±14.52
Obese	22 (12.8%)	18 (81.8%)	4 (18.2%)	31.68±12.27

Table 4: Frequency of CSI<40, CSI >40 points and CSI total score in age subgroup

Age Subgroup (years)	No. (%)	CSI <40, No. (%)	CSI>40, No. (%)	CSI Total Score, Mean±SD
<=30	45 (26.2%)	40 (88.9%)	5 (11.1%)	21.67±11.80
31-40	35 (20.3%)	29 (82.9%)	6 (17.1%)	26.86±13.84
41-50	37 (21.5%)	31 (83.8%)	6 (16.2%)	27.24±12.62
51-60	30 (17.4%)	27 (90.0%)	3 (10.0%)	25.03±12.37
>60	25 (14.5%)	17 (68.0%)	8 (32.0%)	33.84±14.52

Table 5: CSI differences by BMI, age and gender

	ANOVA, F (P)	
	CSI Cutoff Point	CSI Total Score
BMI	2.153 (.096)	1.400 (0.706)
Age	3.714 (.006)	6.302 (0.178)
Gender	1.409 (.161)	0.002 (0.969)

Discussion

In the present study, the CSI score and their distribution were based on 40 point CSI score as a cut off value to identify CS among chronic pain samples. Pain in shoulder (28%), leg (25%), back (23.1%) and neck (22.2%) was most commonly found to be associated with high CSI scores. The previous studies have also claimed a high prevalence of CS in subjects of chronic low back pain[7, 9, 16], neck pain[7, 12 15], extremities pain[15] and knee pain[22]. These differences can be attributed to variation of various factors like different lifestyle, structural, psychosocial and neurophysiological factors[16].

The CSI score>40 was found to be more frequent in overweight and obese individuals and those aged >60 years. However no difference was found among males and females. On further analysis age, gender and BMI was not found to be significantly associated with CS. The previous studies also reported that there is weak association of age[15] and BMI[25] with

CS. However some studies evaluated that CS is significantly associated with women[7, 17].

In addition to the above findings, it was found that participants were also having significant prevalence of anxiety (12.2%), migraine (11.6%), fibromyalgia (11%) and depression (9.9%). Restless leg syndrome (p=0.0001), chronic fatigue (p=0.007), migraine (0.0001), anxiety (p=0.024) and depression (p=0.003) were found to be significantly associated with presence of CS in CMPD patients. The previous studies suggested the gender differences in chronic pain risks and pain related psychosocial characteristics may be related to higher prevalence of CS in conditions like fibromyalgia, migraine, chronic widespread pain and post operative pain[7, 20, 21].

The proposed pathology of CS involves an amplification of neural signalling and circuits in nociceptive pathways caused by membrane excitability and reduced sympathetic inhibition[18]. These changes not only influence the perception of CP, but also enhance other nonpainful stimuli[19]. Thus patients with chronic pain are more sensitive to stimuli like visual and auditory sensations. This shows that these patients had a fundamental problem with pain or sensory processing rather than an abnormality confined to the specific body region where the pain was perceived to be situated[5].

Exercise habits and high resilience have shown to lower the incidence of CS whereas high levels of perceived stress, fewer sleeping hours a day, low resilience and smoking have been found to be associated with increased risk of the development of chronic pain[17]. These findings are in line with research suggesting the important role of psychiatric factors in onset, persistence of chronic pain and prevalence of co morbid psychiatric disorder in CMPDs[24].

The CSI used in the study is a valid tool to assess the significance of CS in CMPDs but the information generated by CSI is a patient reported outcome and is highly subjective in nature. Thus use of CSI needs to be supplemented by objective measures such as quantitative sensory testing that is a proved predictor of CS in CMPDs[24]. The results of the study cannot be generalized and a further research based on wider sample would allow a comparative analysis of the condition.

Conclusion

The present study revealed the presence of central sensitization in chronic musculoskeletal pain disorders. In view of the results obtained, pain physicians as well as physiotherapists must supplement their assessment for chronic musculoskeletal pain for improved decision making during management. The paucity of literature on CS in chronic pain warrants further high quality studies with greater sample size.

Ethical Clearance: Study protocol was approved by Institutional ethical committee of Sri Guru Granth Sahib World University, Fatehgarh Sahib. Approval Date: 25/10/2021, Approval number: SGGSWU/IEC/2021/06. Written informed consent was taken from all participants of the study.

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Original Article

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Correlation of Fatigue with Cognition and Motor Performance among Stroke Patients: A Pilot Study

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Abstract

Introduction: Post-Stroke Fatigue (PSF) is the most common debilitating and persistent symptom after a stroke. The impact of fatigue increases during the first year of post-stroke. When most of the recovery has taken place, fatigue could remain an important problem with disabling consequences for everyday life. Understanding the effect of PSF on cognition and mobility outcomes will help to better manage existing fatigue symptoms in stroke patients and develop strategies to optimize mobility and cognitive performance in patients with the chronic stage of stroke. With this background in mind, the present study aims at establishing a relationship between post-stroke fatigue and cognitive and motor performance among persons with stroke.

Aim: To correlate fatigue with cognition and motor performance in stroke patients

Materials and Method: This is the pilot study where 15 post-stroke patients fulfilling the inclusion and exclusion criteria were included by using the purposive sampling technique. Fatigue was assessed using Fatigue Scale for Motor and Cognitive Function. Motor Function was assessed by using Fugl Meyer Scale for upper and lower extremity, Chedokes Arm and Hand Inventory, Lower Extremity Functional Scale, and Berg Balance Scale. Cognition was assessed by using the Montreal Cognitive Assessment Scale. Using the scores of these scales, fatigue was correlated with motor and cognitive functions using Karl Pearson's correlation test.

Result: The study found a moderately significant correlation between Fatigue and Cognition ($r=-0.605$ $p<0.05$) and a highly significant correlation between fatigue and motor performance ($r=-0.804$ $p<0.001$).

Conclusion: This study provides evidence that post-stroke fatigue has significant relationships with both motor performance and cognitive performance. It is important to consider the influence of fatigue when planning and delivering interventions for individuals with stroke.

Key words: Post Stroke Fatigue, Cognition, Motor performance

Introduction

Stroke is one of the third leading causes of death and disability in India. Among stroke-related health issues, post-stroke fatigue has been collectively reported as one of the most prevalent issues. Prevalence of PSF has been reported to be in the range

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of 25 - 85%. PSF could be a debilitating symptom that affects the quality of life and participation in rehabilitation[1,2]. Fatigue is defined as a reduced capacity for work following a period of mental and physical activity. Ream and Richardson define fatigue as, "A subjective, unpleasant symptom which contains total body feelings starting from tiredness to exhaustion, creating an unrelenting overall condition which interferes with individuals' ability to function to their normal capacity"[4]. Motor fatigue refers to a decrease in motor performance during sustained muscle activity, whereas cognitive fatigue refers to a decrease in performance during sustained cognitive activity[3, 4].

Many studies have shown that there are several contributing factors specific to PSF like de-conditioning, physical impairment, disuse, sleep disorders, medication side effects, and depression. The functional improvement needed to regain mobility and independence could also be impacted significantly by fatigue[5].

The impact of fatigue increases during the primary year of post-stroke. When the foremost of the recovery has taken place, fatigue could remain to be a very important problem with disabling consequences for everyday life[6]. Fatigue occurs frequently, is often severe, and is experienced months or years after stroke. A Significant number of patients report that fatigue is either the worst or one of the worst symptoms of a stroke. PSF is a common risk factor for stroke severity and functional impairment. Even though PSF is associated with higher mortality; it has been a neglected issue[8,9].

Fatigue is independently related to functional outcomes among patients with stroke[10]. Early mobilization and rehabilitation after stroke are very important strategies when trying to prevent permanent disability and help the patient attain a better level of functioning and quality of life. The study aims to investigate fatigue-related variations in cognition and motor performance[11]. There is little evidence that fatigue is directly related to cognition and motor performance. The available studies have used less sensitive outcome measures; hence this study will help to overcome the constraints of previous studies. It is important to contemplate the influence of fatigue when planning and delivering interventions for individuals with stroke[12].

Cognition and mobility are important components of stroke recovery. Understanding the effect of post-stroke fatigue on cognition and mobility outcomes will help to better manage existing fatigue symptoms in stroke patients and develop strategies to optimize mobility and cognitive performance in patients with the chronic stage of stroke. With this background in mind, the current study aims at establishing a relationship between PSF and cognitive and motor performance among stroke patients[15].

Materials and Method

This pilot study was carried out in a period of 12 months from March 2020 to March 2021. Post stroke patients aged over 50 years with sub-acute to chronic recovery and medically stable patients from tertiary hospitals in Dakshina Kannada were recruited for the study. Purposive sampling technique was adopted. Patients were screened supported inclusion and exclusion criteria, after seeking permission from the Institute. We included over 3 months of post stroke patients. Involvement of Middle cerebral artery, Anterior cerebral artery was taken for study based on clinical manifestation. Mainly unilaterally affected patients were taken during this study. Patients who was able to walk with or without assistive device and who was able to understand commands were included in this study. People with prior history of other neurological disorder, presence of any systemic disease were excluded from the study[25].

Ethical clearance was obtained from the Institutional Ethical Committee. Subjects participating in the study were given an information sheet containing the study details and informed consent was obtained from the subjects prior to the study. In this study, all patients were assessed with a series of standardized tests and questionnaires to quantify their fatigue, motor, and cognitive functions; namely Fatigue Scale for Motor and Cognitive Function, Fugl Meyer Assessment Scale, Chedokes Arm, and Hand Inventory Scale, Lower Extremity Functional Scale, Montreal Cognitive Assessment Scale, and Berg Balance Scale. Collected data was tabulated for statistical analysis, which is a reliable and valid scale to assess the respective domains.

Outcome measures

Fatigue Scale for Motor and Cognitive Functions (FSMC):

The Fatigue Scale for Motor and Cognitive function is an assessment of cognitive and motor function with patient reported outcome. It contains 20 items on a 5-point scale (ranging from "does not apply at all" to "applies completely") which produces a score of 1 to 5 for each scored question, with a minimum value of 20 and a maximum of 100. The FSMC can distinguish consistently between motor and cognitive aspects of fatigue[9].

Fugl- Meyer Motor Assessment Scale (FMA):

The Fugl-Meyer Assessment (FMA) is a stroke-specific, performance-based impairment index. This is a quantitative measure used for motor impairment and comprises 2 subscales (FSMUE and FSMLE). It is designed to assess motor functioning, balance, sensation, and joint functioning in patients with post-stroke hemiplegia. It is applied clinically and in research to determine disease severity, describe motor recovery, and plan and assess treatment**.** . It Contains a total of 5 domains which includes activity of daily living, functional mobility, and pain components. The FMA requires a mat or bed, a few small objects, and several different tools for the assessment of sensation, reflexes, and range of motion. Scoring is based on direct observation of performance. Scale items are scored based on the ability to complete tasks using a 3-point ordinal scale where 0=cannot perform, 1=performs partially, and 2=performs fully. The total possible scale score is 226. It takes approximately 30-35 minutes to administer[21].

Chedoke Arm and Hand Activity Inventory (CAHAI):

This scale is used to assess activities of daily living and upper extremity function in stroke recovery patients. The test contains 13 functional tasks and requires 15-30 minutes to administer. CAHAI takes a bilateral approach to analyzing basic functional tasks. The CAHAI is scored on a seven-point scale for each item, which can range from 1 (i.e., the affected limb performs less than 25% of the task) to 7 (i.e., the affected limb completes all required components), with mid-scale scores representing different percentages of contribution of the affected limb and/or help with the task using light touch assistance. The result is a total score ranging from 13 to 91[17].

Lower Extremity Functional Scale (LEFS):

This scale is used to evaluate the functional impairment of a patient with a disorder of one or both lower limbs. The area of assessment contains ADL, balance, coordination, functional mobility, quality of life, and range of motion. It comprises 20 questions about a person's ability to perform activity of daily living. With a maximum score of 80 and a lower score detecting greater disability[19].

Montreal Cognitive Assessment Scale (MOCA):

The Montreal Cognitive Assessment is a cognitive screening instrument developed to detect cognitive impairment. It is a simple 10-minute paper and pencil test that assesses multiple cognitive domains including memory, language, executive functions, visuospatial skills, calculation, abstraction, attention, concentration, and orientation. Montreal Cognitive Assessment scores range between 0-30 and a score over 26 is considered normal[23].

Berg Balance Scale (BBS):

The Berg Balance Scale is used to objectively determine a patient's ability or inability to safely balance during a series of predetermined tasks ranging from standing up from a sitting position to standing on one foot. It is a 14-item list with each item consisting of a five-point ordinal scale ranging from 0 to 4, with 0 indicating the lowest level of function and 4 indicating the highest level of function, and takes approximately 20 minutes to complete[25].

Statistical Analysis

Karl Pearson's Correlation coefficient was used with the level of significance at 5% to be used to test the association between fatigue and cognition along with motor performance. Sample size was calculated using the following formula based on the study conducted by Bradley J et al[3] on post stroke fatigue and depressive symptoms are differentially related to mobility and cognitive performance. It was observed that correlation coefficient between cognition and fatigue was found r=0.426. Data was analyzed using SPSS18.0 and Microsoft excel.

$$n = \frac{(Z_{1-\frac{r}{2}})^2 \times (1-r_{xy}^2)}{r_{xy}^2}$$

$r = 0.4$

$Z_{1-\frac{r}{2}} = 1.96$; [level of Significance].

$n = 20$ [n = sample size]

As this is a pilot study, only15 patients were included in the study.

Result

Table 1: Correlation of fatigue with Cognition and motor Performance

	FMSUE	FMSLE	CAHAI	LEFS	MOCA	BBS
Pearson Correlation FSMC	-.719**	-.734**	-.549*	-.550*	-.605	-.605
Sig. (2-tailed)	.003	.002	.034	.034	.017	.014

FSMUE: Fugl Meyer scale for upper extremity

FSMLE: Fugl Meyer scale for lower extremity

CAHAI: Chedoke Hand and Arm inventory

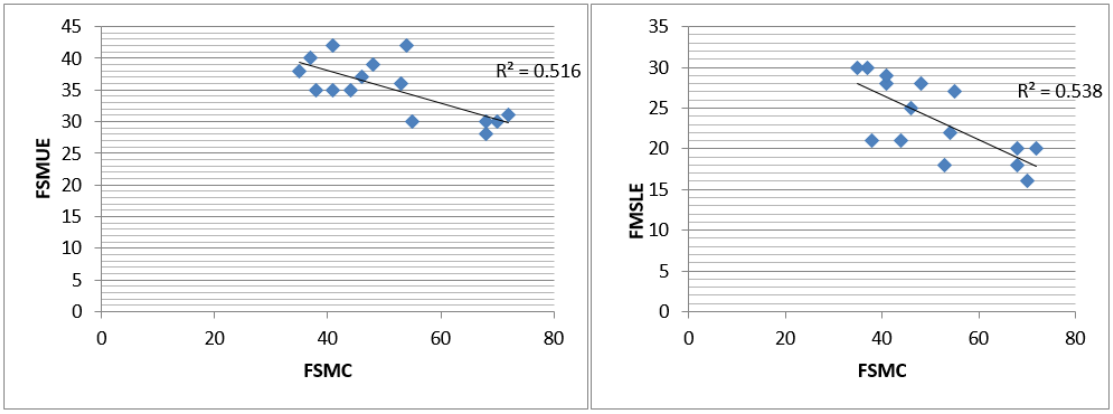
LEFS: Lower extremity functional scale

MOCA: Montreal cognitive assessment scale

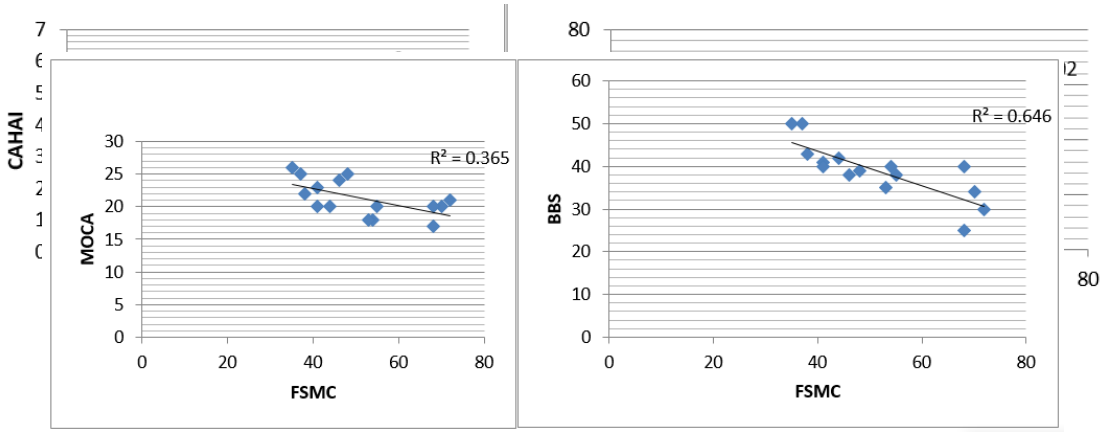
BBS: Berg balance scale

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

*. Correlation is significant at the 0.05 level (2-tailed).



