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Case Study

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Impact of Cawthorne Cooksey Exercise and Strength Training on Gait and Balance Related Impairments in Multiple Sclerosis Patient: A Case Study

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Abstract

Background: Multiple sclerosis commonly develops between 20 to 40 years of age, however also seen in older populations. It is more common in females than in males. Fatigue, impaired coordination, pain, blurred vision, weakness in limbs are often the complaints.

Objective: A case study is to provide evidence of the feasibility, acceptance and benefits of Cawthorne Cooksey exercise and strength training in gait and balance related impairments of a multiple sclerosis patient.

Method: 58 years old multiple sclerosis patient was provided an individualised therapy for 3 weeks. Outcome measures included Tinetti Performance Oriented Mobility Assessment (Tinetti POMA) and Timed Up and Go (TUG).

Result: Findings demonstrated the effectiveness of the cawthorne cooksey exercise and strength training for use by multiple sclerosis patient with gait and balance impairments.

Conclusion: The Tinetti POMA Scale and TUG test scores suggested improved gait and balance. However the results were not clinically significant.

Keywords: Cawthorne cooksey exercise, strength training, multiple sclerosis

Introduction

Multiple sclerosis is a chronic neurodegenerative disease whose symptoms are only partially relieved by medication. Multiple sclerosis affects a wide range of neurological functions, including cognition, vision, muscle strength and tone, coordination and sensation. The many symptoms associated with multiple sclerosis cause mobility limitations, gait and balance disorders in later stages of the disease, and sometimes even in early stages of the disease in recently diagnosed people with multiple sclerosis who present with no clinical disability[1]. Multiple sclerosis have balance related impairments characterised by marked sway while walking and delayed responses

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to perturbations. Many people with multiple sclerosis fall frequently, fear falling, and risk of fall-related injuries is increased. Muscle weakness and fatigue are the main causes of reduced daily activity in such persons. Inactivity further compromises normal functioning of muscle, mobility, and thereby overall physical fitness. The cycle of reduced activity further contributes to increased disability, and reduced quality of life of multiple sclerosis patients. Disability due to this disease can impede activities of daily living and decrease quality of life, both for multiple sclerosis patients and for their care partners and families[2].

Balance is an integrated component of physical function, and a product of the task being done and the circumstances in which it is performed. The maintenance of upright posture or balance requires the involvement and joint functioning of multiple sensorimotor processes (visual, vestibular, proprioception) to generate well coordinated movements that maintain the centre of mass within the limits of stability[3].

Cawthorne Cooksey exercise is an exercise based program designed to reduce dizziness, gaze instability, imbalance and fall risk[4]. Such vestibular exercises help in new arrangements of peripheral sensorial information, allowing new vestibular stimulation patterns necessary for new experiences to become automatic. This practice of balance can help in improving reactions of balance and thereby reducing falls. They involve head, neck and eye movements, posture control exercises in different positions (seated, in two-leg and one-leg positions, walking), use of soft surface to reduce proprioceptive input, and exercises with closed eyes keeping out visual cues.

Strength training is known to promote neural adaptations such as increased motor unit activation and synchronisation of firing rates, which may decline with periods of inactivity. Neural adaptations gained through physical activity may have favourable functional outcomes in multiple sclerosis subjects, depending on multiple sclerosis lesion load and location. Moreover, improving strength in muscle capable of adaptation to overload stimuli may also help maintain or improve overall fitness and functional ability including ambulatory status[5].

Therefore, the purpose of this study is to assess the effectiveness of balance and gait training in multiple sclerosis patients. Increased knowledge about these training interventions will allow a better understanding and will help in providing better assistance.

Case Description

The patient was a 58 year old female, known case of multiple sclerosis since 4 years, not under medications for the same for almost 2 years. Patient complained difficulty maintaining balance while walking, leading to fear of falls. On the Tinetti POMA scale, the patient scored 24, indicating moderate fall risk and on the TUG scale, she took 10.1 seconds to finish the 3 metres walk. A comprehensive approach focusing on balance and gait was devised to address her condition. Cawthorne Cooksey exercises are special exercises that are known to treat the difficulties experienced with the balance impairment. The purpose of these exercises was to build up a tolerance mechanism and slowly the symptoms will disappear. Strengthening exercises was given in order to address the weakness in lower limbs. Regular adherence to the prescribed exercises, coupled with proper technique and posture awareness, were instrumental in achieving optimal outcomes for the patient.

Intervention

The patient attended the session for a total of 3 weeks, 5 days per week. Each session lasted about 45-60 minutes. The Cawthorne Cooksey exercise is an organised program designed specifically to improve balance and coordination gradually. At first, the patient is made to lie on the couch, asked to perform slow and then quick eye movements in various directions (up to down, side-to-side) followed by head movements in the same directions. As the exercise progresses, the patient is asked to go for sitting position and made to do activities like shrugging and circling their shoulders, reaching down to pick up objects from the floor, and even transitioning from sitting to standing, first with their eyes open, then closed.

The exercise done while standing challenged balance further; the exercise started with eye and head movements once again, then throwing a small

ball between hands at different heights, first at eye level and then under the knee. Next the program progressed to walking across the room with open and closed eyes, finally to walking up and down on inclines and stairs with eyes open.

Strength training included specific exercises to strengthen target muscle groups crucial for functional strength and stability. These exercises focused on large muscle groups like quadriceps (straight leg raises, squats), hamstrings (leg curls, marching, single leg bridging), calves (raises), gluteus maximus (leg raises, glute bridging, fire hydrants), and tibialis anterior (dorsiflexion against resistance).

These comprehensive approaches were used to address both balance and functional strength, which was essential for preventing falls and improving overall ambulation.

Outcome Measures

1. Tinetti Performance Oriented Mobility Assessment is a task oriented test that measures gait and balance abilities in older adults. Scoring: It is a three point ordinal scale. It ranges from 0 to 2 points, where 0 shows the highest level of impairment and 2 shows the individual's independence. Total test score is 28 points, out of which 16 is the total balance score and 12 is the total gait score[19].
2. Timed Up and Go test is a goal based test used to assess the mobility of an individual. It measures how quickly an individual can stand up, walk 10 feet, turn around, walk back, and sit down. The variable measured was the total time taken by the test, and then the score assigned in seconds was observed, which was correlated with the risk of falls. It is often done to evaluate mobility in older adults and predict their risk of falls in the neurological population[20].

Results

Table 1 Outcome Measures. Based on the scores, substantial improvements in Tinetti POMA Scale and TUG test scores following the 3 weeks intervention were observed. There was a 10.7% improvement in Tinetti POMA scale and a 18.8% improvement in TUG test.

Table 1. Change in the scores of condition specific outcome measure

Outcome Measures	Baseline	After 3 weeks
Tinetti POMA	24/28	27/28
TUG	10.1 seconds	8.2 seconds

In the Tinetti POMA scale, patient scored 24 in the first week, which progressed to 27 in the third week; ie, patient progressed from moderate fall risk to low fall risk.

In the TUG test, patient finished the test in 10.1 seconds in the first week, which she finished in 8.2 seconds in the third week. Patient has progressed from independent for main transfers to completely independent.

Discussion

The current study was performed with a goal of achieving improved balance and a more stable gait. The aim of the study was to find out the effectiveness of Cathrone Cooksey exercise and strength training on balance and gait impairment of multiple sclerosis patients. The pre and post assessments with different outcome measures showed improvement. Cawthorne Cooksey exercise and strength training were given for 1 session, 5 days a week for 3 weeks. The results have shown that Cawthorne Cooksey exercise and strength training were effective in treating multiple sclerosis patient with moderate impairment. The patient showed progress in three weeks outpatient rehabilitation. There was improvement in the patient's gait pattern and lower limb strength. More importantly, the patient was more confident to walk.

Post intervention Tinetti POMA score increased by 3 points which was clinically not significant (MCID for Tinetti POMA is 7 points)[19]. Similarly, the difference of 1.9seconds seen in TUG scores were not clinically significant (MCID for TUG is 2.1seconds)[20].

In this study, Cawthorne Cooksey exercise showed improved balance in multiple sclerosis patient. Similar study was done by Hosam Magdy Metwally Abd Alhamid et al (2019) about the effectiveness of Cawthorne Cooksey exercises on trunk kinetics and velocity of gait in patients with multiple sclerosis. They concluded that the vestibular

system contributes considerably to the stabilisation of body posture throughout locomotion, hence Cawthorne Cooksey exercises were considered a valuable method for treatment because these exercises reduce vertigo and restore balance[4]. Similarly, Fatemeh Feshki et al (2020) conducted a study on female patients with multiple sclerosis. She tested the effects of balance training and Cawthorne Cooksey exercises on static balance and mobility on 48 individuals. The research results concluded that performing Cawthorne Cooksey exercises improved static balance and mobility in patients with multiple sclerosis[6].

A study conducted by Gregory M Gutierrez et al on effectiveness of resistance training on gait kinematics in persons with multiple sclerosis. It was reported that resistance training in multiple sclerosis patients changed gait characteristics, which after the intervention closely resembled the patterns of normal healthy individuals. They found significant increase of stride time in the swing phase, step length, stride length, and foot angle, and significant reduction of stride time in the stance, duration of the double-support phase, and toe clearance from floor. These changes were more identical to normal gait patterns of subjects without known impairments. Finally, they concluded that resistance training is an effective intervention strategy for improving walking and functional ability in moderately disabled persons with multiple sclerosis[5].

But one main limitation of this approach is that, since the experiment was conducted on one subject with moderate disability, it is not known how it may affect individuals with severe functional limitations. Also, the duration of the study was limited to 3 weeks, long term effects are unknown.

Conclusion

Cawthorne Cooksey exercises and strength training were effective in improving gait and balance. However, the improvements were not clinically significant.

Ethical clearance: Ref no. AJEC/ REV/106/2024 AJ Institute of Medical Sciences & Research Centre, Mangalore

Source of funding: Self funding

Conflict of interest: None

Consent: Informed consent was taken from the participant in the study for the publication work. Participant was fully aware of the procedure that was carried out. The consent was read and signed by the participant.

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Case Study

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Combined Effect of Oro-Motor Stimulation and Aroma Therapy for Successful Feeding in Autism Spectrum Disorder: Case Report

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Abstract

In Autism Spectrum Disorder (ASD) children feeding problems can be categorized as behavioural feeding disorders including food refusal, choking, gagging, expulsion and sensory-based feeding problems such as textural aversions. The oral stimulation increases oral motor organization improve muscle contractility as a result increases oral intake. Sensory characteristics of food such as taste, texture and aroma have effects on food acceptance. We present a case of 3.3 year old male with ASD having feeding issues such as refusal to consume food and would spit when tried to feed him forcefully and accepting only liquids in small quantities as compared to earlier since 55 days. The outcome measure used was Sensory Profile (Dunn, 1999) and Pediatric Eating Assessment Tool (PediEAT). Combined oral motor stimulation and aroma therapy was provided to the child for developing successful feeding skill.

Conclusion: From the above pilot study it may be concluded that combination of oro-motor stimulation and aroma therapy is an effective intervention in decreasing oral sensory issues and thus improving feeding skills in children with ASD.

Key Words: Aroma Therapy, Autism Spectrum Disorder, Case Report.

Introduction

Autism Spectrum Disorder (ASD) children experiences difficulties related to communication, behaviour and feeding. Latest research has shown that approximately 62% (range: 30–84%) of children with ASD may present with feeding difficulties such as increased food selectivity, unhealthy eating habits and associated mealtime related behavioural problems in comparison with other neurotypically developing peers. [1]

In children with ASD most feeding problems may be categorized as behavioral feeding disorders

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(choking, gagging, and expulsion) and sensory-based feeding problems (textural aversions to specific kinds of foods, usually involving the refusal of foods with greater texture).[2]

Mealtime behavior and eating problems are usually not assessed unless a child exhibits failure to thrive, which might explain the lack of research on problem feeding behavior in children with ASD. However, although an increasing number of research studies are targeting children with ASD, research concerned with feeding problems for this population remains unclear.[3]

Furthermore, from the literature review it has been found that many treatment strategies are being used for the children with ASD having feeding problem such as (parent intervening and ignoring, meal preparation and adaptability, play and imagination, distractions, positive reinforcements, modeling);[4] (sensory behavioral intervention, family focused intervention, modified sequential oral sensory sequenced treatment [M-SOS], multicomponent treatment [which included different techniques to address food selectivity such as sensory integration, systematic desensitization, behavior modification, positive reinforcement and escape extension], EAT-UP, BUFFET).[5]

It is a fact that the physiology of oropharyngeal mechanism is essential for developing feeding functions. The physiology of oropharyngeal mechanism depends on planned and coordinated movements of oro motor musculature such as muscle of cheek, lip, jaw, upper-lower gum, internal cheek, tongue, and soft palate.[6] It is also known that Oral motor stimulation (OMS) is the prerequisite for developing oromotor movements as it increases oral motor organization, improve muscle contractility as a result of which increases oral intake. Oral stimulation is used as an effective treatment strategy to enhance oral feeding of preterm infants with feeding problems.[7] There is inconsistent evidence of oral motor stimulation to be used for feeding problem in ASD children.

Literature has often focused upon sensory characteristics of food such as taste, texture, aroma, and appearance have distinct and influential effects on food acceptability. The sensory cues based on food aroma is extremely critical before, during and after eating. Food aroma forms a crucial sensory signal and a fundamental component of flavor perception and thus it shapes the way people experience taste and texture.[8]However, insufficient information is available on the use of food aroma for feeding issues in children with ASD.

Therefore, the rationale of this study is to find out combined effect of oro-motor stimulation and aroma therapy for successful feeding in autism spectrum disorder children.

1. Patient information **-** The child is a 3.3 year old Indian male diagnosed as ASD reported to the department of Occupational Therapy, Swami Vivekan and National Institute for Rehabilitation Training and Research, Cuttack with a chief complaint of refusal to consume food and would spit when tried to feed him forcefully and accepting only liquid in small quantities. This child was taken as a case study to find out the Combined Effect of Oro-Motor Stimulation and Aroma Therapy for Successful Feeding in Autism Spectrum Disorder. Informed consent was taken from parents of the child prior to intervention.
2. Clinical Findings –The raw score of oral sensory processing of sensory profile (Dunn, 1999) was completed and result showed that the child was having definite difference more than others and in tactile processing it was probable difference more than others. We also used Pediatric Eating Assessment Tool (PediEAT), to find out the feeding dysfunction the total score showed that the child is falling in high concern of feeding dysfunction.
3. Therapeutic Intervention – The child received a total of 60 sessions of intervention comprising of 45 minutes in an average of 5 days a week for across 17 weeks of oro motor stimulation, aroma therapy and behavior modification technique. Below are the detailed protocols of the study.

Sl. No.	No. of Sessions	Therapeutic Intervention	Child's Response
1.	First to ninth sessions	Child was exposed using various taste sensation likes a lt and sweet in liquid form.	Child was found to be uncooperative with both the taste showing temper tantrum which included hitting, biting, screaming and crying when exposed over the cheeks and lips.
2.	Tenth session onwards	Child was exposed using various taste sensation like salt and sweet in liquid form.	Child showed better adequate behaviours towards the application of the sweeter liquid i.e., honey. It was noted that he tried to lick and taste honey from the lips, thereafter we decided to put honey inside the mouth.
3.	During the 13th session.	Honey was being applied to the cheeks and the lips.	The child was pointing his finger towards his mouth, while still refusing any other taste or type of food. Child was positively reinforced.
4.	By the end of 20th session.	We explored with thicker liquids such as myonese and tomato ketch-up.	Initial few sessions with the thicker liquid similar temper tantrums was noted as discussed above.
5.	Around 29th sessions onwards.	Through, extensive trial an error of mixing the thicker liquids with various essence of (vanilla, chocolate, green apple, honey, strawberry).	We found the child to be cooperative and interested in the myonese with vanilla essence combination. Child was positively reinforced.
6.	Towards the 30th session.	We shifted to granular solids such as semolina. The viscosity of the semolina was reduced by adding 90% honey with vanilla essence, this mixture was applied through a vibratory spoon.	Accordingly it was dealt with inappropriate behaviours.
7.	From 39th session onwards.	We slowly increased the amount (20%) of semolina in the mixture after every seven consecutive sessions respectively. While adding different kinds of oral motor stimulation intervention.	Accordingly it was dealt with inappropriate behaviours.
8.	With the advent of the 50th sessions.	We gradually increased the thickness of the semolina mixture by adding "Sattu" regional delicacy prepared by mixing finely powdered almond, flat rice, cashew and walnut). One serving of semolina mix with two spoon of "Sattu" and a few drops of vanilla essence were given with vibratory spoon to the child.	Interestingly, this time the child gave positive feedback for this mixture during the feeding session. Child was positively reinforced.

9.	On 53rdsession.	Home cooked food (carrot, potato, rice) all smashed together with vanilla essence along with vibratory spoon was given.	Child responded positively.
10.	During the 57th session.	We fed the child with home cooked food without essence and vibratory spoon,	No inappropriate behaviour was noted during the session.
11.	Around 60th session.	Home cooked food was served.	Independent and social eating behaviour with peer was noted and similar likewise was reported by the parents during home feeding sessions.

Follow-up and Outcomes - At the end of 60th session sensory profile (Dunn, 1999) and PediEAT was again administered and it was found that the raw score of oral sensory and tactile processing suggests typical performance. The PediEAT subscale total score was suggestive of no concern.

Table 1: Shows pre and post scores of Sensory Profile (Dunn, 1999) and PediEAT.

Scales	Domains	Pre Score	Interpretation	Post Score	Interpretation
Sensory Profile	Oral Sensory Processing	27	Definite difference (more than others)	55	Typical Performance
	Tactile Processing	69	Probable difference (more than others)	75	Typical Performance
PediEAT	Total	212	High concern	49	No concern

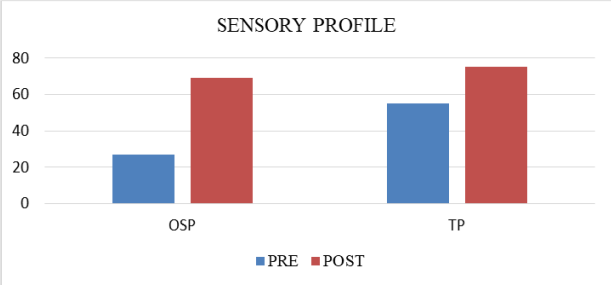

Figure 1: Graphical representation of Sensory Profile (Dunn, 1999)

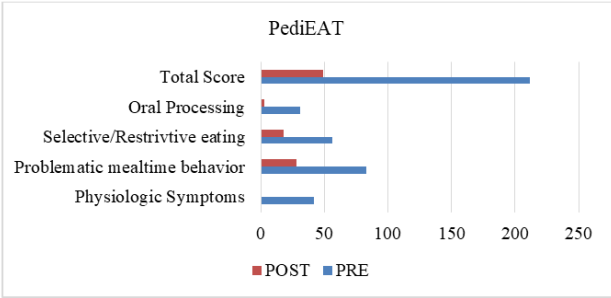

Figure 2: Graphical representation of PediEAT.

Discussion

The aroma of the food serves as a crucial sensory signal being a fundamental component of flavour perception, it shapes the child's experience taste and texture. This aroma provides an olfactory signal of edible (favorite) or inedible (non-favorite) products before the visual input of the same. The fragrance of the food stimulate salivation and enhances secretion of digestive enzyme increasing hunger and appetite. With these effects there is increase of the food products acceptability by the individual which is specifically signaled through odour. Food aromas direct the attention towards the food sources via, priming implicit memories and arouses anticipation of energy or the nutrients associated with its consumption. Retro-nasal aroma exposure has a consistent effect on the satiation and food acceptability.[8]Early oral motor interventions have been found beneficial in oral feeding of pre term infants. Recent researches displays the effectiveness of oral motor stimulation technique which accelerates the transition from tube to oral feeding in pre term infants.[9]From the above

pilot study it may be concluded that combination of oro-motor stimulation and aroma therapy is an effective intervention in decreasing oral sensory issues and thus improving feeding skills in children with Autism Spectrum Disorder.

Parent's perspective – the feeding intervention which was given to my child was very unique. Child has now stopped shouting, crying, hitting or spitting of food whenever placed in mouth. Issues such as rubbing of faces when food was in and around the mouth has decreased. Earlier the child was only preferring liquids now the child is consuming all kind and type of food. Formerly, child was very selective while eating now the child is being fed in all context.

Informed Consent – written informed consent were taken from the parents prior to the study of this case report.

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Declaration of conflicts of interest statement: NA

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Case Study

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Effect of Core Stability Exercise and Treadmill Training on Balance in a Patient with Cerebellar Ataxic Cerebral Palsy: A Case Report

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Abstract

Cerebral palsy (CP) is defined as a set of developmental illnesses that affect posture and mobility, causing activity restriction owing to abnormalities that are not progressive in the developing brain of the foetus or neonate. Children with cerebellar ataxic cerebral palsy often exhibit undeveloped or malformed cerebellar structures, resulting in challenges for the cerebellum to integrate the neural input required to control movement and balance smoothly. Patients with cerebellar ataxic cerebral palsy have difficulty in maintaining balance and trunk control which leads to difficulty in performing their activities of daily living and result in dependency. Thus, reporting cases like these is crucial to evaluate the impact of core stabilization intervention and treadmill walking on balance in a child having cerebellar ataxic cerebral palsy. A 7-year-old female child born at full term delivered via normal vaginal delivery with a birth weight of 2700 gm had no difficulties during antenatal, natal or postnatal phases. At the age of 6 years, mother noticed that the child had difficulty in standing and walking independently, she had difficulty in performing her activities of daily living independently. The patient underwent an 8 weeks intervention consisting of core stabilization exercise protocol and treadmill walking along with traditional physiotherapy intervention. The outcome measures included Paediatric Balance Scale for static balance and My Fitness Trainer (MFT)for dynamic balance. The patient showed significant improvement in both static as well as dynamic balance following the intervention. Thus, combined impact of core stabilization exercise protocol and treadmill walking can bring early effective changes on balance in a patient with cerebellar ataxic cerebral palsy.

Keywords: cerebellar ataxic cerebral palsy, core stability, treadmill training, balance, physiotherapy

Introduction

The term "cerebral palsy" (CP) refers to a set of developmental illnesses that affect posture and mobility, causing activity restriction owing to abnormalities that are not progressive in the developing brain of the fetus or neonate[1]. The motor impairment in CP is multifactorial, and it includes problems such as spasticity, dystonia, muscle contractures, bony deformities, coordination

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problems, loss of selective motor control, and muscle weakness[2].

In India, the total prevalence of cerebral palsy among 1000 children examined was 2.95 [95% CI 2.03-3.88]. Examination of different populations, including rural, urban, and mixed rural-urban, indicated prevalence rates of 1.83 [95% CI 0.41-3.25], 2.29 [95% CI 1.43-3.16], and 4.37 [95% CI 2.24-6.51], respectively[3].

Children with cerebellar ataxic CP often exhibit undeveloped or malformed cerebellar structures, resulting in challenges for the cerebellum to integrate the neural input required to control movement and balance smoothly[4]. Individuals having been diagnosed with cerebellar ataxic cerebral palsy exhibit cognitive deficits rather than contractures[5]. Additionally, they demonstrate deficiencies in coordination, balance, and fine motor skills. They exhibit central and peripheral instabilities, generalized muscle weakness, they also have poor coordination, poor balance, fine motor difficulties, axial and appendicular ataxia with inaccuracy of movement amplitude[6]. Children diagnosed with ataxic cerebral palsy have an unsteady stride, inadequate trunk stability, a broad stance while upright, swaying and stopping while walking, and possibly even taking backward steps to prevent falling[7]. They have reduced postural control because of inadequate equilibrium, defensive reactions, and an imbalance between agonist and antagonist muscles[8]. These children experience compromised trunk control due to diminished strength in abdominal and dorsal muscles which correlates with functional mobility[9].

Core stabilization exercises enhance the strength of muscles located in the abdomen, back, pelvis, and shoulders, facilitating the maintenance of trunk stability and control during both static and dynamic movements[10]. The muscles of the core stability area can be compared to a box, with the diaphragm serving as the roof, the pelvic girdle as the floor, the muscles of the spine and the gluteal region as the anterior and posterior sections, respectively[11]. The core stability training aims to improve the endurance and coordination of these core stability muscles as well as attain the best possible physical ability to preserve the spine's natural state throughout daily activities[12]. Children with ataxic CP benefit from core stability training in terms of standing and walking abilities, endurance, and balance.

Treadmill exercises elicit the dynamic, motion-oriented, and temporal dimensions of gait. It enhances the strength of the muscles in the lower limbs, promotes motor skill development, enhances functional capabilities, and triggers the mechanisms of neuromuscular regulation[13]. Consistent participation in treadmill programs yields comparable advantages, enhancing lower limb muscle strength, balance, and walking proficiency. This enhancement contributes to the amelioration of the dynamic aspect of balance.

There has been literature present on static balance but limited literature was available on dynamic balance whereas in the patients of cerebellar ataxic cerebral palsy dynamic component of balance is also equally affected. Therefore, there was a strong need to determine the effects of core stability exercise with treadmill training on static as well as dynamic components of balance in a patient with cerebellar ataxic cerebral palsy

Methodology

Case Presentation

We describe a case concerning a seven-year-old female child exhibiting a range of developmental abnormalities. The primary considerations regarding the child include functional deficits, coordination issues, involuntary movements and speech dysfluency. The mother has a documented history of miscarriage attributed to excessive workload during the initial first trimester. This patient was born at term following an uncomplicated gestation period of 9 months 7 days delivered vaginally with vertex presentation. Postnatally, the infant weighed 2700 grams and exhibited no delay in initiating a cry at birth, with no requiring neonatal intensive care unit (NICU) admission. The patient demonstrates a kyphotic posture during independent sitting, characterized by protracted shoulders and weight-bearing predominantly on the sacral bone rather than the ischial tuberosities. The patient employs their hands positioned beside them to stabilize and widen their base of support.

Additionally, the patient exhibited altered anthropometric measurements according to the

World Health Organization (WHO) guidelines. In the current assessment, the child exhibits a reduced head circumference of 53 cm, a stature of 103 cm, a mass of 16 kg, and a corresponding body mass index (BMI) of 13.7 kg/m², positioning her at the 50th percentile. Patient presented with involuntary movements in upper extremities while performing any task (intention tremors), titubation and squint present at left eye (esotropia) these symptoms were first noticed by the mother when the child was 3 years old. Maternal apprehensions regarding the child at this age pertain to deficits in functional activities (standing, walking, climbing stairs), performing activities of daily living (ADL's), maintaining balance and coordination and speech fluency.

Motor Milestones were delayed comparing normative time frames as shown in (Table 1) and Clinical Examination presented in (Table 2)

Regarding cerebellar ataxic cerebral palsy, patient had difficulty in maintaining balance and co-ordinations while performing any movement, when ambulated with support the patient had an ataxic gait pattern. The patient remains reliant on transfers, dressing-undressing, toileting, bathing and continues to be dependent on the caregiver.

Table 1: History of Developmental Milestones

Type	Milestone	Achieving age
Gross motor	Neck holding	6 months
	Rolling	7 months
	Crawling	14 months
	Sitting with support	12 months
	Sitting independently	5 years
	Standing with support	5 years
	Standing independently	Not yet achieved
Fine motor	Midline bilateral activities	5 months
	Grasping rattle	10 months
	Releasing rattle/object	12 months
	Manipulating toys	13 months
	Grasping cubes	15 months
	Grasping pencil/crayon	2.5 years
	Buttoning and unbuttoning	Not yet achieved
Social	Social smile	3 months
	Recognizing mother	4 months
	Smiles at mirror image	8 months
	Waves bye-bye	12 months
	Recognizes gender/ full name	6 years
	Goes to toilet alone	Not yet achieved
Language	Alerts to sound	2 months
	babbling	5 months
	Laughs loud	5 months
	Monosyllable	4 years
	Bisyllable	5 years
	1 to 2 words with meaning	5.5 years
	8 to 10 words with meaning	6 years
	Simple sentence	7 years
	Asks Questions	Not yet achieved

Table 2: Clinical Examination of the patient.

EXAMINATION	EXTREMITY	RIGHT SIDE	LEFT SIDE
Tone	Upper extremity	Normal	Normal
	Lower extremity	Normal	Normal
Reflexes	Upper limb	+2	+2
	Lower Limb	+1	+1
	Babinski	Positive	Positive
Range of Motion	Upper extremity	Complete actively	Complete actively
	Lower extremity	Complete actively	Complete actively
Manual Muscle Testing	Upper extremity	3/5	3/5
	Lower Extremity	3/5	3/5
	Upper and Lower Abdominals	2/5	2/5
	Lumbar extensors	3/5	3/5

PHYSIOTHERAPY INTERVENTION

The child was given Traditional physiotherapy intervention (TPI) (Table 3) for 30 minutes with Core stability intervention (CSI)[11] (Table 4) for 20 minutes and treadmill training for 10 minutes. The treadmill training regimen involved the patient walking on a treadmill at a pace set to more than the usual walking speed, for a 10-minute session with low-intensity walking and no inclination. The total treatment time being 1 hour with a gap of 5 mins within each protocol prescription for 8 weeks.

Table 3: Traditional Physiotherapy Intervention

PROBLEM LIST	PROBABLE CAUSE	GOAL FRAMED	PHYSIOTHERAPY INTERVENTION	VOLUME AND INTENSITY OF THE EXERCISE
Difficulty in standing independently	Reduced trunk control	Gain trunk control and independent transition	Sit to stand facilitation on a high stool progress to single leg sit to stand with multidirectional reach outs given in standing.	5 repetitions each set, 2 sets.
			Progress it to a low seated stool sit to stand facilitation.	5 repetitions each set, 2 sets.
Standing transitions	Reduced postural control and inactive base of support	Improve postural control and train into standing with activation of base	Standing training with a table in front for engaging the child in hand activities while therapist provides support at pelvis and knees.	5 mins standing, 2 mins relaxation, twice.
			Progress with narrow base of support with minimal support .	5 mins standing, 2 mins relaxation, twice.
			Task oriented activities are given to acquire weight shifts.	5 mins standing, 2 mins relaxation, twice.

Continue....

Walking transitions	Reduced balance	Improve balance	Stride standing (forward and backward stepping) while performing tasks to encourage weight shifts.	10 repetitions with 2 secs hold.
			Progressing to tandem standing	3 mins, 2 repetitions.
Difficulty walking independently	Inadequate trunk control and weakness in bilateral lower limbs	Gait training with minimal assistance	Walking in a parallel bar in forward, backward and sideways direction over the footprints while the therapist provided minimal support on the pelvis.	3 repetitions each.
			Progressing to walking with minimal/ no support.	3 repetitions each.
Difficulty in climbing stairs	Inadequate trunk control	Gain ground clearance and improve strength of lower limb muscles	Step up and down facilitation with stepper and support with railings.	10 repetitions each set, 2 sets.

Table 4: Core stability exercise program[11]

Week	**Form of Exercise**	**The Volume and Intensity of Exercise**
Week 1 and 2	Contracting abdominal muscles while lying in a supine position.	Three sets and 20 repetitions in each set.
	Contracting abdominal muscles while lying in a prone position.	Three sets and 20 repetitions in each set.
	Contracting abdominal muscles while lying in a squat position.	Three sets and 20 repetitions in each set.
Week 3	Contracting abdominal muscles while lying in a supine position with one leg stretched and the other bent at the knee and pressed against the abdomen.	Three sets and 20 repetitions in each set.
	Contracting abdominal muscles while lying in a prone position with one leg stretched and the body weight on the other leg which is bent at the knee.	Three sets and 20 repetitions in each set.
	Side lying bridge for each side of the body.	Six repetitions, a 10-s pause.
Week 4	Contracting abdominal muscles while lying in a supine position and pulling the limbs upward with arms and legs kept close.	Three sets and 20 repetitions in each set.
	In a squat position, one leg is raised and pulled outward and backward.	Three sets for each leg and 20 repetitions in each set.
	Trunk rotation while holding weights in each hand.	Three sets each part of the body and 20 repetitions in each set.

Week 5	Sitting on a Swiss ball and holding the abdomen in.	Three sets, 10 s.
	Squatting while the Swiss ball is on the shoulder.	Three sets and 15 repetitions for each set.
	Bringing up the arms and legs simultaneously in the prone position.	Three sets and 15 repetitions for each set.
Week 6	Bending 45 to the left or right.	Three sets for each side, 12 repetitions in each set.
	Bridging while shoulders and hands are on the floor and one leg is raised.	Three sets for each leg, 15 repetitions in each set.
	Contracting abdominal muscles while lying in a supine position on the Swiss ball.	Three sets, 12 repetitions in each set.
Week 7	Lying supine on the Swiss ball and rotating the trunk to the sides.	Three sets and 15 repetitions for each set.
	Doing the above exercise while holding weights in patient hands.	Three sets and 15 repetitions for each set.
	Side lying bridge with bringing up the leg.	Six repetitions for each side of the body and a 10-s pause.
Week 8	Lying supine on the Swiss ball and holding the abdomen in and bringing one leg up.	Three sets, 12 repetitions in each set.
	Raising the opposite arm and leg while squatting.	Three sets, 12 repetitions in each set.
	Bridge so that the feet are placed on the Swiss ball and raise one leg.	Three sets and a 15-s pause for each set.

OUTCOME MEASURES:

Used to assess Static and Dynamic Balance

1. Pediatric Balance Scale (PBS) (r= 0.86-0.98)[14].
2. My Fitness Trainer (MFT) Balance board[15].

Results

Outcome measures were evaluated following eight weeks of treatment. Table 5 presents a summary of the scale results obtained upon completion of the treatment period.

Table 5: Assessment of pre and post scores for outcome measures (PBS: Pediatric Balance Scale)

Outcome measure	Before treatment	After treatment
PBS	10	16
Balance System (Lateral component)	3.6 (Disproportionate stability)	3.0 (Improvable stability)
Balance System (forward and backward component)	4.5 (Bad stability)	3.8 (Disproportionate stability)

Interpretation: The child's static balance showed 60% improvement post treatment in Pediatric Balance Scale. Dynamic balance improvement in My Fitness Trainer (MFT) for lateral component was seen at 78% and for forward and backward component it was 80% compared to pre-assessment.

