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Editorial

Empowering pelvic floor rehabilitation: Unveiling technological innovations in the pelvic floor muscle chair; insights and hurdles in the Pakistani context

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Owing to the expeditious advancement of research and technology, the Physical therapy and rehabilitation sciences have made a remarkable pace in recent years. This blooming enhancement has metamorphosed pelvic floor dysfunction treatment and has a great impression on the medical and allied health sciences field. In this article, technological advancements in pelvic floor muscles are explored. It also overviews Pakistan-specific challenges and considerations[1].

Intending to help and manage patients with pelvic floor dysfunction, biofeedback training uses sensors to put forward real-time feedback on pelvic floor muscle activity. It has illustrated Potential enhancement in pelvic floor muscle functioning and curtailing symptoms of pelvic floor muscle dysfunction[2]. The pelvic floor muscles are stimulated using low-intensity electrical currents, resulting in solid muscle contraction, and strengthening. It is promising in improving pelvic floor muscle dysfunction and urine incontinence[3]. Behavioral therapy aims to modify the routines and behavior open to pelvic floor dysfunction. It necessitates lifestyle modifications, bladder retraining, and pelvic floor muscle exercises. It has victoriously improved pelvic floor muscle weakness and urinary incontinence as well[4]. Manual treatment methods that include physical manipulation of the pelvic floor muscles and associated tissues include trigger point release and myofascial release. These methods reduce muscular stress, enhance blood flow, and increase muscle function[5].

While developed nations have successfully incorporated modern technology into rehabilitation practices, the Pakistani context presents unique insights and challenges. The lack of an updated curriculum, limited training opportunities, and budgetary constraints hinder the adoption of the latest technological advancements in pelvic floor rehabilitation in Pakistan. To overcome these hurdles, the following steps are recommended;

Curriculum Update: Rehabilitation degree programs should revise their curricula to align with global advancements in technology. The inclusion of courses focusing on pelvic floor rehabilitation and modern technological interventions would better equip future professionals. *Continuous Professional Development:* Continuous professional development programs should be designed to upskill already graduated professionals in the field of pelvic floor rehabilitation technology. These programs will ensure that healthcare practitioners stay updated with the latest innovations and can effectively incorporate them into their practice. *Increased Budget Allocation:* Allocating a higher budget to the rehabilitation sector, specifically for technological advancements, is crucial. Adequate financial resources would enable the acquisition of state-of-the-art equipment,

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infrastructure development, and research initiatives, thereby facilitating the integration of technological innovations in pelvic floor rehabilitation.

Finally, technological innovations have transformed the landscape of pelvic floor rehabilitation, offering new possibilities for improved outcomes. In the Pakistani context, addressing the insights and hurdles specific to the country is vital for empowering pelvic floor rehabilitation and ensuring that individuals with pelvic floor disorders receive the benefits of modern technology.

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Research Article

Static versus dynamic stretching; short term effects on physical performance in non-athletes- a randomized clinical trial

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Abstract

Background: Non-athletes have varying fitness levels, muscle characteristics, and training backgrounds, which can affect how different types of stretching exercises impact their physical performance.

Objective: to compare the acute effects of static and dynamic stretching on physical performance of non-athletes. A single blinded, cross-over, randomized clinical trial was conducted at Iqra National University, Peshawar for a period of 6 months. A total of n=54 male participants were randomly allocated into group A and B. Group A performed the static stretching while group B performed dynamic stretching. The physical performance measure was endurance, agility, strength, flexibility, and balance respectively.

Result: The result of two-way RMANOVA showed that both stretches had significant interaction effects between interventions and all performance measures ($p<0.001$) except for balance ($p=0.23$). The main effect showed that static stretching significantly reduced agility and balance ($p<0.05$), while dynamic balance improved all measures significantly ($p<0.05$). When compared the mean differences of all variables, dynamic stretches showed significant improvement ($p<0.05$) in all variables as compared to static stretching.