[Table/Fig 2 and 3 Correlation of FSMC with FMSUE and FMSLE]



[Table/Fig 6 and 7 Correlation of FSMC with MOCA and BBS]

In the present study, it was observed that the mean age (in years) of the study participants is 66.3 years with a standard deviation of 10.9 years. Minimum age of 51 years and maximum of 90 years. Using Karl Pearson's correlation coefficient, a moderately negative correlation was observed between FSMC and FMSUE ($r=-0.719$ $p<0.01$) (Figure 2) and also between FSMC and FMSLE ($r=-0.734$ $p<0.01$) (Figure 3). A moderately negative correlation was observed between FSMC and CAHAI ($r=-0.549$ $p<0.05$) and also between FSMC and LEFS ($r=-0.550$ $p<0.05$) (Figures 4 and 5). A moderately negative correlation was observed between FSMC and MOCA ($r=-0.605$ $p<0.05$) (Figure 6). A high negative correlation was observed between FSMC and BBS and was found to be statistically very highly significant ($r=-0.804$ $p<0.001$) (Figure 7).

Discussion

This study was designed to find a correlation between fatigue and, cognition and motor performance among stroke patients and was carried out on 15 stroke patients over the age group of 50. Fatigue was assessed using Fatigue Scale for Motor and Cognitive function. Motor function was measured by Fugl- Meyer scale, Chedokes Arm and Hand Inventory, and Lower Extremity Functional Scale. Cognitive function was measured by the Montreal Cognitive Assessment scale. The analysis revealed a significant relationship between PSF and, cognitive impairment and mobility. First, the results establish that fatigue, along with cognition and motor performance among stroke patients, has a direct effect on post-stroke disability. This finding highlights the need for assessing and treating fatigue in stroke survivors to improve rehabilitation efforts. The study shows a strong correlation between fatigue and other variables which determines that is a very well-established fact not only in stroke but also in other neurological conditions like multiple sclerosis and traumatic brain injury. Finally, the results support the idea that a direct association exists between fatigue and, motor performance and cognition.

During analysis, we found that the cognitive component was significantly associated with fatigue in the study subjects. Previous studies found more frequent memory problems in patients with post-stroke fatigue compared to those without fatigue and that post-stroke fatigue was associated with more complex tasks such as gait and balance but not with simple motor function. Negotiating different barriers in the environment requires attention and higher-order planning. Thus, individuals with a greater level of fatigue may experience more challenges in navigating complex environments. Therefore, we should start with minimal activities in a less complex environment initially, and then progress to complex tasks to prevent fatigue[5, 8].

The subjects showed cognitive impairment mainly in the domains of executive functions, mental speed, and memory. However, when the FSMC was applied, cognitive fatigue turned out to be significantly related to the performance in several cognitive domains, whereas physical fatigue was mainly related to upper and lower extremity function. This study also determines that cognitive fatigue may interrupt motor performance among stroke patients. When compared to lower extremity activity, the study found that upper extremity functions are less associated with fatigue among the patients. Upper extremity motor impairment measured with Fugl-Meyer Scale did not correlate with fatigue. Together with the findings of the lower extremity motor performance, it may be that motor performance measured at the body structure and function level is less influenced by fatigue than more complex motor performance at the activity level such as gait and balance. Studies showed that the movement times of the affected hand in a simple reach action were longer in those individuals who had higher scores on the FSMC[9]. We found that the Montreal Cognitive Assessment (MoCA) score was negatively associated with PSF suggesting that those who reported more severe fatigue also had more severe cognitive impairment. A recent study used Montreal Cognitive Assessment (MoCA) as one of the outcomes to derive a cognitive composite score and reported a significant indirect effect of PSF on the cognitive composite score. Together, these findings suggest that PSF may be a manifestation of stroke-related cognitive deficits, especially deficits

in information processing and attention/vigilance [24].

This study provides evidence that fatigue has a significant correlation with both motor and cognitive performance. It is important to consider the influence of fatigue when planning and delivering interventions for individuals with stroke. Our results further our understanding of the underlying mechanisms of PSF and provide support for the development of behavioral approaches to manage it. Future studies are recommended to identify the potential value of balance and cognitive training in PSF management.

An outcome-based on this study determines functioning in daily life and one's participation in various ADLs, including physical, instrumental, cognitive, and leisure activities. As many stroke patients experience deficits in functioning because of the neuromuscular insults of stroke, it is important to understand how fatigue further influences their functioning. In addition, it is important to assess the impact of fatigue on quality of life, as it may be associated with function as well as with how one experiences fatigue independent of other factors.

Limitation(S)

The main limitation of this study was the relatively small sample size. A more comprehensive test or tests that measure various cognitive domains (attention, short-term memory, processing speed, executive function, etc.) are recommended for future studies. The Sample size was small for item-by-item correlation analyses between Montreal cognitive assessment and the Fatigue scale, which could further study the domain-specific relationship between cognitive impairment and PSF. Finally, the correlational analyses completed in this study do not establish a cause-and-effect relationship between motor or cognitive impairment and PSF. The correlation coefficients reported in this study were fair in strength and should be interpreted with precaution.

Conclusion(S)

This Pilot study found a significant negative correlation between fatigue with motor and cognitive function. PSF is found to be associated with both motor and cognitive performance. It is important to consider the influence of fatigue when planning and delivering interventions for individuals with stroke. Counseling on graded exercise schedules with increasing physical demands appropriate to tolerance level to improve deconditioning and physical tolerance is recommended.

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Review Article

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Comparison of Proprioceptive Neuromuscular Facilitation with other exercises on Pain and Disability in patients with Non-specific Chronic Low Back Pain: A Meta Analysis

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Abstract

Background: Low back pain (LBP) is encountered in both developed and developing countries. It has become one of the commonest health threats. Proprioceptive Neuromuscular Facilitation (PNF) exercises are designed to enhance stimulation of proprioception in neuromuscular junction, thereby leading to greater reduction in pain and disability score along with increase in ROM and core strength. Therefore, the present study is intended to compare the role of PNF and other exercise approach.

Objectives: To compare the effect of Proprioceptive Neuromuscular Facilitation (PNF) and other exercise approaches in Non-specific low back pain.

Methods: In this review, Pub Med, Google Scholar, Cochrane CENTRAL databases were searched for prospective studies fulfilling inclusion and exclusion criteria. Randomized controlled trials comparing PNF with other treatment techniques to treat chronic non-specific low back pain were included in this review. Data was extracted and assessed for the quality of the trials by two independent reviewers. The results were presented in form of forest plots.

Results: 11 studies were included in the review for qualitative analysis and meta-analysis. All the studieshowever, relatively little study has been undertaken examining the effects of massage on women in labour. Methods. A randomized controlled study was conducted between September 1999 and January 2000. Sixty primiparous women expected to have a normal childbirth at a regional hospital in southern Taiwan were randomly assigned to either the experimental (n=30 were included in the meta-analysis of pain and eight of the studies were included in the meta-analysis of the functional disability due to back pain. Overall, there was a small reduction in pain intensity of low back pain in patients receiving PNF treatment as compared to other treatment techniques (SMD: -1.41 [95% CI: -1.97, -0.84], I^2= 82.9%; p<0.000).). There was marked improvement in functional disability in low back patients after PNF than other treatment techniques (SMD: -1.63 [95% CI: -2.28, -0.98], I^2= 80.8%; p<0.000).

Conclusion: PNF group was more beneficial than other treatment techniques in decreasing pain and functional disability scores in 4- to 6-week intervention. This meta-analysis suggests publication bias.

Keywords: Low back pain, Chronic low back pain, non-specific low back pain, treatment techniques in low back pain, PNF in low back pain

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Introduction

Low back pain (LBP) is encountered in both developed and developing countries. It has become one of the commonest health threats.[23] Majority of the population will experience at least one episode at any point in their life.[18] "Low back pain (LBP) is pain, muscle tension or stiffness localized below costal margin and above inferior gluteal folds with or without sciatica".[2, 21] It impacts 85-90% of people.[9] People complain of first episode of low back pain mostly in their third decade of life. The prevalence of LBP increases till 65 years and thereafter it decreases.[21]

In modern life, the utilization of tools have reported excessive biomechanical burden (WG) leading to back pain.[10] The main causes of LBP is due to abdominal, pelvic floor and trunk muscles weakness along with spinal joint instability.[10, 19] Pain coupled with muscle weakness is the most common obstacle in carrying out activities of daily living. It causes some economic problems for individuals and is the most common cause of work absence worldwide.[2]

Any new-onset pain that persists for less than 4 weeks from an identifiable cause like injury is acute low back pain. Pain persisting for more than 4 weeks but less than 12 weeks has been termed as sub-acute pain. "Chronic low back pain persists for more than 12 weeks".[18] "Non-specific low back pain has no known anatomical cause and is not attributed to a recognizable pathology; infection, tumor, osteoporosis, rheumatoid arthritis, fracture, inflammation".[1, 21] It accounts for 85% of cases.[5, 22] Specific low back pain accounts for 20% of all cases.[7, 8] Younger population involved in activities of repetitive lifting or prolonged sitting in bad posture account for major chunk of non-specific low back pain.[8]

One of the widely used treatments for relief from low back pain is physiotherapy. It may be imparted only in form of exercise or in combination with electrotherapy modalities.[5, 15] Exercise on its own was able to decrease risk of low back pain by 33%.[24] To prevent frequent and repeated episodes of low back pain regular exercise along with educational efforts can be crucial.[21, 2, 9]

PNF exercises are designed to enhance stimulation of proprioception in neuromuscular junction. It has been recommended for sensory motor control involving both the stretching and strengthening of muscles.[18] PNF training has been studied extensively by different workers and it was concluded that greater reduction in pain and disability score was achieved along with increase in ROM and core strength as compared to conventional therapy alone.[1, 2, 10, 19]

Therefore, the present study is intended to compare the role of Proprioceptive Neuromuscular Facilitation (PNF) and other exercise approaches.

Objectives

Primary: To compare the effect of Proprioceptive Neuromuscular Facilitation (PNF) and other exercise approaches in Non-specific low back pain.

Method

The protocol was prepared according to PRISMA (Preferred Reporting Items of Systematic reviews and Meta-Analysis) guidelines and registered at International Prospective Register of Systematic Reviews (PROSPERO) (Registration ID: CRD 42022311869).

Search strategy

The review included randomized controlled trials reporting the effect of Proprioceptive Neuromuscular Facilitation (PNF) and other exercise approaches in Non-specific low back pain. We searched PubMed-MEDLINE, Google Scholar, Cochrane Central Register of Controlled Trials (CENTRAL) and other clinical trial registry for this review. Clinical Trial, Experimental, Comparative Study, Preclinical studies, case report, case series, reviews, commentaries, observational studies including case control, cohorts, quasi-experimental studies, letters to editors, conference abstracts, editorials, methodological papers, dissertations and studies were excluded from this review. The key terms and MeSH terms were used to search for the studies.

Participants

Inclusion criteria:

1. Only RCTs that examine the effects of PNF in treating non specific chronic LBP were selected.

2. The subjects in our selected article included participants (over 18 years old) who suffered from chronic LBP for longer than 3 months.

Exclusion Criteria:

1. Patients with any neurological, cardiopulmonary, psychiatric, gynecological and congenital abnormality.
2. LBP with specific causes (disc herniation, trauma, nerve root injury)
3. Patients with spinal or lower-limb surgery.
4. Patients with auto-immune disorders, malignancy or spinal deformity.

Interventions

The trials were divided into experimental group & control group. The experimental group received PNF training or stretching. The control group underwent any one of the treatment methods – general exercise, conventional physical therapy, general stretching or ball exercise.

Primary outcomes

The primary outcome was the intensity of pain (VAS, NRS, Borg Back pain intensity scale) and functional disability (ODI, RMDQ).

Screening and reviewing of studies

Following initial searching of the databases, duplicates were removed using Zotero software. Two reviewers (RR, SS) independently screened the titles and abstracts of studies selected from the database search. The articles eligible for full text review were identified and extracted. The authors (RR, SS) independently reviewed and identified full text articles for their possible inclusion. Any disagreement arising in the process was resolved by discussion between the authors (RR, SS).The final list was prepared on basis of the articles that met the inclusion and exclusion criteria.

Data collection and extraction

A data extraction form (DEF) was prepared on Microsoft Excel (Version 2010) and relevant information including participant details and study details including author name, journal & year of publication, study design, sample size, mean age, intervention, frequency & duration of exercise, instruments for measuring pain intensity & functional disability, back pain score at baseline and end of treatment session, functional disability score at baseline and end of treatment session. Data on the intensity of back pain (mean), (standard deviation), and total participants were independently extracted from included studies by the reviewers (RR and SS). [Table 1]

Assessment of risk of bias in included studies

The Risk of Bias tool 2.0 of the Cochrane risk-of-bias tool for randomized trials (RoB 2) was used to assess risk for each trial using criteria described by the two reviewers independently. Studies were described as low risk, some concerns or high risk depending on the criteria given in the Cochrane handbook. Mutual discussion between two reviewers or involvement of third assessor was done to resolve any disagreement.

Statistical analysis

The forest plots, Cochrane-Q test and I^2 statistic were inspected to assess heterogeneity between the studies. Heterogeneity was considered if I^2 value was greater than 25% or Cochrane- Q >0.1. Heterogeneity was graded as low, moderate, and high for I^2 values of 25%, 50%, and 75%. In case of heterogeneity, random effect model was used. The sources of the heterogeneity were explored by sensitivity analysis according to the risk of bias of included studies. For the outcome intensity of pain & functional disability, publication bias was investigated using funnel plots. Statistical analyses were performed by Strata version 13 software. Two-sided P 0.05 was considered statistically significant except for the sub-group analysis and heterogeneity test, in which P value of 0.10 was considered significant.