Discussion

This study reveals enthralling data that should be carefully considered and interpreted. The incorporation of traditional physiotherapy intervention protocol with core stability protocol and treadmill training appears to yield a positive effect

on balance and trunk control targeting the specific challenges individuals face with cerebellar ataxic cerebral palsy who experience deficits in function, balance and coordination. The specific tailored interventions emphasize the specific needs of the individuals with cerebellar ataxic cerebral palsy in achieving the therapeutic goals effectively.

By incorporating traditional physiotherapy protocol with core stability protocol and treadmill training, the study accentuates the probable advantages of concurrently improving static and dynamic aspects of balance. These results have the potential to provide valuable guidance to clinicians and therapists who specialize in this population, facilitating the development of more comprehensive and customized interventions.

The physiotherapy intervention presented in this research is a comprehensive approach to address cerebellar ataxic cerebral palsy in a seven-year-old patient exhibiting certain developmental abnormalities. All these interventions were customized to address particular components of the child's condition, with the goal of enhancing their overall static and dynamic balance. The Traditional physiotherapy intervention(TPI) could evoke the optimal lumbar-pelvic-hip chain mobility, good acceleration and deceleration, proper muscle balance and proximal stability, and corrects the postural alignments. In this study there was improvement seen in the pediatric balance score supported by the study of Ghaeeni et al. who evaluated the improvement of static balance in children with Down Syndrome by core stability exercise training. The Core stability intervention(CSI) enhances the ability to balance with progressive resistance training similar to weight-bearing exercises. This resulted in enhanced balance through the augmentation of muscle strength[11]. These exercises resulted in tonic activation of deep multifidus and other trunk muscles that have a greater percentage of type I (slow twitch) muscle fibers. In another study it suggests that core stabilization exercises could increase the body's proprioception, resulting in improved balance[10].

The treadmill training regimen involved the patient walking on a treadmill at a pace set to more than the usual walking speed, for a 10-minute session with low-intensity walking and no inclination helped in significantly improving the strength of lower extremity muscles, dynamic balance, and gait. In past literature with 6 months of treadmill training, evaluations revealed elevated mean peak torque, enhanced hamstring and quadriceps muscular strength, and improved dynamic balancing traits[16]. Treadmill training is proven to be beneficial for infants with Down Syndrome as a complement to regular physical therapy treatment approaches which can help in minimizing the delay in the initiation to walk. A higher step rate was obtained by increasing the intensity of treadmill training[17].

Pediatric physiotherapists play a crucial role in delivering essential services to children, leveraging their comprehensive understanding of early childhood development, physiological systems, and normative growth trajectories. Similarly, this tailored protocol had a positive impact on the static and dynamic aspects of the balance within 8 weeks of a protocol in a patient with cerebellar ataxic cerebral palsy.

Conclusion

In conclusion, this case report presents an inclusive intervention approach for individuals affected by cerebellar ataxic cerebral palsy, addressing both functional impairments and balance issues. Integration of traditional physiotherapy with core stability exercises and treadmill training yielded enhancements in both static and dynamic balance, emphasizing the efficacy of combining diverse physical therapy modalities. The significance of individualized treatment plans is highlighted, particularly for individuals with specific needs with cerebellar ataxic cerebral palsy, underscoring the imperative for personalized therapeutic interventions.

With the findings being promising, it is important to recognize the limitations of the study as it is a case study which can restrict the generalizability. Further investigation utilizing diverse samples and controlled designs is necessary to confirm and build upon initial findings.

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Case Study

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Physical Therapy in a Patient with Viral -encephalitis Hemi-Paresis: A Case Report

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Abstract

The purpose of the rehabilitation program is to improve motor skills, coordination, sensory system, mobilization and other existing disorders to achieve activity of daily living (ADL). For a span of five months, beginning two months ago, the patient had been incapable of independent mobilization. Throughout this duration, he was confined to a bed and wheelchair, necessitating assistance from family members for movement, who would lift or carry him as necessary. Physical therapy as part of the multidisciplinary approach can provide core stability exercises, muscular facilitation and stimulation of motion of the upper and lower extremities, balance exercises and mobility exercises, as well as strengthening exercises with PNF facilitation and active stimulation techniques and using the patient's body weight as a training burden. Bobath approach and facilitation exercise can reduce spasticity by strengthening the antagonist muscles. This case report concludes that although physiotherapy is done late with strengthening exercise and core stability strengthening techniques, prone strengthening exercise, it can improve motor skills, coordination, which in turn will increase the patient's independence in carrying out functional activities and ADLs.

Keywords- ADL, MMT, PNF MOTOR SKILL, COORDINATION, MOTOR & SENSORY, SENSORY INTEGRATION,

Introduction

Young people are more prone to developing viral encephalitis than the elderly. About 70% of diagnosed cases are viral, but the cause of many cases remains unknown despite extensive research. This condition affects 3.5 to 7.5 people per 100,000 and is most common among young and elderly people. It remains a major cause of acute neurological disability and long-term disability, particularly in children.[1]

The respiratory system falls prey to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), wreaking havoc globally. Recent statistics from the World Health Organization reveal staggering figures: more than 550 million individuals infected and over 6 million fatalities worldwide. Amid this devastation, it's crucial to recognize the indirect neurological impacts of the virus, ranging from long COVID symptoms to neurological

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complications like strokes and encephalitis. As the pandemic persists, understanding and addressing these neurological implications becomes increasingly imperative, highlighting the interconnectedness of respiratory and neurological health and the necessity for comprehensive approaches to combatting the multifaceted challenges posed by SARS-CoV-2. As the COVID-19 pandemic is still going strong, and there's increasing evidence that the virus can potentially have neurotropic and neuro-invasive effects on the central nervous system.

In addition to gastrointestinal, respiratory, and systemic symptoms, neurological manifestations of COVID-19, such as headache, taste dysfunction, smell dysfunction, and seizures, are becoming more widely recognized in these patients. According to published data, encephalitis is one of the neurologic manifestations of COVID-19 that kills the most people, including adults and children.[2]

An inflammation of the brain parenchyma known as encephalitis can have major neurological malfunction, which is primarily brought on by viruses and is marked by symptoms like confusion, altered or decreased consciousness, fever, headaches, and seizures, as well as mobility disorders.[2]

While neurological complications of SARS-CoV-2 infection are relatively uncommon, their potential long-term impact is significant given the widespread infection rates. COVID-19 is now recognized in the differential diagnosis of several neurological syndromes, necessitating thorough understanding of their underlying pathophysiology for timely management.[3]

Although evidence supports neuro virulence, the virus's neuro invasive and neurotropic capacities appear limited, with immune and vascular mechanisms predominantly implicated in complications. Long COVID, including neuropsychiatric symptoms, presents in a notable proportion of patients, yet its mechanisms remain elusive. Long-term consequences, especially neurodegeneration, will only become apparent through sustained follow-up and research.[3]

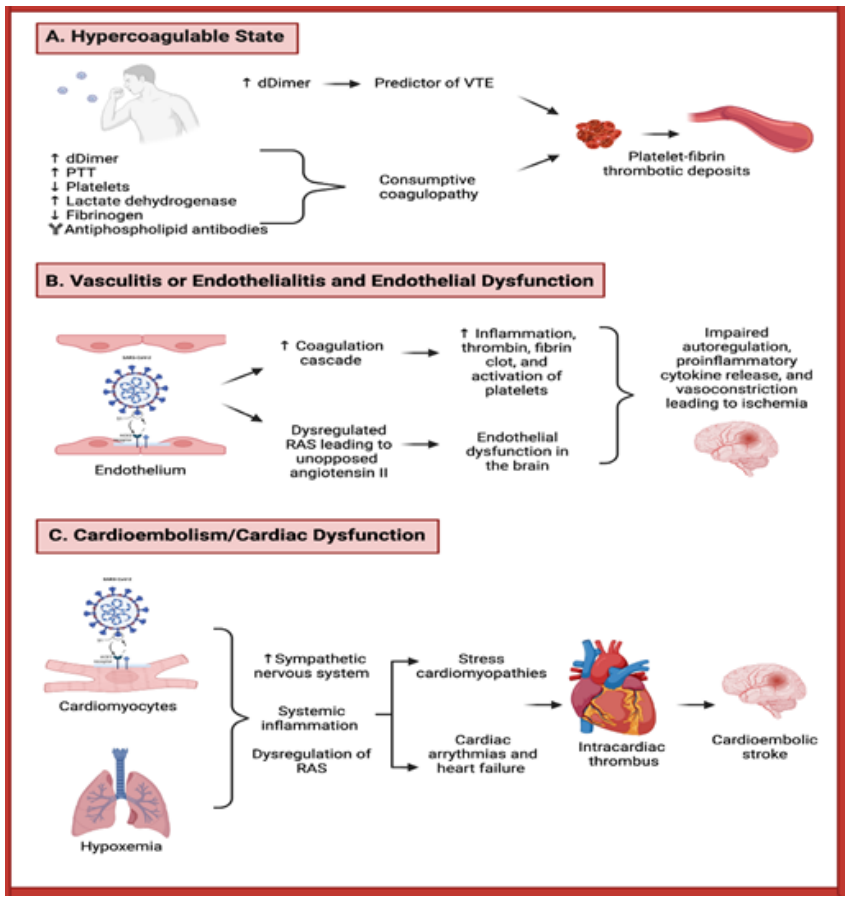

Figure 1: 'Underlying pathophysiology of various neurological syndromes.
Source- Rachel L Brown, et. al[3]

Case Report

A 28-year-old male patient was diagnosed with viral encephalitis five months ago. When he developed a cold, cough, and fever due to COVID-19, he experienced a lower respiratory rate, underwent ventilation, was incubated at home, catheterized, and underwent tracheostomy at the hospital. He also experienced weakness throughout his body, fever of 105°C, and a pressure sore in the sacral area after being treated at the hospital for one month. After treatment, the patient did not routinely undergo physical therapy due to his psychological instability and tendency to experience sadness and pain in the gluteal area following the debridement surgery. Due to the need for continued dressing and cleaning of the pressure sore, the patient lay down more frequently.

Figure 2: Pressure sores in the sacral area, also known as sacral pressure ulcers, result from Pressure sores in the sacral area. Pressure on the skin and underlying tissues in the lower back region.

Till two months ago, the patient was unable to mobilize independently for a period of five months. During this time, his activities were confined to a bed and wheelchair, and he relied on family assistance to move, being lifted or carried as needed. Both lower limbs were too weak for the patient to stand and walk, and spasticity and tremors were common, especially when changing positions from supine to side lying or bending the knees. The patient's left arm could move actively, while the right arm was slightly weak, and the fingers of the right hand were difficult to move actively, although they could still be moved with the help of others.

Figure 3: Active range of motion exercise sessions are conducted with support and rehabilitation to enhance muscle strength and joint flexibility.

The patient's consciousness was compos mentis, blood pressure was 100/70 mmHg, pulse rate was 86x/minute, respiratory rate was 25x/minute. MMT right upper extremity 1/5, left upper extremity 4/5, right lower extremity 1/5, and left lower extremity 3/5. Ashworth scale right upper extremity 3/4, right lower extremity 3/4, left lower extremity 1/4 left upper extremity 1/4. Clonus occurs mainly in the lower right extremity both upper and lower extremity VAS scale 10/10

Initiating movement facilitation and adjusting the patient's position initially. Trunk impairment scale 5/23 and Barthel index 20/100. Scores of 0-20 indicate "total" dependency. Mini Mental Status Examination, rating 0-17 this is an inadequate way of testing whether the MMSE can provide a meaningful measure of change when used longitudinally in a therapeutic setting.

Anthropometric examination showed differences in the circumference of lower extremities, namely

the right patella circumference 20 cm-22 cm left, right upper leg 20 cm-left 25 cm, and left lower leg 20 cm-22 cm. Sensory examination showed complete sensory loss, sensory system and ascending pathways aids comprehension of clinical conditions. Listed conditions relate to sensory system for better understanding.[8]

Material and Methodology

All parameters were recorded in the pre, post intervention program. (Table-1)

Table 1: Assesment Result

Assessment type	Pre intervention	Post intervention
MMT	right upper extremity 1/5 left upper extremity 4/5, right lower extremity 1/5 left lower extremity 3/5	right upper extremity 3/5 left upper extremity 4/5, right lower extremity 4/5 left lower extremity 3/5
Functional abilities	Sitting balanced±10- 15 min	Standing with support on the pelvis and knees ± 5 min
TIS	06/23	13/23
Ashworth scale	right upper extremity ¾ right lower extremity ¾ left lower extremity 3/4 left upper extremity 3/4	right upper extremity 1/4 right lower extremity 2/4 left lower extremity 2/4 left lower extremity 2/4
FIM	50/100	67/100
Barthal index	20/100	52/10

The physical therapy rehabilitation provided consists of a series of exercises starting from relaxation and muscle facilitation in the lower leg area with the Bobath method to reduce spasticity and stimulate movement of the lower and upper extremities it improve motor performance.[12] Stretching of both upper and lower extremity. Stimulation of trunk muscles to improve core stabilization by activating trunk muscles, sit up and posture correction sitting and standing, proprioceptiveneuromuscular facilitation improve (rhythmic initiation, D1 flexion, extension) coordination. In addition to facilitation and sensory integration, these approaches significantly enhance social skills, adaptive behaviour, and sensory processing function.[10]offering promising avenues for holistic intervention in diverse neurodevelopmental disorders, gradual mobilization exercises are also carried out from both right and left rotation, sleeping to sitting, sitting to standing and standing independently.

Until now, a routine physiotherapy program has been carried out for 6 months with a frequency of 6day/week and a duration of 45-60 minutes of home exercise/training session. In addition, the patient family member is given a home education program to sit without leaning for a minimum of four hours per day, and wear a hand splint for the right wrist also use donut pillow to prevent bed sore.

Finding

After six months, informed consent was taken from the patient and evaluation was carried out with changes in the assessment results as follows (Table 2): blood pressure 110/70 mmHg, pulse frequency 76x/minute, respiratory rate 20x/ minute. MMT right upper extremity 3/5, left upper extremity 4/5, right lower extremity 2/5, and left lower extremity 3/5... Ashworth scale right upper extremity 1/4, right lower extremity 2/4, and left lower extremity 1/4. Clonus is reduced, the patient can stand with maximum support without clonus for 10 minutes. Trunk impairment scale 12/23 and Barthel index 65/100. Anthropometric examination showed differences in the circumference of the lower extremities mobilize the patient to a sitting position with minimal assistance.

Table 2: Physical therapy program.

Variables	DURATION 16 weeks of training sessions
Intensity	45-90 minutes per session
TYPE	Spasticity treatment: Stretching, it stimulates actin and myosin and muscle belly and strengthening agonist muscle Strengthening exercises: Lower extremity and upper extremity with passive range of motion, assisted Gradual mobilization exercises: Rolling right and left, prone exercise, lying down to sit exercise, balanced sitting exercise, sitting to standing exercise, balanced standing exercise Core muscle strengthening: Sit ups, push ups Use of hand splint. Sensory integration, proprioceptive neuromuscular facilitation, Gait training, standing with or without support.
	Use of hand splint

Figure 4: Patient achieve improved comfort and prevention of bedsores in the sitting position with the Donut pillow.

Figure 5: The patient can walk with assistance but has not achieved independent walking yet.

Figure 6: Patient is able to engage in walking activities with support but has not yet attained the ability to walk without assistance.

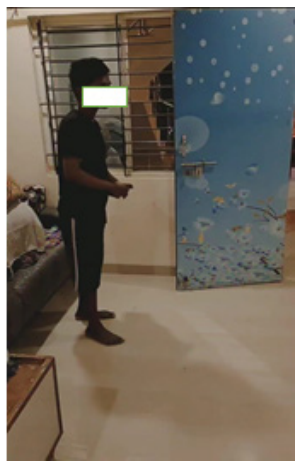

Figure 7: Patient has achieved the ability to walk and participate in activities independently, without the need for any assistance or support.

Figure 8: Significant milestone is achieved a comprehensive rehabilitation program, patient isable to walk independently without requiring any support or assistance.

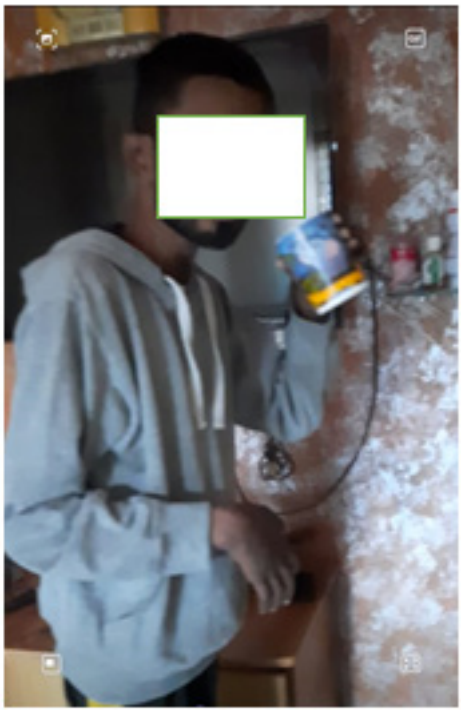

Figure 9: Undergoing physiotherapeutic neuro-rehabilitation, patient is able to regain the ability to walk independently without requiring any support or assistance.

Examination

Before commencing the examination, the informed consent was obtained, following which a thorough examination was conducted. During the examination, he was hemodynamically stable. Physically, the patient presented an ectomorphic physique. On auscultation, the chest was bilaterally symmetrical along with an abdomino-thoracic breathing pattern. There was no murmur or crepitus audible during auscultation, and bilateral air entry was also equal. The patient's current anthropometric measurements are 155 cm in height, 45 kg in weight, with a BMI of 12.78 kg/m2. The chest circumference was 55 cm and the head circumference was 33 cm.1 Patient caregiver education.

Discussion

Adult rehabilitation for viral encephalitis with covid19 infection right side hemiparesis is a complex and challenging endeavor that requires a multidisciplinary approach. Viral encephalitis, particularly in adult, can lead to significant neurological deficits and impairments in motor function, cognition, and behavior loss of sensory and motor function. The study provides valuable physiotherapy rehabilitation of a adult patient with viral encephalitis. The comprehensive approach to rehabilitation, focusing on caregiver and family education, addressing weakness and reduced strength, coordination motor deficit, improving mobility and gait, and enhancing functional activities, highlights the importance of early and multidisciplinary intervention in such cases. The utilization of proprioceptive neuromuscular facilitation (PNF) techniques, strengthening exercises, and task-oriented activities demonstrates a tailored approach to address specific impairments associated with viral encephalitis, such as weakness, loss of strength and balance and mobility limitations. The activities like climbing, walking, and walking with support, sitting to standing not only targets physical function but also promotes engagement and participation in meaningful activities for the adult. When multiple impairments with anatomical variations such as a hemiplegicrightupper and lower, the rehabilitation process becomes even more oriented. This study underscores the importance of

clinical conditions, highlighting their relation to the sensory system, facilitates precise diagnosis and treatment strategies and rehabilitation interventions designed to address the specific clinical impairments and deficits of each individual patient. In the case of viral encephalitis, early rehabilitation efforts focus on mitigating the acute effects of the infection, such as managing seizures, reducing inflammation, prevent pressure sore and providing supportive care to prevent further neurological damage and improve Quality of life.[10,,11]

Conclusion

This study highlights the importance of physiotherapy rehabilitation in adult patients with viral encephalitis. Early initiation of physiotherapy interventions can significantly improve functional abilities, improve motor control coordination, muscle strength, and range of motion, thus overall recovery and quality of life of the patient. The comprehensive approach of neurological physiotherapy acknowledges the complex medical, behavioural, social, emotional, and cognitive issues associated with encephalitis, ensuring a holistic rehabilitation process. It is crucial for healthcare providers to recognize the significance of neurological physiotherapy in managing the consequence of viral encephalitis and to integrate it into the multidisciplinary care of affected patients.

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Review Article

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Flexibar and Non-Flexibar Exercises and its Effects on Trunk Activation: A Review of Literature

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Abstract

Objective: To systematically review the randomised controlled trials to evaluate the effects of flexi-bar and non-flexi-bar exercises, specifically stabilization training, on trunk muscle activity in various postures.

Methodology: The study included randomized control trials and clinical trials published between 2007-2018, focusing on patients with upper trunk muscle weakness aged above 18. Exclusion criteria included a study with overlapping data, a study with associated disorders, or abstract-only papers. The search strategy involved a search of existing literature from databases like PubMed, Google Scholar, Cochrane Library, PEDro, and Research Gate, removing duplicates and identifying relevant articles. The full-text screening was performed, and the remaining relevant articles underwent data extraction. Surface electromyography (EMG) was used to measure the activity of selected trunk muscles, which was then normalized to maximum voluntary isometric contraction.

Result: The findings of this study indicate that flexi-bar exercises resulted in higher activation of trunk muscles compared to non-flexi-bar exercises (stabilization training). The unique physical response induced by the vibration created through the swinging motion of the flexi bar triggered reflexive contractions of core muscles, leading to increased muscle activity. This suggests that flexi bar exercises may be beneficial in promoting muscular activation and potentially alleviating low back pain by evening out muscular imbalances.

Conclusion: The results of this study support the use of flexi-bar exercises for activating trunk muscles, particularly when compared to non-flexi-bar exercises (stabilization training).

Keywords: Flexibar, trunk muscles, non- flexibar, therapeutic exercises.

Introduction

Trunk muscle activity plays a crucial role in providing active stability to the spine and precedes the movement of the human body's upper and lower extremities.[1,2] Impaired and delayed trunk muscle activity leads to unstable upper and lower extremity

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movement.[3] Instability of the lumbar vertebrae is one of the primary causes of low back pain.[4] The global muscles, including the rectus abdominis, external oblique, and internal oblique, play a role in controlling overall trunk stability by generating torque. On the other hand, the local muscles, such as the transverse abdominis (TrA), multifidus (MF), and interspinalis, are deep trunk muscles responsible for fine spinal adjustments and stability between spinal segments. These smaller muscles are particularly effective in controlling the stiffness of individual spinal segments and maintaining proper spinal posture.[5,6]

The application of vibration stimulation, such as whole-body vibration exercise, can provide strong sensory stimulation that activates muscle spindles and enhances proprioceptive senses, ultimately leading to the strengthening of muscles crucial for postural stability. This effect is observed not only in healthy individuals but also in patients with various neurological disorders. By improving proprioception and motion perception during muscle contraction, vibration can contribute to enhancing muscle strength and promoting lumbar stabilization, involving both deep trunk and limb muscles.[7, 8, 9,10,11,12.]

This research seeks to explore how effective bar and non-flexi bar exercises, which involve levels of vibration, on the shoulder joints are in engaging core muscles in different body positions. Prior studies have indicated that vibration can notably boost muscle engagement yet there is a lack of research on vibration exercises targeting body areas. The study acknowledges the significance of both global muscles in ensuring stability in the core and the interaction between these muscle groups for stability. Although the distinction between global muscle systems is not always straightforward their coordinated functioning is vital for maintaining a framework. Hence understanding the balance between local and global muscle activation levels is crucial. Electromyography (EMG) ratios serve as indicators of recruitment patterns and muscle issues guiding this study to examine differences in how local and global muscles work together such as comparing the internal oblique, with rectus abdominis or lumbar with thoracic erector spinae muscles. This investigation includes both individuals and those experiencing back pain (LBP) to assess muscle engagement during various stabilization exercises.

Materials and Methodology

Inclusion criteria consisted of the following: Randomized control trials and randomized clinical trials (RCT), the Publication year 2007- 2018, Patients with weakness of upper trunk muscles participants aged above 18 years, No restriction regarding country, race, or gender.

Exclusion criteria consisted of the following: Associated cardiovascular, neurological, and orthopedic disorders, study with data not reliably extracted, duplicate, or overlapping data, abstract-only papers as preceding papers, conference, editorial, and author response theses and books case reports, case series, and systematic review studies, articles without available full text.

Search strategy: A search of existing literature from the years 2007-2018 was completed from the following databases: PubMed, Google Scholar, Cochrane Library, PEDro (physiotherapy evidence database), and Research gate using keywords such as Flexibar, trunk muscles, non- flexibar, therapeutic exercises. After removing duplicates, relevant articles were identified by titles and abstracts. and underwent full-text screening and were ranked as relevant or irrelevant according to the inclusion criteria. Finally, the remaining relevant articles underwent data extraction.

Review of Literature

Sl. No	Title/ Author/Year	Methodology	Conclusion
	Chung S and Park S. conducted a study on the effects of flexibar and non-flexibar exercises on trunk muscles in different postures in healthy adults in 2015	The purpose of this study was to assess the effects of flex bar and nonflexi bar exercises on trunk muscle activity in different postures in healthy adults. Twenty healthy right-hand dominant adults (10 males and 10 females) were selected for this study. None of the participants had experienced any orthopedic problems in the spine or the upper and lower extremities in the previous six months. The subjects were instructed to adopt three exercise postures: posture 1, quadruped; posture 2, side-bridge; and posture 3, standing. Surface electromyography of selected trunk muscles was normalized to maximum voluntary isometric contraction. The external oblique, internal oblique, and erector spinae muscle activity showed significant differences between flexibar and nonflexibar exercises.	The results of this study suggest that flexibar exercises are useful in the activation of the trunk.
	Seong–Jin Lee, Yong–Nam Kim, Dong –Kyu Lee conducted a study on the effect of flexibar exercise with vibration on trunk muscle thickness and balance in university students in their twenties in 2016	The research evaluated 26 university students in their twenties, equally and randomly divided into two groups. Both the experimental and control groups used an ordinary pole for exercise. In addition, the experimental group exercised by using a flexibar. Ultrasonic imaging was used to measure the changes in trunk muscle thickness. A balance measuring equipment was used to measure balance ability. The thickness of the transversus abdominis and the multifidus muscles in the experimental group increased, and the experimental group showed increased thickness in the transversus abdominis muscle compared to the control group. After 6 months of exercise, there was an improvement in the blind Romberg test and center of pressure moving distance with one leg standing.	These results indicate that the flexibar exercise effectively increases trunk muscle thickness and improves balance.

	Louise Hurley conducted a study on strengthening transversus abdominis in subjects with a history of lower back pain and asymptomatic individuals: The flexibar vs stabilization training in 2007.	A convenience sample of seventeen subjects was classified into two groups; those with a history of LBP, and those without a history of LBP. Nine subjects formed the FLEXIBAR training group and eight the stabilization training group, both performed an exercise program for a training period of four weeks. A pressure biofeedback unit (PBU) was used to assess the performance of the TrA muscle by adopting a test-retest (pre-test and post-test) design. The statistical significance of the changes between TrA function before and after the program was analyzed before and after the program was analyzed by performing a mixed within-subject analysis of variance (ANOVA).Furthermore, another ANOVA was produced to investigate whether the impact is different for HLBP and NLBP subjects. Although not statistically significant, increases in strength were observed in subjects involved with the FLEXIBAR program. In particular greater strengthening of the TrA muscle was seen in the history of the LBP group. This study provides one step forward in the knowledge concerning the efficacy of exercise programs to strengthen the core stability system.	The results seem to indicate that the FLEXIBAR can strengthen the TrA, and could provide an application to aid the rehabilitation of LBP individuals.
	Sin Ho Chung, Young Youl You, Hyung Jin Lee, and Sang Hyo Sim conducted a study on the effects of stabilization exercise using flexibar on functional disability and transverse abdominis thickness in patients with chronic low back pain in 2018.	Twenty-seven patients were randomly assigned to an experimental (14 patients performing stabilization exercises)group. The patients in both groups then underwent stabilization exercises with or without FB 30 min/day, 3 times a week, for 6 weeks. The main outcome measures were perceived disability based on pain, Oswestry disability index (ODI), TrA activation capacity, and thickness. Both groups showed improved ODI, VAS, and TrA activation capacity performed for 6 weeks in patients with CLBP, but all outcomes, except for TrA thickness, showed greater improvements in patients following stabilization exercises with FB than following stabilization exercises.	lumbar stabilization exercises with FB could restore pain, and functional disability and improve TrA activation capacity in CLBP patients.

	EunKyung Kim, and Seong –Gil Kim conducted a study on the effect of an active vibration stimulus according to different shoulder joint angles on functional reach and stability of shoulder joint in 2016.	Thirty healthy male students participated in this study. The upper limb length of each subject was measured to obtain normalized measurement values. The exercise groups were as follows: group 1(n=10, shoulder joint angle of 90), group 2(n=10, shoulder joint of angle 130), and group 3(n=10, shoulder joint of angle of 180). After warm-up, an active vibration stimulus was applied to the subjects with a Flexi Bar. The functional Reach Test and Y-balance test were conducted for the measurement of shoulder stability. Analysis of covariance was conducted with values before the intervention as covariates to analyze the differences among the groups in the two tests. There were significant differences among the groups. According to Bonferroni's post hoc comparison, group 1 showed greater improvement than Group 3 in the Functional Reach Test, and Group 2 showed greater improvement than Group 1 and Group 3 in the Y-balance test.	The effect of the exercises with different shoulder joint angles revealed that the shoulder joint has a certain effective joint angle for its function and stability. In addition, the application of an active vibration stimulus with a flexi bar can be a very effective tool for the improvement of functionality and stability of the shoulder joint.
	Jae-Heon Lim conducted a study on the effects of flexible pole training combined with lumbar stabilization on trunk muscle activation in healthy adults in 2018.	twenty-five participants were enrolled in this study. The subjects were randomly allocated into either the flexible or rigid pole groups. Participants performed lumbar stabilization exercises on quadruped and curled up, with the flexible pole or rigid pole. Electromyography was used to assess the percent maximal voluntary isometric contraction (%MVIC) of the rectus abdominis (RA), external oblique (EO), internal oblique (IO), and erector spinae (ES) muscles. All participants completed one 3-minute session per day, 3 days per week, for 6 weeks. The evaluation was performed before and 6 weeks after the training, and follow-up. The data were analyzed using an independent t-test and two-way repeated measure analysis of variance to determine the statistical significance.	The flexible pole curl-up and quadruped showed an improvement in trunk muscle activation. The flexible pole combined with lumbar stabilization will be useful as an exercise tool to improve the activity of trunk muscles.

	Carolyn Richardson, Rowena Toppenberg, and Gwendolen Jull conducted an initial evaluation of eight abdominal exercises for their ability to provide stabilization for the lumbar spine in 1990.	Eight abdominal strengthening exercises were investigated to evaluate their ability to promote stabilization of the lumbar spine. Twenty-three healthy volunteers aged between 18 and 32 participated in the study. During each of the selected exercises, surface electromyography was used to measure the level of motor unit activity in the right upper rectus abdominis, the right lower rectus abdominis, the right oblique abdominis, and the right lumbar para-vertebral muscles. A formula, based on the relative importance of each muscle in the proposed stability pattern was devised and used to give a single 'stability' score to compare each of the eight exercises tested.	Results indicated that the exercises that involved applied rotatory resistance to the trunk appeared to activate a more appropriate stability pattern for the lumbar spine.

FLEXIBAR[11,12,13,14,15]

The use of flexible poles and flexibars in vibration exercises is effective in improving stability and muscle coordination. These exercises generate vibrations at specific frequencies, such as 5Hz and 4.6Hz, which are transmitted throughout the body. The active vibration exercise using a flexibar stimulates the proprioceptive senses of the joints and causes the tonic vibration reflex in the enthesis, leading to muscle contraction and adjustment of instability during exercise. This type of exercise has been reported to improve trunk muscle thickness, balance, and spinal stability. The vibration stimulation applied to muscles during these exercises also provides strong proprioceptive stimulation, which has a significant impact on movement perception in both healthy individuals and patients with neurological disorders. Furthermore, whole-body vibration exercise can activate muscle spindles and strengthen proprioceptive senses, thereby enhancing postural stability. Overall, these findings highlight the effectiveness of vibration exercises using flexible poles and flexibars in promoting physical stability, and muscle coordination, and improving various aspects of health and well-being.

Variations of the Bar and Oscillatory Force

Table 1: Visualising Bar and Oscillatory Force

STANDARD (RED)	INTENSIVE (BLUE)	ATHLETIC (BLACK)	KIDS (GREEN)
Standard version, ranges of use to cover all indications.	In contrast with the standard Flexi-Bar, the Intensive Flexi-Bar was specifically developed for the management of obesity and weight issues and requires a more forceful swing, which burns fat faster and more effectively.	This Flexi-Bar was specifically designed for advanced and experienced athletes who already have existing successful training routines with the bar and who desire a more demanding load	For children ages 7 - 14 years due to the frequent occurrence of postural disorders in children and young teens. Its measurements and weight have been customized to this model's design following the most current findings on the subject.

PRACTICAL USES AND TRAINING VARIABLES

The intensity of the training is determined by different variables and combinations thereof.

Table 2: Variables Influencing Training Intensity

1	Amplitude motion size Speed of movements
2	Regularity of rhythm (rhythmic or irregular) Frequency of movements
3	Direction of movements Length of training session
4	Number of participating joints Angles or planes of swing
5	Direction of swing Elbow position
6	variations of grips (supination, pronation, inward- or outward-rotation
7	Intmigration of rotation (i.e. in the glenohumeral articulations of extension, adduction, inward rotations after flexion abduction outward rotations)
8	distance of the bar from the body while swinging it, e.g. sagittal elbow extension flexion, upper body right-left rotation, shoulder adduction, and abductions)
9	Dual-task exercise (plus breathing, plus squat, plus crunch, plus leg lift, plus knee lift)
10	In combination with Pilates, Yoga, Thera-Band, Balance-Pad, gyroscopic exercise, trampoline, exercise ball, and Pezzi Ball.

BASIC AND STARTING POSITION WITH SIMPLE VARIATION

- Foot position: at hip width and parallel (heightened stability of pelvic area)
- Foot arch in 3-point position (even distribution of pressure on the heel bone, 1st and last toes)
- Knees: slightly outward
- Pelvis: pelvic neutral
- Buttocks: contracted
- Stomach: pulled in (indirect activation of transverse abdominals and pelvic floor)
- Chest: lifted up
- pull shoulder blades together during all exercises (shoulder adduction and scapular depression)
- Shoulders and pelvis should make as few compensatory movements as possible
- If the bar stops swinging, start over - wrists: neutral (0) position
- Thumbs: neutral (0) position (adduction)
- Thumbs: 90° position (abduction)
- Head in a neutral position (gently nod the chin towards the chest)
- Long, deep breaths to expand the rib cage to its fullest.