Conclusion: Dynamic stretch has a significant contribution in improving all physical performance measures among non-athletes, if incorporated before the activity. While static stretching negatively affects the agility and balance among this population.

Keywords: agility; balance; dynamic stretching; endurance; flexibility; non-athletes; physical performance; static stretching.

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INTRODUCTION

Non-athletes are individuals who do not engage in regular or organized athletic activities or sports. They may still engage in physical activity for health and fitness purposes, but their level of participation in sports or athletic events is limited or non-existent [1]. Physical fitness among non-athletes can vary widely depending on individual lifestyle choices and level of physical activity. While non-athletes may not participate in organized sports or athletic events, they can still engage in regular physical activity for health and fitness benefits[2].

Growing evidence suggested that physical performance and lifestyle behaviours in early years of life contribute to chronic diseases in older population [3]. Stretching exercises can improve flexibility, posture, blood circulation and reduce stress [2, 4]. Which ultimately improves the joint mobility, reduce muscle soreness and pain as well as have positive impact on improve physical performance by allowing for greater ease of movement. Mental health and quality of life [5, 6]. Static stretching and dynamic stretching are two types of stretching exercises that commonly involve lengthening muscles and improving flexibility thus the physical performance [7]. They differ in terms of their timing and the movements involved. Static stretching involves holding a stretch for an extended period, usually 15-30 seconds, without any movement [8, 9].

Static stretching is typically performed after a workout when the muscles are warm and is often used to improve overall flexibility [10, 11]. Dynamic stretching, on the other hand, involves moving through a range of motion that mimics the activity participating in[12]. Dynamic stretching is usually done before a workout or activity to warm up the muscles and prepare the body for the specific movements required in the activity[10]. Research has shown that both static and dynamic stretching can have immediate effects on physical performance, but the effects may differ depending on the type of stretching and the timing of the performance test[13]. Dynamic stretching can improve power and strength immediately after stretching, while static stretching may lead to a decrease in power and strength immediately after stretching. However, the exact timing of these effects may vary depending on the individual, the activity being performed, and the type and duration of stretching used [12, 14, 15].

Although there is lot of literature available on the athlete population regarding both types of stretching, the non-athlete population is still under studied. The non-athletes may experience static and dynamic stretching exercises differently depending on their individual preferences, muscular stiffness, muscle activation, injury prevention, performance enhancement, and other considerations. For non-athletes interested in a variety of sports and physical activities, enhance their health, endurance, and increase strength and flexibility, physical performance is crucial. Understanding the immediate and short-term impacts of these stretching strategies on physical performance is the goal of evaluating the effects of static and dynamic stretching during a single session on physical performance at various time periods. To maximize the physical performance of non-athletes, the impacts at various time periods can be compared to discovering the best timing for executing these stretches. Thus, the objective of the current study was to compare the acute effects of static and dynamic stretching on non-athletes' physical performance at various time points.

MATERIALS AND METHODS

A single blinded, crossover, randomized clinical trial was initiated after getting approval from the Research Ethic Committee (REC) of Riphah International University, Islamabad. The study was conducted at Iqra National University, Peshawar from June 2021 to December 2021. The purpose of the study was explained to the subjects and written informed consent in accordance with Deceleration of Helsinki was obtained from the study participants.

Non-probability convenient sampling technique was used for sample collection. The non-athlete males, aged between 18-25 years, decreased Range of Motion (ROM) of lower limb including hip flexion (SLR)>80 degrees, knee flexion>130 degrees and ankle dorsiflexion>20 degrees, and had normal body mass index (BMI) were included in the study. However, participants who had acute injuries of lower limb, active sports any training programs and had lower limb disabilities were excluded from the study.