Results

A total of 100 articles were searched from different databases and 35 articles were found eligible for full-text selection. Only 11 studies met the inclusion and exclusion criteria and were included in qualitative synthesis and quantitative synthesis or meta-analysis.

Outcomes

1. Pain intensity

Of the 11 articles used, 8 articles used visual analog scale (VAS), 2 studies used numerical rating

scale (NRS) and 1 study used Borg Back Pain Intensity scale for pain evaluation. Overall, there was a small reduction in pain intensity of low back pain in patients receiving PNF treatment as compared to other treatment techniques (SMD: -1.41 [95% CI: -1.97, -0.84], I^2= 82.9%; p<0.000). [Figure 1]

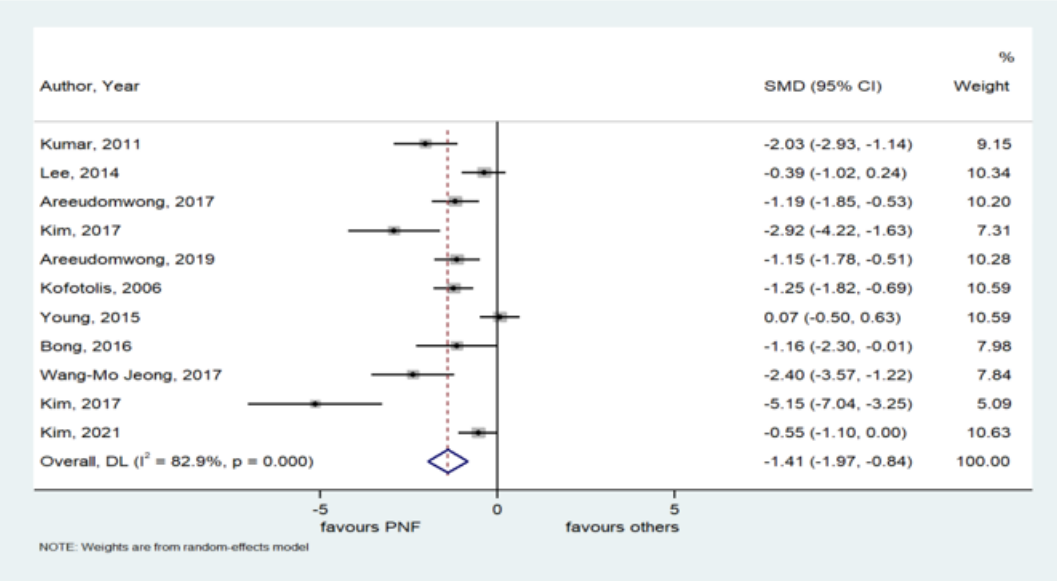

Figure 1: Meta analysis of PNF on pain intensity

2. *Functional disability*

Functional disability was assessed in 8 articles, of which 6 articles used Oswestry disability Index (ODI) and other 2 articles used Roland Morris Disability Scale (RMDQ). There was marked improvement in functional disability in low back patients after PNF than other treatment techniques (SMD: -1.63 [95% CI: -2.28, -0.98], I^2= 80.8%; p<0.000). [Figure 2]

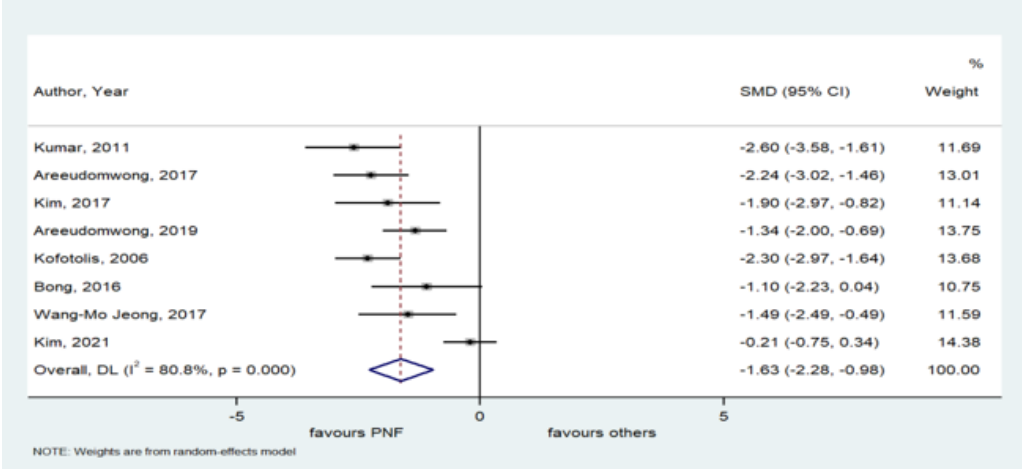

Figure 2: Meta analysis of PNF on functional disability

Risk of bias assessment

The risk of bias assessment for studies included in this meta-analysis is described in figure 3. Out of the 11 studies included, three studies had low risk of bias and remaining eight had some or high concerns in overall assessment. According to the Cochrane recommendations, all the studies had random allocation but only three studies described allocation concealment method. Eight out of the total eleven studies reported high risk of bias in blinding of participants, experimenters and outcome assessment. Therefore, overall risk of bias is high in this study.

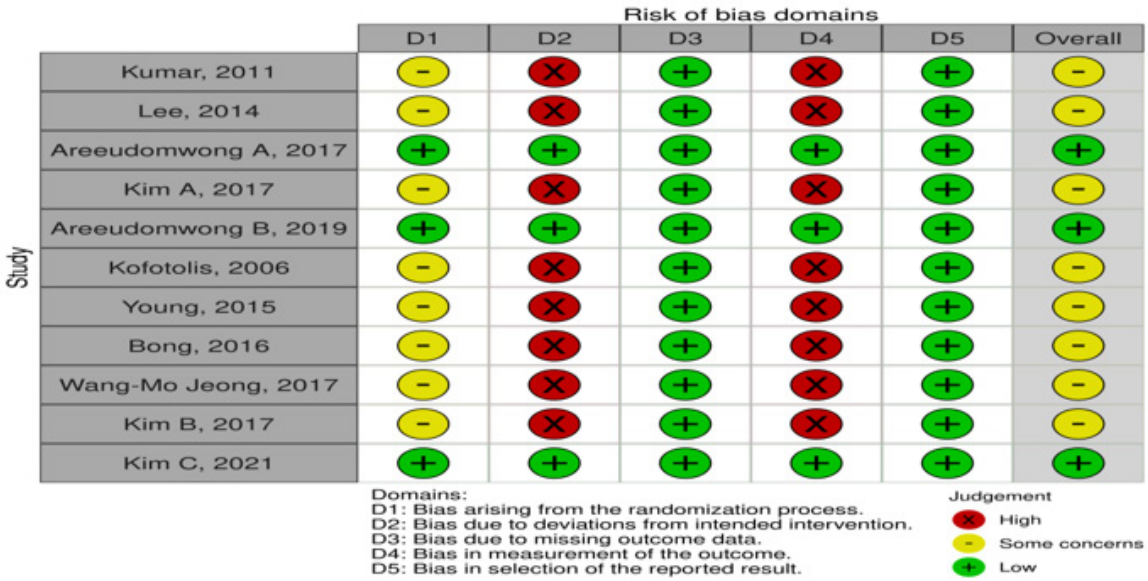

Figure 3: Risk of Bias summary of individual studies

Publication bias analysis

Inverted funnel plot was used to assess publication bias for pain for all the 11 studies included in the meta-analysis. The funnel plot was asymmetrical with p value at 0.002, suggesting publication bias. [Figure 4]

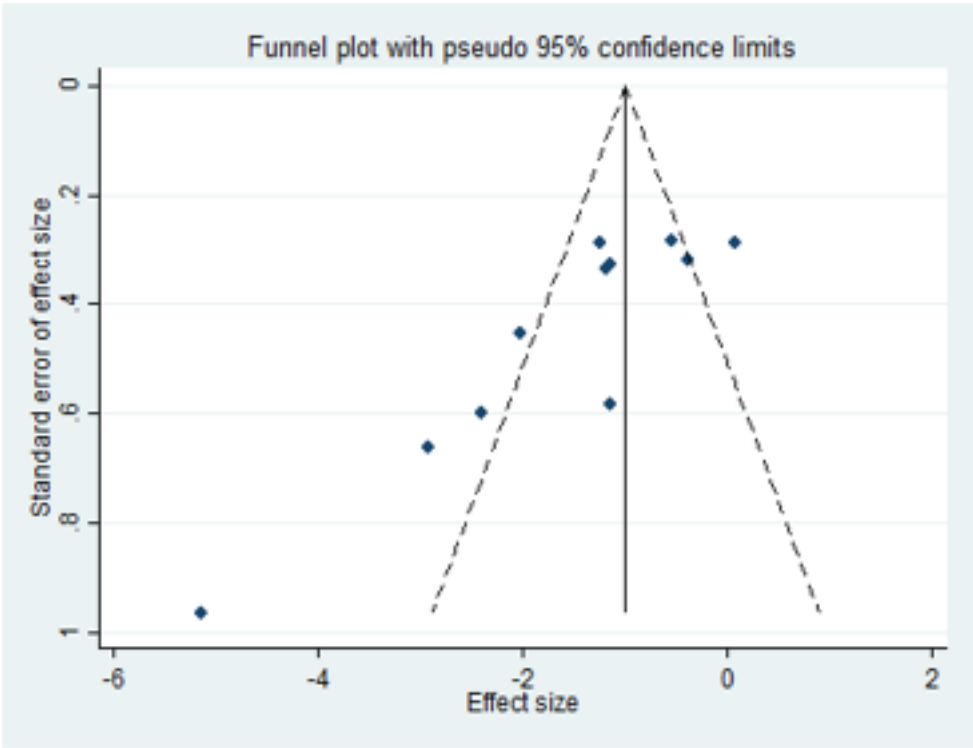

Figure 4: Funnel Plot for evaluating the publication bias for pain

Inverted funnel plot was used to assess publication bias for functional disability for 8 out of the 11 studies included in the meta-analysis. The funnel plot was symmetrical with p value at 0.21, suggesting no publication bias. [Figure 5]

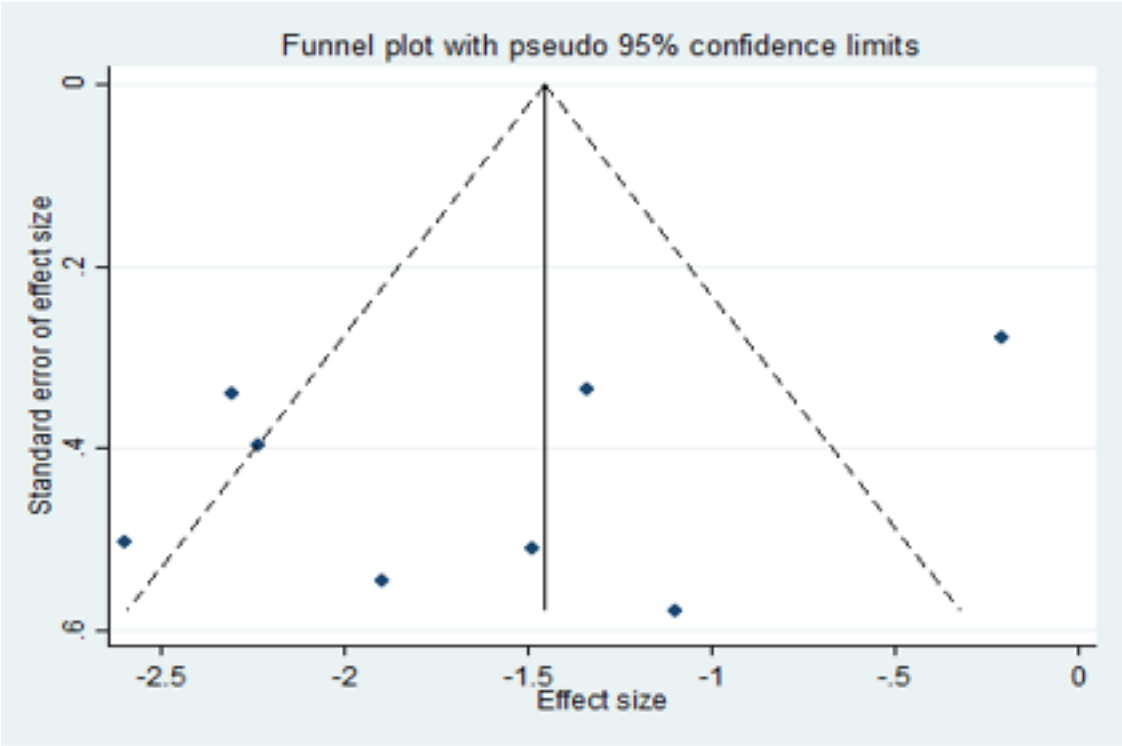

Figure 5: Funnel Plot for evaluating the publication bias of functional disability

Discussion

In this study, total of 11 RCTs were have been investigated to find whether PNF is more effective than other treatment regimes in terms of reducing pain and functional disability among individuals with chronic non-specific low back pain. The Risk of Bias tool 2.0 of the Cochrane risk-of-bias tool for randomized trials (RoB 2) has been used to determine bias of each article.

In our study, we found that PNF is an effective treatment technique and results suggest that it is more effective in decreasing pain and functional disability than the control group in 4-6 weeks treatment regime. Similar results were reported by Areeudomwong et al who concluded that in chronic LBP patients, a four-week PNF training program improved pain-related outcomes, that is, pain intensity and functional disability both in short-term and long term.[2] This could be due to increased deep trunk muscle activity. Our study results are supported by Paolucci et al who suggested that PNF has unique effect in reduction of pain and is a beneficial non-pharmacological treatment for chronic LBP.[22]

The results are consistent with findings of Dhaliwal et al who suggest that PNF decreases pain and functional ability in people with chronic LBP.[6] Pain and functional disability may decrease due to improvement in trunk muscle endurance and trunk mobility. A study by Koutarapu etal, PNF significantly improved pain and disability scores.[16] It may be that PNF develops spinal position and progresses from simple to complex movement pattern, thereby decreasing pain.

This meta-analysis has a few limitations in terms of sample size being small, thus effect of PNF cannot be generalized. An extensive search from the database for more methodologically rigorous articles is required to prevent publication bias and have low risk of bias in future.

Conclusion

PNF group was more beneficial than other treatment techniques in decreasing pain and functional disability scores in 4- to 6-week intervention. Studies included in this meta-analysis suggest publication bias and number of subjects in some studies are less. Thus, we need articles that have long term intervention and more number of subjects.

Ethical clearance has been taken from Institutional Ethics Committee, RIMS, Ranchi.

Source of funding- Self

Conflict of Interest- Nil

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Original Study

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Efficacy of Fascial Stretch Therapy: PNF Pattern of Deep Back ARM Line in Patient with Mechanical Neck Pain: A Quasi Experimental Study

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Abstract

Background: Mechanical neck pain is most prevalent in this era, fascia is the soft tissue component of the connective tissue network that pervades the human body and creates a continuous, three-dimensional structural support matrix throughout the entire body .stretching the fascia with the principles of fascial stretch therapy enables us to treat those patients.

Methodology: 15 Subjects were assigned in single group and underwent fascial stretch therapy –Proprioceptive neuromuscular facilitation pattern technique for a period of 1 weeks and this study used a purposeful sampling technique to assign patients.

Conclusion: The data were analysed using paired T test at 5% level of significance. There was a significant improvement on pain and range of motion in the group. This study revealed that there is a significant improvement in pain and ROM on subjects who underwent fascial stretch therapy.