DETERMINING PROPER INTENSITY

The desired level of intensity is dependent on the respective exercise being done, the level or amplitude of one's arm, the intensity of the oscillations, and for how long the oscillations are maintained.

- **DEGREE OF SWING (BASED ON AN AXIS)**
  - ✓ Easy: Level 1 – 5 to 10 degrees
  - ✓ Intermediate: Level 2 – 10 to 20 degrees
  - ✓ Hard: Level 3 – 20 to 50 degrees max
- **DURATION**: The duration of the oscillations can be anywhere from a few seconds to over a minute per exercise.

These recommendations are approximations and should be based primarily on the subjective responses of the patients, as well as their medical profile, age, gender, constitution, and physical condition.

TRAINING FREQUENCY

When starting a training program with flexible poles or flexibars, it is important not to overdo it. It is advisable to incorporate short breaks into the routine and alternate with other exercises that do not involve oscillating the bar. The recommended frequency of training is ideally 2-3 times per week, with each session lasting at least 10-15 minutes. It is recommended to start with lower amplitudes and gradually increase intensity. The duration of oscillations should be based on the individual's strength, endurance, and coordination skills. Initial difficulties are normal and should not discourage one from continuing the training. It is beneficial to switch upper-body positions, such as flexion, lateral inclination, and rotation, while the bar is still swinging as this activates the muscles and provides protection to the back.

Table 3: Indications and Contraindications Overview

INDICATIONS	CONTRAINDICATIONS
1.Degenerative and chronic spinal disorders 2.protruded/prolapsed discs 3.Spinal canal stenosis 4.Spondylolisthesis (slipped disc) 5.Disorders of the cervical, thoracic, and lumbar vertebrae 6.Post-surgical ailments following spinal and vertebral disc operations 7.Intervertebral disc training 8.Scoliosis therapy 9.Rehabilitative care for spinal and pelvic fractures (bone fractures) 10.Muscular imbalances and damaged/weak posture 11.Back training, postural training 12.Joint flexibility and mobility training 13.Stretching/flexing exercises with vibrations transferred to the musculature 14.Back, shoulder or neck strain 15.Headaches, backaches 16.Improvement of sensorimotor skills 17.Prevention of falls in older adults 18.Coordination training 19.Obesity and weight management 20.Torso rotation training and training of rotation-stabilizing muscles (joint stabilization training of the muscle multifidi)	1.Extreme hypertension 2.Acute inflammations of any body parts to be involved in the exercise 3.1-2 weeks after intervertebral disc surgery 4.Advanced disorders of intervertebral discs, with neurological symptoms 5.Coronary heart disease in acute stages 6.The first few months following a heart attack - heart failure or inflammatory heart disease 7.Arteriosclerosis (peripheral arterial vascular disease stages III or IV) 8.Brain aneurysm 9.Abdominal aortic aneurysm 10.Third trimester of pregnancy 11.Malignant tumors and metastasis

EMG ELECTRODE PLACEMENT:

Surface electrodes were used to measure the electrical activity of specific muscles. The electrode placements for each muscle were as follows:

- ✓ Rectus abdominis: the electrode was attached to the midline of the muscle belly between the umbilicus and pubic bone.
- ✓ External Oblique: The electrode was placed 15cm lateral to the umbilicus.
- ✓ Internal Oblique: The electrode was attached at the midpoint between the anterior superior iliac spine (ASIS) and the symphysis pubis.
- ✓ Erector Spinae: The electrode was placed 2cm lateral to the belly at the height of the first lumbar vertebra.

A reference electrode was placed on the inner third of the clavicle shaft.

To standardize the muscle's action potential, the maximal voluntary isometric contraction (MVIC) was used. Each position was held for 7 seconds to reduce measurement variation at the start and end points of the exercise.

During analysis, the muscle activity was measured for 5 seconds, excluding the first and last second to focus on the consistent activity period.

The EMG values were measured in microvolts (uV).

Discussion

This study indicates that the impact of Flexibar exercises on trunk muscular strength can vary with nonflexibar exercises. A study has shown that the impacts of flexibar exercises on trunk muscular strength differ. While some have revealed severe increases in trunk muscular strength through Flexibar training, others have resulted in no differences from typical resistance training or control groups. As proven by studies, core stability, and typical resistance training significantly increased Trunk Muscular strength. Potential reasons might be differences in study designs, the type of exercises performed, exercise regimes, and other participant characteristics.

Trunk muscular stability is necessary to keep the spinal alignment and help manage external forces. Deep stabilizers of the trunk may be activated by oscillatory or vibratory exercises called Flexibar, resulting in more stamina and energy (additional information on Flexibar workouts was provided in the above text section). There was no discussion regarding the precise impact of Flexibar exercises on trunk muscular stability due to a lack of adequate information. However, the findings show the results of other non-flexibar activities. Additional research should be conducted to see how comparable these outcomes can be transferred to the Flexibar itself.

Trunk muscle function refers to an individual's ability to perform daily activities and sports-specific movements efficiently. The vibration characteristic of the flexi-bar creates a strong proprioceptive stimulation, which has a significant effect on movement perceptions not only in healthy individuals but also in patients with a variety of neurological disorders. In summary, the vibration resulted in the creation of strong external loads by intense stimulation of the muscle proprioceptors, thereby increasing the trunk activities during the exercise. Flexibar exercises have been found to enhance trunk muscle function, but further research is needed to understand their impact on functional performance. Stabilizing the spine during daily activities can increase the risk of future spinal pathology, even in those without low back pain. The flexi-bar has been demonstrated to strengthen the TrA muscle, however, further research is required to evaluate pain, function, and disability in LBP patients. As stabilizing regimens and training become more prevalent, there is a rising demand for a reliable, inexpensive, and quantitative measurement and monitoring system to assess the efficacy of exercise programs.

Conclusion

The study reveals that strength training increases trunk muscle strength, with flexi-bar exercise and non-flexibar exercise strengthening core stability. Vibration training using Flexibar has a more beneficial effect than stabilization training, as it produces 270 vibrations per minute and immediately activates trunk muscles, potentially aiding the rehabilitation of low back pain patients.

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Ethical Clearance: Not applicable

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Original Research Article

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Comparing the Effectiveness of Muscle Energy Technique, Positional Release Technique and Conventional Therapy on Pain, Range of Motion and Functional Ability in Patients with Mechanical Low Back Pain

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Abstract

Background of the Study: Low back pain is one of the most common health problem and 80% of people experiences low back pain in their lifetime. Majority of low back pain is due to the muscle imbalance. Muscle imbalance occurs due to shortened or lengthened in structure and it leads to injury which causes changes in motor programming.

Objectives: To compare the effects of Muscle Energy Technique, Positional Release Technique and Conventional Therapy on improving pain, range of motion and functional ability in patients with mechanical low back pain.

Subjects and Methods: Twenty four patients of complaining of mechanical low back pain participated in the study. Patients were randomly allocated using computer generator software into three groups: group A which received Muscle Energy Technique, group B which received Positional Release Technique and group C which received Conventional Therapy. Treatment sessions were given three times per week for three weeks. Patients were assessed before and after treatment using Numerical Pain Rating Scale(NPRS),Modified Oswestry Disability Index (MODI), and Modified Schobers Test to assess pain severity, functional ability, and range of motion of lumbar spine respectively.

Results: Based on this statistical analysis, Group A showed better statistically significance in NPRS,MODI and ROM mean values as compared to Group B and C. Hence alternate hypothesis is accepted and null hypothesis is rejected. This we conclude that Muscle Energy Technique is more beneficial compared to Positional Release Technique and Conventional Therapy group.

Conclusion: Muscle Energy Technique and Conventional therapy group shows significant improvement on Pain and Lumbar Extension Range of Motion compared to Positional Release Technique, whereas there was no significant difference in MODI on Muscle Energy Technique, Positional Release Technique and Conventional therapy.

Keywords: Muscle Energy Technique, Positional Release Technique, Conventional therapy.

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Introduction

About 80% of people experiences Low back pain in their lifetime and common reason for medical consultation which interferences with quality of life and work performances[1].In any position – standing, sitting or lying down, human body's Centre of gravity try to balance between muscles and bones to maintain the integrity of structure and protect them against injury. If imbalances occurs between the functional load then typically pain will emerge which will refer as mechanical pain. Mechanical LBP is mostly caused by postural deviation and is higher in workers who involve heavy physical exertion as indirect cause of asymmetrical stress factors increase the biomechanical overload and compromises. Prior evidences have shown that changes in muscle tone create muscle imbalances, which leads to movement dysfunction. Abnormal movement pattern may have direct effect on joint surfaces, thus potentially leading to joint degeneration. Core muscles (Iliopsoas, Quadratus lumborum) arises which provide Support and stability to low back and when these muscles become contracted ,it can alter normal biomechanics of pelvis and lumbar, thoracic and even cervical vertebrae and causes back pain.

Muscle energy technique is an active and direct technique which used to restore muscle length and strength and also acts as a pump for lymphatic system[5]. According to Greenman's, the muscle which is contracting during a Muscle Energy Technique pulls on the bony attachments and begins to mobilize the isolated segment. As the result, the range of motion of joint segment is gradually increased with patient generated forces5. This restores not only joint mobility, but also normal function and physiology of the muscles. Positional Release Technique is an indirect osteopathic technique whereby dysfunction joints and their muscles are moved away from their restrictive barrier into a position of ease in the treatment of both musculoskeletal and visceral dysfunction[6]. In Low back dysfunction there is a development of tight ness and instability which causes pain before complete full normal end range movement[7]. In long-standing and severe cases of Low back pain can develop muscle deconditioning due to spasm and atrophy due to limitation of activities through the body Positional Release Technique can be applied for somatic dysfunction. It reduces delayed onset muscle spasm with the use of PRT. It can also produce immediate changes in pressure pain threshold in symptomatic patients.

Exercise Therapy can be given for patients with low back pain with three distinct goals. The goal is to improve or eliminate impairments in back flexibility, reduce the intensity of back pain and to reduce back pain related disability through process of desensitizing of fears and concerns, altering pain attitudes and beliefs. Most studies has observed improvements in global pain rating after exercise programs and many have observed that exercise can lessen the behavioural, cognitive, and disability aspects of back pain syndromes. Thus, the study is conducted with an aim to find out best technique which include direct technique (Muscle Energy Technique), Indirect Technique (Positional Release Technique) and conventional therapy which will help in improving pain, range of motion and functional ability in Mechanical low back pain individuals.

Need for the Study

Muscle Energy Technique and Positional Release Technique along with Convention al therapy are commonly applied for Mechanical Low Back Pain, but there is lack of evidence on comparing the effectiveness of Muscle Energy Technique, Positional Release Technique and Conventional Therapy on improving pain, Range of Motion, functional ability in patients with Mechanical Low Back Pain and so the study is sought to find the" Comparing the Effectiveness of Muscle Energy Technique, Positional Release Technique and Conventional Therapy on improving pain, Range of Motion and Functional ability in patients with Mechanical Low Back Pain"

Objective:

The main objective of the study was to compare the effects of Muscle energy technique, Positional release technique and conventional therapy program on pain, range of motion and functional ability in patients with mechanical low back pain.

HYPOTHESIS

NULL HYPOTHESIS (Ho): There will be no significant difference among Muscle Energy Technique, Positional Release Technique and Conventional Therapy on pain, range of motion and functional ability in patients with mechanical low back pain.

ALTERNATIVE HYPOTHESISv (Ha): There will be significant difference among Muscle Energy Technique, Positional Release Technique and Conventional Therapy on pain, range of motion and

functional ability in patients with mechanical low back pain.

METHODOLOGYSTUDY DESIGN:

Randomized Controlled Trial

STUDY SETTING:

The study was conducted in the Department of Orthopedics & Department of Physical Medicine and Rehabilitation, PSG hospitals, Coimbatore, Tamil Nadu, India.

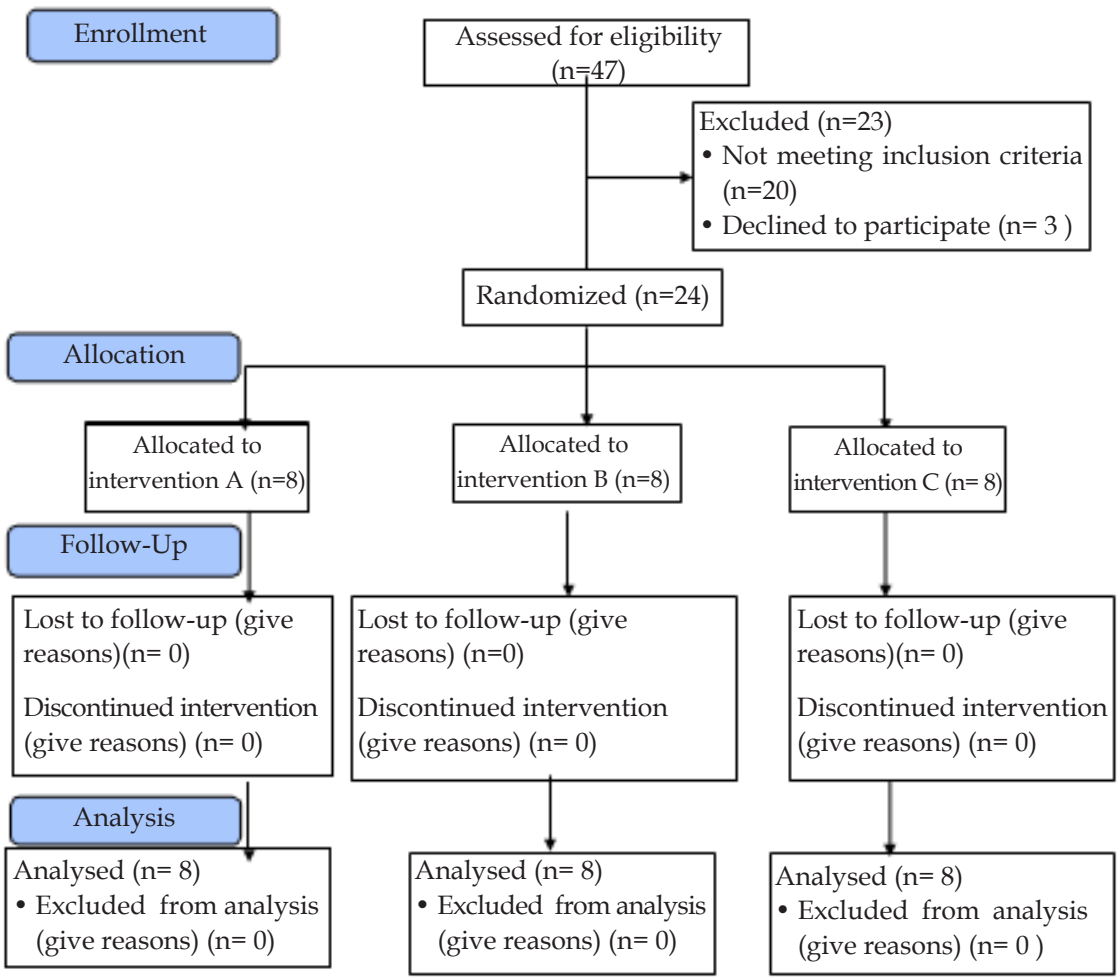
HUMAN PARTICIPATION PROTECTION:

The study was reviewed and approved by Institutional Human Ethics Committee at PSG IMSR, Coimbatore. (PSG/IHEC/2019/Appr/FB/031)

PARTICIPANTS:

24 individuals with Low back pain, age group ranging from 20-45 years were the participants in this study. The inclusion criteria were the following: Age 20 - 45 years, with Low back pain of 12weeks duration, should be medically fit to perform physical training and should give consent to participatein the study. The individuals whomet the following criteria were excluded: Osteoporosis, recent fractures, Structural deformities of spine, Disc pathology, Tumour, Systemic disease, Pregnant women, Radicular symptoms, any other medical conditions contra-indicatory to physical activity. The flow of participants in the study is explained in consort flow chart Figure1.Based on the selection criteria 24 participants were selected using convenience sampling and were randomly assigned using computer generated random numbers in to three groups: **Group A :** Muscle Energy Technique **Group B :** Positional Release Technique **Group C:** Conventional Therapy Figure:1Consort flow chart showing the flow of participants in the study

Figure 1: Consort flow chart showing the flow of participants in the study



INTERVENTIONS:

The details of the intervention[13-19] given for each group are given in the table 1**.**

Table 1: Intervention details

GROUP-A MUSCLE ENERGY TECHNIQUE	GROUP-B POSITIONAL RELEASE TECHNQUE	GROUP–C CONVENTIONAL THERAPY
• Position of the patient • Patient do the movement against the resistance • Hold the breath for 7-10 seconds • Release the breath on slowly ceasing contraction • Release, a rapid stretch is applied to new barrier and held for 10 second • Procedure repeated for 5 times • **Muscle Energy Technique:** 45 mins/ session, 3 days / week for 3 weeks.	• Palpate a tender point • The patient is moved in such a way that the pain associated with pressure on the tender points is relieved by at least 70 percent to find position of ease • Hold position of ease as 90 seconds • Procedure Repeated for 3times • **Positional ReleaseTechnique:** 45 mins/session, 3 days/ week for 3 weeks.	• Interferential therapy • Stretching exercises • Strengthening exercises • Conventional Therapy: • 45 mins/session, • 3 days/week for 3 weeks.

OUTCOME MEASURES

The outcome measures used in this study were Numerical Pain Rating Scale (NPRS), Modified Oswestry Disability Index (MODI) and Modified Schober's Test (MST). The pretest assessment was taken on the first day of intervention by using outcome measures. The Intervention was given to each group separately for 3 weeks. Final assessment was taken after the 3 weeks of treatment using same outcome measures. Comparison of pretest and posttest values with in the group and between the groups was done finally.

STATISTICAL ANALYSIS

Descriptive statistics were used for all variables. Data were evaluated using Multivariate analysis (MANOVA). It assess the independent factors on three dependent variable (NPRS, MODI, Modified schober's test). Homogeneity was tested using the Levene's statistics. The effective size for each MANOVA model was produced using Partial Eta Squared. A value of $p<0.05$ was considered significant. SPSS statistical software 16.0 window was used for all analyses.

The pretest and posttest values for Groups A, B and C was obtained before and after intervention.The pain reduction and improvement in functional ability and range of motion was measured using Numerical Pain Rating Scale (NPRS), Modified Oswestry Disability Index (MODI), and Modified Schobers test. The mean, standard deviation and F values were used to find out whether there was any significant difference between pretest and posttest values within the groups and between the groups.

Results

In this study totally 24 individuals with lowback pain werer andomized into three groups. The baseline characteristics of the participants in all the groups were similar. The base line characteristics of the 24 participants are given in table 2.

Table 2: Baseline characteristics of the participants

	Group A	Group B	Group C	P value
Age(years)	42.66	43.12	42.85	>0.05
Gender				
Male	5	4	5	>0.05
Female	3	4	3	
VAS	7.12	7	6.25	>0.05

Groups A, B & C TABLE: 3 Mean, Standard deviation, Test of between subjects

Dependent variable	GROUPS	Mean(cms)	Standard Deviation	'F' Value	'p 'Value
NPRS	A	7.12	1.126		
Pre-test	B	7.00	1.069	0.778	<0.05
	C	6.25	1.282		
NPRS	A	1.88	.641		
Post-test	B	3.38	.916	1.256	<0.05
	C	3.25	1.389		
MODI	A	47.50	7.151		
Pre-test	B	44.00	7.251	0.290	<0.05
	C	46.00	7.783		
MODI	A	16.75	3.845		
Post-test	B	24.50	10.515	0.031	<0.05
	C	24.75	9.618		
MST(FLEXION)	A	2.25	.707		
Pre-test	B	3.25	1.035	0.568	<0.05
	C	3.00	.756		
MST(FLEXION)	A	5.75	.707		
Post-test	B	5.13	.835	0.421	<0.05
	C	5.63	1.302		
MST(EXTENSION)	A	2.13	.641		
Pre-test	B	2.62	1.061	2.039	<0.05
	C	1.88	.641		
MST(EXTENSION)	A	4.75	1.035		
Post-test	B	4.25	1.282	1.916	<0.05
	C	3.62	.744		

Data were analyzed using MANOVA. In the descriptive analysis, among the three groups, mean values of Muscle Energy Technique (A) group was NPRS (pre=7.12, post=1.88), MODI (pre=47.50, post=16.75), Flexion range of motion (pre=2.25, post=5.75), Extension range of motion (pre=2.13, post=4.75), which shows statistically significant compared to Positional Release Technique(B) and Conventional Therapy groups(C).

Prior to conducting a series of followup MANOVA, homogeneity of variance assumption was tested for all three variables. Based on series of Levene's F test, homogeneity of variance of all scales NPRS (F=1.256, p=0.305 (p>0.05), MODI (F=0.031, p=0.970(p>0.05), Flexion Range of motion (F=0.421, p=0.662 (p>0.05), Extension range of motion (F=1.916, p=0.172(p>0.05) assumption was satisfied.

Multivariate analysis of variance was conducted to test the hypothesis. A Statistically significant MANOVA effect was obtained (F=1.087, p>0.05(p<0.05), Wilks' Lambda

=0.070, Partial Eta Squared=0.735. In between subjects analysis, the groups has a statistically significant effect on NPRS(F=-5.230, p=0.14(p<0.05). But not significant in MODI (F=2.279, p=0.127(p>0.05) Lumbar flexion range of motion (F=0.907, p=0.419(p>0.05), Lumbar extension range of motion (F=2.333, p=0.122 (p>0.06) .

Finally, series of post-hoc analysis (Turkey) were performed to examine individual mean difference comparison across all three levels of variables. The result revealed that NPRS were statistically significant between Groups A and B (p=0.008) p<0.05, A and C (p=0.014) p<0.05.and not significant between B and C (p=.810) p>0.05. MODI was not statistically significant between groups A and B, p=0.355, A and C, p=0.689 and B and C,0.595(P>0.05), Lumbar flexion range of motion was not statistically significant between groups A and B, p=0.217A and C p=0.802 and B and C ,p=0.320(P>0.05). Extension range of motion was statistically significant between groups A and C (p=0.043) p<0.05 and not significant between group A and B (p=0.349) p>0.05 and B and C (p=0.244) p>0.05.

Based on this statistical analysis, Group A showed better statistically significance in NPRS, MODI and ROM mean values as compared to Group B and C. Hence alternate hypothesis is accepted and null hypothesis is rejected. This we conclude that Muscle Energy Technique is more beneficial compared to Positional Release Technique and Conventional Therapy group.

Discussion

The study was undertaken to compare the effectiveness of Muscle Energy Technique, Positional Release Technique and Conventional Therapy on decreasing pain, improving range of motion and improve functional ability in patients with Mechanical Low Back Pain. The result of this study revealed that group A (MET) is effective in reducing pain severity, increase in functional ability and lumbar range of motion as compared to other groups (PRT, CT). In between subject analysis, the groups have a statistically significant improvement in the reduction of severity of pain by giving these three interventions to the patient with Mechanical Low Back Pain.

In this study, NPRS shows statistically significant in group A (Muscle Energy Technique) and this result was supported by the finding of the Selkowetal., found MET may be better than any other technique in reducing pain and increases range of motion for several patients because it uses a low-force isometric contraction in pain free position. Post-isometric relaxation technique uses a contract relax method with an added gentle stretch. Agonist contraction activates Golgi tendon organ, which in turns target muscles and break pain-spasm pain cycle[23]and also this study findings supported by Ulger et al.,. Compared Muscle Energy Technique and exercise in patients with chronic low back pain at the end of the treatment, MET was found more effective in reducing pain and functional ability[24.]

In between subject analysis, PRT group shows statistically improvement in NPRS thereby it results in decrease in pain severity this findings agree with the Meseguetal., found there was a reduction in pain in PRT groups due to analgesic effect of PRT may be attributed to the relaxation of the damaged tissue which achieved by placing patient in a position of sensitizing inflammatory mediators and he concluded that the application of PRT may be effective in producing hypoanalgesic and decrease there activity of tender points and this findings also has been supported by Albert et al.,. Compared immediate effect of strain counter strain in treatment of tender points in theupper trapezius and found that it was effective in reducing tenderness o tender points inupper trapezius[24]. The reduction of pain can be

achieved by using PRT within 3 weeks duration and these findings agree with the study of Wong et al.,. Conducted study to assess the effect of SCS on tender points and strength of hip muscles and he conclude that SCS reduces trigger point pain[25]and this study also supported the findings of Pedowitzetal. That use of Counter-strain an athlete can experience reduction in pain and capable of returning to full activity in less than 3weeks from initiation of treatment

Conventional Therapy also shows statistically significant in NPRS. In this study, we gave standard physiotherapy program of stretching and strengthening exercises. There was a significant reduction of pain in conventional therapy groups and this finding agree with the study of Liddle SD et al., .stretching exercises reduces muscle tension and relieve the compression on muscle nociceptors and on the nerve root and it broke the vicious circle also it decreased cellular connective tissue in muscle e and decreased muscle stiffness which leads to reduction of pain[27] and Wittink et al.,. Strengthening exercise has a role in the reduction of pain by increases plasma concentration level of beta endorphins and activation of ergo receptors which stimulate enkephalinergic nerve cells in the thalamus which decreases the pain and improve functional activities.

Generally, exercise therapy brings wellness in many aspects like promoting relaxation, improving flexibility, strengthening and self-confidence, overcoming the fear about pain and decreasing the illness behavior. James Rayville et al. In their study suggest that exercise may be used as a tool to lessen excessive fear and concern about back pain and alter stifling pain attitudes and beliefs and overall literature suggest that exercise treatment is more effective in treating depression than no treatment than and as effective as psychotherapy and antidepressant medication[12] Sullivan et al., (2000) who stated that improvement in physical activity and pain severity responsible for decrease disability and increases range of motion[29].

In our study, lumbar range of motion is statistically significant in group A and C (MET and CT). The result of this study is supported by the Brinda et al., compared the effects of MET to the CT and both treatments were similarly effective in reducing low back pain[30]and also this finding supported with Schenk et al.,, performed a randomized CT to determine effectiveness of MET in Lumbar extension in symptomatic individuals and showed that MET were able to increase Lumbar Extension compared to compared to control groups[31].

The participants in this study were in the age group of 20 to 45 years, so the generalizability of the results was reduced. The Future studies can be done with large number of samples. And, other muscles which are prone for tightness in this conditions can also be included in the intervention in future studies.

Conclusion

Thus the study concluded that muscle energy technique and conventional therapy techniques are useful in reducing pain and increasing extension range of motion for individuals with low back pain. So the therapist could use both the interventions for the low back pain condition.

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Ethical Clearance: The study was reviewed and approved by Institutional Human Ethics Committee at PSG IMSR, Coimbatore. (PSG/IHEC/2019/Appr/FB/031)

Declaration of Conflicts of Interest: No conflict of interest for any of the authors of this study

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Original Research Article

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A Cross Sectional Survey-Strength Training & Conditioning Attitudes, Behaviour & Knowledge Among Physiotherapy Students & Physiotherapist

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Abstract

Background: A significant growth has been associated with ST & conditioning practices over past few decades among the physiotherapist all across India whether they are confident & education perceived help in adequate implementation within ST practices, yet very little article has been reported about the ST attitudes, behavior & knowledge among physiotherapists of India. The purpose of this study aimed at assessing the ST attitude, behavior & knowledge among physiotherapist

Method: An online survey conducted using Google forms among participants includes practicing physiotherapist & students. Participants were asked to answer 25 questionnaire of attitude, behavior & knowledge via online survey

Results: The study shows, majorly strong agreement of ST practices among the participants in all the questions & less shown disagreement. Similarly, it shows no significant relationship among the professional variables

Conclusion: The study concluded that all the physiotherapy participants have major ST attitude, behavior & knowledge & are confident in their ability & the education perceived prepare them to adequately apply ST in their practices

Keywords: Strength training (ST), Exercise, Physiotherapist(PT)

Introduction

Strength training is most popular form of exercises utilizes in PT practices & also a strategy applied in sports & physical training processes[1-2]. ST has achieved a wide acceptance by all the populations of medicinal institutions & organizations[3]. ST programs are not only beneficial in sports or athletes performance enhancing but also effective in improving muscle strength[4], improve functional abilities[5], increases in whole-body lean mass & body cell mass[6], improve muscle quality[7], skeletal muscle fiber hypertrophy, &

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enhance ability to perform activities of daily living &, thus, an improved quality of life of the population[8]. Nevertheless, psychological interventions also considered important within ST that importance to be flexible in meeting the individual training needs[9]. According to Fit India mission, physical fitness is the ability to perform day to day normal activities with vigor, alertness, without undue fatigue & values to enjoy a lifetime of active healthy living[10]. Strength training is also beneficial to reduce musculoskeletal pain in shoulders, wrists, cervical, thoracic & lumbar spine[11]. Also beneficial in neurological conditions like Parkinson's disease in controlling motor & non-motor symptoms & gives positive effects of physical activity[12]. Also according to research the Perception of ST in dancers are increasing positively to enhance their muscle strength[13]. There is plausible knowledge to ST implementation in practices but very little literature has been published pertaining to this topic. The purpose of this study was therefore to determine PT knowledge about how they are using the ST in their profession, whether they feel the need of improving muscular strength of other condition of patients is important apart from the sports & athletes training & confident in prescribing & applying ST. The study also aims that whether their physiotherapy education prepare them to prescribe patients on ST or it is inadequately applied in their practices.

Materials and Methods

An online survey was conducted from December 2023 to February 2024 using a previous ST study questionnaire[1] which was modified by self- structured questions. The survey consist demographic characteristics, 8 Attitude questions, 7 Behaviour questions & 10 Knowledge questions, however the last questions of knowledge was more of miscellaneous questions. Survey was prepared through google forms & distributed online through all Social media messages. The primary population targeted were Indians PT having professional degrees from renowned Indian institute of paramedical courses including Bpth final year students, interns, Mpth students & all PT professionals who uses ST in practices. However for analysis we only reported data having B.P.T & M.P.T education degrees. All potential participants received hyperlink that directed them to survey, we began with few initial participants then ask them to refer other eligible individuals within their network. Only completed surveys were analysed. Out of 218 participants, there were 121 B.P.T. professionals, 94 M.P.T., 2 D.P.T., & 1 B.Sc. in PT participants. For further analysis, only participants with B.P.T. & M.P.T. professional's degrees were selected. Data analysis was performed using SPSS Version 20 software. Response frequencies from the attitudes, behaviour & knowledge sections were reported for Bpth & Mpth then compared via Pearson chi-squared tests.

Findings: The above data presents attitude, behaviour and knowledge. Table 1: ST Attitudes of B.P.T. (n=121) & M.P.T. (n=94)

Survey items	BPTH% (n)	MPTH% (n)
A1. Improving the muscular strength of your Patient is important		
Strongly agree	44.0 (96)	36.2 (79)
Agree	11.0 (24)	6.4 (14)
Disagree	0.5 (1)	0.5 (1)
Strongly disagree	0 (0)	0 (0)
A2. Are you confident in your ability to appropriately prescribe ST exercises (frequency, sets, reps, rest periods, intensity)		
Strongly agree	27.1 (59)	22.9 (50)
Agree	25.2 (55)	19.3 (42)
Disagree	2.8 (6)	0.9 (2)
Strongly disagree	0.5 (1)	0 (0)

Continue.....

A3. Do you think that patient's age or gender must be considered while implementing the ST program		
Strongly agree	31.2 (68)	32.1 (70)
Agree	23.4 (51)	10.6 (23)
Disagree	0.5 (1)	0.5 (1)
Strongly disagree	0.5 (1)	0 (0)
A4. Prior to prescribing ST programme to your patients, assessment is important		
Strongly agree	47.7 (104)	35.3 (77)
Agree	7.8 (17)	7.8 (17)
Disagree	0	0
Strongly disagree	0	0
A5. The education you received while pursuing your primary profession adequately prepared you to prescribe & educate the patients on ST		
Strongly agree	18.3 (40)	15.6 (34)
Agree	28.0 (61)	16.5 (36)
Disagree	4.6 (10)	9.6 (21)
Strongly disagree	4.6 (10)	1.4 (3)
A6. ST with heavy weights is more likely to harm, rather than help the patients during practice		
Strongly agree	8.3 (18)	8.3 (18)
Agree	25.2 (55)	19.7 (43)
Disagree	15.1 (33)	11.9 (26)
Strongly disagree	6.9 (15)	3.2 (7)
A7. ST is adequately applied in profession.		
Strongly agree	17.9 (39)	15.6 (34)
Agree	32.6 (71)	18.8 (41)
Disagree	4.6 (10)	6.9 (15)
Strongly disagree	0.5 (1)	1.8 (4)
A8. Do you think ST is important only for elite athlete's performance & not in other conditions		
Strongly agree	3.7 (8)	2.8 (6)
Agree	5.5 (12)	1.8 (4)
Disagree	20.6 (45)	15.6 (34)
Strongly disagree	25.7 (56)	22.9 (50)

The results show that improving muscular strength of patients is important (A1), & confidence in prescribing ST exercises based on age or gender while few disagreed (A2, A3). 46% with a BPTh degree agreed that their education adequately prepared them, compared 32.1% MPTH degree (A5), 9.2% of BPTh degree participants disagreed, compared to 11% of MPTH degree. 33.5% of BPTh degree participants agreed heavy weight could be harmful compared to 28% of MPTH. However 22% of BPTh participants disagreed compared to 15.1% of MPTH (A6). 50.5% of BPTh participants felt ST is adequately applied compared to 34.4% of MPTH (A7). Few participants agreed that ST is important not only for elite athletes' performance but also in other conditions, with 46.3% of BPTh professionals strongly disagreeing, compared to 38.5% of MPTH (A8)

Table 2: ST Behaviours of BPTH (n=121) & MPTH (n=94)

Survey items	BPTH%(n)	MPTH%(n)
B1. Do you prefer for yourself doing full body ST exercise to help you improve your muscular strength		
Strongly agree	28.4 (62)	23.9 (52)
Agree	25.7 (56)	17.9 (39)
Disagree	0.9 (2)	0.9 (2)
Strongly disagree	0.5 (1)	0.5 (1)
B2. Does patient psychology must be considered when you prescribed the ST program		
Strongly agree	26.1 (57)	25.7 (56)
Agree	28.0 (61)	17.0 (37)
Disagree	1.4 (3)	0.5 (1)
Strongly disagree	0 (0)	0 (0)
B3. Do you follow any social media account of ST & conditioning/any online exercises		
Strongly agree	16.1 (35)	9.2 (20)
Agree	25.2 (55)	22.5 (49)
Disagree	11.9 (26)	10.1 (22)
Strongly disagree	2.3 (5)	1.4 (3)
B4. Training sessions should include at least one rest or recovery day – but not more than three.		
Strongly agree	16.1 (35)	18.8 (41)
Agree	36.2 (79)	23.4 (51)
Disagree	2.8 (6)	0.5 (1)
Strongly disagree	0.5 (1)	0.5 (1)

B5. Do you think ST & conditioning is age related		
Strongly agree	10.1 (22)	10.1 (22)
Agree	30.7 (67)	24.3 (53)
Disagree	9.6 (21)	6.9 (15)
Strongly disagree	5.0 (11)	1.8 (4)
B6. How do you assess muscular strength in your patients		
Dynamometer	2.3 (5)	1.8 (4)
Manual muscle testing	42.2 (92)	27.5 (60)
Observation	1.4 (3)	0.9 (2)
1RM testing	9.2 (20)	11.5 (25)
Other method	0.5 (1)	1.4 (3)
B7. Do you keep records/ document for your patients/clients when they perform ST exercises like blood pressure, cues provided (eg, verbal cue for exercise form), HR, number of sets & reps, presence/absence of pain, rating of perceived exertion, rest in between sets, tempo that exercise was performed at, weight used, other (eg SpO2, movement quality, ROM, compensations, patient confidence/perception of movement, adverse symptoms, respiratory rate, frequency of training, recovery time, girth measurement.		
Strongly agree	18.8 (41)	13.3 (29)
Agree	28.4 (62)	21.1 (46)
Disagree	6.4 (14)	7.8 (17)
Strongly disagree	1.8 (4)	0.9 (2)

The results show that 54.1% of BPTh participants prefer doing full-body ST exercises to help improve their muscular strength, compared to 41.8% of MPTh (B1). 54.1% of BPTh participants felt that a patient's psychology must be considered when prescribing ST, compared to 42.7% with an MPTh degree; few participants disagreed (B2). 41.3% of BPTh have agreed that they follow social media accounts/online exercises for ST compared to 31.7% of MPTh, while 14.2% of BPTh participants have disagreed that they do not follow, compared to 11.5% of MPTh (B3). Most BPTh (52.3%) felt training sessions should include rest periods, compared to 42.2% of MPTh, while both groups shared opinion that no rest period should be given (B4). Both groups agreed that ST is age-related, while 14.6% of BPTh participants disagreed compared to 8.7% of MPTh (B5). (B6) majority reported that they keep documentation of patients, fewer participants disagreed.