Sample Size: A total of n=56 sample size was calculated through G power, keeping effect size small (0.2), α error margin at 0.05. To avoid β error probability, the power (1- β) was set at 0.95%. A total n=298 males non/recreational athlete were evaluated for the inclusion criteria, n=242 participants did not fulfil the selection criteria, so excluded from the study. A total of n=56 participant was then randomly divided into group A (n=28) and group B (n=28). One participant from each group did not complete the follow up after the washout period, so in the final analysis n=54 participants were included. (Figure 1)

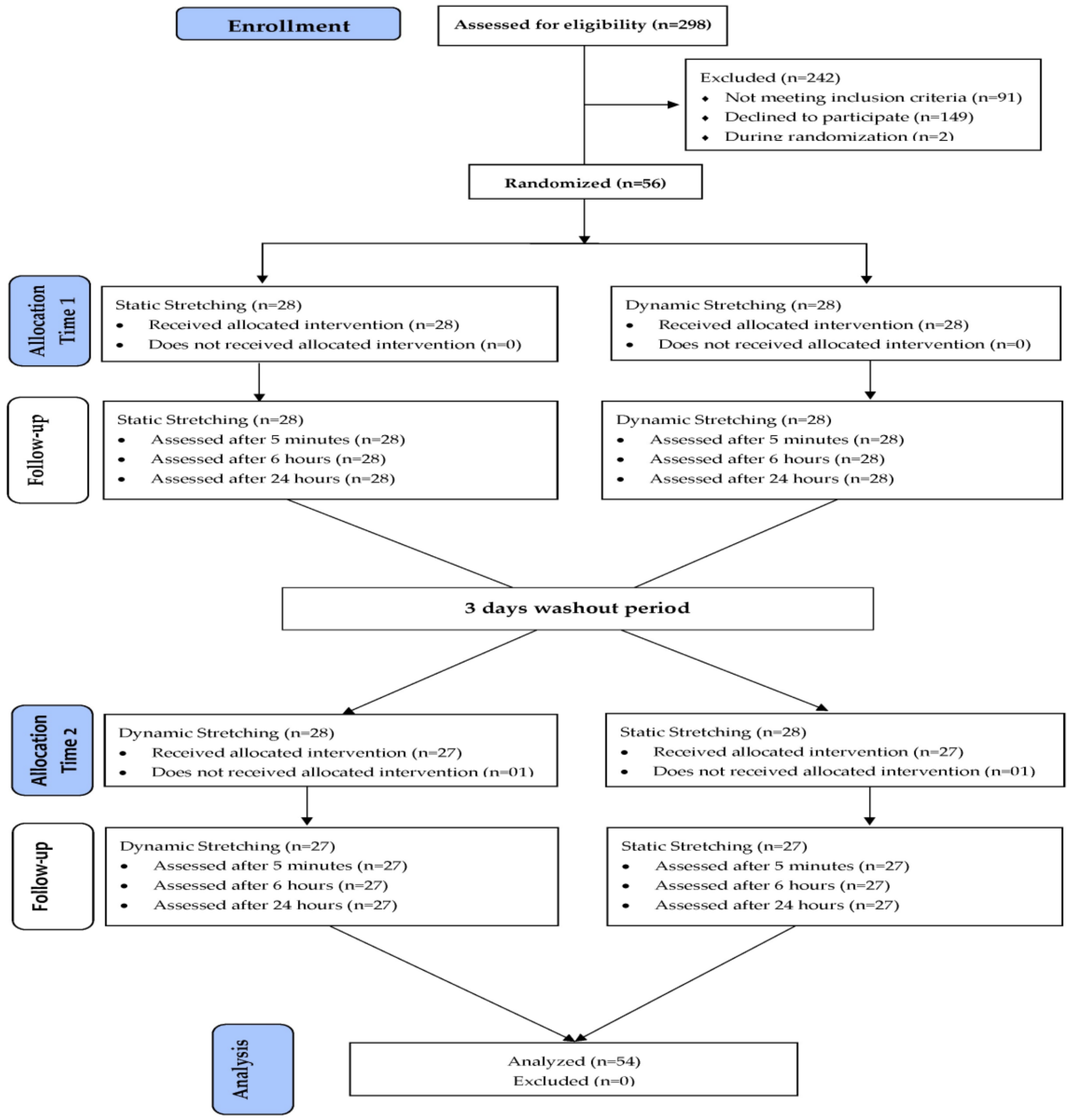

Figure 1. CONSORT Diagram.