Key Words: Fascia, Fascial stretch therapy, proprioceptive neuromuscular facilitation, neck disability index, mini mental state examination, visual analog scale

Introduction

Two-thirds of people will encounter mechanical neck pain at some point in their lives. It can have a muscle origin or a cervical spine abnormality. One of the contributing factors to mechanical neck discomfort is any deformity in the fascia lines (DBAL). Pain can also be brought on by any stiffness in the fascia line that covers the neck muscles, including the trapezius, levator scapulae, and rhomboids. The dorsal cervical region, between the occipital condyles and the C7 vertebral prominence, is where stiffness and/or pain are typically felt in the neck. But neck pain frequently comes with pain in the jaws, upper thoracic area, and the occiput (a headache). [1] . Clinically, it is recognized that even in subjects with no evidence of nerve root irritation or compression, neck pain may be associated with pain referred along myotomal patterns to the anterior chest, arm, and dorsal spine regions. The neurological examination would, of course, be normal. The less common causes of neck pain include tumours, systemic arthropathy (e.g rheumatoid arthritis, ankylosing spondylitis), infections, thyroid disorders, oesophageal obstruction or reflux disease. Additionally, the neck is a site for referred pain from cardiac, gastric and diaphragmatic disease processes.

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Clinically, it is understood that neck discomfort may be related to pain referred along myotomal patterns to the anterior chest, arm, and dorsal spine areas, even in people without symptoms of nerve root irritation or compression. Of sure, the neurological evaluation would be clear. Tumors, systemic arthropathies (including rheumatoid arthritis and ankylosing spondylitis), infections, thyroid conditions, oesophageal obstruction, and reflux illness are among the less frequent reasons of neck pain. Additionally, the neck is a location for referred pain from processes associated with diaphragmatic, gastric, and cardiac disease. A more benign diagnosis, such as neck sprain, mechanical neck pain, muscular neck pain, myofascial pain syndrome, postural neck pain, etc., will likely be given to 95% of neck pain patients. It was less common in men than in women (p 0.001, total test adjusted for age group), with the comparable figure for men being 38 (36-39%) compared to nearly every other woman's rate of 48 (46-49%). The connective tissue system's soft tissue component, or fascia, pervades the human body and creates a continuous three-dimensional matrix that provides structural support throughout the entire body (Fascia Research Congress 2007).[1]

It is a continuous network of viscoelastic tissue that surrounds the muscles, bones, and internal organs in the body. The transmission of mechanical forces between muscles is one of its key functions (Huijing, 2009), and treatments that target the fascia may enhance balance and posture (DellaGrotte, 2008). Fascia becomes less pliable and tightens during acute inflammation. The fascia may shorten due to long-term postural stance that precludes full fascial excursion as well as potential short-term processes. "Fascia is the only tissue that modifies its consistency when under stress (plasticity) and which is capable of regaining its elasticity when subjected to manipulation (malleability). A connective membrane that covers all muscles forms the deep fascia. It has no fat, surrounds numerous organs and glands, and creates sheaths for the nerves and blood vessels. Collagenous fibres make up the majority of deep fascia as well, however they are compressed and frequently structured in such a way that they can be mistaken for aponeurotic tissue [greys anatomy].[4] The forearm and arm's deep fasciae had similar histological traits.Both fasciae were made up of several layers of collagen fibre bundles and ranged in thickness from 100 to 200 m on average. They were parallel to each other, varied in size, and displayed an undulating trajectory.

Fibroblasts were positioned between and parallel to the collagen fibre bundles, occasionally displaying star-shaped cytoplasmic elongations. From layer to layer, the bundle alignment varied. A thin layer of adipocytes separated each layer from the one next to it.The muscles, bones, nerves, and blood arteries of the body are encircled by this fibrous connective tissue. In the form of aponeuroses, ligaments, tendons, retinacula, joint capsules, and septa, it facilitates connection and communication. The deep fasciae specialise in muscles (epimysium, perimysium, and endomysium), nerves, and all bone (periosteum and endosteum), cartilage (perichondrium), and blood vessels (tunica externa) (epineurium, perineurium, and endoneurium). The deep fascia's strength and stability come from the collagen fibres' great density.

10 ESSENTIAL PRINCIPLES OF FST 1. Sync breathing with movement, 2. Adapt your nervous system to your needs. 3.Go in a logical sequence, 4. Gains in range of motion without discomfort 5. Extend neuromyofasciae in addition to muscle, 6. Make use of several planes of motion, Target the joint in its entirety, 8. Get the most lengthening possible with traction. Facilitate body reflexes for best results, and 10. Modify stretching to meet current objectives. In order to stretch muscles and expand joint ROM, the PNF contract-relax technique concentrates on facilitating GTOs (Golgi tendon organ) and inhibiting spindles. That may make sense if GTOs and spindles made up the majority of the fascia, the tissue in our body that is most likely to multiply. They only make up 20% of our mechanosensory system, which provides information to our proprioceptive loops. Following are the forms of the remaining 80%: Free nerveendings, Ruffini corpuscles (with"spraylike"endings), Paciniform corpuscles (with lamellated endings).[7]

The aim of the study is to relieve neck pain and increase range of motion in patient with mechanical neck pain by fascial stretch therapy of deep back arm line.

Deep Back Arm Line [5]

Spinous process of cervical and thoracic	1	
	2	Rhomboids & levator scapulae
Medial border of scapula	3	
	4	Rotator cuff muscles
Head of humerus	5	
	6	Triceps
Olecranon process	7	
	8	Ulnar periosteum
Styloid process of ulna	9	
	10	Ulnar collaterall ligament
Triquetrum, hamate	11	
	12	Hypothenar muscles
Outside of little finger	13	

Methodology

Inclusion Criteria

- Clinical diagnosed as mechanical neck pain
- Gender-both male and female
- Age- 30-45 years
- MMSE >24

Exclusion Criteria

- Cervical vertebral fractures
- Nerve root compression pain
- Systemic localized infection
- Open wounds in the area
- Osteoporosis
- Inflammatory condition

Study Method

The selected subjects were explained about the study procedure after taking informed consent letter from the patient and relatives the subjects are enrolled 1 week into study. Subjects were screened for inclusions according to the specified criteria included in the study.

The mini mental state examination scale used to identify cognitive impairment with the maximum score for the MMSE is 30. A score of 25 or higher is classed as normal. If the score is below 24, the result is usually considered to be abnormal, indicating possible cognitive impairment.

Intervention

1) Dish Rag": shoulder protraction, trunk rotation – posterior shoulder and upper back Goal**:** To target tissues within the SBAL, DBAL: posterior shoulder and upper back.

2) Neck traction – cranial/cervical joint capsules and tissues – DBALGoal: To target tissues within the SBAL, DBAL: sub occipitals, decompress upper cervical joints and increase relaxation through parasympathetic activation.

3) Full traction – cranial cervical joint capsules, overlying tissues –SBL, SBAL, DBAL Goal: To target tissues within the SBL, SBAL, DBAL: increase general neck ROM, decompress cranial cervical joints and stretch overlying tissues, Increase relaxation.

4) Levator scapulae release: neck rotation, side flexion same side levator scapula – DBAL Goal: To target tissues lying within the DBAL: levator scapulae. Because this area has been in a contracted state for some time from previous sequences, it is quite nice to release it with this last stretch to finish the sitting series.

5) Combination of neck lateral flexion and rotation right – left cervical lateral flexors, rotators, extensors –DBAL Goal: To target tissues within the LL, SPL, SBL, SBAL, DBAL, DFL: left Cervical lateral flexors, rotators, extensors. To increase lateral flexion and rotation. Client position: Supine with head lifted into flexion and rotation.

Statistical Method

Paired 't' test :

$$SD = \sqrt{\frac{\sum(d-\bar{d})^2}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{SD}$$

Where,

– Calculate mean difference between pre-test and post-test values., – Difference between pre-test and post-test values. , – Sample size. , – Standard deviation.

Results and Data Analysis

PAIRED 't' TEST

PAIN

Data Presentation

Tabular Presentation

1) Paired 'T' Test For Pain

OUTCOME MEASURE	MEAN VALUE		CALCULATED T VALUE	TABLE T VALUE	LEVEL OF SIGNIFICANCE
VAS	PRE TEST	POST TEST	4.29	1.761	P<0.05 SIGNIFICANT
	93	54			

2) PAIRED 't' TEST FOR FLEXION ROM

O U T C O M E MEASURE	MEAN VALUE		CALCULATED T VALUE	TABLE T VALUE	LEVEL OF SIGNIFICANCE
GONIOMETER	PRE TEST	POST TEST	3.916	1.761	P<0.05 SIGNIFICANT
	1098	1175			

3) PAIRED 't' TEST FOR NECK DISABILITY INDEX

OUTCOME MEASURE	MEAN VALUE		CALCULATED T VALUE	TABLE T VALUE	LEVEL OF SIGNIFICANCE
NDI	PRE TEST	POST TEST	4.090	1.761	P<0.05 SIGNIFICANT
	289	207			

The pre-test and post-test values of pain is accessed for patients with mechanical neck pain by using fascial stretch therapy –PNF pattern using paired 't' test for 14 degrees of freedom and at 5% level of significance and the table t value is 1.761 and the calculated 't' value is 4.29.since the calculated 't' value is greater than the table 't' value, null hypothesis is rejected. Hence there is significant effect of FST-PNF pattern on pain

RANGE OF MOTION

The pre-test and post-test values of ROM is accessed for patients with mechanical neck pain by using fascial stretch therapy –PNF pattern using paired 't' test for 14 degrees of freedom and at 5% level of significance and the table t value is 1.761 and the calculated 't' value for flexion is 3.916 and for extension is 3.956 .since the calculated 't' value is greater than the table 't' value, null hypothesis is rejected .Hence there is significant effect of FST-PNF pattern on ROM.

Discussion

A more benign diagnosis, such as neck sprain, mechanical neck pain, muscular neck pain, myofascial pain syndrome, postural neck pain, etc., will be given to 95% of neck pain patients. It was less common in men than in women (p 0.001, overall test adjusted for

age group), with the equivalent figure for men being 38 (36-39)% compared to 48 (46-49)% for women. CI = 0.66 for the estimated odds ratio (men/women) (0.60, 0.73). Compared to women of working age, elder women (65 years old) experienced neck pain less frequently.

One of the contributing factors to mechanical neck discomfort is any deformity in the fascia lines (DBAL). Pain can also be brought on by any stiffness in the fascia line that covers the neck muscles, including the trapezius, levator scapulae, and rhomboids.

FST has a straightforward name: the Stretch Wave. The term "synchronised movement" refers to the therapist moving the client's entire body (or a portion of it) while breathing with the client. It was originally inspired by the wave-like action of tidal (at rest) breathing.

Contrasted with static and self-stretching, contract-relax stretching has a lengthy research history of producing the best results for enhancing range of motion. Additionally, it was described how FST employs a modified variation of this method (called FST-PNF).

In this study, the PNF pattern of deep back arm line fascial stretch therapy was given to 15 patients with clinically confirmed mechanical neck discomfort who also met the inclusion criteria.

The research discovered significant variations in pain, ROM, and quality of life.

Summary and Conclusion

Summary

- The study evaluated the effect of fascial stretch therapy –PNF pattern of deep back arm line in patient with mechanical neck pain on pain , range of motion and quality of life.15 patients who met the inclusion criteria were assigned in the study. Pre-test and post-test for pain is accessed By VAS scale and ROM by goniometer, and quality of life by NDI .The difference between the pre-test and post-test were analysed using paired 't' test.

Conclusion

The study has been concluded that the fascial stretch therapy –PNF pattern is good at increasing the ROM, pain in patients with mechanical neck pain.

Limitation

- Long term follow up was not done.
- Small sample size was included in the study.
- Only the patient with MMSE > 24 was selected.
- The questionnaire was filled by respondent so there may be chance for bias.

Suggestions

- Long term follow up of same treatment can be under taken.
- Further studies can be done on larger samples.
- Other age groups should be consider.
- Ergonomic assessment should be done.

Conflict of Interest: Nil

Source of Funding: Self Funded

Ethical Clearance: Ethical clearance has been obtained from the Institutional Ethics Committee

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Original Article

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To Compare the Effectiveness of Positional Release Technique Versus Kinesio Taping in Patients with Upper Tapezius Trigger Points

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Abstract

Background: Muscles of the neck and shoulder region always function as a unit, and there is no movement in the upper extremity that would not be reflected in the neck musculature. Neck muscles show a strong tendency to develop hyper tonus and spasm. The principal muscle to carry the load is trapezius which may get tender point or spasm more frequently. The study aimed to find the effects of Positional Release Technique (PRT) and Kinesio Taping (KT) in Upper Trapezius Trigger Points (Trigger points).

Method: A total of 30 patients were taken with mean age of 26.16 and were allocated into two groups, Group A Positional Release Group and Group B Kinesio Taping Group. Pain intensity level, Range of Motion (ROM) and disability was measured using numeric pain rating scale (NPRS), Universal goniometer and neck disability index (NDI), respectively at baseline, 1st week after treatment and at the end of treatment.

Conclusion: There was significant improvement in both PRT and KT groups. Statistical comparison of the result showed that Group A had greater improvement in pain and ROM as compared to Group B. PRT along with Standard PT treatment and therapeutic exercises appeared to be more effective than KT to reduce pain and increase ROM in patients with upper trapezius Trigger points.

Key Words: Upper trapezius Trigger Points, Positional Release Therapy, Kinesio Taping, Numerical Pain Rating Scale, Neck Disability Index, cervical ROM.

Introduction

Myofascial pain syndrome (MPS) is a non-inflammatory disorder of musculoskeletal origin, which is one of the frequent causes of muscle pain[1,2]. MPS is defined as sensory, motor, and autonomic symptoms that are caused by the presence of myofascial trigger points (Trigger points)[3]. Trigger points is "a hyperirritable spot, usually within a taut band of skeletal muscle or in the muscle fascia which is painful on compression and can give rise to characteristic referred pain, motor dysfunction and autonomic phenomenon"[4]. MPS is very common in general population and its incidence is as high as 54% in women and 45% in men. Common age presentation is between 27.5 to 50 years with preference in sedentary individuals[5]. Highest prevalence of MPS is reported in neck and shoulder that is 49%[6].

Trigger points are divided into two categories: active and latent Trigger points. Latent Trigger points do not cause local or referred pain until direct

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pressure is applied. They do not cause persistent pain; however, they restrict movement, induce early fatigue and cause loss of tissue. Active Trigger points cause persistent pain even without direct manual pressure. It can result into movement restriction and in turn may reduce the muscle strength, activity and tonicity. Latent Trigger points may spontaneously become active Trigger points if ignored[8].

The cervical spine is the most intricate region of the spine and so are it's muscles[9]. Muscles of the neck and shoulder region always function as a unit, and there is no movement in the upper extremity that would not be reflected in the neck musculature[9]. Working tasks that involve continuous arm movements always generate a static load component on these muscles, the principal muscle to carry this load is the trapezius[9]. Upper trapezius is designated as postural muscle and is highly suspected for over use[7] because it works constantly against gravity to maintain an erect head and neck position[10]. Any trigger point in the upper trapezius can cause neck stiffness, restricted cervical rotation and lateral flexion, shoulder elevation, neck pain and headache[11]. Fischer in his study measured the pressure pain threshold (PPT) of eight different muscles using a pressure algometer and found that upper trapezius was the most sensitive muscle tested[12].