Table 3: ST Knowledge of BPTH (n=121) & MPTH (n=94)

Survey items	BPTH% (n)	MPTH% (n)
K1. Knowledge of biomechanics is important for understanding human movements, including those involved in sport & exercise		
Strongly agree	39.4 (86)	34.4 (75)
Agree	16.1 (35)	8.7 (19)
Disagree	0 (0)	0 (0)
Strongly disagree	0 (0)	0 (0)
K2. From clinical perspective, it has been reported that regular participation in a resistance training program can result in a decrease in body fat, improvements in insulin sensitivity, & enhanced cardiac function among obese children & adolescents		
Strongly agree	27.1 (59)	27.1 (59)
Agree	27.5 (60)	16.1 (35)
Disagree	0.5 (1)	0 (0)
Strongly disagree	0.5 (1)	0 (0)
K3. ST can be a safe & effective method of conditioning for males & females of all ages & abilities		
Strongly agree	26.6 (58)	23.9 (52)
Agree	27.5 (60)	17.4 (38)
Disagree	1.4 (3)	1.8 (4)
Strongly disagree	0 (0)	0 (0)
K4. Tests & measurement can be used to assess patients talent, identify physical capacities in need of improvement, provide reference values to evaluate the effectiveness of a training program, & set realistic training goals		
Strongly agree	25.2 (55)	22.9 (50)
Agree	29.8 (65)	19.7 (43)
Disagree	0 (0)	0 (0)
Strongly disagree	0.5 (1)	0.5 (1)
K5. A warm-up can provide benefits that enhance subsequent performance		
Strongly agree	33.5 (75)	28.9 (63)
Agree	22.0 (48)	14.2 (31)
Disagree	0 (0)	0 (0)
Strongly disagree	0 (0)	0 (0)

K6. Your patients complains of soreness 2 days after performing ST. What is the BEST way to treat them today to reduce their perceived soreness		
Prescribing ST with an emphasis on eccentric contractions	11.0 (24)	10.6 (23)
Prescribing light intensity aerobic exercises	14.7 (32)	14.2 (31)
Applying ice or heat to the affected body regions	24.8 (54)	16.1 (35)
Advising the patients or clients to rest	5.0 (11)	2.3 (5)
K7. Which weight you are determining to use when prescribing ST to your patients, who is a novice with the ST. What is the SAFEST & MOST appropriate way to determine which weight to use		
Use observational expertise to determine which weight to use	12.4 (27)	6.4 (14)
Have the patients work up to performing 1RM	27.1 (59)	22.9 (50)
Have the patients perform 15 repetitions & ask how many more could they have done	4.1 (9)	3.2 (7)
Have the patients perform an 8 repetition maximum (8RM) & then calculate their estimated 1RM	11.9 (26)	10.6 (23)
K8. Are you aware any of the physical fitness guidelines by WHO, India		
Yes	35.8 (78)	29.4 (64)
No	19.7 (43)	13.8 (30)
K9. Are you aware of any books for referring the exercises or planning the programme for the patients		
Yes	30.3 (66)	28.9 (63)
No	25.2 (55)	14.2 (31)

The results show all participants agreed having knowledge of human biomechanics is important in practices for ST & helps in decreasing body fat & enhancing cardiac function among obese individuals & children (K1, K2). 54.1% of BPTh participants believe ST is an effective & safe method for all age groups, compared to 41.3% of MPTh (K3). 24.8% of BPTh participants believed in managing soreness by advising patients to apply ice or heat to affected body regions, compared to 16.1% of MPTh (K6). The majority of respondents felt that having patients work up to performing 1RM is the safest & most appropriate way to determine which weight to use, although there are variations in determining the weights to be used (K7). There is general awareness across all participants of having book references for planning programs (59.2%), while 39.4% of all participants are not aware of any book references.

Discussion

According to the survey, there is reasonably high awareness among physiotherapy practitioners regarding ST & conditioning, assessment & confidence in prescribing exercises though differences exist in attitudes & behaviours & knowledge. While there is majority agreement among participants regarding confidence in their ability & adequacy of education received to prescribe exercises, variations in agreement levels & instances of disagreement suggest knowledge for providing a program designed for optimal gains appears to be limited[14].

Recent studies highlight importance of social media as adjunct learning tools that support new graduate physiotherapists in transitioning into professional practice & overcoming traditional barriers[15]. However, the views expressed in our findings are based on opinions, & there is still a lack of evidence demonstrating that ST is inadequately applied in clinical practices[16-17.] Manual muscle testing is most commonly used for assessment, & requires little space, cost-effective alternative training method for poorly equipped facilities to conventional ST[18.] Considering psychology of patients while prescribing exercises is important, can modestly improve psychological function while enhancing muscle strength[19]. Optimizing exercise intensity through longer rest periods & implementing various factors such as training periods, intensity, time under tension, & rest between sets play crucial roles in improving muscle strength & should be considered in exercise training programs targeting healthy older adults[20-21]. It was observed physical activity levels were high among participants, majority being physically active while some with low physical inactivity which may be due to lack of support & motivation for physical exercise & sports, received during primary & secondary schooling[22].The established American College of Sports Medicine recommendations advice only 20 minutes of high-intensity exercise each day, 20 to 30 minutes is an appropriate amount of time to exercise[23]. Apart from that we also observed that there is more additional certificates like the yoga therapist, Pilates & aerobics, personal fitness trainer & only certificate of ST by the participants despite being confident in prescribing the ST exercise in their practices. This may be due to lack of professional motivation/ interest in their ST practices & access to the needy population in the community. This is not to say that the other organizations & other certifications are not respectable, however considering the certification regarding ST help in better implementing & setting the goals for the patients.

Conclusion

The majority of physiotherapists exhibit a general agreement regarding knowledge, attitudes, & behaviours related to ST. The findings of this study concluded that physiotherapist had positive knowledge about ST & are confident in their ability in implementing ST in their practices. Further, we observed that majority of the participants have mentioned that there is increasing awareness while some of them mentioned that there is less awareness of ST & to increase more awareness on ST learning, a greater emphasis at entry level education is recommended.

Conflict of Interest: Dr. Bharti Bisht & Dr. Ashish Dev Gera declare that they have no known financial interests, personal relationships, or affiliations that could appear to influence the work reported in this study. They have received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors related to this research.

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Ethical Cleareance: This study titled "ST & Conditioning Attitudes, Behaviour & Knowledge among Physiotherapy Students & Physiotherapists - A Cross Sectional Survey" has been reviewed & approved by the Institutional Ethics Committee of Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun, Uttarakhand, India. The committee has determined that the research complies with the ethical standards set forth by the institution & that the rights & welfare of the participants will be adequately protected. The researchers, Dr. Bharti Bisht & Dr. Ashish Dev Gera, have provided comprehensive information about the study, obtained informed consent from all participants, & ensured data confidentiality & security.

Ethics Committee Approval Number: DIBNS/ RAC/21-23/019 Date of Approval: 11/06/2024

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Original Research Article

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Arch Check Tool: An Innovative Instrument to Measure Arch Height

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Abstract

Background: Pes planus, commonly known as flat foot is a deformity of the foot, characterized by loss of the medial longitudinal arch of the foot. There are several diagnostic methods available, such -as radiographs and digital footprint scanning techniques, that involve the usage of ink, dyes, and expensive instrumentation which may be harmful and not readily available at all time.

The arch height may prove to be a user-friendly, portable, and affordable means of grading the foot. However, no tools were found during the search for review of literature.

Hence, a need for a tool to measure the arch height and further give standard range of the arch height for flat feet and non-flat feet was identified.

Objective: To design a tool and further provide values to differentiate flatfoot and non-flatfoot using arch height as a measurement tool.

Relevance: The instrument was designed to quantify arch height and values to differentiate flatfoot and non-flatfoot are provided by comparison with Chippaux Smirak Index (CSI).

Method: The study evaluated the medial longitudinal arches of 30 individuals (60 feet) using static footprints and arch height measurement with tool. The footprints were classified into flatfoot and non-flatfoot using CSI. Data was subjected to appropriate statistical analysis.

Results: The range of medial longitudinal arch height between 15-21 mm in sitting position and 13-19 mm in standing position identified with non-flat foot, while the range of medial longitudinal arch height between 10-14 mm in sitting position and 8-12 mm in standing position identified with flat foot when compared with CSI. These findings suggest that the tool can be used effectively to measure the medial longitudinal arch height and differentiate between individuals with flat foot and non-flat foot.

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Conclusion: The study concludes that the tool is effective in measuring the medial longitudinal arch height and can be used to differentiate between individuals with flat foot and non-flat foot. Designers of the tool would like to name the tool as ArchCheck Tool.

Keywords: Flat foot; Arch Check tool; Arch Height; Static Footprints; Chippaux Smirak index

Introduction

The ankle and foot complex is composed of 28 bones that form 25 component joints, as well as muscles, nerves, vessels, and soft tissues. The bones of the foot are arranged into three arches, which are supported by various muscles and ligaments of the ankle-foot complex. The three arches are referred to as the Medial longitudinal arch, Lateral longitudinal arch, and transverse arch.[1]

There are three types of foot classified based on the medial longitudinal arch: [1] normal foot, [2] flat foot or pes planus, and [3]high arched foot or pes cavus.[2]

Pes planus(flat foot), is the commonest foot deformity that occurs when the medial longitudinal arch of the foot collapses, causing the sole of the feet to come closer to the ground or make contact with the ground while standing.[3]

Flat foot can be either congenital or acquired.[4]

Congenital flat foot can be caused due to genetic malformations, congenital vertical talus, congenital talipes equinovarusand acquired flat foot can be a result of obesity, posterior tibial tendon dysfunction, and ligamentous laxity in the spring ligament, plantar fascia or other supporting plantar ligaments also in medical conditions such as cerebral palsy, rheumatoid arthritis, and muscular dystrophy.[4]

Assessing flat feet can be done through various methods like ultrasound, which

Provides dynamic images of soft tissues in the foot, CT scans, which provide detailed 3D x-ray images of the foot, and MRIs, which provide detailed information regarding soft tissue abnormalities in the ankle foot complex. Each method has its advantages and limitations, and the choice of assessment method may depend on factors such as the scale of the study, cost considerations, and the specific information needed. Radiographs can be a reliable method for assessing the medial longitudinal arch, but they are less applicable for larger scale studies due to their cost and the risk of radiation exposure. As an alternative, footprints have been found to be a simple, fast, reliable, non-invasive, and inexpensive method for assessing flat feet. Footprint analysis has been employedto the radiographic method and has been used for qualification, categorization, and surveillance of pes planus.[4]

However, allergies to ink, messiness for foot prints and sensory issues may hinder the procedure. Thus it is important to develop other simpler methods to measure the medial longitudinal arch height with an as precise as possible tool. The arch height further needs to be identified for classification into flat foot or non-flat foot.

OBJECTIVE

To design a tool and further provide values to differentiate flatfoot and non-flatfoot using arch height measurement tool.

Materials and Methods

Inclusion criteria

Young adults from 18-25 years of age of either gender were requested to volunteer for participation in the study.

Exclusion Criteria

Volunteers with specific medical conditions that may significantly affect foot structure or function, such as severe arthritis, neuropathy, or foot deformities were excluded. Volunteers with recent foot injuries such as fractures or ligament injuries and those who had undergone recent foot or lower limb surgery were excluded. Those who regularly used orthopedic devices, such as orthotic insoles or custom footwear were also excluded.

Methodology

The study protocol was reviewed and granted approval by the Institutional Ethical Committeevide document number SDMIEC:0104:2015. A triangular

tool (Figure 1) with angles of 90º, 60ºand 30º was designed and further marked with standard mathematical graph paper to measure the height. A group of 50 young adults in the age group of 18 to 25 years were randomly selected and explained the need for the study and procedure for the same. A written informed consent was obtained from the 40 persons who volunteered for participation, and further screened for the study. 4 individuals had plantar fasciitis, 3 individuals reported an issue with the ink being used and 3 had a history of foot injuries in the past 6 months. Thus 10 individuals were excluded from the study and 30 participants were ultimately selected to be part of the sample.

The medial longitudinal arch height was measured twice in both the feet of the 30 participants and the highest reading was recorded. Static footprints were also obtained from all the participants at the same time. The footprints were further evaluated using the Chippaux Smirak Index for the classification of foot type. The measured arch heights were further correlated with the corresponding measurements derived from the arch height tool. The footprints were classified into flatfoot and non-flat foot and further subjected to data analysis of the arch height.

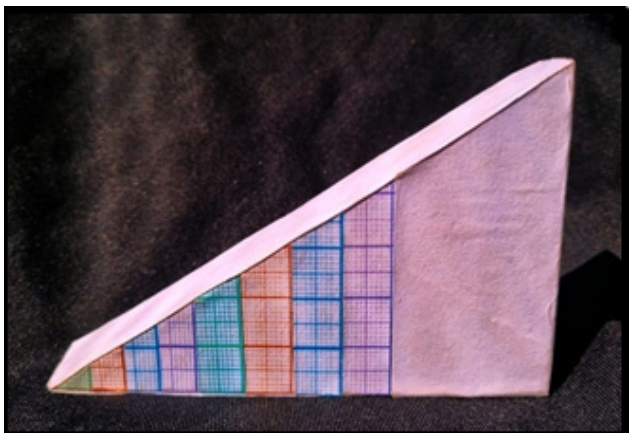

Figure 1: ArchCheck Tool

Method of Measurement of Arch Height: Arch height was measured in sitting and standing positions.

In Sitting: The participant was seated on a stool with hips and knees at 90 degrees of flexion and was instructed to maintain an erect spine with feet hip-width apart, looking straight forward. The arch height tool's smallest angle tip was placed at the highest visible point of the arch being tested. The tool was slid under the foot till the initial resistance was felt. The measurement for arch height was noted twice for each foot. The highest reading was recorded.

In Standing: The participant was asked to stand up from the stool and was instructed to look straight forward and equally weight bear on both feet. The tool was placed at the highest visible point of the arch being tested, and the participant confirmed if they perceived the tool to be at the middle of their foot. Adjustments were made if necessary based on the participant's directions, and the measurement for arch height was noted for each foot.

Method of footprint collection:

The individual was seated on a chair with the hip and knee flexed at 90 degrees each. A tray containing paint mixed with water was prepared. The participant was asked to place both feet in the tray. They were then advised to place both feet hip-width apart on a sheet of paper placed outside in front of the tray. They were asked to evenly distribute the weight on both feet and later move out of the sheet. The footprint created on the paper was assessed with CSI and the foot was classified thereafter.

Chippaux-Smirak Index was employed to measure the flatness of the footprint. The indices were determined by drawing two lines: one at the minimal distance of the midfoot region, one at the maximal distance of the forefoot area.

The Chippaux-Smirak Index is the ratio of the minimal distance of the midfoot regions (midfoot width CD) divided by the maximal width of the forefoot area (metatarsal width AB) multiplied by 100.[6] (Figure 2: A)

Figure 2: A. Chippaux Smirak Index = CD/AB x 100. B. Foot Print of a Normal Feet. C. Foot Print of a Flat Feet

Results

The data of 60 feet was subjected to data analysis. All analysis was done using Statistical Package for the Social Sciences (SPSS) version 23.0.

The data was analyzed for normality using Kolmogorov-Smirnov test and was found to be normally distributed. The baseline characteristics were assessed using Mean and Standard deviation for the descriptive statistics.

All calculations were done with a p-value ≤0.05 as statistically significant.

Table 1 presents the demographic information pertaining to the participants involved in the study.

Table 1: Demographic details of the participants

	MALES	FEMALES	TOTAL
NUMBER	15 (50%)	15 (50%)	30 (100%)
MEAN AGE YEARS (SD)	19.6 (±0.73)	19.6 (±0.50)	19.6 (±0.62)
UNILATERAL FLAT FOOT (as per CSI)	0	5 (16.7%)	5 (16.7%)
BILATERAL FLAT FOOT (as per CSI)	3 (10%)	2 (6.7%)	5 (16.7%)
NORMAL FOOT	12 (40%)	8 (26.66%)	20(66.6%)

The study comprised a sample size of 30 individuals, which included 15 (50%) females and 15 (50%) males with mean ages 19.6 (±0.73) and 19.6 (±0.50) respectively. The ages were not significantly different with a t-value of 0 at a p-value of 0.5.

Frequency distribution showed that 5 participants (all females) had unilateral flat foot while 5 participants (3 males and 2 females) had bilateral flat foot. The number of females affected with flat feet were 7 (23.4%) while males were 3 (10%). The number of females and males were not significantly different with a z-value of 1.3856 and p-value of 0.2. The feet wise distribution showed that 9 feet in females (15%) were flat while 6 feet in males (10%) were flat. The numbers were not significantly different at z-value of 0.8944 and p-value of 0.4.

Totally 15 (25%) feet out of 60 were flat while 45 (75%) feet were found to be normal. The number of flat feet was significantly lower than the number of normal feet at a z-value of -5.4772 and p-value of <0.00001.

Frequency distribution showed that 7 (46.7%) females were found have flat foot while 8 (53.3%) females were found to have normal foot. The number of females with flat foot and normal foot does not exhibit significant difference at a z-value of0.3651 and p-value of 0.7. Feet wise distribution showed that 9 (30%) feet of females were flat feet while 21 (70%) feet of females were found to be normal. The number of flat feet was significantly lower than the normal feet at z -value of 3.0984 and p value of 0.002.

Frequency distribution showed that 3 (20%) males were found to have flat foot while 12 (80%) males were found to have normal foot. The number of flat foot was significantly lower than the number of normal foot at a z–value of -3.2863 and p-value of 0.001. Feet wise distribution showed that 6 (20%) feet of males were flat feet while 24 (80%) feet of males were found to be normal. The number of flat feet was significantly lower than the normal feet at z–value of 4.6476 and p-value of <0.00001.

The mean arch heights of all the participants in sitting [Rt. 16.5 mm (±3.5),Lt.16.7 mm (±3.5)] and standing [Rt. 14 mm (± 3.6), Lt. 14 mm (±4)] were 17.6(±3.5) and 15.2(±3.8) respectively. The arch heights in sitting and standing were significantly different with the t-value of 3.77184 and p-value of 0.0003.

Comparison of arch height in sitting, between participants with flat foot[12 (±2)] and normal foot [18(±3)] as per CSI were significantly different with a t-value of 6.95886 at a p-value of<0.00001.

Comparison of arch height in standing, between participants with flat foot [10(±2)] and normal foot [16 (±3)] as per CSI were significantly different with a t-value of 6.90854 at a p-value of <0.00001.

Discussion

The included sample of participants was seen to be homogenous with equal distribution of females and males in the study. The results of our study showed that both female and male gender had equal probability of developing flat foot and this result

is supported by another study which reports that gender does not play any role in the occurrence of flat foot.[5]

The results also showed that an equal number of individuals had unilateral and bilateral flat foot. However a study shows that bilateral flat foot is more prevalent as compared to unilateral flat foot. The results of our study may not be in coherence with other studies and may be attributed to the very small sample size.[5]

The range of medial longitudinal arch height between 15 - 21 mm in sitting position and 13 -19 mm in standing position identified with non-flat foot, while the range of medial longitudinal arch height between 10 - 14 mm in sitting position and 8 -12 mm in standing position identified with flat foot when compared with CSI. These findings suggest that the tool can be usedeffectively to measure the medial longitudinal arch height and differentiate between individuals with flat foot and non-flat foot.

Conclusion

Study concludes that the tool is effective in measuring the medial longitudinal arch height and can be used to differentiate between individuals with flat foot and non-flat foot.

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Original Research Article

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Psychosocial Treatment Techniques to Augment the Impact of Occupational Therapy Interventions for Chronic Low Back Pain among School Teachers

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Abstract

Background: School teachers perform numerous tasks that contribute to low back pain and affect their activities of daily living, social and vocational abilities. Low back pain is multidimensional in nature constituting physical, psychological and social components. Psychosocial variables pose as an obstacle to rehabilitative recovery and have a role in development of chronicity, these factors are often neglected in the rehabilitation process, the present study integrates psychosocial factors with musculoskeletal factors and utilises a rehabilitation program that focuses on overall recovery.

Objectives: This study aims to find effective treatment for psychosocial variables and examines the physical and psychosocial changes that occur in school teachers suffering with CLBP when they receive occupational therapy augmented with psychosocial intervention. The intervention targets anxiety, perceived stress, and self-efficacy.

Methodology: The study sample consisted of 60 school teachers, half of the sample was enrolled for occupational therapy intervention and other half for occupational therapy intervention augmented with psychosocial treatment techniques.

Results: At post-treatment participants in the occupational therapy augmented with psychosocial treatment group showed significant difference in measures of anxiety, perceived stress and self-efficacy, pain intensity, pain severity, pain disability and 5-minute walk test distance compared to participants who received occupational therapy treatment only. The two groups did not differ significantly in finger-to-floor test.

Conclusion: The findings of the study suggest that augmenting psychosocial variables is beneficial to person-environment factors of disability and result in better rehabilitation outcomes in terms of both psychosocial variables as well as pain related variables.

Keywords: Chronic Low back pain, psychosocial treatment, school teachers, integrative approach

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Introduction

A recent study suggests that low back pain is the leading cause of disability worldwide and is a major cause of years lived with disability (YLD). In 2020, low back pain affected 619 million people globally, with incidences found higher in Women, with a projection of 843 million prevalent cases by 2050, which the highest increase in Asia and Africa.[1]

Psychological factors are often assessed separately while there is an overlap between physical and psychological components. Fear avoidance beliefs, depression, anxiety, perceived disability, fear of movement, catastrophic thinking, poor self-efficacy and social stress are highly prevalent in adults with chronic LBP.[2,3] Psychosocial factors such as low job satisfaction, monotonous tasks, social relations, perceived demands, self-reported stress, and work pace show a strong association with low back pain.[4] A study found that if a worker is under psychosocial stress while performing a lifting task, it leads to increased muscle activity and increased spine compression and lateral shear.[5] Psychosocial factors have also been associated with influencing the development of LBP chronicity.[6]

As per the latest Unified District Information for Education plusreport, India is home to 95,07,123 school teachers. The average age of teachers with LBP was measured to be 42.22± 10.[7] School teachers perform numerous tasks that contribute to back pain, standing in the classroom or at the blackboard for long periods of time, bending over desks to read or grade students work, having to lift heavy books or classroom equipment, and absence of ergonomic classrooms and staff rooms.[8,9] Since LBP is multidimensional in nature its management should establish an integrative and multidisciplinary approach. From a socioecological perspective challenges related to regional differences, inadequate infrastructure, a lack of qualified workers, cultural issues, gender norms, social shame, religious views, economical implications, out-of-pocket costs and language problems leads to barriers in accessing multidisciplinary healthcare in India.[10]

Despite the call for the profession to embrace a more integrated and holistic approach to practice, therapists may be faced with practical challenges, including issues related to client caseloads, productivity demands, scheduling, entrenched practices, limitations on service imposed by payer sources, staffing and budgetary restraints. Due to these limitations, current OT practice may be predisposed to adopt a more reductive approach to the evaluation and treatment of symptoms, wherein psychosocial factors may be neglected, resulting in an unbalanced, fragmented, and incomplete approach to patient care.[11]

Materials and Methods

The research design is a before-after with control experimental study.

Participants: The study sample consisted of 60 school teachers from Apex public school and Joseph and Mary public school, using convenience sampling. Prior permission was taken from all participants and consent forms were signed. Every measure was taken to retain their confidentiality in the study. All the participants were informed about the study and its purpose. The participants were not harmed physically, emotionally, culturally or economically at any point of intervention and data collection, they retained the liberty to withdraw from the study in case of any discomfort.

Inclusion criteria: Participants suffering from chronic (> 12 weeks) / recurring/ progressive LBP, within the age group of 30-50 years. Participants of both genders. Participants with or without radiating pain.

Exclusion criteria: Individuals with reduced level of consciousness or psychiatric disorders (psychosis), cognitive and language disorders. Participants with LBP with history of trauma. Individuals currently seeking psychological counselling. Individuals engaging in other physical activity programs like gym, swimming, athletic activities etc.

Procedure: The sample was divided into Group A- experimental group (Psychosocial treatment along with OT intervention) and Group B- control group (Occupational therapy intervention only) for 4-weeks. Half the sample (27 women and 3 men) received intervention in a group setting of 5 participants in 6 groups, sessions were conducted weekly for 45 mins along with OT treatment administered under

supervision once a week for 45 mins in group setting including 6 groups of 5 participants. The other half (27 women and 3 men) received OT treatment only administered under supervision once a week for 45 mins in group setting including 6 groups of 5 participants, exercises were explained and demonstrated for the week and a printed booklet for the exercise program was provided to all the participants as a part of OT intervention. Feedback was taken from participants daily telephonically.

Measures:

Anxiety: The Hamilton anxiety scale (HAM-A) consists of 14 items, each defined by a series of symptoms, and measures both psychic anxiety and somatic anxiety. The reliability and the concurrent validity of the HAM-A and its subscales proved to be sufficient.[12]

Physical function: To measure physical functions, two functional performance tests will be used: a 5-minute walk and a finger-to-floor test. These assessments constitute a component of a battery that was previously evaluated on various patient populations.[13]

Self-rated disability: The Pain Disability Index (PDI) assesses the degree to which respondents perceive themselves to be disabled in seven different areas of daily living. The PDI has been shown to be internally reliable and significantly correlated with objective indices of disability.[14,15]

Severity of pain: The short-form McGill Pain Questionnaire (SF-MPQ) is a shorter version of the original MPQ, a study concluded that the SF-MPQ-2 is a valid instrument for use in clinical trials to assess pain qualities in patients with low back pain.[16]

Stress: PSS-10 The Perceived Stress Scale (PSS-10) is a 10-item questionnaire, it evaluates the degree to which an individual has perceived life as unpredictable, uncontrollable and overloading over the previous month. The psychometric properties of the 10-item PSS were found to be superior to those of the 14-item PSS.[17]

Self- efficacy: The General Self-Efficacy Scale is a 10-item psychometric scale that is designed to assess optimistic self-beliefs to cope with a variety of difficult demands in life. Criterion-related validity is documented in numerous correlation studies where positive coefficients were found with favorable emotions, dispositional optimism, and work satisfaction.[18]

Psychosocial intervention:

Table 1. Distribution of Psychosocial intervention over 4 weeks

Week 1	Administration of assessment scales. Introduction to relaxation techniques. Incorporating relaxation technique for 10 minutes after every exercise session. Incorporating positive reinforcement during both psychosocial and exercise therapy sessions.
Week 2	Goal setting and leisure activity planning. Participation in leisure activity over the week. Identification of movement fears and incorporating graded exposure during exercise session.
Week 3	Patient education and challenging negative pain and disability beliefs.
week 4	Explaining Importance of positive self-talk and group discussion.
End of week 4	Re-administration of assessment scales.

Occupational therapy intervention:

Table 2. Distribution of Occupational therapy intervention over 4 weeks.

Week 1	Administration of assessment scales and brief OT assessment.
Week 2	Client-centered goal setting and establishing client-centered home-based treatment program. Distribution of exercise booklet. Hands-on treatment and telephonic follow up for the rest of the week.
Week 3	Follow up program.
Week 4	Follow up program.
End of week 4	Re-administration of assessment scales

Results

Demographic characteristics (Table 3) and outcome measure scores (Table 4) were comparable between the two groups at the pre-intervention stage tested using independent t-test.

Table 3. Sample distribution on the basis of Gender and Age.

GENDER	EXPERIMENTAL GROUP	CONTROL GROUP
FEMALE	27	27
MALE	03	03
AGE GROUP (Years)	**EXPERIMENTAL**	**CONTROL**
30-40	17	16
40-50	13	14

Table 4. Descriptive statistics of pre-treatment comparison of variables between experimental and control group

Variable	GROUPS	N	Mean	SD (±)	T-Test	P-Value (Two-tailed)	Significance
HAM-A-1	Experimental Control	30 30	23.87 22.37	3.674 4.735	1.438	.156	Not significant
5MWT-1 (m)	Experimental Control	30 30	330.57 331.07	9.898 8.166	-.213	.832	Not significant
FTFT-1 (cm)	Experimental Control	30 30	19.66 19.36	1.9201892 1.2925071	.710	.481	Not significant
PDI-1	Experimental Control	30 30	32.27 32.90	3.571 3.044	-.739	.463	Not significant
SF-MPQ-1	Experimental Control	30 30	24.23 23.90	2.431 2.187	.558	.579	Not significant
VAS-1	Experimental Control	30 30	6.67 6.40	1.241 1.163	.859	.394	Not significant
PSS-1	Experimental Control	30 30	24.67 24.47	3.397 4.075	.206	.837	Not significant
GSE-1	Experimental Control	30 30	22.43 23.07	2.873 3.084	-.823	.414	Not significant

Paired t-tests assessed the effectiveness of treatment provided to both group by comparing Pre-treatment and Post-treatment outcome scores (Table 5). The treatment provided had significant effects on indices of pain severity (VAS, SF-MPQ), physical function (5MWT, FTFT), or psychosocial variables (HAM-A, PDI, PSS, GSE) between pre-treatment and post-treatment of experimental group as well as control group.

Table 5. Descriptive statistics of comparison of variables between pre and post-treatment scores for experimental and control groups.

Groups	Experimental group					Control group				
Variable	**Mean**	**SD (±)**	**T-Test**	**P-Value (Two-tailed)**	**Sig.**	**Mean**	**SD (±)**	**T-Test**	**P-Value (Two-tailed)**	**Sig.**
HAM-A 1 HAM-A-2	23.87 17.07	3.674 3.183	27.603	.000	Sig.	22.37 20.13	4.375 4.125	14.969	.000	Sig.
5MWT-1 (m) 5MWT-2 (m)	330.57 355.47	9.898 8.042	-17.212	.000	Sig.	331.07 341.13	8.166 7.011	-22.264	.000	Sig.
FTFT-1 (cm) FTFT-2 (cm)	19.66 17.86	1.9201892 2.0750737	11.753	.000	Sig.	19.36 18.14	1.29 1.31	17.212	.000	Sig.
PDI-1 PDI-2	32.27 17.67	3.571 2.496	24.731	.000	Sig.	32.90 23.10	3.044 3.155	30.006	.000	Sig.
SF-MPQ-1 SF-MPQ-2	24.23 15.20	2.431 1.769	25.762	.000	Sig.	23.90 20.03	2.187 2.092	16.216	.000	Sig.
VAS-1 VAS-2	6.67 3.33	1.241 .959	19.796	.000	Sig.	6.40 4.10	1.163 1.185	27.028	.000	Sig.
PSS-1 PSS-2	24.67 13.30	3.397 1.932	25.641	.000	Sig.	24.47 20.77	4.075 3.626	13.205	.000	Sig.
GSE-1 GSE-2	22.43 28.63	2.873 2.918	-21.145	.000	Sig.	23.07 24.97	3.084 2.883	-10.846	.000	Sig.

At post-intervention data was compared between the two groups using independent t-test (Table 6). The two groups did not differ significantly in terms of physical functions in measure of finger-to-floor test (p=.535), but differed in 5-min walk test (p=.000), there were significant improvement in pain severity (SF-MPQ, p= .000), pain intensity (VAS, p=.008), and pain disability (PDI, p=.000), most pronounced differences were on post-treatment psychosocial variables including anxiety (HAM-A, p=.002), perceived stress (PDI, p=.000) and self-efficacy (GSE, p=.000)

Table 6. Descriptive statistics of post-treatment comparison of variables between experimental and control group

Variable	GROUPS	N	Mean	SD (±)	T-Test	P-Value (Two-tailed)	Significance
HAM-A-2	Experimental Control	30 30	17.07 20.13	3.183 4.125	-3.224	.002	Significant
5MWT-2 (m)	Experimental Control	30 30	355.47 341.13	8.042 7.011	7.358	.000	Significant
FTFT-2 (cm)	Experimental Control	30 30	17.8600 18.1400	2.0750737 1.3119083	-.625	.535	Not significant
PDI-2	Experimental Control	30 30	17.67 23.10	2.496 3.155	-7.397	.000	Significant
SF-MPQ-2	Experimental Control	30 30	15.20 20.03	1.769 2.092	-9.661	.000	Significant
VAS-2	Experimental Control	30 30	3.33 4.10	.959 1.185	-2.755	.008	Significant
PSS-2	Experimental Control	30 30	13.30 20.77	1.932 3.626	-9.953	.000	Significant
GSE-2	Experimental Control	30 30	28.63 24.97	2.918 2.883	4.896	.000	Significant

Discussion

The primary aim of this study was to examine the physical and psychosocial changes that occur in CLBP among school teachers when occupational therapy intervention is augmented with psychosocial intervention. Two samples of school teachers with CLBP were selected and data was compared on a number of clinical outcomes. Most marked differences between the two groups at post-treatment were among psychosocial variables, which can be explained as the psychosocial treatment was designed to target psychosocial risk factors for pain and disability. The psychosocial treatment also proved valuable by having an impact on pain intensity, severity, disability and 5-minute walk test. However, it is understandable that there wasn't significant difference between the two groups in terms of Finger-to-floor test because the two groups received comparable OT treatment. Psychosocial treatment techniques affected OT treatment with client-centered goals and graded exposure to feared movements.

Crofford et al.(2015) suggested that it is more important to identify psychological comorbidities in patients with chronic pain and develop a management plan taking these into account.[19] Turk et al. (1983) provided a cognitive behavioral perspective into disability and suggested that along with physical interventions, CBT has been recognized as a tool in the management of psychosocial factors associated with low back pain, traditionally it is delivered by psychologists. It uses several different techniques for pain management, that may include self-instruction (e.g., motivational self-talk), relaxation or biofeedback, exposure, developing coping strategies, minimizing negative or self-defeating thoughts, changing maladaptive beliefs about pain, and setting goals.[20] This study incorporates such treatment techniques focusing on relaxation, client-centered goal setting, patient education, engaging in leisure activities, challenging negative beliefs, graded exposure to feared movements, positive reinforcement and positive self-talk for targeting psychosocial risk factors.

The use of group sessions resulted in social bonding between teachers. LBP and the disability associated with it proved to be a common topic of discussion and facilitated social friendships that further existed beyond treatment sessions. Shariatetal. (2019) suggested that prior studies have shown the effectiveness of relaxation techniques on pain perception and reduction, the most frequently employed are progressive relaxation, autogenic training, guided imagery and deep breathing.[21] This study utilizes all four of the relaxation techniques mentioned. In this study Relaxation exercises were implemented for 10 minutes at the end of every session and helped participants reduce stress and feelings of anxiety. Engaging in leisure activities had positive benefits in bringing joy and motivation to the participants. 10-20 minutes of leisure activities were part of the participant's daily activity schedule and were chosen based on participant's interests and brought about nostalgia and enjoyment. Traeger et al. (2015) suggests that there is evidence that patient education can provide long-term reassurance, reduce pain-related distress, and reduce healthcare use in patients with LBP.[22] This study involved patient education about the causes of LBP and its effects on physical and mental well-being, precautions to be taken to avoid exaggeration of symptoms and to maintain proper posture and mechanics while going about their day; open discussion about negative beliefs and their effects in daily life. Negative beliefs were challenged through rationalizing negative thoughts, using medical facts and building a new perspective towards the same. Coppack et al. (2012) suggest that goal setting has been found to have a positive effect on adherence to exercise and on self-efficacy.[23] In this study goals included feared movements attained using exposure therapy. Practicing positive self-talk helped participants to feel optimistic and motivated to exercise.

Pergolizzi et al. (2020) described that biopsychosocial interventions for LBP were found to be more effective than education/advice for LBP patients. The most effective forms of biopsychosocial interventions were those that focused on psychosocial factors (understanding the nature of pain, coping skills, goal setting, and pushing aside unhelpful thoughts).[24] Using a biopsychosocial approach, OTists can incorporate psychosocial and occupation-focused assessments and interventions to improve overall well-being and rehabilitation outcomes. Incorporating psychosocial treatment

along with occupational therapy is a cost-effective approach, programs that include routine evaluation of psychosocial variables can facilitate timely identification of risk factors for chronicity and their reduction to prevent long term disability.

Conclusion

The present findings conclude that providing psychosocial treatment along with occupational therapy can augment the impact of occupational therapy for CLBP among school teachers. It also concludes that treatment techniques focusing on relaxation, client-centered goal setting, patient education, engaging in leisure activities, challenging negative beliefs, graded exposure to feared movements, positive reinforcement and positive self-talk are effective in targeting psychosocial risk factors and have additional benefits towards pain management.The length of treatment program was 4 weeks long and should be considered while interpreting the findings of this study. Nevertheless, the results are clinically significant. It is further recommended that treatment program incorporated in this study could be designed for a longer duration with a long-term follow up post intervention, and could be implemented for different musculoskeletal conditions among a range of population.

Conflicts of Interest: None

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Original Research Article

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Effects of Bilateral Upper Extremity Exercises Training on Trunk Performance, Posture and Gait in Patients with Subacute Stroke: A Quasi Experimental Study

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Abstract

Background and objective: Stroke is one of the neurological disorders which is caused by disturbance in blood supply to the brainresulting in weakness in contralateral limbs and axial musculature. Stroke is the leading cause of physical impairment where the most prominent motor deficit is paresis of one side of body, which is contralateral to the event. This study was conducted with an aim to assess the effectiveness of bilateralupper extremity training on trunk performance, posture and gait in patients with subacute stroke.

Method: 30 subjects with subacute stroke were selected for the study. Subjects were treated for 3 days/week for 12 sessions with 45 minutes of task oriented, strengthening training and PNF technique for bilateral upper extremity along with conventional training. The rehabilitation protocol consists of bilateral functional exercises, activity of daily living goal, exercises in multiple movement games, strengtheningexercises for lower limb, controlled sitting training, sit to stand training, weight bearing and balance training

Conclusion: Significant improvement in all items of TIS, PASS and DGI were observed after intervention ($P< 0.001$). The study concluded that bilateral upper extremity training is more effective in improving trunkcontrol, posture and gait in subacute stroke patients.

Keywords: Stroke, Trunk Control, Bilateral upper extremity trainings, Posture, Gait

Introduction

Stroke was the second leading cause of death worldwide, according to the global burden of diseases (GBD) study in 1990.[1] During the past two decades, there is 26% increase in global deaths of stroke and stroke still remains the second leading cause of death worldwide.[1] The prevalence rate of stroke for total of urban and rural population, varied from 44.54 to 150/100000 where urban population prevalence rate was 45 to 487/100000 and rural population was 55 to

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388.4/100000.[2] Stroke is the leading cause of physical impairment where the most prominent motor deficit is paresis of one side of body, which is contralateral to the event.[2,3,4] Stroke is one of the chronic disorders and it can affect the arm-hand performance with the trunk performance permanently.[3,4,5,6,7]

During reaching or any activities requiring arm extension there is excessive compensatory trunk movements in patients resulting in the secondary complications including contractures, disuse of limbs, balance impairment, pain and more energy expenditure.[8] Problems of breathing, speech, balance, gait and arm and hand function is associated with poor trunk control. One can lose the ability to control trunk movements, sitting and standing balance with loss of selective trunk control.[9] One of the most important predictor of motor and functional recovery is sitting balance post stroke.[10] For coordinated movements of the extremities, balance and tasks performance, trunk control is a core component.[11,12] With the hand, trunk begins to move simultaneously or slightly before, when an individual try to reach object beyond its arm length. Impaired upper extremity control and coordination leads to excessive trunk movements.[13]Compensations between shoulder and upper trunk during arm movements is found to be slightly higher in stroke patients.[14]

A study indicated that trunk muscles are activated before movement of upper extremities.[15] Another study reported that limitation of compensatory trunk movement may be an essential element during task-related training of upper extremities particularly for chronic patients with hemiparesis and controlled movements of upper extremities activate trunk muscles.[16,17] It was also demonstrated that bilateral upper extremity training effectively reduces the trunk compensation.[18] A literature suggested that movement of upper extremities are associated with trunk muscle activity.[19]It has also been reported bilateral upper extremity exercise decrease the need of trunk involvement.[20]

Trunk rehabilitation has gained only a little attention despite the evidence of its importance in day-to-day activities. Some of the studies suggested that upper extremity function gets improved with trunk rehabilitation.[20] A literature concluded that trunk impairments and gait are positively correlated in stroke patients. This indicates the need for the early implementation of truncal rehabilitation for better rehabilitation outcomes.[21]Hence, this study was focused to assess the efficacy of bilateral upper extremity exercises training on trunk performance, posture and gait of patients with subacute stroke.

Materials and Methods

SOURCE OF DATA:

Subjects were obtained from R.V. College of Physiotherapy - OPD and other selected Neurological Rehabilitation centres and Physiotherapy Clinics across Bengaluru

METHOD OF COLLECTION OF DATA:

The data for the study was collected based on the following categories:

- **Study recruitments:** Subacute stroke patients selected from the study setting (14 days to 6 months)
- **Sampling Method:** Purposive sampling
- **Sample size:** Total sample size = 30

INCLUSION CRITERIA:

- Age group between 45 to 60 years
- Patients willing to participate as volunteers and sign the written informed consent
- Patients able to walk independently
- Patient able to remain in sitting position without support
- Fugl-Meyer Scale for Upper Extremity score above 19
- Ability to follow 2 step commands
- Patient with 4 and 5 grade in voluntary control grading

EXCLUSION CRITERIA:

- Any other neurological or rheumatic disorders
- Significant orthopedics or pain condition in upper extremity
- Any spinal or limb deformities
- Uncontrolled hypertension

- Skin rashes or allergy
- Evidence of neglect
- Patient with shoulder hand syndrome
- Patient with cognitive issues

PROCEDURE:

After obtaining an approval from the Institutional Ethics Committee (IEC) of R.V. College of Physiotherapy® subjects were selected according to inclusion and exclusion criteria of the study.Subjects who fulfill the inclusion and exclusion criteria were included in the study.

Informed consent was taken from the subjects and the procedure of the study was explained to them. A detailed neurological examination was performed.

Pre-test

Subjects were screened for hand function by Fugl-Meyer Scale for Upper Extremity

↓

Pre-assessment of outcome measures (TIS, PASS and DGI) was done by a researcher.

↓

Subjects were treated for 3 days/week for 12 sessions with 45 minutes of task oriented, strengthening training and PNF technique for bilateral upper extremity along with conventional training. The rehabilitation protocol consists of bilateral functional exercises, activity of daily living goal, exercises in multiple movement games, strengthening exercises for lower limb, controlled sitting training, sit to stand training, weight bearing and balance training.

↓

All activities were performed with increasing the difficulty levels and with progression in range of motion according to patient capacity followed by exercise performance feedback and was supported byverbal instruction like reach and point to the target and touch the target etc. for most of the task (shown in table below), subject initially performed few repetitions and then gradually increases this to N no. of sets.

↓

Each exercise was designed based on timing and spatial coordination.

Post-test- At the end of 4 weeks, the researcher re-evaluated the outcome measures (TIS, PASS and DGI).

Task training	Strengthening training	Conventional training
Pushing and pulling with both arm	Carrying an object	Bridging exercise
Wipe table with both arm	Repetition of active and passive bilateral forearm supination and pronation	Lower limb strengthening
Bilateral reaching and placing object	Same movement with resistance	Controlled sitting training
Elbow extension duringreach	Repetition of wrist flexion and extension	Sit to stand
Bilateral Grip object of different size and shape (volleyball, rectangular box,)	Same movement with resistance	Range of motion exercisesfor lower limb
Drinking water from abottle	Bilateral isometric hand grip force training	Balance and gait training

STATISTICAL ANALYSIS:

The data collected for this study was analyzed statistically in the following 2 ways:

1. **Descriptive statistics:** All the categorical variables were presented in a tabular form, the result was expressed in frequency tables, percentage wherever necessary. The quantitative variables were described by means of descriptive statistics like Mean, Median, SD or interquartile range with standard error of mean and 95% confidence interval for mean. Wherever necessary the result was presented graphically.

2. **Inferential statistics**: The difference in the mean scores from pre-test to post-test between the outcome measures scale (TIS, PASS and DGI) was assessed by using paired t-test or Wilcoxon signed rank test, subject to verification of normality assumption. Results was considered significant whenever P≤0.001.

Results

Table No. 1: Age wise distribution of subjects

Age (yrs.)	Frequency	Percent
46 - 55	11	36.7
56 - 60	19	63.3
Total	30	100.0

In the present study, it was observed that, out of 30 subjects studied, 11 (36.7%) were in age group 46 to55 and 19 (63.3%) were in age group 56 to 60.

Table No. 2: Gender wise distribution of subjects

Gender	Frequency	Percent
Male	16	53.3
Female	14	46.7
Total	30	100.0

Out of 30 subjects 16 were male and 14 were female. The proportion of male subjects was 53.3% andfemale subjects was 46.7%.

Table No. 3: Distribution of subjects by affected side

Affected side	Frequency	Percent
Right	22	73.3
Left	8	26.7
Total	30	100.0

In the present study it was observed that, out of 30 subjects, 22 (73.3%) were right side hemiparesis and8 (26.7%) were left side hemiparesis.

Table No. 4: Trunk Impairment Scale (TIS)

Trunk impairment scale (TIS)	Pre-test		Post-test		t - value	P-value
	Mean	SD	Mean	SD		
Static sitting balance (SSB)	4.57	1.30	6.27	0.58	8.323	< 0.001
Dynamic sitting balance (DSB)	5.10	1.47	9.27	1.31	14.082	< 0.001
Coordination	2.40	1.16	5.17	0.95	13.350	< 0.001
Total score	12.07	2.97	20.83	2.45	20.880	< 0.001

- In the present study, the mean ± SD of static sitting balance pre-test was 4.57 ± 1.30 and for post-test it was 6.27 ± 0.58. Here, the difference in mean is found to be statistically significant (t-value =8.323, p < 0.001).
- The mean ± SD of dynamic sitting balance pre-test was 5.10 ± 1.47 and post-test it was 9.27 ± 1.31. Here, the difference in mean is found to be statistically significant (t-value =14.082,p<0.001)
- The mean ± SD of coordination pre-test was 2.40 ± 1.16 and post-test it was 5.17 ± 0.95. Here, the difference in mean is found to be statistically significant (t-value= 13.350, p< 0.001)
- The mean ± SD of total score of Trunk Impairment Scale (TIS) pre-test was 12.07± 2.97 and post-test was 20.83 ± 2.45. There is a significant difference of t-value= 20.880 (p<0.001). Thisshows that there is a significant improvement for trunk impairment score.

Table No. 5: Postural Assessment Scale for Stroke patients (PASS)

Postural assessmentscale for stroke patient (PASS)	Pre-test		Post-test		t - value	P - value
	Mean	SD	Mean	SD		
Maintaining posture (MP)	10.53	2.33	13.77	1.01	10.753	< 0.001
Changing a posture (CP)	16.67	2.70	20.43	0.86	9.344	< 0.001
Total Score	27.20	4.51	34.30	1.76	11.843	< 0.001

- In the present study, the mean ± SD of Maintaining Posture pre-test was 10.53 ± 2.33 and for post-test it was 13.77 ±1.01. Here, the difference in mean is found to be statistically significant (t-value =10.753, p < 0.001). This shows that there is a significant improvement in maintainingthe posture.
- The mean ± SD of Changing a Posture pre-test was 16.67 ± 2.70 and for post-test it was 20.43 ±
- 0.86. Here, the difference in mean is found to be statistically significant (t-value =9.344, p <0.001). This shows that there is a significant improvement in Changing the Posture.
- The mean ± SD of total score of PASS pre-test was 27.20± 4.51 and post-test was 34.30 ± 1.76. There is a significant difference of t-value= 11.843 (p<0.001). This shows that there is a significant improvement in PASS score.

Table 6: Dynamic Gait Index (DGI)

Dynamic Gait Index (DGI)	Mean	SD	t - value	P - value
Pre-test score	14.50	3.893	11.986	< 0.001
Post-test score	20.27	2.638		

- In the present study the mean ± SD of total score of Dynamic Gait Index (DGI) pre-test was 14.50± 3.893 and post-test was 20.27 ± 2.638. There is a significant difference of t-value= 11.986 (p<0.001). This shows that there is a significant improvement for DGI score.

Discussion

The present study was conducted to assess the effectiveness of bilateral upper extremity training on trunk performance, posture and gait in patients with subacute stroke in the age group between 45 and 60 with FMUE score above 19. A total of 30 subjects had participated in this study after signing the informed consent form. Outcome measures were recorded pre- and post- interventions.

After stroke, the sensorimotor impairment of trunk interferes with daily living affecting the functional performance of the individual. Trunk control is the ability of the trunk muscles to maintain the body upright, perform different movements like bending forward, backward and sideways, rotation of trunk, adjust the weight shifts and maintain the center of mass of the body during postural adjustments withinthe base of support.[22] The present study shows a significant improvement in trunk impairment scale score with significant difference of t-value= 20.880 (p<0.001).

Several studies have reported the weakness of trunk flexor-extensor and bilateral trunk rotators muscles with either left or right side body weakness in stroke survivors when compared to the age of healthy matched control.[23] Even pelvic alignment which is the major component for standing, walking and maintaining the posture is not normal after stroke and is influenced by poor trunk control.[24] The present study shows a significant improvement in PASS score with significant difference of t-value= 11.843 (p<0.001).

A study was conducted to examine the relation between upper extremity function and trunk control, balance and functional mobility in individuals with chronic stroke where upper extremity function was evaluated with upper extremity sub scale of the STREAM scale and trunk control, balance and functional mobility by TIS, BBS and TUG respectively. As a result, a relation was detected between upper extremity function, trunk control and balance highlighting the importance of focusing on upper extremity to improve trunk control, posture and balance in stroke survivors.[25]

In the present study there was significant improvement in all items of TIS, PASS and DGI were observed after intervention (P< 0.001). Another study has suggested that individuals with better upper extremity function has better balance, mobility and trunk control. Hence, it is important to focus on upper extremity as well as trunk control to improve balance and mobility in rehabilitation of stroke patients.[25] In the present study, there is a significant difference of t-value= 11.986 (p<0.001) of DGI score.

LIMITATIONS:

- The sample size was small.
- Study focused on only pre- and post-assessment variables documentation.
- A present study lacked with follow up interval.

RECOMMENDATION:

- Large sample size with more than 6 weeks of interventions with regular follow-ups can be performed.

Conclusion

The objective of the study was to assess the effectiveness of bilateral upper extremity training on trunk performance, posture and gait in patients with subacute stroke. The results of the present study states that the bilateral upper extremity training can be included with conventional training in the treatment protocol for subjects with subacute stroke with impaired trunk performance, posture and gait. Hence, it can be concluded that bilateral upper extremity training along with conventional therapy can provide more stability, improve the gait pattern, prevent fall and help with ADL activities in patients with subacute stroke.

Ethical Clearance: Approval was obtained from the Institutional Ethics Committee (IEC) of RV College of Physiotherapy®.(RVCP/RESEARCH/0920 Dated 24.08.2021)

Source of Funding: Self

Conflict of Interest: Nil

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Original Research Article

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Effectiveness of Visual Feedback Balance Training on Equiboard Versus Traditional Balance Training in Post Stroke Patients: A Comparative Study

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Abstract

Background: A Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system by a vascular cause and is a major cause of disability and death worldwide.(1) Balance problems are thought to be common after stroke and they have been implicated in the poor recovery of activities of daily living and mobility and increased risk of falls.(2) Postural sway for patients with hemiplegia can be twice that of their age matched peers. Many balance training are used but No general physiotherapy approach has proven to be superior for promoting balance recovery from stroke.(3) Novel biofeedback devices based on Virtual reality (VR)technology are now being used for neuromotor rehabilitation. Traditional balance training is based on the automatic repetition of specific movements. These methods can become repetitive and thus reduce the motivation of the patient and adherence to treatment. So the need of my study is to compare the effectiveness of visual feedback balance training on equiboard and traditional balance training in post stroke patients.

Aims and objectives: To study and compare the effectiveness of visual feedback balance training on equiboard versus traditional balance training in post stroke patients.

Methodology: 30 patients with stroke were equally divided into two groups. patients in group A received the conventional physiotherapy while the patients in group B received visual feedback balance training on equiboard. All the subjects were treated for 1 month, 5 days a week. BBS-Berg Balance Scale and step test was used as the outcome measure at the beginning and end of study.

Results: Results showed significant improvement within both the groups for both the outcome measure(p,0.05), while there was no significant difference between two groups in BBS($p>0.5$), but there was significant difference in the step test of experimental group($p<0.5$)

Conclusion: It can be concluded that visual feedback balance training is more effective than the traditional balance training alone in stroke patients.

Keywords: stroke, balance training, visual feedback.

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Introduction

A Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system by a vascular cause, including cerebral infarction, intracerebral hemorrhage and sub arachnoid hemorrhage and is a major cause of disability and death world wide.[1] After congenital heart disease & cancer of all types, stroke is the 3rd leading cause of death worldwide. However unlike caucasians, Asians have a low rate of Chronic Heart Disease(CHD)& have a higher prevalence rate of stroke. Among the Asians the number of people died from stroke was 3 times that of CHD.[4] It is the most common condition affecting many people. The incidence rate in India is 119- 145/100000 based on the recent population based Studies(2013). The estimated adjusted prevalence rate of stroke range 84-262/100000 in rural and 334-424/100000 in urban india.[5] The most common impairments seen post stroke are sensory impairments, weakness, headache, visual changes, alteration in muscle tone, abnormal synergy pattern, abnormal reflexes, altered coordination, altered motor programming, postural control, balance, ipsilateral pushing, speech, language, swallowing, emotional status, bladder and bowel function, perception and cognition.[6] Balance problems are thought to be common after stroke and they have been implicated in the poor recovery of activities of daily living and mobility and increased risk of falls. [2] Postural sway for patients with hemiplegia can be twice that of their age matched peers.[7] Symmetry of weight bearing is also impaired following stroke with patients bearing as much as 61% to 80% of their body weight through their non paretic lower extremity.[8] Among many biological and functional characteristics, postural control is the best predictor of achieving independent living and shows the highest correlation (rp=0.70) with person-perceived disability after discharge from rehabilitation.[9] Balance problems in hemiparetic patients after stroke can be caused by different impairments in the psychological system involved in postural control, including sensory afferents, movement strategies, biomechanical constraints, cognitive processing and perception of verticality.[10] The commonly used interventions for training balance include pertubation training, force plateforms, it to stand, one leg standing, standing on narrow BOS(tandem standing & tandem walking, training on foam pads, wobble boards & vestibular ball , step up and down etc.[11] Novel biofeedback devices are now being used for neuromotor rehabilitation. In the last few years, there has been increasing research interest in the application of virtual reality (VR) technology to rehabilitation procedures. In contrast with traditional rehabilitation procedures, which may be tedious, resource intensive & costly VR provides patient with stroke opportunities to engage in meaningful, intensive, enjoyable & purposeful tasks related to real life interest and ADL. The published clinical results indicate that the recovery of motor function in stroke patients with motor difficulties appears to be enhanced by using VR technology. Virtual reality is the use of interactive simulations created with computer hardware and software to present users with opportunities to engage in environments that appear to be and feel similar to real world objects and events. User interact with displayed images, move and manipulate virtual objects and perform other actions in a way that attempts to immerse them within the simulated environment.[12]

Biofeedback can be defined as the use of instrumentation to make covert physiological processes more overt. The use of biofeedback provides patients with sensorimotor impairments with opportunities to regain the ability to better assess different physiological responses and possibly to learn self-control of those response.[13]

Visual feedback related to weight distribution and center of pressure positioning has been shown to be effective in increasing stance symmetry following stroke. Upon changing the COG on the support base, the patient can view the movement of the object on the monitor. Visual biofeedback stimulate proprioceptive information that may be negatively affected in stroke victims.[14]

One such device is equiboard sport by technoconcept. Equiboard is a freeman board with biofeedback used in physiotherapy and specially adapted for reprogramming sensorimotor skills and balance training. The equiboard plate is fitted with an 3D accelerometer. This sensor measures the oscillation of the plate in all directions . The red dot (ball), in different games represents the angular position of the

plate. A tilt in the sagittalplane(rotation along x axis) provides the movement path following the y axis. A tilting movement in the frontal plane (along the y rotation axis) gives a path following the x axis. It is a device with Bluetooth wireless connectivity that is battery operated. The equiboard software contains different games that provides motivational task oriented exercises specifically designed for balance affected people by clinical therapists. The user caninteract naturally with the game by the means of weight transference of feet.[15]

Materials and Methodology

The patients coming to physiotherapy department on OPD basis were selected according to the inclusion and exclusion criteria. All the patients were discussuced about the nature and purpose of study. Written informed consent was taken from all the patients in their understandable language. Inclusion criteria for the patients were Willingness to participate in 4 week study,. having ischemic or haemorrhagic stroke, diagnosed clinically with stroke > 6 months, age group 40-70 years, who are able to stand with or without support, spasticity MAS<3, BBS score>21. (i.e moderate risk of falling), MMSE score>26 and Patients without any visual defects. Exclusion criteria were Patients with brain tumor or any other neurological condition, with any other medical condition which might hamper patient's participation in the intervention, with any perceptual problems, with ataxia or any other cerebellar symptoms, with dementia or aphasia and the Patients who are undergoing any other intervention to improve balance. Total 30 patients were selected for the study and were equally divided into two groups. Demographic data of all the patients were taken and pre treatment assessment was done. Patients in group A were given traditional balance training which included Balance training consisted of 20 minutes session which included following exercises: double leg stance, tandem stance, step forward and backward, step sideways on exercise step, sitting on a swiss ball with support and bending trunk forward and side to side, walking forward and backward in tandem walking pattern and perform single leg stance[16]. The patients in group B were given traditional balance training along with visual feedback games exercises on equiboard Protocol for games

Week 1- sagittal bridge, frontal bridge, sagittal path, frontal path and tracking(with single hand supported)

Week 2- self control left-right, self control rear front, basket, tracking and glutton. (with 2 finger supported)

Week 3- Sagittal bridge, frontal bridge, sagittal path, frontal path and tracking (without hand support)

Week 4- self-control left-right, self-control rear front, basket, tracking and glutton (without hand support)

Protocol for week 1 and 3 was similar and for week 2 and 4 was similar. There was no fixed schedule of the game presentation, rather it was presented randomly. This was done to prevent blocked practice of learning. Rests was given in between as and when patient got fatigue. Outcome measure BBS (Berg Balance Scale)and Step test were taken at the beginning and end of 1 month treatment.

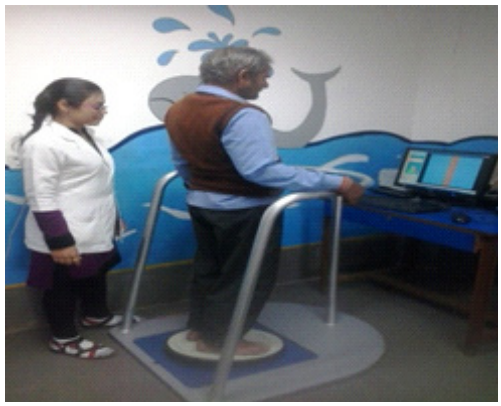

Fig.1 Visual feedback balance training on equiboard – given to experimental group

Results

Data of 30 patients group A(13 male, 2 female) and group B(11 male and 4 female) were analysed by using statistical package for social science version 16(SPSS 16) and Microsoft excel 2010.Wilcoxen signed rank test was applied to analyse pre and post outcome measures within groups,while between group analysis was done by using Mann Whitney U test for all the outcome measures. Baseline measurement showed no significant difference for pre berg balance and step test outcomes between both the groups.

Table 1: Analysis of Berg Balance Scale in both groups

	Pre BBS (Mean±SD)	Post BBS (Mean±SD)	Z value	P value
Group A	**43.6±6.17**	**51.53±3.27**	-3.302	0.001 (<0.05)
Group B	**43.73±6.25**	**51.26±3.28**	-3.415	0.001 (<0.05)

Table 2: Analysis of Step test in both the groups

	Pre ST (Mean±SD)	Post ST (Mean±SD)	Z value	P value
Group A	**1.8±1.33**	**3.36±1.27**	-3.309	0.001
Group B	**1.56±0.94**	**1.27±0.94**	000	1.00

Between Group Analysis.

Analysis of Berg Balance Scale in between group.

"Mann- Whitney U test" was applied for between group comparison of Group A and Group B.

Table 3: Table shows Mean changes in Berg Balance Scale (Mann- Whitney U Test)

Groups	Mean of difference of post treatment Score	SD	U value	p value
Group A	7.533	4.70	111	0.950
Group B	7.533	3.90		

Above results showed significant improvement in BBS and Step test within the group(p,0.05) while there was no statistically significant difference in BBS(p>0.05) in between group but there was a statistically significant difference in step test(p,0.05) t for the group 2. A recent study (2023) also showed that balance training on an unstable surface along with visual feedback had greater impact on gait speed, trunk stability and mobility in chronic stroke patients[17].

Discussion

The goal of the present study was to compare the effectiveness of visual feedback balance training on equiboard versus traditional balance training in post stroke patients. Thirty subjects were conveniently divided into Control Group (n= 15) and Experimental Group (n=15). The patients in experimental group received visual feedback balance training on equiboard as well as other conventional physiotherapy exercises. The patients in control group received traditional balancing exercises as well as other conventional physiotherapy exercises. Both the control and the experimental group were similar at the baseline characteristics of age, gender distribution, side of affection (dominant and non dominant), duration of stroke, Pre scores of Berg Balance Scale and Step Test. The result of within group analysis shows significant improvement in the score of Berg Balance Scale (p=0.001). The analysis for Step test score within the experimental group showed significant improvement (p=0.001) but there was no significant improvement within the control group (p=1.000). The result of between group analysis shows highly significant improvement in the step test (p=0.000) but there was no significant improvement in the Berg Balance Scale Score (p=0.95). The major finding of the study is that the subjects treated with visual feedback balance training on equiboard (experimental group) showed significant improvement in the Step Test score.

The intervention required the subject to stand on the wobble board and maintain balance by using the visual feedback received by playing different types of games with there feet. The different games involve by shifting weight in antero-posterior direction, medial-lateral direction and in rotatory direction.

The improvement in functional balance and stepping frequency might be due to

- Better alignment
- Decreased postural asymmetry
- Improved proprioception of lower limb
- Increased ankle ROM
- Increased strength of lower limb muscles
- Activation of hip and ankle postural control strategies

Conclusion

From the present study it can be concluded that both the traditional balance training and visual feedback balance training are effective in improving balance in post stroke patients but stepping frequency was more in visually guided patients. Further studies should be carried out in future for better conclusions.

Source of funding: Nil

Ethical clearance: Ethical committee clearance was taken prior to study(25-3-14) ref no-IECGSI/ Approval/56/14.

Conflict of interest none

LIMITATIONS OF THE STUDY

1. One of the limitations of this study was the small sample size. The results of the study can't be made applicable to the whole population of Stroke patients.
2. There was no specific follow up of the subjects.
3. Only subjects with mild to moderate risk of fall were taken into the study.

FUTURE RECOMMENDATIONS

1. A large sample size study should be done to make the findings more specific and applicable to whole stroke community.
2. Specific follow up periods should be set, to find the carryover effect of the visual feedback balance training intervention.
3. The mechanisms of effects of visual feedback balance training are probably multi factorial and require further study for definition.
4. An experimental study should be conducted for the patients with high risk of falling i.e. BBS<21. 5) As patients get dependent on visual sense, they must be further treated with eyes closed so that their vestibular and somatosensory system gets activated.

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Original Research Article

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Correlation Between Level of Physical Activity Using GPAQ and Exercise Capacity Using 6 Min Walk Test in Non-Insulin Dependent Type 2 Diabetes Mellitus

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Abstract

Background: This study was designed to find the Correlation Between the Level of Physical Activity and Exercise Capacity in Non-Insulin Dependent Type 2 Diabetes Mellitus.

Purpose: To find the Correlation between the Level of Physical Activity and Exercise Capacity in Non-Insulin Dependent Type 2 Diabetes Mellitus.

Materials and Methods: Materials required for this study were Countdown timer(or stopwatch),Two small cones, Chair, Worksheet on a clipboard, Sphygmomanometer. It was a correlational study design. The sampling method used was Convenient type of sampling. Sixty subjects with non-insulin dependent type 2 were included in this study. The written informed consent was taken. Informed consent document was signed, retained by the principal investigator and a copy was given to the participant. Global Physical Activity Questionnaire and 6 Minutes walk test was used to study the Physical Activity and Exercise Capacity respectively. All the data obtained was statistically analysed using proper tests.

Results: The results showed positive significant (p value< 0.0001) correlation between the level of physical activity and exercise capacity, Physical activity level correlates statistically with distance walked in percentage.

Conclusion: Our study concluded that Physical activity level correlate statistically with distance walked in type 2 diabetic patients.

Key Word: Physical Activity (PA), Global Physical Activity Questionnaire (GPAQ), Diabetes Mellitus (DM), Type 2 Diabetes Mellitus(T2DM), 6 Minute Walk Test(6MWT).

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Introduction

Diabetes mellitus (DM) is an aggregation of all metabolic diseases with hyperglycaemia due to increased glucose level in the blood. It is a characterized by hyperglycaemia due to insufficient secretion and impaired utilization of insulin. Although not a direct cause of death, DM yields serious damages by causing blindness, kidney failure, non-traumatic limb amputation, and complications such as coronary artery disease and stroke. Therefore, DM can be called as a chronic disease whose symptoms can be controlled but cannot be cured.[1]

Type 2 Diabetes Mellitus (T2DM) mostly results from the interaction among genetic, environmental and other risk factors. Furthermore, loss of first-phase of insulin release, abnormal pulsatility of basal insulin secretion, and increased glucagon secretion also accelerate the development of T2DM. Although T2DM patients are generally independent of exogenous insulin, they may need it when blood glucose levels are not well controlled with diet alone or with oral hypoglycaemic drugs. In addition, people with T2DM are often accompanied by complications, such as cardiovascular diseases, diabetic neuropathy, nephropathy, and retinopathy. Diabetes and its associated complications lower the quality of people's lives and generate enormous economic and social burden.[2]

Physical activity level and exercise capacity are important determinants of health status and mortality.