Positional Release Technique (PRT)

Positional Release Therapy was developed by Lawrence H. Positional Release Technique (PRT) originally termed as starin-counterstrain is a therapeutic technique that uses tender points or Trigger points and a position of comfort to resolve the associated dysfunction[13]. PRT is a method in which muscles are placed in a position of greatest comfort, and this causes normalization of muscle hyper tonicity and fascial tension. PRT is an indirect (the body part moves away from the resistance barrier, i.e., the direction of greatest ease) and passive (the physiotherapist performs all the movements without help from the patient) method of treatment[14].

Kinesio Taping (KT)

KT method was developed from 1973 to 1979 by Dr. Kenzo Kase, in an intension to provide support for musculoskeletal structure without over immobilization and the side effect from it[15]. Kinesio tape is made from a thin elastic adhesive material that can be stretched from 120-140% creating a dynamic flexible tape[16]. The tape without medicinal properties is water resistant and can remain on skin for 3 to 5 days[15]. It is found that KT increases the ROM, reduce swelling, inflammation, muscle tone, and can be used in muscle spasm, cramps prevention and speedy recovery of overloaded muscle[17]. According to Kase, for muscle inhibition or muscle relaxation, the tape is applied from the muscle insertion to its origin, with the tension being weaker than 15–25% of the original tension, while for muscle strength, tape is applied from the muscle origin to the insertion, with tension stronger than 25–50%[15].

Material and Method

This study took place in the Department of Physiotherapy, Sharda Hospital, Greater Noida. A total of 30 patients were taken according to convenient sampling and were divided into two groups.

Inclusion Criteria- patients between the age of 18-40 years with Active Trigger points in the upper part of the trapezius muscle, with the absence of skin allergies, and consent to physical examination and taping application were included in the study.

Exclusion Criteria- Patients having any history of upper limb, back or neck severe injury in the last 12 months, surgical intervention in shoulder and neck, upper limb fractures, whiplash injury, fibromyalgia, pharmacological treatment at present (NSAIDs), infection, open wound, radiating pain in upper extremity were excluded from the study.

The outcome measures used were Numeric pain rating Scale for pain, goniometry for Active Range of Cervical Motion and Neck Disability Index for neck disability. All the measures were taken at baseline, at the end of 1st week and end of treatment. Treatment was carried out for 3 times a week alternatively for 2 weeks.

Subjects were randomly divided in to two groups by concealed envelope method so that, there were an equal number of subjects in each group. Group A i.e., PRT group (PRT+ Standard PT treatment) Group B i.e., KT group (KT+ Standard PT treatment).

PROCEDURE

Standard PT Treatment

Standard PT Treatment[18]

1. Hot pack for 20 minutes
2. Ultrasound – 0.8 watt/cm^2 for 5 minutes
3. TENS – 2 pole – 0 – 150Hz for 20 minutes

Positional Release Therapy

Participant was in the supine position with cervical spine in neutral and therapist standing on the affected side. The head of the participant was laterally flexed towards the affected side of the Trigger points. While the therapist applied pressure on the Trigger points and hold the subject's forearm and abduct the shoulder to 90 degrees. The ideal position of ease, i.e., when there is approximately 70% reduction in pain is produced. Position is maintained for 90 seconds, followed by the passive return of the body part to an anatomically neutral position. The procedure was repeated 3 times with 1minute interval[9].

Kinesio Taping

Tape was measured from the midline of the acromion to the hairline on the nape of the neck. Tape was then cut into the form of an 'I' bar and the muscle is placed to in the stretched position. The base is fixed and tape is elongated with a tension of 10-25% over the muscle belly. Tape is then rubbed in elongated position[19]. Subject is instructed to remove the tape after 24 hours of application.

After 1week participants in both the groups being with the therapeutic exercises which included- Active ROM exercise for neck, Chin tuck in exercise, Shoulder shrugs, Isometric exercise for neck and Rowing exercise. Participants performed all the exercises in 3 sets with 10 repetitions in each.

Statistical Analysis

The Statistical Package for Social Sciences (SPSS Statistics v. 22) was used for data analysis. Un-paired t- test was used to evaluate the score difference among both the groups. A level of significance 0.05 was used to determine the statistical significance.

Results

Table 1: Comparison of NPRS between the groups

		PRT	KT	P value (p≤0.05)
NPRS	Baseline	7.73±0.88	7.8±1.01	0.84
	1st week	6.53±1.12	6.86±1.06	0.41
	2nd week	5.26±1.03	6±0.92	0.04

Table 2: Comparison of EXTENSION ROM between the groups

		PRT	KT	P value (p≤0.05)
EXTENSION ROM	Baseline	43.53±5.99	38.13±8.22	0.04
	1st week	53.26±4.63	49.06±4.65	0.01
	2nd week	64.06±2.63	60.13±1.64	<0.0001

Table 3: Comparison of ROTATION ROM (TOWARS RIGHT & LEFT) between groups

ROTATION ROM (TOWARDS RIGHT)		PRT	KT	P value (p≤0.05)
	Baseline	37.86±8.92	41.2±5.51	0.20
	1st week	58.73±5.07	59.6±4.23	0.61
	2nd week	84.33±1.11	81.33±2.22	<0.0001
ROTATION ROM (TOWARDS LEFT)		PRT	KT	P value (p≤0.05)
	Baseline	37.86±8.29	41.2±5.51	0.20
	1st week	58.73±5.07	59.6±4.23	0.61
ROTATION ROM (TOWARDS RIGHT)	2nd week	84.33±1.11	81.33±2.22	<0.0001

Table 4: Comparison of LATERAL FLEXION ROM (TOWARS RIGHT & LEFT) between groups

LATERAL FLEXION ROM (TOWARDS RIGHT)		**PRT**	**KT**	**P value (p≤0.05)**
	Baseline	27.86±4.37	20.4±1.91	<0.0001
	1st week	32.66±3.79	25.8±1.97	<0.0001
	2nd week	37.73±3.63	31.86±1.55	<0.0001
LATERAL FLEXION ROM (TOWARDS LEFT)		PRT	KT	P value (p≤0.05)
	Baseline	26.66±2.60	21±2.13	<0.0001
	1st week	32.73±2.25	27.33±3.33	<0.0001
ROTATION ROM (TOWARDS RIGHT)	2nd week	38.73±2.34	33.33±3.90	<0.0001

Table 5- Comparison of NPDI between groups

NECK PAIN DISABILITY INDEX		**PRT**	**KT**	**P value (p≤0.05)**
	Baseline	0.13±0.05	0.19±0.04	<0.0011
	1st week	0.12±0.05	0.17±0.04	<0.0053
	2nd week	0.11±0.04	0.14±0.04	<0.04

Discussion

The current study was carried out to evaluate the effects of PRT and KT in the management of upper trapezius Trigger points. The result showed that PRT along with Standard PT treatment and KT along with Standard PT treatment could benefit in the treatment of upper trapezius Trigger points. There was a significant difference ($p<0.05$) in the pain intensity and ROM at the end of treatment when compared to baseline in Group A.

Positional release therapy, with the treatment time selected for this study produced significant pain relief. The treatment time of 90 seconds used in this study was chosen from the evidence available. Positional release therapy for 90 seconds in a position of comfort for the upper trapezius muscle was used since it is preferred in cases somatic dysfunctions as preferred by available evidence suggested by previous researches[9].

In previous studies, PRT has been applied for the treatment of Trigger points and other disorders. Alagesan et al. indicated that 7 consecutive treatment sessions of PRT decreased pain and significantly increased the active ROM of lateral flexion, in

contrast with the present study[9]. Kumaresan et al. also reported a significant decrease in pain and an increase in ROM after 7 treatment sessions with PRT[19]. Mohammadi Kojidi et al. investigated the effects of PRT versus active soft tissue therapy on pain and ROM in women with latent Trigger points. The participants received 3 treatment sessions within 1-day intervals. Similar to the present study, VAS scores decreased, while the active ROM of contralateral flexion increased insignificantly[20].

According to the Korr model, placing the muscle in a shortened position may decrease the muscle spindle activity and enable the central nervous system CNS decrease gamma discharge activity, therefore inhibiting the facilitated segment of the spinal cord. By shortening the extrafusal fibers or placing them in a position of ease, Korr's hypothesis is that the intrafusal and extrafusal fibre disparity decreases and the gamma discharge is turned down. This enables the muscle to return to its normal resting length as the hyperactive muscle spindles cease to fire. This passive approximation may be referred toas "positional release". Jones also refers to "spontaneous release by positioning" where he describes taking a lesion into a position that exaggerates the deformity and achieves relief of pain and restores normal motion[9].

Conclusion

When both the treatment techniques were taken into statistical considerations for significant difference Group A i.e., Standard PT treatment + PRT showed a significant difference than Group B i.e., Standard PT Treatment + KT.

Therefore, from the present study we concluded that PRT when given with Standard PT Treatment is more effective in reducing upper trapezius Trigger points.

Ethical Clearence- Institutional Research Ethics Committee, School of Allied Health Science, Sharda University, Greater Noida, Uttar Pradesh.

Conflict of Interest- none

Source of Funding- self

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Original Article

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Levels of Physical Activity and Prevalence of Obesity among Undergraduate Physiotherapy Students in Navi Mumbai: A Descriptive Study

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Abstract

Background: Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. A steadily increasing trend of obesity among young adults, especially college and university students, is becoming more evident. Weight gain and drop of physical activity during early adulthood can increase the risk of chronic medical conditions. The aim of this study is to determine the physical activity levels and the prevalence of overweight and obesity among undergraduate physiotherapy students in Navi Mumbai.Method : 176 undergraduate physiotherapy students will be asked to fill the IPAQ form to evaluate their physical activity levels, and their weight and height will be measured to calculate BMI.Results : 29% of participants reported high level of activity (50 out of 176); 48% reported moderate physical activity (85 out of 176); 23% of participants reported low physical activity (41 out of 176). The distribution of different categories of BMI revealed that 18% and 6% were classified as obese1 and obese2 respectively. 17% are at risk of obesity.

Keywords: Obesity, physical activity, IPAQ form,young adults, undergraduate physiotherapy students

Introduction

As life changes and becomes more developed there are a lot of health problems and disease immerges. One of these major health problems is obesity. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Body mass index (BMI) is used to classify overweight and obesity in adults.[1] Body mass index is a ratio of weight in kilograms divided by height in metres squared (kg/m2). It is a good predictor for overall health and nutritional status. Obesity is one of the most neglected health problems which lead to diabetes and cardiovascular disease. More than 1.9 billion adults are overweight and 650 million are obese. Approximately 2.8 million deaths are reported as a result of being overweight or obese. [2]

Overweight and obesity have become a major public health problem in both developing and developed countries. India is a developing country which is in a transitional state of under nutrition due to poverty and obesity due to the industrialization and rapid urbanization. In India, more than 135 million individuals were affected by obesity.[2] This current

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obesity epidemic is more pronounced in developing countries undergoing rapid epidemiological transitions (demographic, social and economic). Until recently, it was perceived that obesity mostly affected middle aged adults. However, a steadily increasing trend of obesity among young adults, especially college and university students, is becoming more evident. Young adults between the ages of 18-25 are in a period of 'transition' from adolescence to adulthood. [3]

Physical activity decreases total body fat mass and slows the development of abdominal obesity, which improves the cardiovascular and metabolic health. Young people should aim for atleast an hour per day of vigorous activity to counteract the negative health effects of sedentary behaviour which is commonly accompanied by overeating habit. The obesity is a result of multiple factors, but mostly two factors generate obesity : an increased intake of caloric foods and insufficient amount of physical activity.

Unfortunately these life habits are dominantly present during student's life. [4 Students practice unhealthy dietary and lifestyle behaviours that should be targeted and modified. Weight gain and drop of physical activity during early adulthood can increase the risk of chronic medical conditions. Many studies have confirmed that a large majority of young adults fail to meet scientifically approved recommendations for physical activity for better health, and that the proportion of overweight and obesity is increasing in whole population, independently of age, gender, race, or nationality.[4]

Need Of Study

1. The sedentary lifestyles of students and young people and the lack of time due to studying makes it difficult for students to be additionally involved in any kind of physical activity. There exist differences in the physical activity levels among various populations. Therefore this study is undertaken to describe the levels of physical activity as well as to determine the prevalence of overweight and obesity among undergraduate physiotherapy students in Navi Mumbai.

AIM:

- To determine the levels of physical activity and prevalence of obesity among undergraduate Physiotherapy students in Navi Mumbai.

Objectives

- To determine the levels of physical activity among undergraduate Physiotherapy students in Navi Mumbai.
- To determine the prevalence of obese and under risk obese undergraduate Physiotherapy students in Navi Mumbai.

Hypothesis:

- Null Hypothesis :

There will be no statistical significant prevalence of obesity among undergraduate Physiotherapy students in Navi Mumbai.

- Alternate Hypothesis :

There is statistical significant prevalence of obesity among undergraduate Physiotherapy students in Navi Mumbai.

STUDY DESIGN

- Type of Study : Descriptive type
- Study Setting: Colleges of Physiotherapy in Navi Mumbai
- Study Population: Undergraduate Physiotherapy students
- Sampling Method: Simple random
- Sample Size: 176
- Inclusion criteria:

Students studying BPTh (1st to 4th years, as well as interns)

Age group 18-25 years

Both genders Male and female

- Exclusion criteria:

Students not studying UG Physiotherapy from a college in Navi Mumbai

Female students suffering from PCOD

Students aged less than 18 or more than 25 years

- Materials used :

Google document

IPAQ form

Methodology

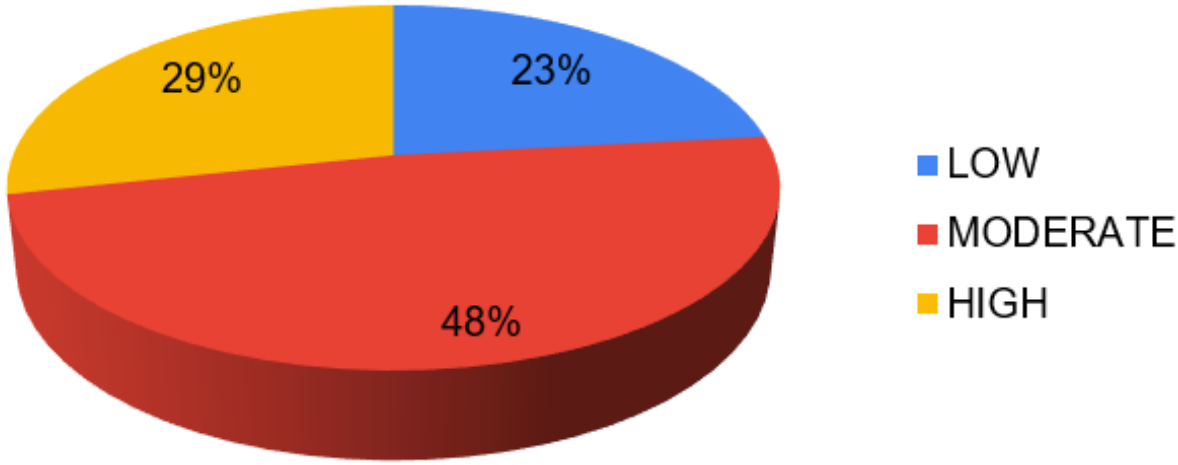
- Ethical clearance was taken from Institutional ethical committee.
- Participants was selected based on inclusion criteria.
- Informed consent form was obtained from all participants.
- Demographic data was obtained.
- Participants was asked to fill the google form to evaluate their physical activity and BMI.
- Data was analysed.