Physical activity (PA) is any bodily movement produced by skeletal muscle that result in energy expenditure beyond resting energy expenditure.[3]

During any type of PA, glucose uptake into active skeletal muscles increases via insulin-independent pathways. Blood glucose levels are maintained by glucoregulatory hormone- derived increases in hepatic glucose production and mobilization of free fatty acids, which may be impaired by insulin resistance or diabetes. Improvements in systemic and possibly hepatic, insulin sensitivity after any PA can last from 2 to 72 h, with reductions in blood glucose closely associated with PA duration and intensity. In addition, regular PA enhances B-cell function insulin sensitivity, vascular function, and gut microbiota, all of which may lead to better diabetes and health management as well as disease risk reduction.[4]

PA level of patients can be assessed using a WHO validated Global Physical Activity Questionnaire (GPAQ).[5]

The GPAQ uses a standardized protocol as surveillance of PA engagement at the population level with self-report and interview-administrated modes. The GPAQ has questions revolving around three domains: Occupational, transport-related, and leisure-time PA. For each domain, there is a pre-set PA list to help participants recall PA, which ensures the reliability and validity of the questionnaire. Moreover, the GPAQ can also standardize data collected, focusing on the moderate-to- vigorous PA (MVPA) for work and recreation, minutes of walking and bicycling for transport only.[6]

For validity, GPAQ demonstrated fair-to-moderate correlations for moderate-to- vigorous physical activity (MVPA) for interviewer-administration (rs-046) Reliability for MVPA revealed moderate correlations (-0.63) for interviewer-administration.

Walking has emerged as one of the most popular activities to improve fitness over the last few decades. It is popular because it is simple and can be performed by individuals of all ages and abilities owing to its low risk of injury. Walking exercise is easy to use, as it requires simple preparation and has many desirable effects such as improving aerobic capacity and reducing body fat, risks of depression and anxiety, and blood cholesterol levels. In particular, the 6-minute walk test (6-MWT) is also a widely used method for evaluating cardio-pulmonary performance. The correlation between the 6-MWT travel distance and the maximum oxygen uptake was shown to be high ($r = 0.73$). Therefore, walking is an attractive aerobic exercise that is easily selected for exercise testing.

The 6-MWT can be performed in accordance with the guidelines of the American Thoracic Society. 6MWT is a practical simple test that requires 100-ft hallway. Walking is an activity performed daily by all but the most severely impaired patients. This test measures the distance that patient can quickly walk on a flat hard surface in a period of 6 minutes.

It evaluates the global and integrated response of all the systems involved during exercise. The self -paced 6MWT assesses the submaximal level of functional capacity. Most patients do not achieve maximal exercise capacity during the 6MWT; instead, they choose their own intensity of exercise and are allow to stop and rest during the test. However, because most activity of daily living are performed at submaximal levels of exertion, the 6MWD may better reflect the functional exercise level for daily PA.[7]

AIM

To study the correlation between level of physical activity and exercise capacity in non-insulin dependent type 2 diabetes mellitus patients.

Material and Method

Materials required for this study were Countdown timer, two small cones to mark the turnaround points, A chair that can be easily moved along the walking course, Worksheets on a clipboard, Sphygmomanometer. It was a correlational study conducted on 60 subjects with T2DM, age between 40-60 years, was taken from Outpatients department tertiary hospital and care centre. The method used in this study for sampling was Convenient sampling.

Inclusion criteria:

- Age: 40-60 years
- Patients diagnosed with type 2 diabetes not less than 6 months and not more than 24 months before baseline examination.
- Management by lifestyle with pharmacotherapy without insulin.

Exclusion criteria:

- Type 1 diabetes
- Uncooperative patients
- Recent lower limb and spine
- Recent surgeries
- Complication such as diabetic neuropathy, diabetic nephropathy, diabetic retinopathy.

Outcome measures:

1. **Global Physical Activity Questionnaire (GPAQ)**

   PA was assessed using the GPAQ. It comprises 16 questions (P1-P16) and collects information on PA in three different situations: at work, when moving from one place to another, and during leisure time. To analyse the questionnaire data, the metabolic equivalent (MET), which expresses the ratio between metabolic rate during PA and metabolic rate at rest, was used. It is estimated that the caloric expenditure of a moderately active person is four times higher than that of a person at rest. While that of a very active person is eight times higher than the caloric expenditure of a person at rest. So, energy expenditure of 4 METs was attributed to time spent in moderately intense PA, and 8 METs to time spent in intense PA. Thus, the total PA score was calculated as the sum of all METs per week in work, commuting and leisure respectively. Finally, PA levels were classified into 3 classes: intense (MET / min / week ≥ 3000), moderate (600 ≤ MET / min / week ≤ 2999) and low (MET / min / week <600 .

2. **The 6-minute walk test:**

   The 6-MWT was performed in accordance with the guidelines of the American Thoracic Society. The subject was instructed to walk for 6 minutes at a given time along a 30-m line at an interval of 1.5 m in an outdoor corridor, and the distance walked was recorded in meters. The walk test was conducted in hallways or outdoor corridors, and the patients were encouraged to continue walking as fast as possible.

Procedure

Ethical approval was taken from the ethical Committee. Subjects were screened according to inclusion and exclusion criteria and only those eligible were included in the study (n=60). and age group of 40-60 years were selected. The written informed consent was taken. After filling the consent form, the participants demographic data was taken. PA of the individual was measured by using GPAQ Scale and the score was noted down. The exercise capacity of the individual was measured by using 6MWT. In the 6MWT, the patient was asked to walk as far as possible. Before and after the test parameters were taken. The subjects were instructed to walk

for 6 minutes at a given time along a 30-m line at an interval of 1.5 m in an outdoor, and the subjects were encouraged to continue walking as fast as possible. The data was analyzed using Graphpad Prism version 10.2.1 and Microsoft Excel 2007.

Fig 1: Pre parameters were taken

Fig 3-post parameters were taken

Data Analysis

Table 1: Age Wise Distribution

AGE	PARTICIPANTS	PERCENTAGE
40-45	5	9%
46-50	3	5%
51-55	2	3%
56-60	50	83%

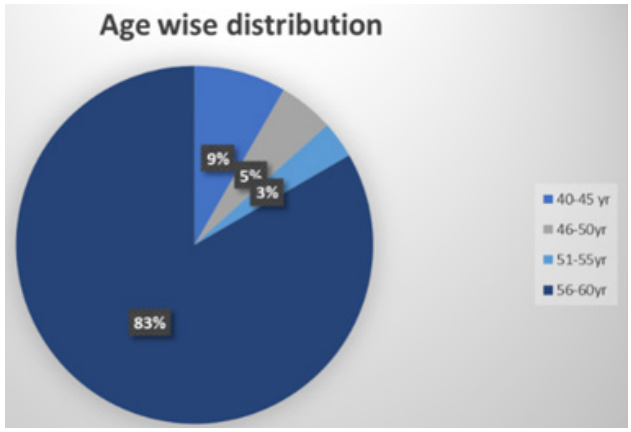

Figure No. 1

INTERPRETATION: The fig shows that participants between the age group of 40-45 years were 5 participants which is 9% and participants between the age group of 46-50 years were 3 participants which is 5%. Participants between the age group between the group of 51-55 years were 2 participants which is 3%.and participants between the age group of 56-60 years were 50 participant which is 83%.

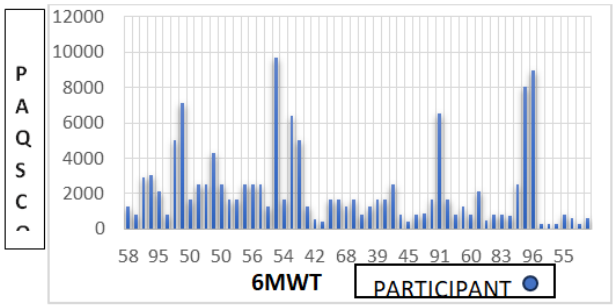

Figure No. 2

INTERPRETATION: Figure shows that there is positive significant correlation between physical activity and exercise capacity

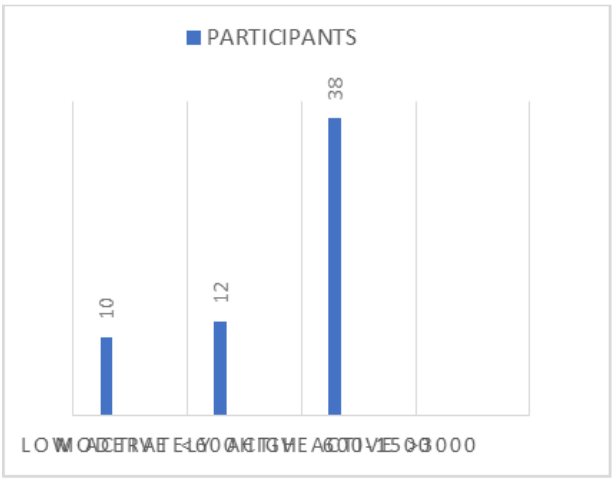

Figure No. 3

INTERPRETATION: Figure 3 shows that 10 participants were low active <600.12 participants were moderately active 600-1500.and 38 participants were high active >3000.

Result

Statistical analysis was performed using GraphPad Prism version 10.2.1 and Microsoft Excel 2007.

Normality test was applied to see the normality of the data.

Table 2: Correlation of GPAQ score and 6MWT in non-insulin dependent type 2 diabetes mellitus

GPAQ score and 6 Min Walk Test	
SPEARMAN r	0.4838
p – value	<0.0001

Non-parametric test Spearman's correlation coefficient was used for data which was not normally distributed.

Based on the statistical analysis:

Figure 1 shows that out of 60 subjects 9% were between 40-45 years, 5% were between 46-50 years, 3% were between 51- 55 years and 83% were between 56-60 years.

Figure 2 shows that that there is positive significant correlation between physical activity and exercise capacity.

Table 3: Distribution of GPAQ with low, moderate and high active

	LOW ACTIVE <600	MODERATELY ACTIVE 600-1500	HIGH ACTIVE >3000
PARTICIPANTS	10	12	38

Figure 3 shows that 10 participants were low active <600, 12 participants were moderately active 600-1500,and 38 participants were high active >3000.

Discussion

A correlation study was carried out in 60 Type 2 diabetic patients to find out relation between physical activity level and submaximal exercise capacity.

Functional exercise capacity was assessed by the 6MWT and PA was assessed by the GPAQ scale and found that there is discrepancy between functional exercise capacity and daily PA in patients with T2DM.

The average distance walked by the participants was 484 meter, 64% of their predicted distance which is less than normal individual

The PA score averaged to 2197 which is low according to GPAQ.

The results showed that PA level correlates statistically with distance walked in percentage.

Moderate PA level is more common among T2DM patients which could be due to the information dissemination of health care providers about the health benefits of doing regular PA. It is necessary that health care workers know about the socio-cultural habits and expected barriers in giving

advice to patients with T2DM to enhance adherence to lifestyle modification by developing a diversified and appropriate health education programmes for these high risk group.

Poor glycemic control was associated with low PA level. A study among diabetic patients showed that moderate and vigorous PA provides good glycemic control by reducing the value of HbA1c.

PA helps in glycemic control by improving insulin sensitivity thus improving glycemic control. In a meta-analysis of 14 clinical controlled trials of PA intervention among middle-aged diabetic individuals lasting for about 8 weeks or more demonstrated that regular exercise resulted to a decrease in HbA1c levels.[9] Findings of the available clinical research in knowing the physiologic relationship between diabetes and PAstill remains insufficient. Aside from searching for complete data of the applicable physiology, we should also give priority towards identifying the strategies on how to encourage our patients to have a sustained exercise that will offer health improvement.

A Significantly higher percentage of those aged 60 years had lower PA than those with younger age group. Older age group prefers to do low intensity PA because of their perception that diabetes 'weakened' and 'aged' the body causing them to have some demotivational effect in involving or maintaining a regular exercise regimen and more intense PA.

Indeed, these recommendations suggest that patients engage in moderate activity every day of the week. The effect of PA on insulin resistance lasts between 24 and 72 hours. In addition, in the areas of PA studied, the efforts made during travel and leisure activities were significantly more intense with diabetics than in non-diabetics. On the other hand, efforts made at work were comparable in both groups. This result identifies areas where PA should be more pronounced in non-diabetic subjects as part of primary prevention.[8]

In the study of Determinants of Exercise Capacity in Patients with T2DM The study demonstrates that in addition to the expected associations with aging, female gender, and obesity, impaired exercise capacity in T2DM is also associated with control poor diabetes.[9]

The association of poor glycaemic control with poorer exercise is seen with studies of asymptomatic T2DM. Studies have also shown that HBA1C is inversely correlated with maximal oxygen consumption, exercise duration. It is important to note that chronic maintenance of near normal blood glucose levels is associated with improved cardiopulmonary function and increased exercise capacity.

Glycosylation may impair the function of some proteins, and vascular or endothelial dysfunction may be a plausible link between decreased exercise capacity and disorders metabolism associated with poor diabetes control, including abnormalities in glucose transport and utilization increased free fatty acids.[9]

Diabetes belongs to a group of disorders that reduce regular PA, the poor exercise capacity in patients with diabetes based on the results of the 6MWT might be because of the link between diabetes and adverse cardiac effects. Impaired exercise capacity is a powerful and independent predictor of an increased risk of cardiac events in DM patients.

In this situation, poor glycemic control has been associated with increased stiffness of vessels in the vascular bed in several organs, including the lungs. Compliance plays a significant role in modulating coronary artery blood flow, which has important consequences for myocardial work capacity and, therefore, leads to reduced exercise capacity. A reduction in the distance walked in the walking test was also observed in patients with diabetes.[10]

From the observation it clearly demonstrates that there is positive correlation between PA and exercise capacity in T2DM. The factors contributing could be age, medical condition, occupation etc.

Conclusion

Our study concluded that Physical activity level correlate statistically with distance walked in type 2 diabetic patients.

Limitations

The limitation of this study is that physical activity was assessed by using a questionnaire which provides a crude measurement of PA and is subjected

to recall bias. Participation to PA itself might be under-reported because most of the patients were not able to recall exactly the type and duration of the activity done.

Ethical Approval: Institutional Ethics Committee of LSFPEF'S College of Physiotherapy, Pune[Ref. LSFPEF/PT/IEC/15/2023 dated 16/03/2023]

Conflict of Interest: Nil

Source of Funding: Self

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Original Research Article

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Effectiveness of Positional Release Therapy and Muscle Energy Technique on Glenohumeral Impingement Among the Elite Swimmers

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Abstract

Background: Glenohumeral impingement is one of the common clinical conditions among the overhead athletes. Elite swimmers develop impingement at the glenohumeral joint due to overuse injuries. This type of impingement is due to lack of muscle strength, demanding training session and altered flexibility. Muscle energy technique and positional release therapy are two different manual therapy interventions that may improve joint range and glenohumeral function.

Aim: The aim of the study is to compare the effectiveness of positional release therapy and muscle energy technique on glenohumeral impingement among the elite swimmers.

Methods: The study included about 40 elite swimmers in which group A (n=20) received positional release therapy with strengthening exercise and group B (n=20) received muscle energy technique with strengthening exercise. The intervention was given for the duration of 4 weeks and the outcome measures used were numerical pain rating scale, range of motion of the glenohumeral joint and the shoulder pain and disability index.

Results: The results of the present study were analyzed using Mann Whitney U test and Wilcoxon signed rank test. The pre and post-test values were taken. The results from analysis shows both groups shows statistically significant improvement but group A show highly significant improvement in reducing pain, improving range of motion and shoulder functional ability comparing to group B, 'p' value < 0.05

Conclusion: The study concluded that positional release therapy was effective clinically and statistically shows significant improvement in reducing pain, improving Glenohumeral range of motion and shoulder function.

Keywords: Positional release therapy, Muscle energy technique, Numeric pain rating Scale, Goniometer, Shoulder Pain and Disability Index.

Introduction

The shoulder joint is the most important joint in the human body and is of greater risk for strain and injuries when compared to other joints in the body. Due to the repetitive overhead activities in sports like swimming, throwing and tennis, most of the athletes are prone to injuries.[1] Swimmers shoulder

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is the term used to describe the problem of shoulder pain among the swimmers. Kennedy and Hawkins used this term in 1974 to describe supraspinatus tendon impingement under the coraco-acromial arch and caused by the frequent shoulder abduction and forward flexion essential for freestyle and butterfly swimming strokes.[2] The most frequent musculoskeletal injury in competitive swimmers owing to sub acromial impingement syndrome, overuse, scapular dyskinesia, laxity, instability, labral damage, Subscapular neuropathy.[3] The incidence of shoulder pain in swimmers normally corresponding to the age, years of training and levels of competition.[4]

Swimming is an individual or team sport that constitute up to 90% of the dynamic power and requires different shoulder motion, mostly performed in clockwise and counter clockwise superintendence with the diverse degree of internal and external rotation, Scapular protraction and retraction. [5] There are four different types of shoulder strokes, Such as: freestyle or front crawl stroke, backstroke, breaststroke and butterfly strokes. This type of training predisposes swimmers to stereotyped injuries of the shoulder, often leading to secondary impingement. [8, 9]

Shoulder range of motion in swimmers is related to that of other overhead athletes, changes in the limited internal rotation and excessive external rotation. The deterioration of the rotator cuff tendons and scapular stabilizers to sustain centring of the humeral head in the glenoid fossa can lead to excessive humeral head translation with subsequent impingement.[11,12] The impingement can be sub acromial or intra- articular and may occur in different positions during the swimming strokes.[12]

Positional release technique was developed by Dr. Lawrence h. Jones, an osteopathic physician. Positional release therapy was originally termed as strain – counter strain technique. It was a therapeutic technique that uses the tender points and a position of comfort (POC) in a muscle to resolve the somatic dysfunction of the muscle. Positional release technique was opposite to the stretching mechanism. This technique was used to normalize the muscle tone, decrease the fascial tension, improve joint mobility, and increase localized circulation. Muscle energy technique are a form of soft tissue, or joint, manipulation or mobilization, deriving from osteopathic medicine, employed in the treatment of musculoskeletal dysfunction. Numeric pain rating scale was used to measure the pain intensity and the goniometry is an instrument used to measure the ROM in the joints.

The present study focusses on comparing the positional release therapy and muscle energy technique on Glenohumeral impingement among the elite swimmers.

Methodology

PROCEDURE:

The study is an experimental design which included 40 swimmers who were selected based on the inclusion criteria. The swimmers who have undergone training for atleast 5-6 days a week and 2 hours per day were included. Only male swimmers were included in the study with age group between 18-22 years. The participants were explained about the merits of the interventions and informed consent obtained from the swimmers. The ethical approval has been received from the department ethical committee and also permission obtained from Shri Ishari velan mission hospital, Thalambur where the samples were treated. The swimmers were allocated into two groups in which group A received Positional release therapy and group B received Muscle energy technique. The pre- test and the post intervention measures were taken using the outcome measures.

Group A: Positional release therapy was given along with strengthening exercises

Supraspinatus lateral fiber

Location of the tender point- The tender point is located deep to the belly of the lateral deltoid muscle just inferior to the acromion process. The therapist must flex or abduct to approximately 90 degree in order to slacken the deltoid sufficiently to allow for palpation of the tender points.

Position of the treatment- With patient in supine lying, the therapist produces a combination of flexion and abduction of the arm to approximately 120 degree and adds slightly external rotation to fine tune.

The ideal position of comfort achieved was held for a period of 90 seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy was continued for 5 minutes duration with rest interval. The therapy was given for 6 times a week for 4 weeks and applied for 2 times a day.

Supraspinatus medial fiber

Location of the tender point- The tender point is located at the belly of the supraspinatus muscle in the supraspinatus fossa or at the musculoskeletal junction just medial to the posterior aspect of the acromion clavicular joint. Pressure was applied anteriorly and inferiorly.

Position of the treatment- With patient in supine lying, the therapist on the side of the patient , palpate the tender points and grasps the forearm near the elbow and places the shoulder into 45 degree of flexion, abduction and external rotation.

The ideal position of comfort achieved was held for a period of 90 seconds and followed by the passive return of the body part to an anatomically neutral position. The therapy was continued for 5 minutes of duration with rest of interval. Therapy was given for 6 times a week for 4 weeks and applied for 2 times a day.

Infraspinatus superior fibre

Location of the tender points- the tender point is located along the inferior border of the spine of the scapula. Pressure was applied anteriorly.

Position of the treatment- With patient in supine and the therapist on the side of the patient, grasps the forearm and flexes the shoulder approximately 90 degree to 100 degree with moderate horizontal abduction and slightly external rotation.

The ideal position of comfort achieved was held for a period of 90 seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy was continued for 5 minutes duration with rest interval. The therapy was given for 6 times in a week for 4 weeks and applied for 2 times a day.

Infraspinatus middle fiber

Location of the tender point – the tender point is located in the upper portion of the infraspinatus fossa. The pressure was applied anteriorly.

Position of the treatment- With patient in supine lying and the therapist standing on the side of the patient, grasps the forearm and flexes the shoulder approximately 110 degree to 120 degree with moderate horizontal abduction and slightly external rotation.

The ideal position of comfort achieved was held for a period of 90 seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy was continued for 5 minutes duration with rest interval. The therapy was given for 6 times in a week for 4 weeks and applied for 2 times a day.

Infraspinatus inferior fiber

Location of the tender point- The tender point is located in the Centre or lower portion of the infraspinatus fossa. Pressure was applied anteriorly.

Position of the treatment- With patient in supine lying and the therapist standing on the side of the patient grasps the forearm and flexes the shoulder approximately 130 degree to 140 degree and fine tunes with slight abduction/ adduction and internal/ external rotation.

The ideal position of comfort achieved was held for a period of 90 seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy was continued for 5 minutes duration with rest interval. The therapy was given for 6 times in a week for 4 weeks and applied for 2 times a day.

Group B: Muscle energy technique was given along with strengthening exercises

METS – SUPRASPINATUS

The therapist stands behind the seated patient, with one hand stabilizing the shoulder on the side to be treated. While the other hand reaches in front of the patient to support the flexed elbow and forearm.

The patient's upper arm was maintained in adduction position, to its easy barrier and the patient then attempts to abduct the arm using 20% of strength against practitioner resistance. After a 7–10 second isometric contraction, the arm was taken gently towards its new resistance barrier into greater adduction, with the patient's assistance. Repeat several times, holding each painless stretch for not less than 30 seconds.

METS – INFRASPINATUS

The patient in supine lying position in which upper arm at right angles to then trunk, elbow flexed so that the lower arm is parallel to the trunk, pointing caudally, with the palm downwards. This brings the arm into internal rotation and places infraspinatus at stretch. The practitioner ensures that the posterior shoulder remains in contact with the table by means of light compression.

The patient slowly and gently lifts the dorsum of the wrist towards the ceiling, against resistance from the practitioner, for 5 to 7 seconds. After this isometric contraction, on relaxation, the forearm is taken towards the floor (combined patient and practitioner action), so increasing internal rotation at the shoulder and stretching infraspinatus (mainly at its shoulder attachment). The stretch is held for up to 30 seconds.

Figure 1: Positional Release Therapy

Figure 2: Mets-Supraspinatus	Figure 3: Mets-Infraspinatus

Figure 4 & 5: Posterior Strengthening Exercise

DATA ANALYSIS:

GROUP A: POSITIONAL RELEASE TECHNIQUE

Intra-group analysis (within the group) Group A:

Analysing the effect of treatment of positional release technique on Numeric pain rating Scale, SPADI, Range of Motion

Table 1: Intra-Group Analysis

Group A	MEAN		Standard deviation		't' value	'p' value
	Pre-test	Post-test	Pre-test	Post-test		
NPRS	7.15	2.95	0.745	0.686	22.535	0.000
SPADI	61.75	29.81	2.489	6.60	24.604	0.000
Internal rotation	57.75	77.25	4.993	3.796	22.132	0.000
External rotation	55.00	73.50	5.380	4.007	22.584	0.000

GROUP B: MUSCLE ENERGY TECHNIQUE

Intra-group analysis (within the group) Group B:

Analysing the effect of treatment of Muscle Energy Technique on Numeric pain rating Scale, SPADI, Range of motion

Table 2: Intra-Group Analysis

Group B	MEAN		Standard deviation		't' value	'p' value
	Pre-test	Post-test	Pre- test	Post-test		
NPRS	7.35	4.30	0.671	0.571	34.616	0.000
SPADI	63.50	79.43	3.967	8.61	8.816	0.000
Internal rotation	57.25	66.25	3.432	3.932	13.077	0.000
External rotation	55.75	64.25	3.726	4.375	11.573	0.000

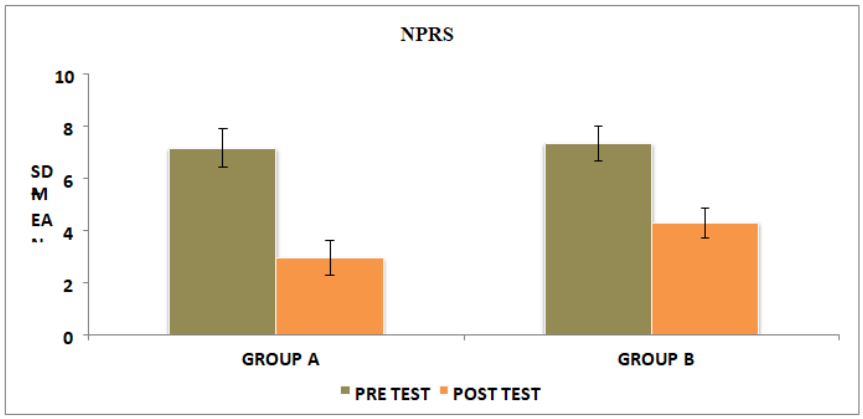

Figure 5: Intra group analysis of Numerical Pain Rating scale between Group A & Group B

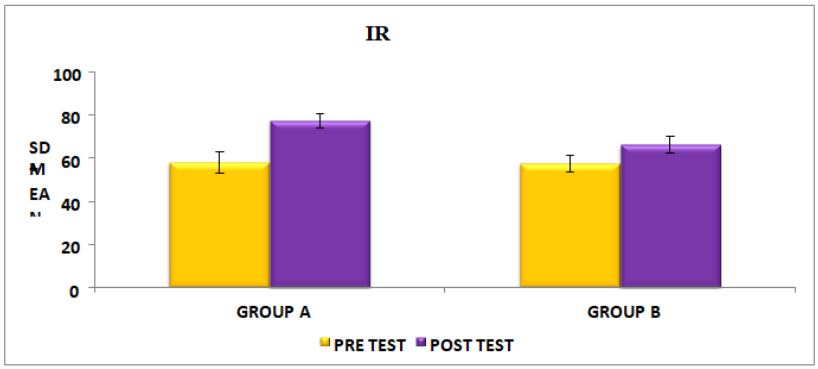

Figure 6: Intra group analysis of shoulder internal rotation between Group A and Group B

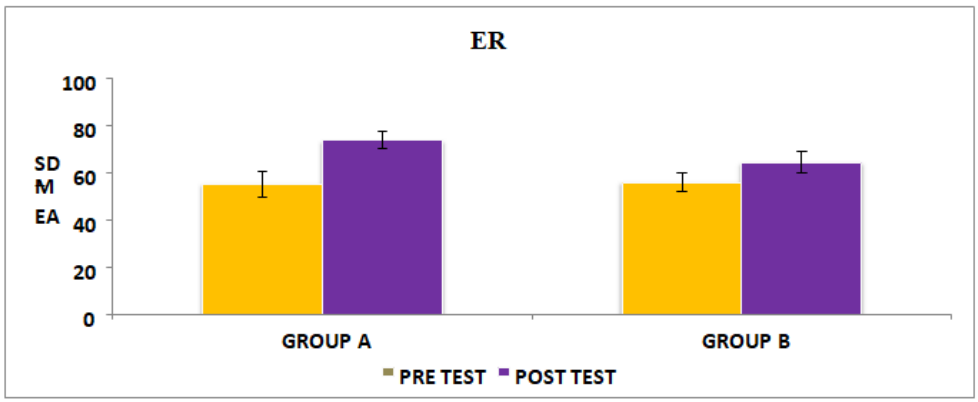

Figure 7: Intra group analysis of shoulder External Rotation between Group A and Group B

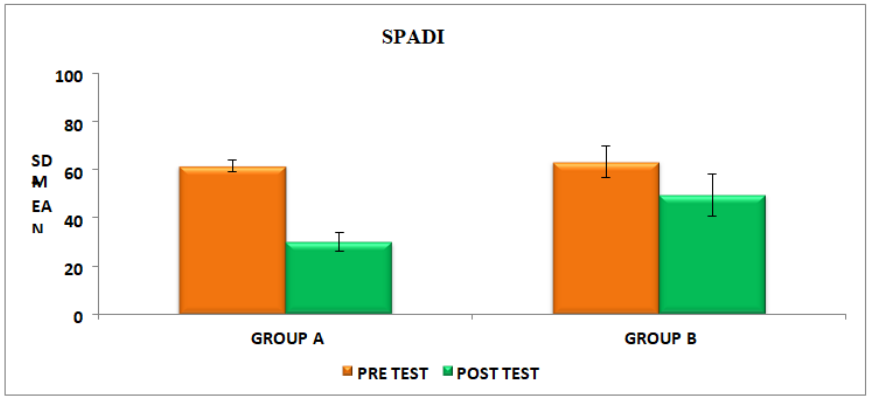

Figure 8: Intra group analysis of shoulder function (SPADI) between group A and Group B

Result

The results of the present study have been analyzed using SPSS software and the nominal data have been calculated using Mann Whitney U test and Wilcoxon signed rank test. The within group analysis have been done with paired 't' test.

NUMERIC PAIN RATING SCALE

The mean and standard deviation for NPRS in Group B was 3.050 and 0.394 with 'p' value 0.000 and Group A which has 4.200and 0.834 with 'p' value 0.000 showing significant improvement(P<0.0005) in both groups. But, Group A shows highly significant in reducing the pain.

INTERNAL ROTATION

The mean and standard deviation for Internal rotation in Group B was -9.000 and 3.078 with 'p' value 0.000 and Group A which has -19.500 and 3.940 with 'p' value 0.000 showing significant improvement (P< 0.005) in both groups. But, Group A shows highly Significant in improving the Internal Range of Motion

EXTERNAL ROTATION

The mean and standard deviation for NPRS in Group B was -8.500 and 3.285 with 'p' value 0.000 and Group A which has -18.500 and 3.663 with 'p' value 0.000 which shows significant improvement (P<0.005) in both groups. But Group A shows highly significant in improving the External range of Motion.

SPADI

The mean and standard deviation for NPRS in Group B was 14.06650 and 7.13557 with 'p' value 0.000 and Group A which has 31.93150 and 5.80397 with 'p' value 0.000 which shows significant improvement (P<0.005) in both groups. But Group A shows highly significant in improving the functional ability of the patient.

Discussion

Glenohumeral impingement is a clinical syndrome in which the soft tissue becomes entrapped in the area of shoulder joint. While doing overhead activity of the shoulder, the pain may elicited. Due to the repetitive nature of the activity like (swimming, tennis, throwing) are prone to develop shoulder injuries.

Kennedy and Hawkins coined this term 1974 to describe supraspinatus tendon impingement under the coraco-acromial arch due to repetitive motion of shoulder abduction and forward flexion. Mc Master WC et al., (1993) - The incidence of shoulder pain in swimmers generally, related to age years of training and level of competition[4].

Beach et al., there was a correlation found between the endurance ratio and shoulder pain so, he suggested that improving the external rotation and abduction endurance can reduce the shoulder pain.[16]

Bak and Magnusson et al., found there was a minimal strength in internal rotators in elite swimmers which cause the shoulder pain than elite swimmers without an shoulder pain.[17]

Speicher et al., positional release technique to treat injuries of the shoulder like shoulder impingement or scapular dyskinesia need to be identified and treat over multiple session to correct the problem.[19] The

muscle energy technique used to assist in decreasing the risk of shoulder pain by improving the flexibility.

Borsa S et al., shows that laxity of Glenohumeral joint in elite swimmers with shoulder pain was not significantly different from those without shoulder pain.[18]

Conclusion

The present study concluded that positional release is effective in improving the range of motion, Pain reduction, and increasing the functional ability of the patient with Glenohumeral impingement. From the above results and table values we reject the null hypothesis and accepting the alternative hypothesis, although, the Muscle energy technique shown improvement in pain, range of motion and functional ability. But PRT shows highly significant improvement in reducing the pain, improving ROM and improving Functional ability. Thus clinically the above results can be implemented by using PRT along with posterior Strengthening exercise in order to relieve pain reduction and better performance of activities of daily living.

Ethical Clearance: Taken from VELS Institute of Science Technology and Advance Studies (VISTAS) School of Physiotherapy, Thalambur Campus Ref no. SOPT/VISTAS//IEC/2022 DATED 11.04.22

Conflict of Interest: Nil

Source of Funding: Nil

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Original Research Article

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Effectiveness of Retraction 30 over Gross Stretch for Relieving Pectoralis Minor Tightness among College Students: Comparative Study

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Abstract

Background: Pectoralis minor muscle originates from different 3 ribs and converges into one attachment point. Pectoralis minor shortening can contribute for many syndromes and impairments especially at the shoulder. Pectoralis minor tightness is very high in college going students. The gross stretch is the stretching procedure which increases the length of the pectoralis minor muscle. This shoulder position produces movement of the muscle insertion in a posterior direction in conjunction with scapular motion that is performed at flexion and elevation in the scapular plane, thereby lengthening the muscle. Retraction 30 is stretching with scapular retraction at 30 degrees of shoulder flexion; the flexion angle at 30 degrees can lengthen the muscle along muscle fiber direction in the coronal plane. 30 degrees of flexion is considered to be more comfortable than a higher angle of flexion, as well as the angle is closest to the line of force

Objectives of the study: To compare the effectiveness of gross stretch and retraction 30 in relieving pectoralis minor muscle tightness which can be in co-operated in further treatment protocols.