Results

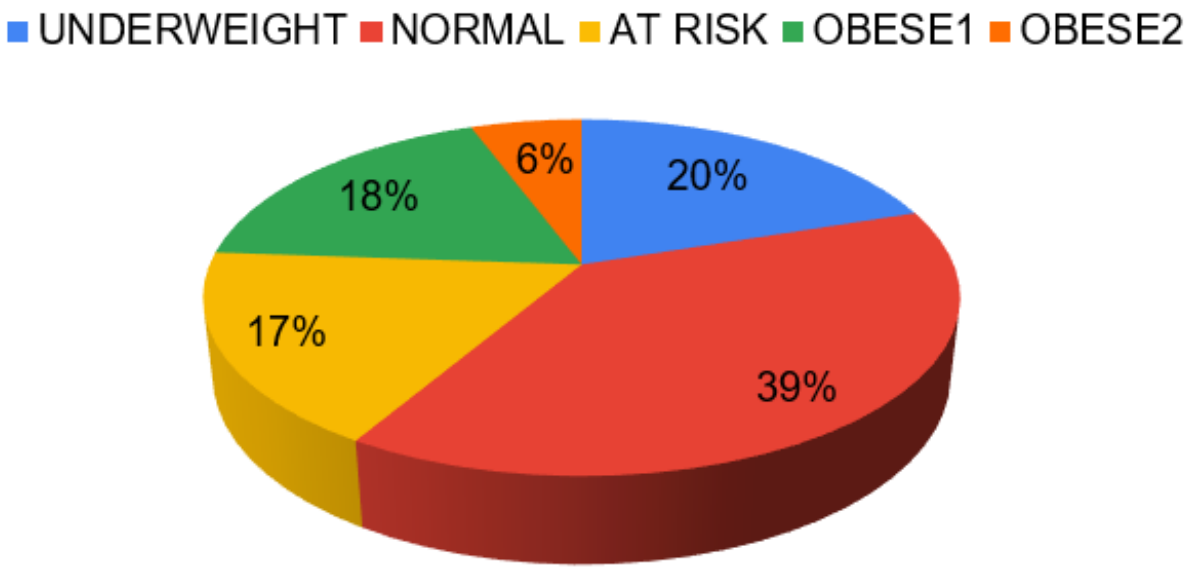
➢ Data were analyzed by descriptive statistical method using Microsoft excel. The data were presented as mean ± standard deviation and percentage (%) distribution.

Data presented in pie chart :

PHYSICAL ACTIVITY LEVELS :

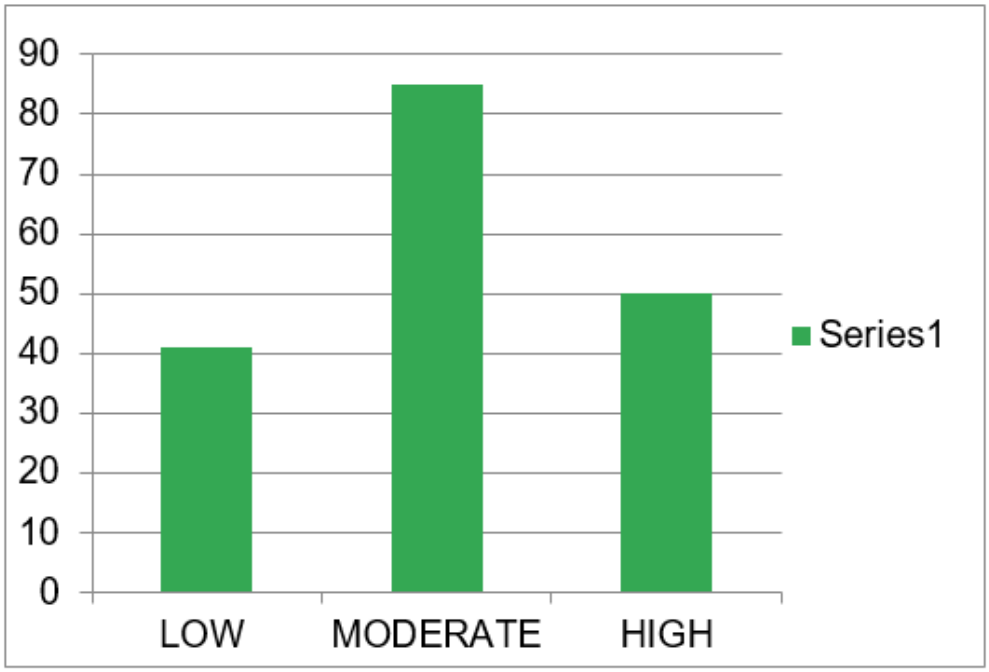


BMI :



Data presented in graphs :

PHYSICAL ACTIVITY LEVELS :



Data presented in Tabulation: Table 1

- Descriptive analysis of amount of physical activity:

		Day/week	Min/day
Vigorous	Mean ± SD Min-max	1.30 ± 1.78 0-7	24.26 ± 36.11 0-150
Moderate	Mean ± SD Min-max	1.83 ± 2.05 0-7	27.92 ± 35.07 0-120
Walking	Mean ± SD Min-max	5.45 ± 1.72 0-7	47.92 ± 36.11 0-180
sitting	Mean ± SD Min-max	6.7 ± 1.3 0-7	Hours/day 6.28 ± 3.37 2-20

- The results of IPAQ questionnaire are presented in table 1
- The number of days of vigorous physical activity, moderate physical activity, walking, sitting during last 7 days and the duration of these four domains are shown in table 1.
- Duration of activity sessions (exercise and walking) are expressed in minutes but duration of sitting is expressed in hours, 29% of participants reported high level of activity (50 out of 176) ; 48% reported moderate physical activity (85 out of 176) ; 23% of participants reported low physical activity (41 out of 176)

Data presented in Tabulation: Table 2

- Descriptive parameters of BMI:

N = 176	Mean ± SD	MIN/MAX
AGE	21.22 ± 1.43 year	18-25
HEIGHT	1.61 ± 0.89 m	1.31 – 1.82
WEIGHT	57.95 ± 11.19 kg	37-92
BMI (kg/m)	22.19 ± 3.98	15.4-32.9

- The total number of participants was 176, with response of 100% majority age range 18-25 years of physiotherapy students.
- Their height ranging was 1.31-1.82 meters and weight range to 37-92 kg, with their BMI ranging to 15.4-32.9
- According to table 2: 17% (31 out of 176) are at risk of obesity, 18% (32 out of 176) are obese1 and 6% (10 out of 176) are obese2.
- Data has been presented using pie chart and bar graph.

Discussion

- Obesity is a global public health concern affecting people of all age groups and socioeconomic status. While medical conditions associated with under nutrition are still an important topic, nowadays diseases associated with unhealthy lifestyles, overweight and obesity are dominant. [6,7,8]
- Previous studies done by **Marwa Muhammed Yousif** revealed that prevalence of obesity among medical students was 6.5% which is less than the general population.[1] Whereas our study shows that 24% physiotherapy students fall under obese category and 17% are at risk of obesity.
- The majority of health sciences students examined in one study were at risk (24.3%) and obese (18.4%), similarly as in our sample. [13]
- Previous studies show that less than half of students (44.9%) had low activity level, 32.0% had moderate activity level and 23.1% had high physical activity level .[1]
- Whereas our results show that higher percentage of physiotherapy students (48%) have **moderate levels** of physical activity, 29% have high activity level and 23% have low physical activity level.

Recommendation for future scope:

- Further studies are needed to detect determinants of obesity in non-medical students and in general population in aim to compare and to explore the possible mechanisms behind obesity among young adults.
- The physical activity levels and body mass index can be compared among variety of settings such as schools, workplaces and other settings
- Improve the methods for measuring body composition and physical activity in populations.
- The study can be done in different district areas.
- Maintain and enhance systems for monitoring trends in overweight/obesity and physical activity.

Limitations:

- The limitations of this study are it was conducted only among physiotherapy students
- The study is done only in one area.
- We utilized only short IPAQ version.

Conclusion

- Higher percentage of physiotherapy students have reported moderate levels of physical activity and least percentage of physiotherapy students have low physical activity level.
- The distribution of different categories of BMI revealed that 18% and 6% were classified as obese1 and obese2 respectively. 17% are at risk of obesity.

Ethical Clearance: Taken from ethical committee

Source of funding: Self

Conflict of Interest: Nil

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Original Study

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A Study to Correlate Waist Circumference (WC) and Peak Expiratory Flow Rate (PEFR) in Overweight Women: A Correlational Study

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Abstract

Background and objective: Obesity is a major health issue and there is steady trend of increasing obesity over the past several decades. Obesity can alter the respiratory function and may impair the health of an individual. Although several factors such as respiratory muscle strength, lung compliance, resistance to airflow and even obesity affect the lung functions, the nature of relationship with markers of adiposity, the role of body fat distribution has received limited attention. So the objective of this study was to correlate PEFR and WC in overweight women. Methods: 100 overweight women whose BMI was 25-29.9 kg/m2, who fulfill the inclusion and exclusion criteria, aged between 20-50 years were selected for the study. Waist circumference (WC) and Peak expiratory flow rate (PEFR) of all the subjects were measured. Results**:** Data were analyzed using Spearman's correlation coefficient. The result showed non- significant correlation (p=0.057) (r = -0.057) between PEFR and WC in overweight women. Conclusion: The study concluded that obesity, measured as WC did not significantly affect the PEFR in young overweight females in the age group of 20 to 50 years. A central pattern of fat distribution, as measured by WC alone was not associated with lower values for PEFR in young female overweight adults.

Keywords: Waist circumference (WC), Peak expiratory flow rate (PEFR), Overweight women.

Introduction

World Health Organization (WHO) describe obesity as "A condition with excessive fat accumulation in the body to the extent that the health and wellbeing are adversely affected". Obesity results from a complex interaction of genetic, behavioral, environmental and socioeconomic factors causing an imbalance in energy production and expenditure.[1] Overweight refers to an over fat condition relative to other individuals of the same age or height despite the absence of accompanying body fat measures. The overweight condition refers to a body weight that exceeds some average for stature, and perhaps age, usually by some standard deviation unit or percentage. The overweight condition frequently accompanies an increase in body fat, but not always, and it may or may not coincide with the co morbidities glucose intolerance, insulin resistance, dyslipidemia, and hypertension.[2]

Weight and body mass index (BMI) are used as the measures of overall adiposity whereas waist hip ratio (WHR) and waist circumference (WC) are used as the measures for abdominal obesity.[1]

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Obesity can profoundly alter pulmonary function and diminished exercise capacity by its adverse effects on respiratory mechanics, resistance within the respiratory system, function of respiratory muscles, work and energy cost of breathing and gas exchange.[3]

Pulmonary function test (PFT) is a basic and essential tool for the diagnosis and assessment of lung dysfunction, diseases, and treatment effects. Peak expiratory flow rate (PEFR) is the maximum flow rate generated during a forceful exhalation, starting from full lung inflation. It is the maximal airflow during the effort dependent portion of the expiratory maneuver and reflects the large airway flow and depends on the voluntary effort and muscular strength of the participant. The ease with which one can measure PEFR with the help of a portable device can be beneficial for short- and long-term monitoring and can provide the health professionals with a reliable and objective measurement for early detection and therapeutic intervention.[4] The study was undertaken to correlate waist circumference (WC) and peak expiratory flow rate (PEFR) in overweight women. The objectives of the study are 1) to measure waist circumference (WC) in overweight women.2) to measure peak expiratory flow rate (PEFR) in overweight women.3) to correlate waist circumference (WC) and peak expiratory flow rate (PEFR) in overweight women.

Methodology

- Study Setting: Shree K.K. Sheth Physiotherapy College, Rajkot.
- Source of data: In and around Rajkot city.
- Method of collection of data:
  - Sampling technique: Purposive sampling technique.
  - Study population: Overweight women
  - Sample Size: 100 overweight women
  - Study design: Correlation study.
  - Study duration: One time study
- Inclusion Criteria:
  - Women with BMI-25 to 29.9 kg/m^2
  - Age: 20-50 years
  - Ability to understand and follow instructions.
- Exclusion Criteria:
  - Non-consent.
  - Pregnant women
  - Subject who do intense physical exercise.
  - Subjects having habit of alcohol and tobacco chewing.
  - Subjects with Respiratory disorder, Cardio vascular disorder, chest and spinal deformity
  - Subjects with neurological disorder, history of smoking, chest trauma.
  - Subject having history of recent surgery

Materials Used for the Study

1. Wright Peak Flow Meter (Pulmo Peak™, Design No. 2100423)
2. Weighing Machine
3. Measure Tape
4. Paper
5. Pen
6. Scale
7. Cotton
8. Spirit
9. Consent form
10. Data collection sheet

Measurement Procedure:

The proposed title and procedure has been approval by ethical committee members,100 subjects from in and around Rajkot city were taken, who fulfilled the inclusion and exclusion criteria taken for the study purpose. After proper explanation about the purpose and procedure of the study, subjects who were willing to participate in the study were requested to sign a written consent form. The selection of subjects was done by purposive sampling.

Body Mass Index (BMI) Determination: [5]

The height (in m) and weight (in kg) of women, with shoes off and wearing the least possible clothing, was measured**.** The same measurements were taken for each subject. Their body mass index (BMI) was

calculated from the relationship- body weight in kilograms/ height in meters squared (WHO, 2006).

$$BMI = \frac{\text{Body weight in Kg}}{(\text{Height})^2 \text{ in m}}$$

Peak Exploratory Flow Rate (PEFR) Procedure: [6]

The peak expiratory flow rate was determined by using Wright's peak flow meter. The subjects were asked to stand in an upright position with the peak flow meter held horizontally in front of their mouth and allowed to take a deep breath in, and closed the lips firmly around the mouthpiece, making sure that no air leaks around the lips. The subject was asked to breathe out as hard and as fast as possible and the around the lips. The subject was asked to breathe out as hard and as fast as possible and the number indicated by the cursor was noted and the sequence was repeated twice more, thus obtaining three readings.

Waist circumference (WC) measurement Procedure: [2]

Waist circumference (WC) measurement were done with minimal, adequate clothing (light clothes) with feet together where minimum girth lies in standing position without compression of the skin.

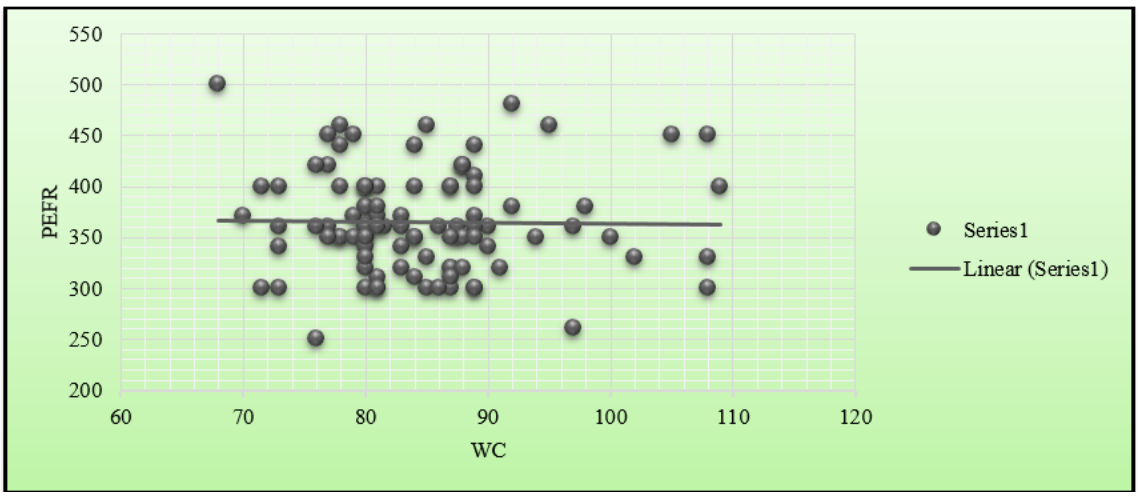
Result

Statistical analysis:

Data were entered in MS Excel 2013 and analyzed using SPSS version 20 for MS windows. Mean and standard deviation were calculated as measure of central tendency and measure of dispersion respectively. Normality of the data were checked by **Kolmogorov-Smirnov test** and it shows that data is of nonparametric type. So co-relation between waist circumference (WC) and peak expiratory flow rate (PEFR) was assessed using **Spearman's correlation coefficient**. The level of significance was set at $p<0.05$.

Table 1. Result of Spearman correlation Coefficient showing co-relation between WC and PEFR in overweight women

Measures	Spearman Correlation Coefficient(r)	p value	N
WC and PEFR	-0.057	0.570	100



Graph 1: Result of Spearman correlation Coefficient showing non- significant co-relation between WC and PEFR in overweight women.

Spearman correlation coefficient between WC and PEFR was r= -0.057 and p= 0.570. Above table and graph shows **no significant co-relation** between **WC and PEFR** in overweight women.

Discussion

The intent of the study was to correlate waist circumference and peak expiratory flow rate in overweight women.The result of the present study

favors the null hypothesis which indicates there is no statistically significant correlation between WC and PEFR in overweight women. (p=0.570) (r= -0.057).

The probable reasons which may contribute in getting non-significant association between WC (waist circumference) and PEFR (peak expiratory flow rate) in present study are as follows. It is possible that distribution of fat affects the thoracic mechanics which is not enough to cause decrease in pulmonary function in overweight women. In present study, wider range of age group (20 to 50 years) was used, only overweight female subjects and more numbers of young subjects (20 to 25 years, 43%) were recruited.

WC is a measurement tool for the central pattern of obesity and central pattern which is also called as the upper body pattern (apple shaped) usually seen in obese men and peripheral pattern or lower body pattern (pear shaped) which is usually seen in obese women.[7]

A study done by SaraswathiIlango (2014**)** who had correlated WHR with PEFR in obese male and female and found no correlation of PEFR and WHR in females and suggested that in women, fat deposition is more in the extremities (peripheral obesity) whereas in men, it is seen more in the truncal region (central obesity) and it is independent of overall fat in the body, which supports the result of the present study.[1] The result of the present study is equivalent with the result of Dayananda G. (2009) who had found no significant differences of PEF and FEV1 between the normal and overweight groups and this is because marked degrees of adiposity may be needed to have an effect on pulmonary function.[3]

Yogesh Saxena et al (2010), K. Soundariya (2013) and Canoy et al (2004**)** found negative correlation between WC and pulmonary function parameter which is incompatible to the result of present study. Mechanism explained in their study is abdominal adiposity may influence pulmonary functions by restricting the descent of the diaphragm and limiting lung expansion as compared to overall adiposity which may compress the chest wall.[8,9,10]

LIMITATIONS OF THE STUDY:

1. Sample size was small.
2. Large age group (20-50 years)
3. Only WC was used as an anthropometric measures in the present study.
4. The present study could not explain the cause of obesity and its effect on PEFR value in overweight women
5. All women were included in study was Sedentary.
6. Control group is not taken.

FUTURE RECOMMENDATIONS:

1. Comparison of PEFR between different classes of obesity can be done.
2. Co relational study can be done to check the effect of WC on different pulmonary functions parameters with larger sample size.
3. Study can be conducted using different anthropometric measurement with different outcome measures.
4. Interventional study can be conducted to see the effect of exercise on pulmonary function in obese adults.
5. Study can be conducted post Bariatric surgery.

CLINICAL IMPLICATION:

Obesity is a global health hazard which has been linked to various co morbidities. Obesity is negatively associated to the pulmonary functions. The mechanism for this association is still debated & the best marker of obesity in relation to pulmonary function is still not clear. The result of the present study concludes that obesity, measured as WC does not significantly affects the PEFR in overweight women in the age group of 20 to 50 years.

These results suggest that WC may be a better predictor of pulmonary function if it is used with other measures of overall obesity like WHR or BMI and considered when investigating the determinants of pulmonary function.

Conclusion

The study concludes that obesity, measured as WC does not significantly affect the PEFR in overweight females in the age group of 20 to 50 years.

A central pattern of fat distribution, as measured by WC alone was not associated with lower values for PEFR in overweight women.

CONFLICT OF INTEREST: Nil

SOURCE OF FUNDING: Self

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A Study to Find Out the Effect of Plyometric Training on Power and Agility Performance in High School Basketball Players: An Interventional Study

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Abstract

Introduction: Plyometric training is a training strategy designed to improve the performance by incorporating the basic needs of agility and power, allows muscle to reach exponential increase in the maximum strength and speed of movement in the shortest duration. Basketball requires players to move forward, backward, laterally, diagonally and need to change Directions in a split second.

Methodology: This study was an interventional study, where 30 high school basketball players with age group 14-20 years were selected by inclusion and exclusion criteria. Players who were willing to participate in the study were requested to fill the consent form. 30 high school basketball players received plyometric training. Outcome measurements vertical jump height and T-agility measured before 5 weeks and after of the training. RESULT &

Conclusion: Data were analyzed by Statistical package of social science (SPSS) 20.0 software applying paired t test for pre treatment and post treatment comparison of vertical jump height and wilcoxon sign ranked test used for T-agility. The results revealed that vertical jump height showed significant improvement after training ($t=-10.679$, $p<0.05$), and T-agility test also showed significant improvement after training ($t=-5.295$, $p<0.05$) in high school basketball players. The result showed significant difference of pre and post training. So, it can be concluded that plyometric training effective on power and agility in high school basketball players.

Key Words: Basketball players, Plyometric, T-agility test, vertical jump height.

Introduction

The "plyometrics" comes from the Greek word "pleythyein". In 1964 plyometrics has published new type of training accustomed increase the speed and explosiveness of Russian track and field athletes and utilized in major athletic programs in 1970. Within the early 1990s, George Davies and Kevin wilk introduced plyometrics into rehabilitation.[1]

Plyometric training also called stretch shortening drills or stretch strengthening drills. There are three phases of plyometric training (a) Rapid eccentric loading phase, (b) Concentric phase and (c) amortization phase - Time between eccentric and Concentric phase. During the initial phase of eccentric contraction muscle-tendon units create potential energy which is stored and so retrieved to be used during the concentric contraction. Furthermore advantages of plyometric are to stimulate the proprioceptors of muscles, tendons,

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ligaments, and joints, increase the excitability of the neuromuscular receptors, and improve the reactivity of the neuromuscular system. Even some evidences suggested that plyometric training is related to a decreased incidence of lower extremity injury and also utilized in the later stage of rehabilitation of active individuals who must achieve a high level of physical performance in specific, high-demand activities.[2]

Vertical jump test used in physical education, Fitness or Sports programs, as a method to assess lower limb "power". Johnson & Nelson (1974) report a reliability of 0.93 for this test.[3] The vertical jump may be a movement commonly performed in a number of sports. In certain sports like basketball and volleyball, success largely depends on vertical jump.[4]

Agility has been defined as simply the power to vary direction rapidly, include whole-body change of direction yet as rapid movement and direction change of limbs. The fundamental movement patterns of the many team sports require the player to perform sudden changes in body direction together with rapid movement of limbs. Other factors like visual processing, timing, latency, perception, and anticipation which are helpful to the players successfully within the actual game with the utilization of agility maneuvers, that the purpose of most agility tests is solely to live the flexibility to rapidly change body direction and position within the horizontal plane.[5]

There are many tests which measure agility for e.g. Illinois agility test ,5-0-5 agility test, Pro-agility shuttle test, Three-cone shuttle test, Four corners test, T-agility test, Hexagon test but among that during this study used T-agility test. The T-test appears to be 0.98 reliable and measures a mix of components, including leg speed, leg power, and agility.[6]

Basketball may be a very demanding and challenging game which needs sustenance of maximum performance throughout the sport. The fundamental requirement of the play is that the ability to come up with lower body power, that may include the adequate strength, endurance of the muscles in sustenance of activity; speed of movement; power of the muscles in delivering the movement (sprinting and jumping); agility (exploratory power with changing and varied demands of the game) and also the ability to form multi-directional changes.[7]

Participation of kids and adolescent in a minimum of 1 hour of moderate to heavy intensity physical activities which are developmentally appropriate is suggested. Studies have mentioned great benefits of physical activity in children, including control of weight by increasing energy expenditure, avoiding developing adult obesity, reducing the chance of developing premature disorder, type-2 diabetes, metabolic syndrome, bone formation and remodelling, reducing depression and anxiety, enhancing mood, self-esteem and quality of life, reducing rule-breaking behavior and improving academic performance.[8] So purpose of the study was to find out the effect of plyometric training on power and agility performance in high school basketball players and objectives were 1. To evaluate the effect of plyometric training on power in high school basketball players. 2. To evaluate the effect of plyometric training on agility in high school basketball players.

Material and Method

Source of data: Various schools and sports institutes of Rajkot

Study setting: Sports academic Balbhavan, Rajkot.

Study design: An Interventional Study

Sampling technique: Purposive sampling

Sample size: 30 basketball players.

Study duration: 1 session in a week for 5 weeks.

SELECTION CRITERIA:

Inclusion Criteria:

- Age group: 14-20 years.[9]
- Healthy male basketball players.
- Players playing basketball 1 year and more than that for 5 days in a week.

Exclusion Criteria:

- Players with any musculoskeletal and neurological impairment, any pathological condition of spine, hip, knee and pelvis, any traumatic condition in past 6 months.[3]

- History of any cardiovascular problem.
- History of metabolic disorders.[9]
- Uncooperative athletes

Materials to be used:

- Pen
- Paper
- Chalk
- Inch tape
- Weight machine
- Cones
- Barrier
- Stop watch
- Record or data collection sheet
- Consent form

MEASUREMENT PROCEDURE:

The proposed title and procedure has been approved by ethical committee members. Basketball players from various school and sports institutions from Rajkot were screened and amongst them those who fulfilled inclusion and exclusion criteria were requested to participate in study. 30 players were selected from them by convenient sampling method. Procedure, potential risks and benefits were explained in brief and written consent was taken from all and then Baseline measurements were taken for all players for power by vertical jump test and agility by T-agility test.

The training program is based on recommendation of training intensity, volume, training drills, sets and repetitions. The number of foot contacts per exercise session is indicated training volume of lower body. In this study in 1st and 5th week training volume range was used from 60 to 80 foot contact per training session. And in 2nd, 3rd and 4th week training volume range from 100 to 120 foot contact per session.

Starting of every session warm up exercise: 10 to 15 minutes, included dynamic stretching of hip flexors, gluteus maximus, quadriceps, hamstrings and calf muscle, and slow jogging. End of every session cool down exercise: 10 minute includes dynamic stretching. Total session duration time was 90 minutes. Outcome measurements vertical jump height and T-agility test were checked before and after training.

PROCEDURE FOR VERTICAL JUMP TEST[10] (POWER):

The player stands with the shoulder adjacent to a wall with the feet flat on the floor before reaching up as high as possible touch the wall with the middle finger. Measure the distance (in cm) from the wall mark to floor. Bend the knees to roughly a 90 degree angle and place both the arms back in winged position. Thrust forward and upward, touching as high as possible on the wall; no leg movement is permitted before jumping. Perform three trials of the jump test and use the highest score to represent the player's best vertical jump height. Compute the vertical jump height as the difference between the standing reach height and the vertical jump height in centimeter.

PROCEDURE FOR T AGILITY TEST [11](AGILITY):

In this test three cones placed at set five meters apart on a straight line and a fourth cone placed ten meters from the middle cone, forming a T Shape. Player starts at cone A. On the command of the timer, the player sprints to cone B and touches the base of the cone B with their right hand. Then turn left and shuffle sideways to cone C and this time touch its base with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. Then shuffle back to cone B touching with left hand and run backwards to cone A. The stopwatch stopped as they pass cone A. The test was repeated 3 times. Best of three was recorded.

Results

STATISTICAL ANALYSIS

- Statistical software:

All statistical analysis was done by SPSS version 20.0 for windows software. Microsoft word were used to generate tables.

- Statistical test:

Mean was calculated as a measure of central tendency for vertical jump height and T agility test and Standard Deviation (SD) was calculated as a measure of dispersion. Shapiro-wilk test using for checked normality of data. Difference of pre and post training value of vertical jump height follow

normal distribution so for that used paired t test, and Difference of pre and post training value of T-agility test not follow normal distribution so for that used wilcoxon sign ranked test. Level of significance (p value) was set to 0.05.

30 high school basketball players between the age group of 14 to 20 years 14.8 ± 0.76 (SD) were included. Outcome measures vertical jump test and t agility test were taken before and after Completion of five sessions of training (1 session / week for 5 weeks).

Result

Table (a): Mean and SD of pre training and post training of vertical jump height and T agility test.

OUTCOME MEASUREMENTS		MEAN	SD
VERTICAL JUMP HEIGHT (cm)	Pre training	35.49	8.78
	Post training	39.62	8.94
T-AGILITY TEST (Sec)	Pre training	14.28	0.92
	Post training	13.46	1.2

Interpretation of table (a): The above table shows the mean value of pre training vertical jump test i.e.35.49 ± 8.78(SD) and post training i.e.39.62 ± 8.94(SD). The mean value of pre training i.e. 14.28± 0.92(SD) and post training T-agility test i.e. 13.46± 1.2 (SD).

Paired t test was used for pre training and post training comparison of vertical jump height and Result shows significant difference for pre & post training of vertical jump height ($t= -10.679$, $p<0.05$). Wilcoxon sign rank test was used for comparison of pre and post training of T-agility test and Result shows significant difference for pre & post training of T-agility test ($Z= -5.295$, $p<0.05$).

These above findings suggest that there is statistically significant difference for pre training and post training comparison of vertical jump height and T-agility test. Hence, null hypothesis was rejected and experimental hypothesis was accepted.

Discussions

The intention of the study was to find out effect of plyometric training on power and agility in high school basketball players. In present study when the values of pre training and post training vertical jump height and T-agility were analyzed, it absolutely was statistically significant in both the outcomes. Plyometric exercises are specialized exercises that enable a muscle to achieve maximal strength within the shortest space of time. This works by stretching a muscle so hoping on its elastic properties to provide greater forces than are normally possible within the reflex contraction (as the muscle returns to its resting length). So as to attain this greater muscular force, the muscle must contract with within the shortest possible time following lengthening.[12]

Neural components of adaptation: specifically with an increased neural drive to the agonist muscles and changes within the muscle activation strategies (i.e. improved inter muscular coordination), or changes within the mechanical characteristics of the muscle tendon complex. These neurophysiologic changes together may improve the flexibility to store and release potential energy during the stretch shortening cycle. Specifically, upon landing after a depth jump, an increased level of pre-activation enables the muscle sarcomeres to keep up their length, while the tendons keep elongating and store potential energy.[13] Improve motor unit recruitment may account for the foremost important adaptation encountered during plyometric training regimens. Since larger motor units (composed predominantly of type 2 muscle fibers or fast twitch) have higher neural thresholds than do smaller motor units, therefore they're stimulated only under greater intensity training; plyometric training achieves this demand, leading to recruitment of the larger more powerful motor units. Training explosively may lead to adaptation that allow the athlete the power to recruit larger motor units sooner or more efficiently.[14]

The study shows increase in vertical jump height that may be explained well with an example of a "dig" just before vertical jump. By lowering the centre of gravity quickly, the muscles involved within the jump are momentarily stretched producing more powerful movements. Other theory relies on a neurophysiological model, which explains the instinctive reflex. The reflex increases the activity within the muscle more forcefully. The result is a power braking effect on the potential for a robust concentric muscle action. The flexibility to

use the stored potential energy is affected with three variables - time, magnitude of stretch and velocity of stretch. The quick change in direction is that the important factor when using the elastic component of the muscle.[12]

Selvam Ramachandran et al (2014)[7] which reported that short term period plyometrics educational program combined with dynamic stretching program shows statistically significant improvements in vertical jump height and agility and no changes in muscle girth and isometric muscle strength. John Shaji et al (2009)[15] also suggested that two days of plyometric training every week together with dynamic stretching for four weeks is sufficient enough to indicate improvements in vertical jump height but not sufficient enough to indicate improvements in agility while plyometric training was sufficient.