Study Design: Comparative Study

Methodology: Two group pre-test post-test study design with purposive sampling method was opted. Selected subjects were allocated to two groups. Forty subjects (20 males and 20 females) who fulfilled inclusion and exclusion criteria were recruited for the study. The independent variables are gross stretch and retraction 30 whereas the dependant variables were PMI (pectoralis minor index), pectoralis minor length test and Cervical Curvature.

Result: This study results implies that retraction 30 is better when compared to gross stretch for correcting pectoralis minor tightness. Hence should be included as an inevitable part of stretching treatment. Practicing clinicians should continue to use evidence based decisions when treating pectoralis minor tightness.

Keywords: Pectoralis minor, Stretching, Retraction 30, Gross stretch

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Introduction

The pectoral musculature in human being represents two muscles, the Pectoralismajor and minor. Pectoralis minororiginates from the second, third, fourth, and fifth ribs near their coastal cartilages and passes supra-laterally and inserts on the medial border and upper surface of the coracoid process of the scapula. Absence or under development of the pectoral muscles is rare but happens which is called as the Poland syndrome. [1]

Prevalence of pectoralis minor tightness is greater in college going students. The shoulders tilt anteriorly because of a shortness of pectoralis minor with associated scapular disorientation and motion. Adaptive shortening of muscle restricts superior & posterior scapular motions which affect the shoulder motions. [2, 3, 4]

Stretching is a form of physical exercise in which is specified to improve the muscle elasticity and achieve comfortable muscle tone which results in increased flexibility. So that it is the most appropriate in the early stages of a correction treatment program protocol. [5]

Neurophysiological response to stretch:

There are two sensory organs of muscle-tendon unit, the muscle spindle and the Golgi tendon organ which are the mechanoreceptors that convey information from the muscle-tendon unit to the central nervous system.

Muscle spindles are small, encapsulated receptors composed of afferent sensory fiber endings, efferent motor fiber endings, and specialized muscle fibers called intrafusal fibers.

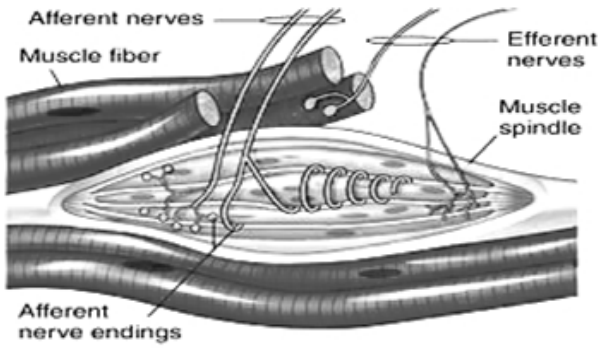


Figure 1: Muscle Spindle(Source:medicoapps.org)

Intrafusal muscle fibers are bundled together and lie parallel to Extrafusal muscle fibers in a skeletal muscle. Intrafusal fibers connect to extrafusal muscle fibers at the ends. The intrafusal fibers are of two types: (a) nuclear bag fibers and (b) nuclear chain fibers.The muscle spindle is the major sensory organ of muscle and is sensitive to quick and sustained (tonic) stretch. The main function is to receive and convey information about changes in the length of a muscle and the velocity of the length changes. [5]

The Golgi tendon organ (GTO) monitors tension in the stretched muscle fibers. When a prolonged stretch force is applied it has an inhibitory effect on the muscle tension in the muscle-tendon unit called autogenic inhibition. This contributes to reflexive muscle relaxation during a stretching which generally occurs in 1-2 milliseconds, enabling a muscle to be elongated against less muscle tension.

Methodology

INCLUSION CRITERIA:

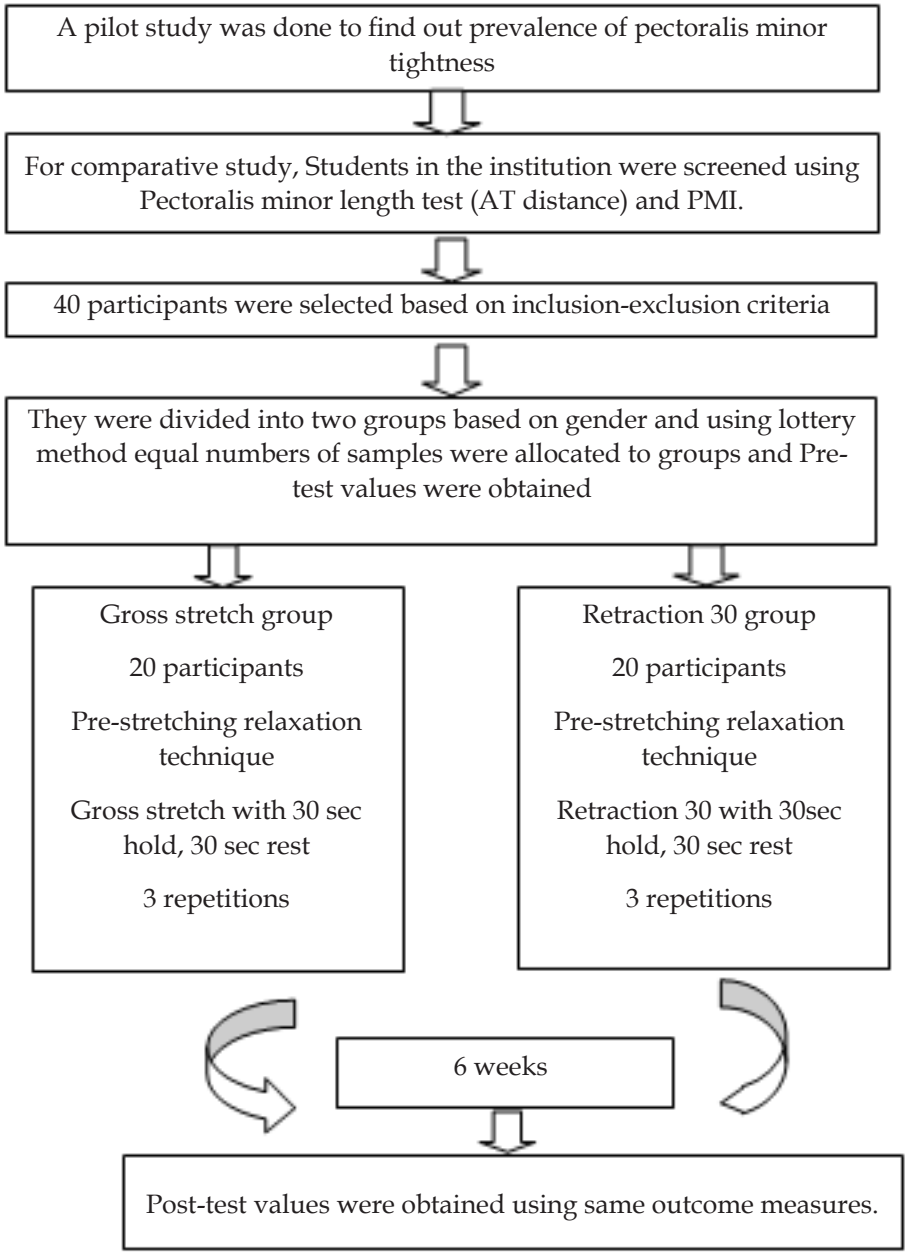
- Willingness of participants
- Age 18-24years
- Pectoralis minor length test >2.5cm
- Pectoralis minor length index <7.65cm
- Those using doubles tapped backpack
- Mobile phone usage above 6hrs/day
- No specific physical activity for postural correction

EXCLUSION CRITERIA:

- Any cervical spine pathologies or recent surgeries
- Any recent fractures at or around the neck or shoulder
- Shoulder injuries
- Rib fractures
- Cervical Radiculopathy
- Rheumatoid arthritis
- Any neurological condition
- Chest deformities
- Kyphosis
- Corticosteroid usage

MATERIALS REQUIRED:

- Inch tape
- Set square
- Flexible ruler
- Calculator
- Paper and Graph paper
- Couch



PROCEDURE:

A pilot study was done in the target population in order to find out the significance of pectoralis minor tightness in college going students and the data obtained wasanalysed statistically using chi-square. A prevalence of $p<0.01$ was found and the dominant side was being affected more.

For comparative study, Students who were interested and willing to participate in the study were included in the screening process. The screening was done using Pectoralis minor length test (Acromion to Table distance further noted as AT distance) and PMI after obtaining informed consent from the participants. 40 subjects were selected based on Inclusion- exclusion criteria. They were divided into two groups based on gender; from the groups recruited subjects were allocated into groups using lottery method participants. Group A: Gross Stretch Group and Group B: Retraction 30 Groups, each group consists of 20 subjects. Their pre-test values were obtained. The respective stretching procedures along with conventional relaxation technique were administered for the groups respectively. After 6 weeks of stretching program the post-test values were obtained using same outcome measures.

Group A: Gross stretch procedure

The subject is positioned in the supine position with the test arm abducted and externally rotated to 90° and the elbow flexed to 90°. The investigator stabilizes the subject's body by placing a hand on the contra lateral coracoid. The investigator then passively, horizontally abducted the subject's shoulder.[4] with 30 seconds hold, 30 second of rest period, with a frequency of 3repetitions.

Figure 2: Demonstration of Gross Stretch Procedure

Group B: Retraction 30 procedure

The subject is in sitting position. The examiner flexed the shoulder joint to 30 degree and applied a postero-superior force to the elbow along the longitudinal axis of the humerus.[6] with 30 seconds hold, 30 seconds of rest period, with a frequency of 3 repetitions.

Figure 3: Demonstration of Retraction 30 Stretch Procedure

Post exercise active movements

All active movements of shoulder were performed.

Figure 4: Shoulder Flexion

Figure 5: Shoulder Extension

Figure 6: Shoulder Abduction

PMI (Pectoralis Minor Index): The PMI=(Resting muscle length / height)*100.PMI is suggested to reflect a shortened pectoralis minor when PMI is 7.6 or lower.[7]

Figure 7: Resting Muscle Length for PMI Calculation

Pectoralis minor length test (AT Distance): A distance greater than 2.5cm suggests muscle shortening.[7]

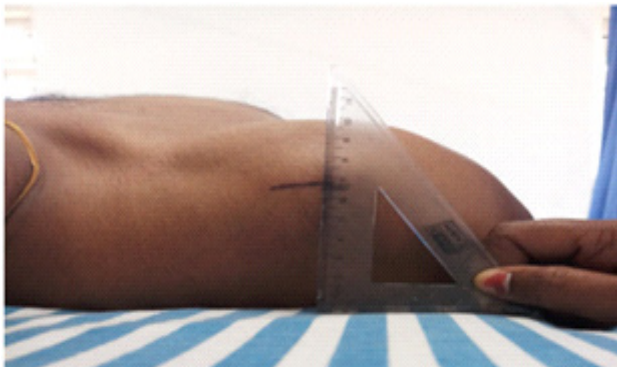


Figure 8: Pectoralis Minor length Test (A-T Distance)

Cervical curvature measurement using flexible ruler

The investigator placed the flexible ruler firmly against the erect cervical spine and measurement between the occiput and the seventh cervical spinous process is taken. The shape of the flexible ruler was traced on paper with the endpoints clearly marked and the reverse tangent was found using the following formula. Q = 4 arc tan (2 b/a).

A is the length between the two endpoints of the cervical curve and b is the length of the perpendicular from the midpoint of line a to the curve. Q is the calculated angle.[8]

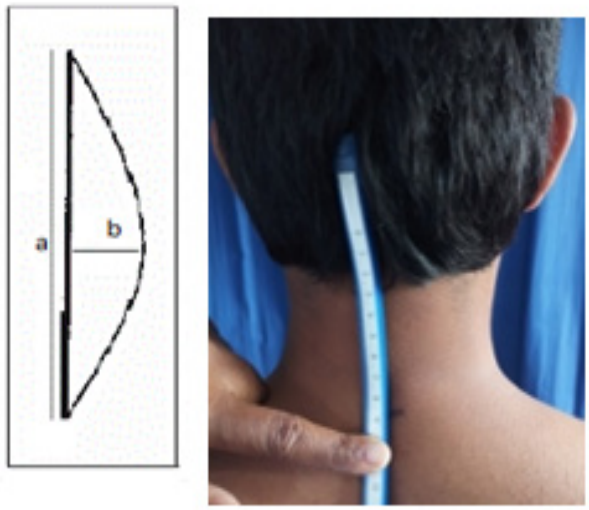


Figure 9: Cervical Curvature Measurement

Result

GENDER DISTRIBUTION IN THE STUDY

Male and female participants were equally distributed in to two groups.

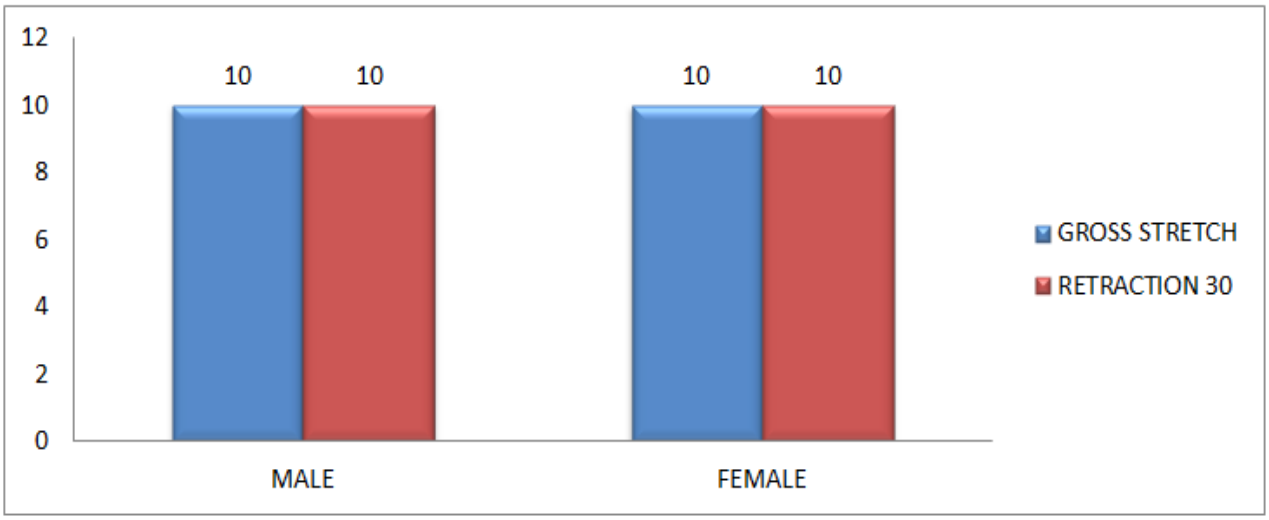


Figure 10: Graphical Representation of Gender Distribution

Age Distribution of Participants

The population selected was between 18-24 years of age. Statistically, the mean age of gross stretch group was 20.8 and retraction 30group was 21.5.

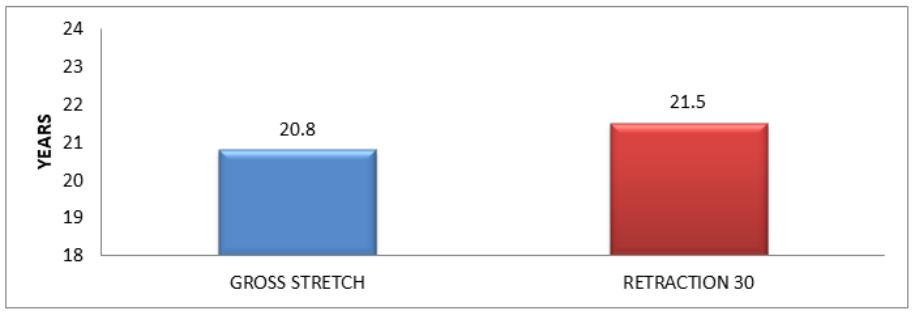


Figure 11: Graphical Representation of Age Disribution

DATA ANALYSIS WITH IN GROSS STRETCH GROUP

PRE-TEST AND POST-TEST PMI DATA WITH IN GROSS STRETCH GROUP

Analysis of PMI data showed that; pre-test mean was 6.71 and post-test mean is 9.93 with standard deviation of 0.48 and 2.64 respectively. On comparison of the pre-post values it showed an increment of 3.22 in mean PMI value. t-value was 5.2 which is greater than the table value at 5% level of significance ($p<0.05$). Therefore it showed a significant difference within the group.

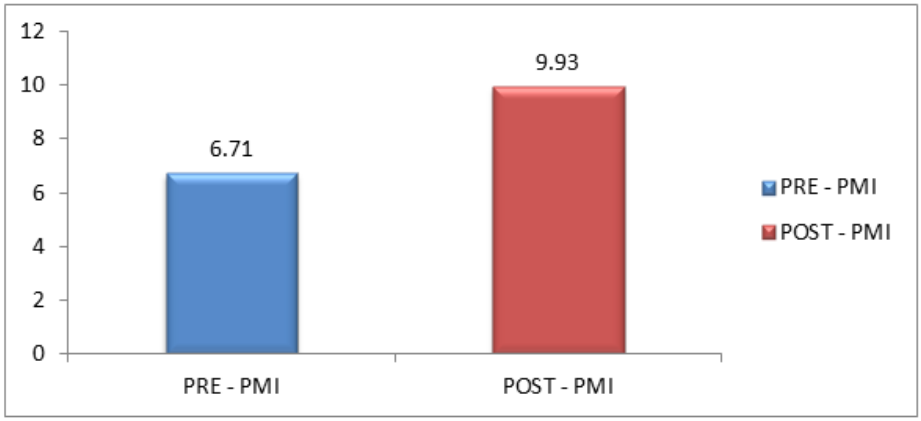


Figure 12: Graphical Representation of Pre-Post PMI values in Gross Stretch Group

PRE-TEST AND POST-TEST DATA OF PECTORALIS MINOR LENGTH TEST WITH IN GROSS STRETCH GROUP

On comparing pre-post values it showed a decrement of 1.65 in mean AT Distance value. t-value was 10.06 which is greater than the table value at 5% level of significance ($p<0.05$). Therefore it showed a significant difference within the group.

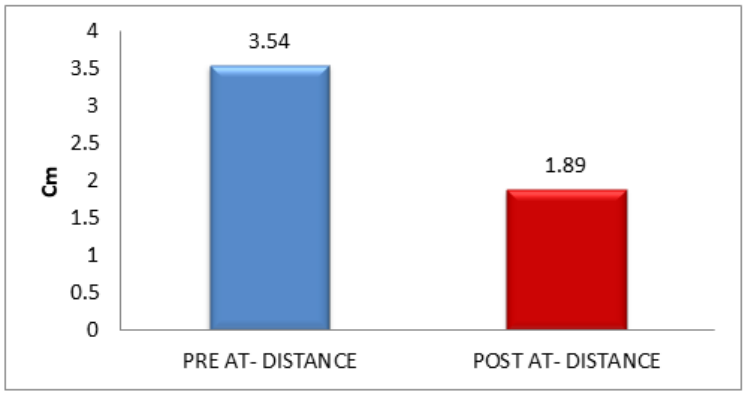


Figure 13: Graphical representation of Pre-Post Pectoralis Minor Length in Gross Stretch Group

PRE-TEST AND POST-TEST CERVICAL CURVATURE DATA WITH IN GROSS STRETCH GROUP

Analysis of cervical curvature data showed that; pre-test mean was 64.22 and post-test mean is 64.22 with standard deviation 15.25.Since it showed no difference in the value it was excluded from analysis.

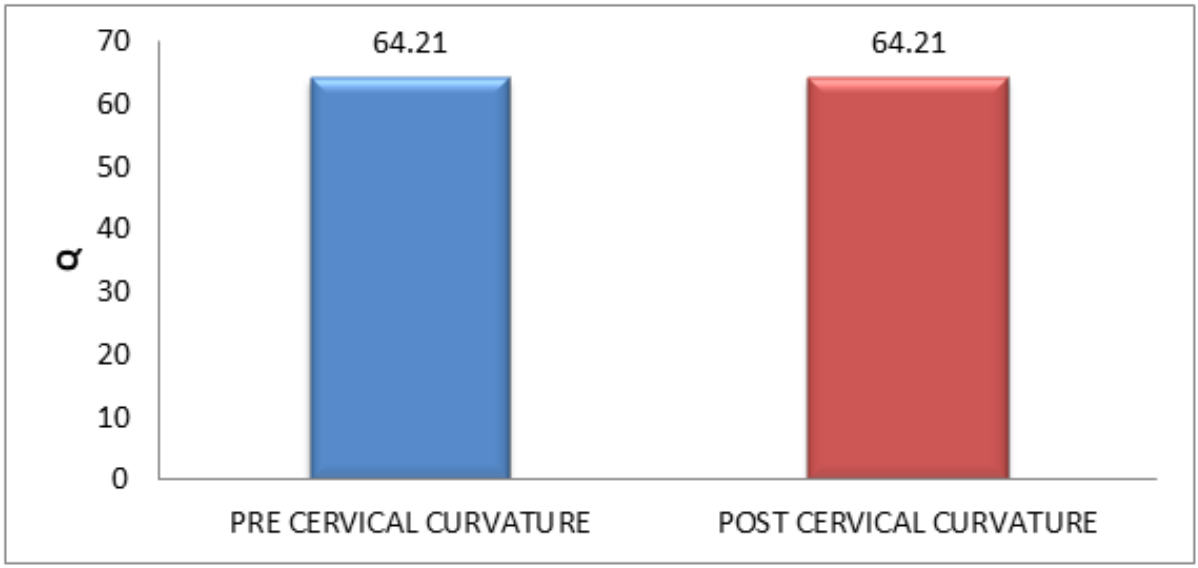


Figure 14: Graphical Representation of Pre-Post Cervical Curvature values in Gross Stretch Group

PRE-TEST AND POST-TEST PMI WITH IN RETRACTION 30 GROUP

The pre-test, post-test PMI data showed that; pre-test mean was 6.53 and post-test mean is 13.88 with standard deviation of 0.39 and 1.21 respectively. This showed an increment of 7.35 in mean PMI value. t-value was 27.79 which is greater than the table value at 5% level of significance ($p<0.05$). Therefore it showed a significant difference within the group.

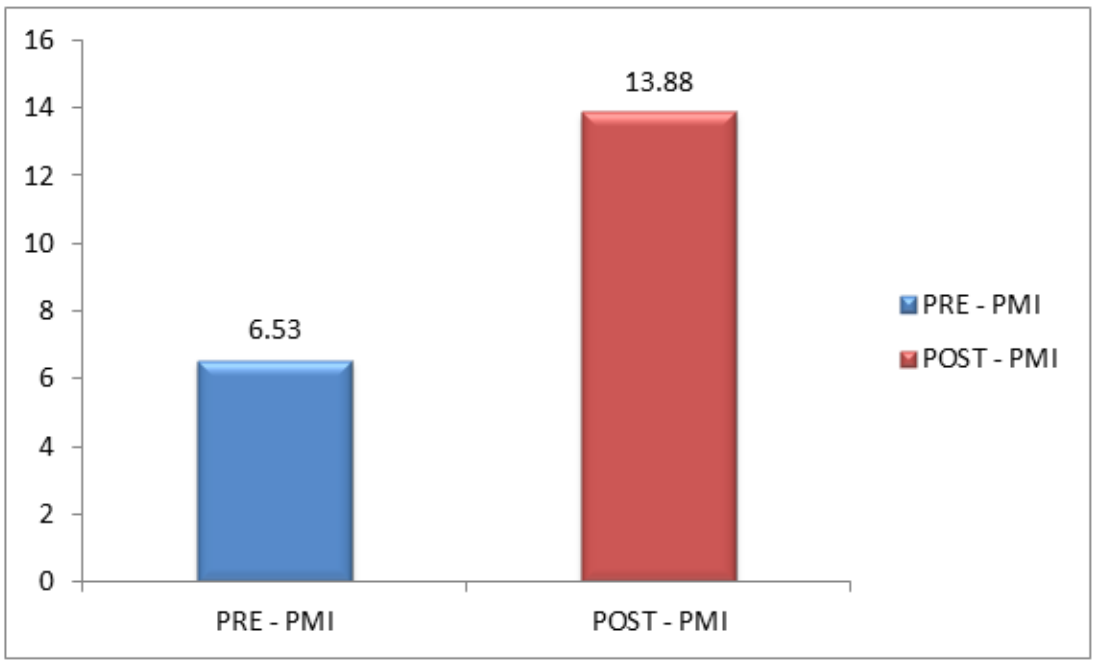


Figure 15: Graphical representation of Pre-Post PMI values in Retraction 30 Group

PRE-TEST AND POST-TEST OF PECTORALIS MINOR LENGTH TEST WITH IN RETRACTION30 GROUP

Analysis of AT Distance data showed that; pre-test mean was 3.16 and post-test mean is 0.84 with standard deviation of 0.37 and 0.29 respectively. On comparison of the pre-post values it showed a decrement of 2.31 in mean AT Distance value. t-value was 39.33 which is greater than the table value at 5% level of significance ($p<0.05$). Therefore it showed a significant difference within the group.

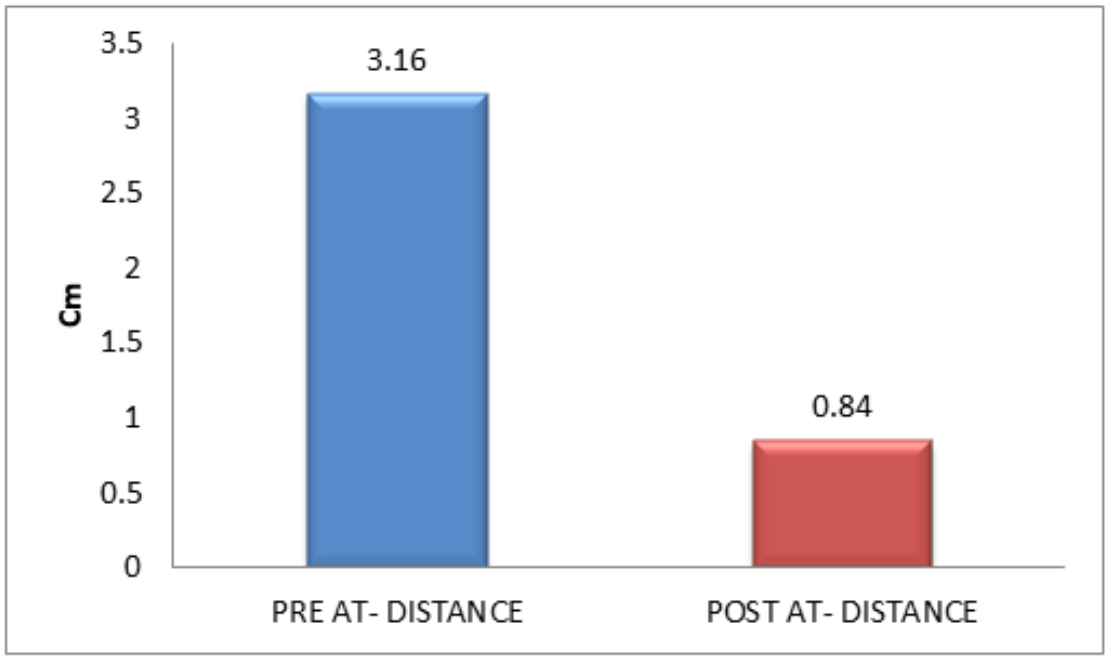


Figure 16: Graphical Representation of Pre-Post Pectoralis Minor Length in Retraction30 Group

PRE-TEST AND POST-TEST DATA OF CERVICAL CURVATURE WITH IN RETRACTION30 GROUP

Analysis of pre-test, post-test cervical curvature data showed that; pre-test mean was 71.18 and post-test mean is 71.18 with standard deviation 17.73.Since it showed no difference in the value it was excluded from analysis.

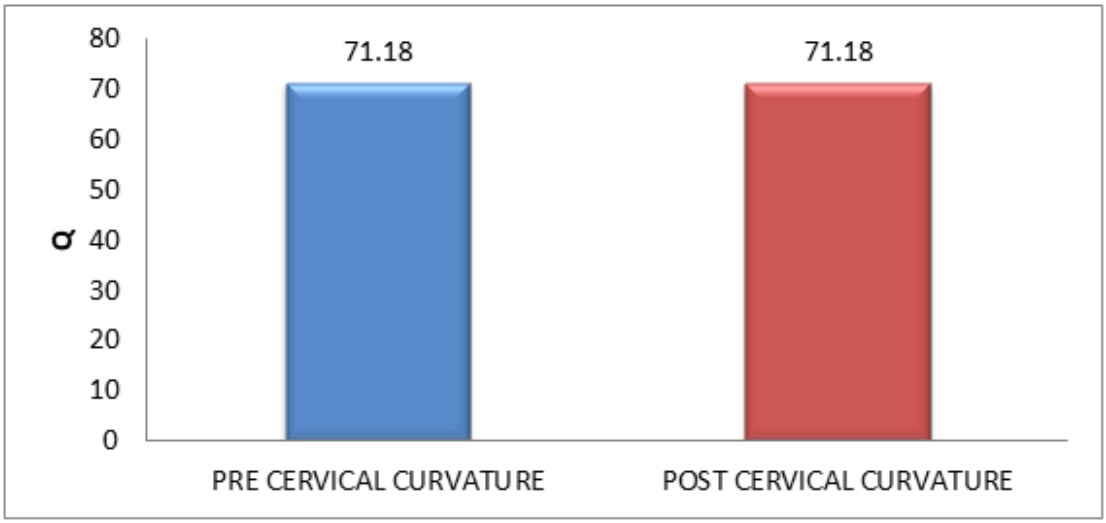


Figure 17: Graphical Representation of Pre-Post Cervical Curvature in Retraction 30 Group

COMPARISON OF PRE- POST TEST DIFFERENCE IN PMI BETWEEN GROSS STRETCH AND RETRACTION 30

Analysis between the differences of pre-test post-test means of groups showed that change in PMI in gross stretch group was 3.22 and in retraction 30 group was 7.34 with standard deviations 2.77 and 1.18 respectively. It showed a difference of 4.12 and greater improvement was seen in retraction 30 group. Calculated t- value was found to be 6.12 which is greater than table value at 5% level of significance ($p<0.05$).

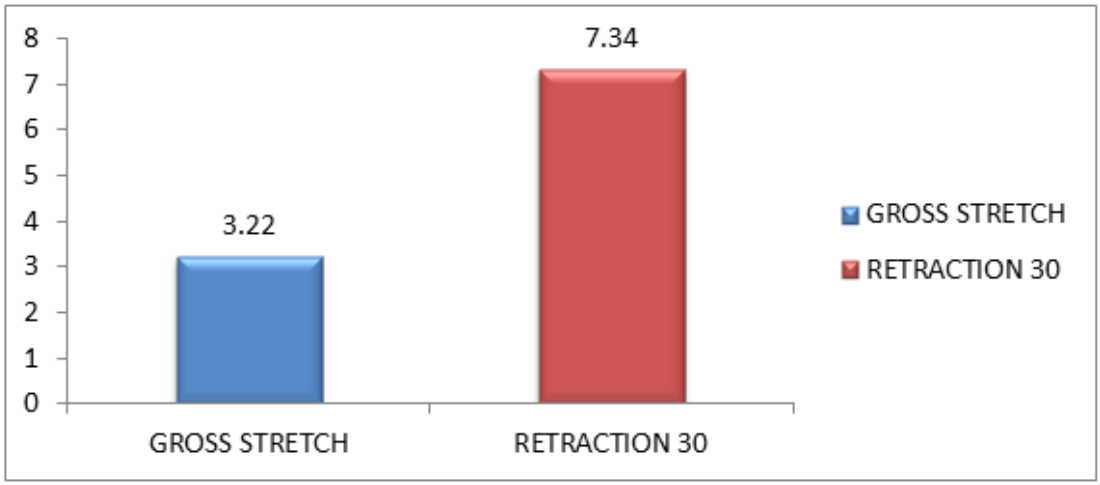


Figure 18: Graphical Representation of PMI Comparison between Gross stretch and Reraction30 Groups

COMPARISON OF PRE-TEST, POST-TEST DIFFERENCE IN PECTORALIS MINOR LENGTH TEST BETWEEN GROSS STRETCH AND RETRACTION 30

Analysis between the differences of pre-test post-test means of groups showed that change in AT Distance in gross stretch group was 1.64 and in retraction 30 group was 2.31 with standard deviations 0.73 and 0.26 respectively. It showed a difference of 0.67 and greater improvement was seen in retraction 30 group. Calculated t- value was found to be 3.83 which is greater than table value at 5% level of significance ($p<0.05$)

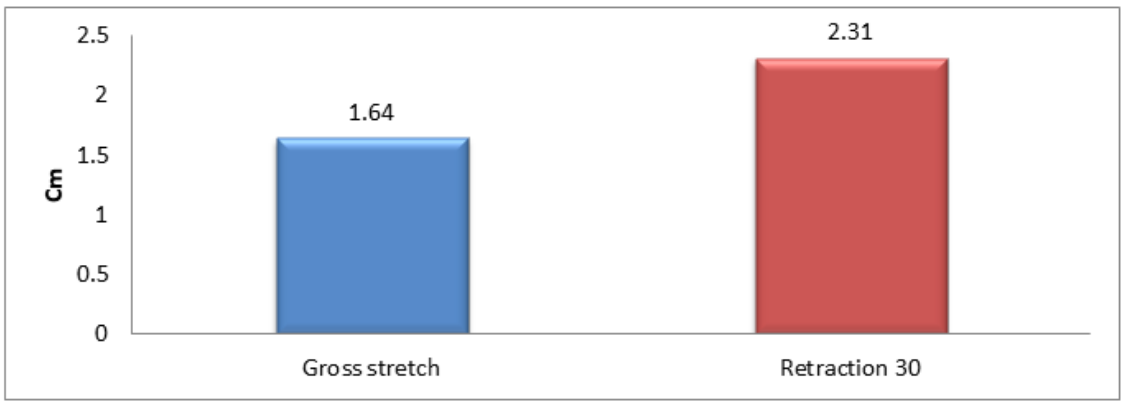


Figure 19: Graphical Representation of difference in Pectoralis Minor Length Test between Gross Stretch and Retraction 30 Groups

Discussion

It is a well-known fact that muscle stretching is beneficial for injury prevention, reduction of delayed-onset muscle soreness and attenuation of postural changes. Postural deviations and muscle imbalance are correlated, so that short pectoralis minor muscle

can be associated with a number of syndromes that affects the shoulder and upper quadrant. Short pectoralis minor is suggestive of many complications in and around the shoulder and upper quadrant which is supported by john D. Borstad and Bruce Greenfield in their study concluded that short pectoralis minor may affects the scapular kinematics which potentially increases the risk of sub acromial impingement syndrome and significant forward head posture.[10,16,17]

Stretching is employed to elongate the short or tightened soft tissue structures in the human body. Alterations in the scapular motion decrease the subacromial space as the acromion fails to move away from the humeral head during arm elevation, which results in increased compressive loads on the tendons of the rotator cuff or long head of the biceps muscle. Adhesive capsulitis is a syndrome characterized by shoulder pain with restriction of both active and passive movements.[10-14] However, it lacks clarity regarding the appropriateness in prescribing of these stretching procedures and its effect on correction of body posture.