Conclusion

The result suggested that plyometric training effective on power (vertical jump height) and agility (T-agility) in high school basketball players.

Limitations

- Small sample size.
- Short duration training.
- Only male players were included.
- No anthropometric data was measured in this study and there was no tracking of Changes in body structure over the study.
- Blinding was not done in the study.

FURTHER RECOMMENDATIONS

- To form a sport specific plyometric training protocol for different sport.
- Influences of variety of surfaces and plyometric training on performance.

PRACTICAL IMPLICATION

- The results of this study suggest that 5 weeks plyometric training program once a week into the training regime of adolescent male basketball players may be beneficial for improving power production and agility. These improvements may yield a significant transfer of training effect to on court performance.
- It is necessary to raise awareness of the trainers/coach with the importance of the plyometric exercises because of their significant influence on improving the vertical jump performance in basketball players.

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Conflict Of Interest Nil

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A randomized controlled trial investigating the effects of the upper limb tension test on the treatment and management of pain and range of motion in patients diagnosed with cervical radiculopathy

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Abstract

Introduction: The clinical diagnosis of cervical radiculopathy is a disorder of the nerve root that can be caused by a herniated disc, a spur, or cervical osteophyte. This condition is classified as a radiculopathy. Cervical radiculopathy is a common disease that affects the spinal cord. It is also the most common cause of arm pain and significant functional limitation. Cervical radiculopathy can occur at any point along the cervical spine.

Methods: Two arms parallel pretest-posttest experimental research design. Random sampling with total number of 40 subjects who have been diagnosed my medical doctors were selected by simple purposive random sampling method after giving due consideration to inclusion and exclusion criteria.

Results: The independent t-test further revealed that the readings which we got after the intervention were different and this difference was statistically significant. All the dependent variables, flexion (t=-6.0303, p=0.0001), extension (t=-4.0628, p=0.0002), side flexion to right (t=-5.4393, p=0.0001), side flexion to left (t=-3.9808, p=0.0003), and VAS (t=3.758, p=0.001) showed statistically significant difference after the treatment.

Conclusions: This study concluded that the Upper Limb Tension Test does reduce pain, symptoms and improve the range of motion for the cervical spine.

Key Words: Cervical radiculopathy, Upper limb tension test, Range of motion, Pain, Visual Analogue Scale.

Introduction

Cervical radiculopathy is a clinical diagnosis that is classified as a disorder of the nerve root due to a disc herniation, spur, or cervical osteopathy. Cervical radiculopathy is a common disease affecting the spinal cord and the most common cause of arm pain and significant functional limitation.

Physiotherapists are frequently encountered with subjects with pain, tingling, weakness and restriction of cervical range of motion.The various conservative treatment procedures for cervical radiculopathy included intermittent cervical traction, handling and electrotherapeutic.

The various conservative treatment procedures for cervical radiculopathy included intermittent cervical traction, handling and electrotherapeutic modalities such as shortwave diathermy, ultrasound therapy, TENS and neck work-outs. There would be a short term and long term protocol in dealing with the patient's condition. Late there has been a great deal of interest in mechanical reasons that might cause radiculopathy and methods for overcoming those problems were nervous system mobilization merits particular attention.[4-6]

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Mobilization of the nervous system refers to the movement of nerve tissue within the peripheral nervous system. David Butler has put forward a new approach which helps to explain Nerve Baroreceptors. David advocates that system of mobilization depends on Maitland's gradations.

The upper limb tension test (ULTT) was developed in 1979 and popularized in recent years. The current study focused on mobilizing the nervous system by using the Upper-Limb Tension Test to see if it would alleviate the limitation of Range of Motion and previous pain in subjects with cervical radiculopathy.

The universal goniometer has been determined to be a reliable instrument for the measurement of one of the variables under investigation, which is the range of motion of the cervical spine. In this particular study, cervical radiculopathy was one of the most prominent symptoms, and the Visual Analogue Scale was used to measure its severity.[10,11] Statement of problem: Subjects with cervical radiculopathy suffer from symptoms of pain, tingling, restricted movement and weakness. Subjects with these kinds of symptoms benefit from neural mobilization. This experiment examines cervical radiculopathy patient's range of motion and pain.

The purpose of the current study was to research the relation between upper limb tension test and pain in subjects with cervical radiculopathy. When it comes to treating certain patient populations with neural mobilization, there is a paucity of evidence indicating that the treatment is effective, and the optimal dosage parameters (i.e., duration, frequency, and amplitude) are still in the process of being figured out. When applied in a clinical setting, these methodologies need to be implemented in a way that is both realistic and founded on consistent clinical reasoning.

Methodology

Design of study

Two arms parallel pre test- post test experimental research design.

Ethical clearance was obtained from the departmental research and ethics committee of physical therapy department of Jazan University Saudi Arabia.

Random sampling.

A total number of 40 subjects who have been diagnosed my medical doctors were selected by simple purposive random sampling method after giving due consideration to inclusion and exclusion criteria. They were divided into a control group (A) of 20 subjects and an experimental group (B) of 20 subjects by random lottery sampling.

Materials: Universal 180 degree goniometer, Visual Analogous Scale sheet and 12 cm ruler with 1mm increments, Pencil, Papers and recording sheets, assessment charts.

1) Subjects who do not have any limitation that might preclude walking.

Inclusion Criteria:

Participants who have cervical radiculopathy as diagnosed by a medical professional, age from 30 years to 60 years. Subjects who would be able to tolerate the procedure of ULTT, Subjects having radicular pain in either one of the upper limbs in male and female.

Exclusion Criteria:

Every patient who suffers from cervical instability, spinal compression, or tumors.

All participants who satisfied the inclusion criteria were randomly selected and granted consent to participate in the study. Subjects were properly treated and given correct management according to the following outlined protocol over 12 days with one session each day.

In addition to the conservative management that both groups received. The experimental group received neural mobilization for the upper limb using the upper limb tension test according to the below mentioned protocol.

Both groups of subjects were recorded for their cervical range of motion on the first and twelfth days of the study protocol Cervical flexion, extension, side flexion to right and side flexion to left were recorded using a universal 180 degree goniometer.

They were compared against the normal values suggested by the American orthopedic association. Pain score was measured by visual analogue scale (VAS) and was recorded on the first and twelfth day. The extreme words of no pain and pain as bad as possible have been translated into Arabic language, as this study setting was in Jazan region Saudi Arabia.

Protocol:

Control group (A) – Total duration 60 minutes.

• Short wave diathermy with 20 minutes, 20 minute's; intermittent cervical traction, 20 minute's isometric and active neck exercises performed in the PT department for 12 days.

In experimental group (B), treatment was conducted for 60 minutes.

Short wave diathermy with 20 minutes, treatment for 12 consecutive days using disc electrodes.
For 20 minutes, cervical traction every day for 12 days. The studies were done in the department of physical therapy for 20 minutes, one time a day for 12 days.

Neural mobilization of arm for the affected arm limb using the upper limb tension test for median nerve. Initially the treatment session was started with gentle oscillations and then progress into a series of repetitions.

Figure: Therapeutic intervention of Neural Mobilization Technique.

Result

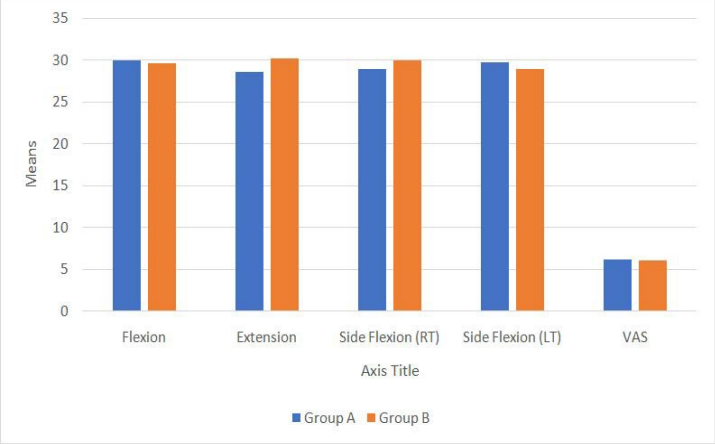
The data was tabulated and the difference between the intergroup and the intergroup variable selected for both the t-test groups was determined. After factoring the p-value, the probability level was set at a >= .05. Five percent chances of the study result is not attributed to extraneous sources.

The independent samples t-test and paired samples t-test were used to find the differences between male and female students.

Table: 1 gives the demographic details of the 40 subjects who were selected for the study.

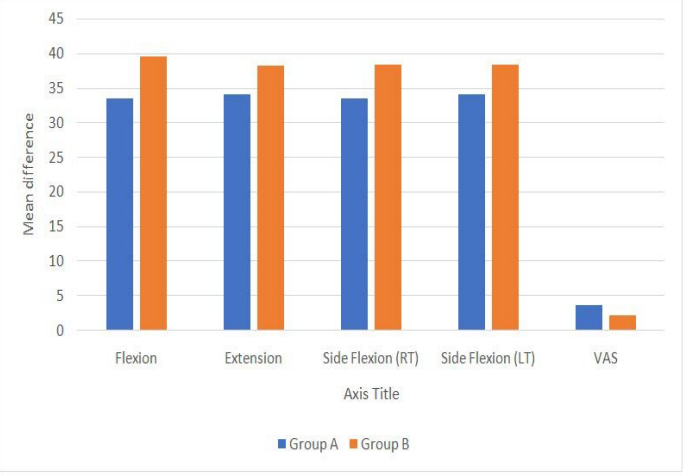
Age group	Control group (A)		Experimental group (B)	
	Male Subjects	Female subjects	Male Subjects	Female subjects
30-35	2	1	1	1
35-40	1	1	1	0
40-45	2	2	2	1
45-50	3	1	2	1
50-55	2	0	3	2
55-60	3	2	3	3
Total	20 subjects		20 subjects	

To find out the difference between the control and experimental groups an independent t-test was performed which showed before the treatment there wasn't any difference between both the groups [Table 1]. Hence both the groups were considered similar and considered as matched groups.



Graph 1. Comparison of means between baseline readings of both the groups.

The independent t-test further revealed that the readings which we got after our intervention were different and this difference was statistically significant [Graph 2].



Graph 2. Comparison of means difference between the readings after the intervention between both the groups.

All the dependent variables, flexion (t=-6.0303, p=0.0001), extension (t=-4.0628, p=0.0002), side flexion to right (t=-5.4393, p=0.0001), side flexion to left (t=-3.9808, p=0.0003), and VAS (t=3.758, p=0.001) showed statistically significant difference after the treatment, when both the groups were compared.It was found out that the group B or experimental group shown better improvement in term of increase in range of motion as well as decrease in pain.

Within Group Analysis

To find out the difference with in the same group before and after the treatment a paired t-test was performed and the findings are shown in table 2, which shows that both the groups have shown improvement after the treatment and range of motion was increased which was statistically significant,also there was decrease in pain in both the group after treatment.

Table 2: Comparison of difference with in the group before and after the intervention in both the groups.

Variables		Pre Test Mean ± SD (N=20)	Post Test Mean ± SD (N=20)	T-Test	
				t	P
Group A	Flexion	30 ± 4.23	33.5 ± 3.75	-4.7422	0.0001
	Extension	28.6 ± 4.31	34.1 ± 3.58	-7.1796	0.0001
	Side Flexion Rt	28.9 ± 3.77	33.35 ± 3.24	-7.16	0.0001
	Side Flexion Lt	29.7 ± 2.87	34.05 ± 3.79	-7.9229	0.0001
	VAS	6.17 ± 1.48	3.62 ± 1.44	7.1452	0.0001
Group B	Flexion	29.6 ± 4.59	39.5 ± 2.33	-13.1372	0.0001
	Extension	30.2 ± 3.39	38.2 ± 2.74	-9.7851	0.0001
	Side Flexion Rt	29.95 ± 3.42	38.35 ± 2.54	-14.4282	0.0001
	Side Flexion Lt	28.95 ± 2.86	38.4 ± 3.08	-15.3008	0.0001
	VAS	6.08 ± 1.39	2.26 ± 0.73	12.6802	0.0001

The results of this study showed a significant improvement,statistical significance (P<0.05) for flexion, extension, right side flexion, left side flexion and vas scores at the control group which were treated with traditional methods.

In addition, the treatment group showed improvement with a statistically significant difference (P<0.05) with reference to the flexion, extension, right side flexion and left side flexion, in favour of the treatment group.

This study proved that there was a significant difference in the pain levels of Visual Analogue Scale scores. The experimental group showed a highly significant value at 99.5% (P<0.05) with a value of 12.68. Compared to the control group, there was a significant difference in the pain relief scale in the experimental group.

The study showed that using the tension test for the upper limb as a method to mobilize neurons actually showed better results than a control for the movement of the cervical spine and pain.

Discussion

The purpose of this study was to study the effect of the upper limb tension test in the cases of cervical radiculopathy as a therapeutic method for mobilizing the nervous system in order to limit the r pain and improve the range of motion.[12,13]

This study has indicated that conservative and experimental methods of treating cervical radiculopathy subjects led to improvement in the subjects' pain and laxity of the spine. However the experimental group responded better than the control group to the treatment as discussed below.[14,15]

None of the suggested statistical procedures were able to guarantee adequate results. There has been research to improve the pain and other symptoms by mobilizing the nervous system.[16&17]

Butler described that one can treat pain via nervous system mobilization. A double-blind study was conducted by Sheereen FJ et al 53 subjects were recruited, two-arm parallel-group randomized comparative design.She evaluates the effectiveness of two procedures, namely NT(neurodynamic technique) and CBMT (carpal bone mobilization technique), in conjunction with TGE (tendon gliding exercises) as a standard adjunct. The results of this study showed that each group had made significant progress over the course of the study. The NT group performed better than the CBMT group in terms of the severity of symptoms, functional status, and nerve conduction speed; the only exceptions to this were pain and grip strength. A visual analogue scale (VAS) was utilized in the evaluation of the primary outcome measures, which included the evaluation of pain intensity, functional status, grip strength, and motor nerve conduction study.[18]

The study shows that all the team members that attended traditional therapy were out of the training session after just one session.

This study is of great clinical relevance, since it adds another dimension to the management of cervical radiculopathy symptoms.

Conclusion

This study conclude the Upper Limb tension test does reduce the pain symptoms and improve the range of motion for the cervical spine.

Other factors could be the release of root cause pain. Pain relief plays an important role in reducing neck spasm that, when relieved, allows the Cervical spine to move freely

Limitations of the research.

Subjects with neuritis or radiculopathy of different nerve roots are included in the study. Another weakness would be the chosen sets of upper limb tension test. The base test tends to have a slight positive bias towards the median nerve.

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