In round shoulder posture due to pectoralis minor shortening scapular change can be seen which results in protraction of shoulder along with sub-acromial space reduction. Pectoralis Minor Stretch has a positive effect that is proven to be beneficial in reducing the complications.[15, 16, 17] Even though gross stretch of the pectoralis minor can create an acute, temporary change in length. It is proven to have null effect on scapular kinematics. [4, 17, 19]

Result of the study shows that Retraction 30 showed a greater improvement in pectoralis minor length. This is because the muscle should be stretched along muscle fiber direction, which is close to 30 degrees of flexion. Approximately 90 degrees of flexion can cause pain in subjects with sub-acromial impingement and other shoulder conditions. Therefore, 30 degrees of flexion is more comfortable than a higher angle of flexion and the angle closest to the line of force. Even though there are studies which examine the effectiveness of stretching for postural correction, none of the short duration studies have established positive result. Whereas, there are very little evidence that demonstrate positive result through longer duration study.[19,22,24,25] For analysing the effect of retraction 30 for correction of posture by alterations in cervical curvature necessitates initiation of long duration study which is a prospective scope of the study.

Conclusion

From the statistical analysis, retraction 30 is seen superior to gross stretch for correcting pectoralis minor tightness. Hence should be included as an inevitable part of treatment protocol. Practicing clinicians should continue to use evidence based clinical decisions making for improving the quality and to widen the horizon of treatment.

Conflict of interest: There was no conflict of interest among the authors since there was no need for external resource.

Source of Funding: Self Funded

Ethical clearance: Ethical clearance certificate was issued with Ref.No.MTH/EC/ 2306/2017

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Original Research Article

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A Pilot Study Examining the Efficacy of Occupational Therapy Rehabilitation Programmes for Students with Work-Related Muscular-Skeletal Disorders

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Abstract

Background: Musculoskeletal issues at work have an influence on daily life, productivity, and quality of life. Musculoskeletal issues that go untreated can result in severe damage and function loss, which can limit participation, cause financial loss, and add to the rising burden of illness in the world.

Objective: The purpose of this study was to find the effect of occupational therapy rehabilitation program in occupational therapy students with work related musculoskeletal disorder.

Study Design: Quasi-experimental, pilot study design was chosen for the research

Methods: The study employed a quasi-experimental study design. Thirty occupational therapy students aged 20-25 years were recruited through convenience sampling after a prevalence check where 30 students reported 54 musculoskeletal problems. A total number of participants (n= 30) received occupational therapy rehabilitation program. Standardised Nordic musculoskeletal questionnaire (SNMQ) and Numeric pain rating scale (NPRS) were administered to Pain and work related musculoskeletal disorder for all the participants.

Result: It revealed that there was a statistically significant difference in pre-test and post-test with numeric pain rating scale (t=10.625, p=0.000). There was a significant difference in percentage in 7 days component of SNMQ. There was no statistical difference with post-test of score of 12 months component of SNMQ.

Conclusion: Occupational therapy rehabilitation program is effective for reducing Musculoskeletal disorder or discomfort in occupational therapy students.

Key words: Work related musculoskeletal disorders, Occupational therapy, Occupational therapy rehabilitation program.

Introduction

A collection of inflammatory and degenerative illnesses that impact muscles, tendons, ligaments, joints, peripheral nerves, and other systems are together referred to as "musculoskeletal disorders"[1]. They support the blood vessels as well. The low

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back, neck, shoulder, forearm, and hand are the body areas most commonly affected; however, in recent times, greater focus has been placed on the lower extremities.

Musculoskeletal disorders (MSDs) are a prominent problem in today's society that have a big impact on the job. When it comes to short-term or temporary job impairment, MSDs are second only to the common cold. Musculoskeletal disorders connected to the workplace (WMSDs) are recognised as a major occupational health risk factor, linked to increased medical costs and benefits, reduced productivity, and a worse quality of life. They are the reason behind morbidity in a large number of working people. The traits that define WMSDs are complex. MSD is a major problem with occupational health in India, accounting for about 40% of the expenditures of treating work-related injuries[2,5].

Studies on WMSDs among healthcare workers have mostly concentrated on physicians, dentists, physiotherapists, lab technicians, and nurses[1]. Medical, dental, and nursing personnel most frequently report problems with their backs, necks, shoulders, and knees. It is common for individuals with chronic musculoskeletal diseases to receive occupational therapy (OT)[2]. The goals are to improve their ability to perform routine tasks (i.e., activities and significant life responsibilities at work, home, during leisure, and in social settings), to prevent function losses, to facilitate successful adaptation to lifestyle changes, and to maintain or enhance their psychological well-being[3].

In addition to receiving ergonomics training as part of their academic programme, many therapists also act as occupational health providers for other staff members in their places of employment[4]. Evidence suggests that these physicians are susceptible to musculoskeletal injuries related to patient handling, even with their high degree of training and experience[5,6].

Occupational Therapy Rehabilitation Program

In order to help people who have suffered work-related injuries accept returning to work for pay, occupational rehabilitation programmes are post-acute, comprehensive treatment interventions with the goals of improving client safety, regaining physical function, and addressing psychological issues. Occupational rehabilitation programmes give therapy to increase overall tolerance for occupational obligations using a multidisciplinary approach, a multimodal approach, or a mix of the two[7].

The primary goal of the one discipline's (occupational therapy, for instance) general occupational rehabilitation programme was to help clients develop the general physical endurance and tolerance necessary to return to part-time work, which is defined as up to 20 hours per week.

Methods

A sample of occupational therapy institutions in and around Chennai was selected. Thirty samples in all were collected, and they were enrolled based inclusion and exclusion criteria mentioned below. The Standardised Nordic Musculoskeletal Questionnaire and the Numeric Pain Rating Scale (NPRS) were used for the pre-assessment.

a) Inclusion criteria:

- Age- 20 to 25 years
- Both genders
- Musculoskeletal problem in different body areas over 12 months and 7 days recall period
- Working in any occupational therapy institution for 2hours or more than 2 hours.
- With minimum 3hours clinical practice during college hours.

b) Exclusion criteria

- NPRS score 4 or less than 4
- With other disorders other than musculoskeletal problems
- Students presents with deformities
- Students with other musculoskeletal problems other than occupational injuries.

Instruments Used[12]

Standardised Nordic Musculoskeletal Questionnaire (SNMQ) and NPRS (Numeric Pain Rating Scale)

Intervention Protocol

The intervention is referred from an article published in AJOT which stated success of

occupational rehabilitation program for factory workers[14].

Occupational rehabilitation program

- Flexibility routine Whole-body stretching and injury-site–specific flexibility
- Strengthening at moderate repetition for[8,13]
    - o Lower extremity strengthening
    - o Upper extremity strengthening
- **Core stability[9]**
- Scapular stability exercises
- Spinal stabilization exercises (e.g., straight-leg raises)
- **Work simulation of general work-related tasks, including**
- Lifting and carrying with lifting box[13]
- Pushing and pulling using a weighted sled or rolling cart
- Standing tolerance with upper-extremity tasks.[10]
- **Initial intensity** -3days/2week 30 minutes/ session.
- **Maximum intensity-** 5days/4week 45min/ session.

Data Analysis

With SPSS 22.0, data analysis was carried out. The institutions were informed of the purpose of the study, and a permission form was acquired. Based on the inclusion and exclusion criteria, thirty students studying occupational therapy were included in the research. The NPRS with a score of at least four and the Standardised Musculoskeletal Questionnaire (SNMQ) were used for the screening. A programme for occupational therapy rehabilitation was presented to the patients. For the first two weeks, the treatment was administered three days a week for thirty minutes each session. After that, individuals received four weeks of maximum intensity, five days a week, and forty-five minutes of training per session. Using NPRS and SNMQ, the post-test results were acquired after six weeks.

Result

Descriptive analysis such as frequencies and measures of central tendency was used to describe the demographic data. T-test was used to calculate the significance of scores in this study. The hypothesis being tested identifies whether there exists statistically significant effect of the treatment being given.

Table 1 depicts the demographic data in terms of age. Total of 30 participants were included in the study. Individuals between ages of 21-22 were 9 in number and 23-25 were 21 in number. The mean and standard deviation are 23.10 and 1.34 respectively.

Table 2 depicts the demographic data in terms of gender. Total of 30 participants were recruited for the study. Male and female participants were 43.33% and 56.67% respectively.

Table 3 depicts the demographic data in terms of hand dominance. Total of 30 participants were recruited for the study. Right-handed and left-handed participants were 86.67% and 13.33% respectively.

Table 4 depicts the demographic data in terms of body mass index. Total of 30 participants were included in the study. Individuals between BMI of 18.5 - 24.9 were 16 in number, 25 - 29.9 were 14. The mean and standard deviation are 23.06 and 3.06 respectively.

Table 5 depicts the demographic data in terms of year of study. Total of 30 participants were recruited for the study. Post graduates and interns' participants are 53.33% and 46.67% respectively.

Table 6 depicts the demographic data in terms of clinical working hours. Total of 30 participants were recruited for the study. The mean and standard deviation are 5.40 and 1.52 respectively.

Table 7 depicts the demographic data in terms of part time working hours. Total of 30 participants were recruited for the study. The mean and standard deviation are 3.10 and 0.60 respectively.

Table 8 depicts the demographic data in terms of primary focus of caseloads by the participants. Total of 30 participants were recruited for the study. The neurological caseloads are 6.67%, orthopaedic caseloads are 3.33% and paediatrics caseloads are 90% respectively.

Table 9 depicts the descriptive analysis for Prevalence of reported musculoskeletal problems, prevention of activity and needs to seek attention in the sample reporting a problem in the 12 months. The percentage analysis showed highest risk of WRMDs on lower back (40%) followed by neck (37%) respectively.

Table 10 depicts the descriptive analysis for Prevalence of reported musculoskeletal problems, prevention of activity and needs to seek attention in the sample reporting a problem in the 7 days. The above analysis reported highest WRMDs around lower back (37%) followed by neck (33%) respectively.

Paired t-Test was used to identify the effect of occupational therapy rehabilitation protocol on NPRS. The results showed that there was statistically significant difference ($p<0.05$) between the pre-test and post-test scores in NPRS ($t=10.625$, $p=0.000$). (Table 11)

Table 12 depicts the descriptive analysis for Prevalence of reported musculoskeletal problems, prevention of activity and needs to seek attention in the sample reporting a problem in the 12 months. The Pre-test and post-test values in percentage for the body areas are as follows in the table.

Table 13 depicts the descriptive analysis for Prevalence of reported musculoskeletal problems, prevention of activity and needs to seek attention in the sample reporting a problem in the 7 days. The Pre-test and post-test values in percentage for the body areas are as follows

Table No. 1 Demographic distribution based on age

Years		Frequency	Percentage	Mean ± SD	Min-Max
AGE	21	5	16.67	23.10 ± 1.34	21 - 25
	22	4	13.33		
	23	10	33.33		
	24	5	16.67		
	25	6	20.00		
	TOTAL	30	100		

Table No. 2 Demographic distribution based on Gender

Gender	Frequency	Percentage
MALE	13	43.33
FEMALE	17	56.67
TOTAL	30	100

Table No. 3 Demographic distribution based on Hand dominance

Hand Dominance	Frequency	Percentage
Right	26	86.67
Left	4	13.33
Total	30	100

Table No. 4 Demographic distribution based on Body Mass Index

BMI		Frequency	Percentage	Mean ± SD	Min-Max
BMI	19	2	6.67	23.06 ± 3.06	19 - 29
	20	2	6.67		
	21	5	16.67		
	23	6	20.00		
	24	1	3.33		
	25	1	3.33		
	26	5	16.67		
	27	4	13.33		
	28	2	6.67		
	29	2	6.67		
	TOTAL	30	100		

Table No. 5 Demographic distribution based on Year of Study

Year of Study	FREQUENCY	PERCENTAGE
Post Graduate	16	53.33
Interns	14	46.67
TOTAL	30	100

Table No. 6 Demographic distribution based on Clinical hours

Hours		Frequency	Percentage	Mean ± SD
Clinical Hours	4	16	53.33	5.40 ± 1.52
	7	14	46.67	
	TOTAL	30	100	

Table No. 7 Demographic distribution based on Part time working hours

Hours		Frequency	Percentage	Mean ± SD
Part time working Hours	2	4	13.33	3.10 ± 0.60
	3	19	63.33	
	4	7	23.34	
	TOTAL	30	100	

Table No. 8 Demographic distribution based on Primary focus of caseload

Caseload		Frequency	Percentage
Primary Focus of caseloads	Neurological	2	6.67
	Paediatrics	27	90.00
	Orthopaedics	1	3.33
	TOTAL	30	100

Table No. 9 Prevalence of musculoskeletal pain of occupational therapy students within 12 months.

Body Area	Total Problems (n%)	Problems preventing daily activities (n)	Problems requiring physician or health professional assistance (n)
Neck	11(37)	9(30)	8(27)
Shoulder	5(17)	5(17)	5(17)
Upper back	4(13)	3(10)	3(10)
Elbows	2(7)	1(3)	1(3)
Wrist/Hands	8(27)	7(23)	6(20)
Lower back	12(40)	10(33)	8(27)
Hip/thighs	4(13)	4(13)	4(13)
Knees	5(17)	5(17)	5(17)
Feet/ankles	3(10)	3(10)	3(10)

Table No. 10 Prevalence of musculoskeletal pain of occupational therapy students within 7 days.

Body Area	Total Problems (n)	Problems preventing daily activities (n)	Problems requiring physician or health professional assistance (n)
Neck	10(33)	7(23)	3(10)
Shoulder	5(17)	3(10)	1(3)
Upper back	3(10)	2(7)	2(7)
Elbows	2(7)	1(3)	1(3)
Wrist/Hands	5(17)	1(3)	1(3)
Lower back	11(37)	7(23)	4(13)
Hip/thighs	2(7)	2(7)	2(7)
Knees	3(10)	1(3)	1(3)
Feet/ankles	2(7)	1(3)	0(0)

Table No. 11 Effects of occupational therapy intervention on NPRS

		MEAN	N	Std. Dev.	t-value	df	p-value
NPRS	PRE	6.633	30	1.033	10.625	29	0.000 S
	POST	2.233	30	2.079			

S-Significance NS- No Significance

Table No. 12 Effect of occupational therapy intervention on reported musculoskeletal problems, prevention of activity and needs to seek attention in the sample reporting a problem in the 12 months

BODY AREA	TOTAL PROBLEMS N (%)		PROBLEMS PREVENTING DAILY ACITVITIES N (%)		PROBLEMS REQUIRING PHYSICIAN OR HEALTH PROFESSIONAL ASSISTANCE, N (%)	
	PRE - TEST	POST-TEST	PRE - TEST	POST-TEST	PRE - TEST	POST-TEST
NECK	11 (37)	11 (37)	9 (30)	9 (30)	8 (27)	8 (27)
SHOULDERS	5 (17)	5 (17)	5 (17)	5 (17)	5 (17)	5 (17)
UPPER BACK	4 (13)	4 (13)	3 (10)	3 (10)	3 (10)	3 (10)
ELBOWS	2 (7)	2 (7)	1 (3)	1 (3)	1 (3)	1 (3)
WRIST	8 (27)	8 (27)	7 (23)	7 (23)	6 (20)	6 (20)
LOWER BACK	12 (40)	11 (37)	10 (33)	10 (33)	8 (27)	8 (27)
HIPS/THIGHS	4 (13)	4 (13)	4 (13)	4 (13)	4 (13)	4 (13)
KNEES	5 (17)	5 (17)	5 (17)	5 (17)	5 (17)	5 (17)
FEETS/ ANKLES	3 (10)	3 (10)	3 (10)	3 (10)	3 (10)	3 (10)

Table No. 13 Effect of occupational therapy intervention on reported musculoskeletal problems, prevention of activity and needs to seek attention in the sample reporting a problem in the 7 days

BODY AREA	TOTAL PROBLEMS N (%)		PROBLEMS PREVENTING DAILY ACITVITIES N (%)		PROBLEMS REQUIRING PHYSICIAN OR HEALTH PROFESSIONAL ASSISTANCE, N (%)	
	PRE - TEST	POST-TEST	PRE - TEST	POST-TEST	PRE - TEST	POST-TEST
NECK	10 (33)	5 (17)	7 (23)	5 (17)	3 (10)	2 (7)
SHOULDERS	5 (17)	3 (10)	3 (10)	3 (10)	1 (3)	2 (7)
UPPER BACK	3 (10)	3 (10)	2 (7)	3 (10)	2 (7)	3 (10)
ELBOWS	2 (7)	1 (3)	3 (10)	1 (3)	2 (7)	1 (3)
WRIST	5 (17)	3 (10)	1 (3)	2 (7)	1 (3)	1 (3)
LOWER BACK	11 (37)	4 (13)	7 (23)	4 (13)	4 (13)	2 (7)
HIPS/THIGHS	2 (7)	1 (3)	4 (13)	2 (7)	3 (10)	1 (3)
KNEES	3 (10)	1 (3)	4 (13)	1 (3)	2 (7)	0
FEETS/ANKLES	2 (7)	0	1 (3)	0	0	0

Discussion

One in three occupational therapy students already have musculoskeletal work-related problems prior to graduation, which interfere with daily activities and require medical treatment[11,14]. Because musculoskeletal illnesses are so common, it is imperative that researchers and educators develop long-term remedies for them, taking into account the residual effects of previous disorders and working with psychosocially oriented musculoskeletal health caseloads[15].

Furthermore, the results demonstrated a noteworthy improvement for study participants and demonstrated the efficacy of an occupational rehabilitation programme for patients with musculoskeletal problems associated to their place of employment[14].

Conclusion

The purpose of the study was to evaluate the efficacy of an occupational therapy rehabilitation regimen in treating musculoskeletal diseases connected to the workplace in students pursuing occupational therapy. Based on the NPRS (Numeric Pain Rating Scores) pre- and post-test results, there was a statistically significant difference between the subjects (t=10.625, p=0.000). and a sharp decline in the Standardised Nordic Musculoskeletal Questionnaire's (SNMQ) prevalence % of musculoskeletal illnesses. As a result, among students studying occupational therapy, the rehabilitation programme is beneficial for musculoskeletal disorders connected to the workplace.

Conflict of Interest: No conflicts in this work.

Source of Funding: Self

Ethical Clearance: This study obtained ethical approval with the ethical clearance number SRMIEC-ST1122-263 from the institutional committee of SRM Medical college & Research centre, kattankulathur, Chengalpattu.

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Original Research Article

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High Prevalence and Impact of Shoulder Pain Among Gym Instructors: A Study on Work-Related Musculoskeletal Disorders

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Abstract

Introduction: Gym instructors within the fitness industry play a pivotal role in guiding individuals towards achieving a range of health and fitness goals. In addition to muscular and skeletal health, gym instructors are instrumental in boosting the immune system. Even though they help in maintaining the body gym trainers have a limited knowledge of mechanism of injury, neglecting and repetitive movements of the joint leads to worsening of injury and increase in the pain. Musculoskeletal pain can stem from various sources, including uncommon or repetitive activities that strain muscles, tendons, and ligaments. Additionally, it may result from sudden, jerky movements, falls, fractures, or underlying musculoskeletal conditions. The result of repetitive activities that strain the muscles, tendons and sprain the ligaments. Insufficient recovery time, rapid pace work, repetitive motion patterns, heavy weight lifting, forceful manual exertions, mechanical pressure concentrations or whole body vibrations can lead to development of other musculoskeletal disorders. The impact of a musculoskeletal condition on an individual's quality of life is substantial, extending beyond mere physical discomfort. Such conditions not only affect personal well-being but also impose a considerable financial strain, manifested through compensation payments and lost wages. Instances of sick leave,absenteeism, and even job abandonment contribute to diminished job efficiency, further exacerbating the socioeconomic repercussions of these disorders.

Methodology: A total of 147 participants were selected on the basis of inclusion and exclusion criteria. A consent form was filled by them and the study and questionnairewas explained to them. Self-made Questionnaire was explained to each gym instructors according to language understood by that person as well as google forms were also made available for their convenience. Each gym instructor completed a self administered questionnaire which included information regarding complaints of current shoulder pain. The total data was collected and was statistically analyzed.

Conclusion: The Prevalence of shoulder pain in gym instructors is high (78%). The presence of shoulder pain causes a gym instructors to avoid certain activities due to pain which causes a hindrance in their work related activities.

Keywords: Prevalence of shoulder pain, Shoulder pain, Gym instructors, impact of shoulder pain, work - related musculoskeletal disorders.

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Introduction

Gym instructors within the fitness industry play a pivotal role in guiding individuals towards achieving a range of health and fitness goals. These professionals employ their expertise to design and implement exercise programs that significantly enhance cardiovascular endurance. The gym instructors perform high intensity work during their personal session or while assisting their clients during their workout session.[1] Furthermore, they prioritize exercises that enhance mobility and balance, which are essential for everyday activities and minimizing the risk of falls, especially as one ages. Improving posture is another critical area of focus, as it not only affects physical appearance but also plays a significant role in preventing back pain and other musculoskeletal issues. "The number of people in this industry has increased in last 10-15 years of attendees and employees and today almost 7,50,000 people work within this industry. [2] The result of repetitive activities that strain the muscles, tendons and sprain the ligaments. Insufficient recovery time, rapid pace work, repetitive motion patterns, heavy weight lifting, forceful manual exertions, mechanical pressure concentrations or whole body vibrations can lead to development of other musculoskeletal disorders. [3] High energy force in a repetitive manner predisposes the static and dynamic stabilizers of shoulder joint to chronic injuries and attenuation following whicha mild instability pattern develops that places increased demand on rotator cuff muscles. Due to muscle hypertrophy and overuse, poor technique can lead to nerve injuries such as supra scapular neuropathy [4]. Gym trainers have a limited knowledge of mechanism of injury, neglecting and repetitive movements of the joint leads to worsening of injury and increase in the pain [1]. Musculoskeletal pain can stem from various sources, including uncommon or repetitive activities that strain muscles, tendons, and ligaments. Additionally, it may result from sudden, jerky movements, falls, fractures, or underlying musculoskeletal conditions. Weightlifting is one of the exercises which is commonly done by every gym instructors. It is a method of strength, resistance training in which a load is pulled or pushed as a form of resistance. Enhancing muscle strength and endurance, it also offers additional benefits such as increased resting metabolic rate, improved blood lipid profile, reduced resting blood pressure, enhanced bone mineral density, better mental health, and a reduced risk of type 2 diabetes. However, despite these advantages, repetitive actions can result in shoulder injuries and subsequent pain.[5] The impact of a musculoskeletal condition on an individual's quality of life is substantial, extending beyond mere physical discomfort. Such conditions not only affect personal well-being but also impose a considerable financial strain, manifested through compensation payments and lost wages. Instances of sick leave, absenteeism, and even job abandonment contribute to diminished job efficiency, further exacerbating the socioeconomic repercussions of these disorders Additionally, the financial burden associated with the treatment of musculoskeletal conditions and the management of accompanying discomfort is substantial, reflecting both the direct costs of medical care and the indirect costs stemming from reduced productivity and quality of life.[3]

Materials and Methods

A cross-sectional study was carried out from the month of September 2023 - March 2024 in 30 gyms out of 250 gyms in the Pune city. A total of 147 participants were included on the basis of age between 25 - 35 years, work experience of more than 3 years and work for minimum of 6 hours or more. There was no specific criteria to select a gym and no written permission was required for the survey. The purpose of the study was explained to the gym instructors and consent was taken from them. A self-made questionnaire was made as an outcome measure. The questionnaire consisted of presence of shoulder pain and the impact that is being caused in their work related activities. The participants were given detailed information and they were asked to fill the questionnaire which took about 5-10 minutes. The collected data was analyzed by using Microsoft Excel 2016. Data is resulted in the table and graphical form which represents the result achieved from the analysis.

Results and DiscussionResults

Cross sectional study was carried out between September 2023-March 2024, study included total 147 participants which are gym instructors in which there were Males 133(90%) and Females 14(10%) with

average age of 29.38 ± 2.85 years and 9.19 ± 2.75 years of work experience.From 143 participants prevalence of shoulder pain is seen in the average of 33.33% of gym instructors

Table 1

Hand Dominance	Percentage
Right	82.99%
Left	17.01%

TABLE 1. The table shows that there are more number of right hand dominant (83%) gym instructors than left hand dominant (17%).

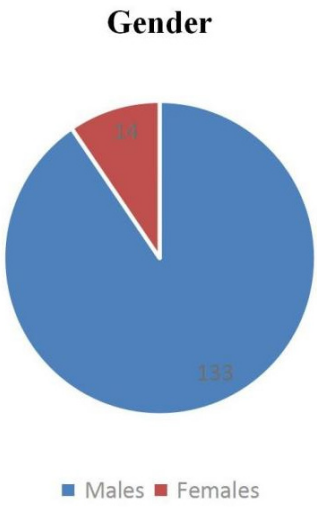

Figure 1

FIGURE 1. is a graphical representation of presence of male gym instructors(90%) being more in the industry compared to the female gym instructors(10%).

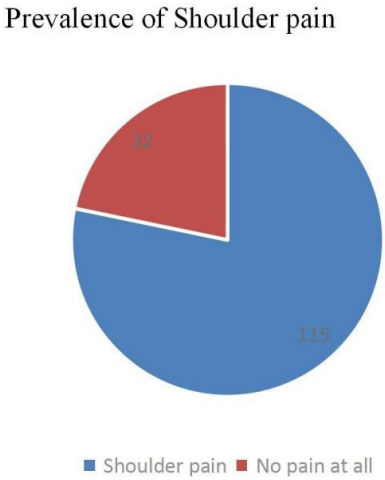

Figure 2

FIGURE 2. is the graphical representation of prevalence of shoulder pain is seen 115 (78%) and the remaining participants have no shoulder pain at all 32 (22%).

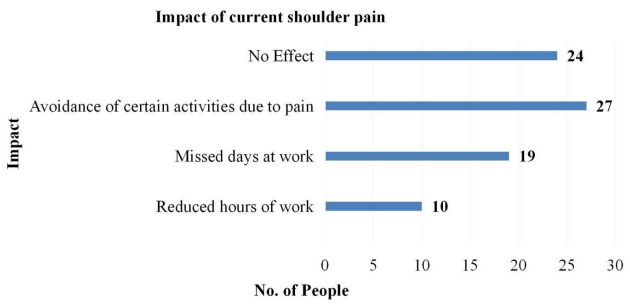

Figure 3

FIGURE 3. is the graph which shows impact of present shoulder pain with prevalence of Avoidance of certain activities due to pain being 27 (18.37%), followed by no effect being 24 (16.33%), missed days at work is 19 (12.93%), and the last being reduced hours of work 10 (6.80%). this graph shows the prevalence of impact that occurs in daily lives of gym instructors.

Discussion

This study seeks to determine the frequency of shoulder pain among gym instructors in Pune city. Common work-related musculoskeletal disorders have been observed in this group, with previous studies indicating that the shoulder is the most prevalent site for pain and injury (79%). With the growing demand for individual fitness, the industry has garnered significant attention, prompting concerns regarding injuries and pain among gym instructors.

This survey utilized a self-designed questionnaire to gather data on factors such as age, hand dominance, years of experience, work hours, presence of shoulder pain, and its impact on day-to-day occupational tasks. Findings indicate a high prevalence of shoulder pain (78%). Given the continuous nature of gym instructors' workouts, shoulder pain may arise without adequate rest and time for recovery.

The study shows that there are more number of right hand dominant participants compared to left hand dominance. Previous studies shows that the strength of the dominant hand is more compared

to non-dominant hand and the injury and pain of the shoulder is very common to happen in the non-dominant hand. Based on the study done by Pud D, Golan Y and Pesta R the study found significant differences in pressure pain threshold asymmetry between left and right-hander, with left-hander demonstrating a distinct pattern compared to right-hander. The pain threshold of right handed participants were more than compared to left hand of those participants. There was no significant change seen in left hand dominant participants.[16]

The survey shows that from total participants there are more number of males (90%) seen. This industry requires proper protocols for resistance training, strengthening exercises and preference of male instructors is more in comparison to female instructors. A similar study done by Mazzetti SA, Kraemer WJ, Volek JS, et al in a previous study propose an alternative perspective. They argue that adherence to and the intensity of exercise might also be significantly influenced by the dynamics inherent in the relationship between the trainer and the trainee, with particular attention paid to the gender of the trainer. Therefore, considerations regarding the gender of the trainer and the ensuing perceptions could hold significant implications for optimizing exercise adherence and intensity, thereby warranting further exploration within the realm of exercise science and training methodologies.[17]

Several studies have explored the impact of the coach's gender across various sporting domains, including athletics, volleyball, basketball, and strength and conditioning. Parkhouse and Williams, as well as Weinberg et al., have documented that male athletes often harbor negative attitudes towards female coaches. Moreover, female athletes have expressed a preference for the prospect of having an unsuccessful male coach over a successful female coach. Qualitative investigations have revealed that in a sample of collegiate female athletes spanning disciplines such as basketball, softball, golf, cross-country, track and field, and soccer, the majority exhibited a preference for male coaches.[19] However, Medwechuk and Crossman's research contradicts this trend, showing that swimmers tend to favor coaches of the same gender. More recent studies have indicated that male collegiate athletes generally lean towards male strength and conditioning coaches, while female counterparts do not exhibit a strong gender preference in this domain.[18,19]

This study aims at finding the prevalence of shoulder pain in gym instructors. Based on the data the results show that there is prevalence of shoulder pain (78%). As gym instructors are the ones who workout in sessions one after other so there is no proper rest. The study done by Shinde N, Sahasrabuddhe P.in "Prevalence of musculoskeletal pain and injuries in gym instructors" there is prevalence of musculoskeletal pain and injury is seen in the shoulder joint as the shoulder joint is renowned for its remarkable mobility, but this comes at the expense of stability. Due to the extensive range of motion it allows, the muscles and ligaments supporting the shoulder joint are often stretched beyond their normal limits, rendering the joint vulnerable to instability. This stretching of the shoulder ligaments can result in pain, which may occur suddenly or gradually over time. Activities involving frequent overhead movements, such as arm abduction and flexion, can also aggravate shoulder pain. [1]

As the result of the survey states that there is prevalence of avoiding certain activities due to pain (18%). As its their occupation and they are paid for the hours they put in the gym avoiding certain activities can lead to less number of people coming to them for workout sessions. If they are taking up less session which can lead to reduce in their salary as their performance is reviewed at the end of the month which can affect their lives financially.

Based on the study done by George SA, Abraham AT. A, in "Review on Musculoskeletal Pain and Injuries among Fitness Instructors." A musculoskeletal condition not only profoundly affects an individual's quality of life but also imposes a substantial financial strain due to compensation payments and lost wages. Factors such as sick leave, absenteeism, and even job abandonment further diminish job efficiency, exacerbating the economic impact of these disorders. Moreover, the associated treatment costs and the discomfort experienced by individuals dealing with musculoskeletal issues contribute significantly to the overall financial burden. Thus, beyond the personal toll they take on individuals, these conditions represent a significant economic challenge, affecting both employers and society at large.[3]

Based on the previous study, experience of the gym trainers can be one of the reason for prevalence of shoulder pain. There is correlation between the qualification and years of experience of the instructors who are responsible for the training session and preventing any further pain or injury. The study done by Ahmed S, Rashid M, Sarkar AS, Islam MJ et al., qualification plays no significant role in becoming the gym instructors. The findings of the study suggest that individuals who engage in workouts under the guidance of experienced trainers are prone to experience less pain compared to those under the ones of less experienced instructors. [20]

Another study done by Lau R, Mukherjee S. in "Prevalence of shoulder and elbow overuse injuries among competitive overhead youth athletes in Singapore" the prevalence of shoulder injury (31%) was seen. In this study it also shows that athletes having less than 8 years of experience have shoulder overuse injuries (95%). There is prevalence seen in shoulder injuries in comparison to elbow overuse injuries in athletes with less years of experience.[21]

Another point of concern for the prevalence of shoulder pain is when instructors work for more hours without having a proper rest and more heavy weights are prone to havingshoulder pain. According to Merat G, Bonato M, Agnello L. et al, this study revolves around the examination of musculoskeletal disorders, it became evident that various ailments were prevalent among Fitness Instructors. These included muscle tightness, which refers to the shortening of a muscle, along with incidents such as ankle, knee, and wrist sprains, shoulder dislocations, contusions, as well as occurrences of low-back pain and articular pain.[22]

This study brings attention to prioritize promoting health, offering rehabilitation services, and implementing preventive measures. This includes advocating for comfortable working postures and utilizing ergonomically designed equipment and tools. By addressing these aspects, gym instructors can help mitigate the risk factors contributing to shoulder pain within their profession. Focusing on these recommendations not only supports the well-being of gym instructors but also enhances their ability to perform their duties effectively while minimizing the occurrence and severity of shoulder-related discomfort.

Conclusion

This study shows there is high prevalence of shoulder pain in gym instructor being 78%. the impact of the current shoulder pain is that there is more of avoiding certainactivities due to shoulder pain which is 18%. Continuous hours of work without proper rest intervals, also presence of previous shoulder pain or injury, have been observed to contribute to present shoulder pain.

Ethical Clearance: Taken from St.Andrews College of Physiotherapy (ST.A/COP/IEC/209/2024) Faculty Research ethics Committee (ON 6 April 2023, REFRENCE :- Dr. Venkatesan R.) IEC REFERENCE NO :- BPTH/Ethics/0075

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