Randomization: The enveloped sealed method using a computerized random number generator was used for randomization. An individual who was not directly involved in the study did the random allocation. The random numbers were then written on the index cards and placed in a thick and opaque sealed envelope before the start of the study. After obtaining written informed consent, the physical therapist opened the envelope and provided the respective interventions to the patients. As the assessing physical therapist was blinded to the intervention so the study was single-blinded.

Intervention: The intervention detail was explained to subjects and none of the participants were harmed during the study. Each participant was assessed initially at the baseline and then stretching exercises were performed. Initially group A received 7-static stretching and group B received 8-dynamic stretching exercises. The assessment was done after 5 minutes, then 6 hours and after 24 hours to measure short term effects. After that, an interval of 3-days was given as washout period. After washout period interventions were switched, so group A received dynamic stretching protocol while group B received static stretching and similar assessment procedure was repeated to determine the difference. The force of the bounce or swing of dynamic stretching was taught to gradually increase, while avoiding radical or uncontrolled movements. Each dynamic stretch held at the end-range was for 2-3 seconds and then asked to take the joint through its range-of- motion. (Table 1)

These all exercises were performed by the participants actively under supervision after being demonstrated by the therapist, inside the physiotherapy laboratory of Iqra National University, Peshawar Pakistan.

Table 1. Intervention protocol.

	Static Stretching Exercises Group (n=27)	Dynamic Stretching Exercises Group(n=27)
Exercises	Neck Stretches	Neck rotations
	Overhead triceps stretches	Lunges with twist
	Biceps stretched	Knee to chest
	Gluteal stretches	High kicks
	Seated butterfly stretches	Hip stretches with twist
	Hamstrings stretches	Pushups
	Standing quads stretches	Squats
	-	Arm circles
	Protocol	
Frequency of session	Once	Once
Repetitions stretches in each session	5	5
Duration of stretch in single stretch	10 seconds	3-5 seconds

Assessments: The demographic data along with height, weight, BMI, and ROM of hip flexion, knee extension and ankle dorsiflexion were obtained. The outcome measures were endurance, agility, strength, flexibility, and balance. The endurance was measured by Cooper 12-minute walk/run test, modified Illinois agility test was used to determine agility of spine and pelvis, vertical jump test determined the strength, flexibility was assessed through sit-and-reach test while functional reach test was used to determine balance.

Statistical methods: For within group comparison, The Two-way repeated-measures ANOVA was used to see the interaction effects between intervention and assessments. While for main effects, RMANOVA for with-in group changes and independent T-test to compare the mean differences (MD) of physical performance measures were used as the baseline differences were exist. The level of significance was set at $p<0.05$ and SPSS version 28 was used to analyze the data.

RESULTS

The mean age of the participants was 19.33±0.80 years. The height (in feet) and weight (in kg) were calculated with mean of 5.6±0.15 feet and 69.77±2.98 kg respectively. The ROM was measured for hip flexion, knee flexion and ankle dorsiflexion. The mean ROM for hip flexion was found to be 74.42±3.97 degrees, knee flexion was 133.50±2.28 degrees and ankle dorsiflexion ROM was 19.50±2.48 degrees.

The result of two-way RMANOVA showed that both stretches had significant interaction effects between interventions and endurance {$F=35.72(1.56, 82.79)$, $p<0.001$, $\eta p^2=0.40$}, agility {$F=310.52(1.78,94.8)$, $p<0.001$, $\eta p^2=0.85$}, strength ($F=30.61(1.39,74.12)$, $p<0.001$, $\eta p^2=0.36$) with larger effect size. While between interventions and flexibility {$F=7.08(1.24, 65.84)$, $p=0.006$, $\eta p^2=0.11$} interaction effect is small. However, the interaction effects of both types of stretching on balance {$F=1.45(1.0,53.26)$, $p=0.23$, $\eta p^2=.027$) were insignificant. (Figure 2)

Main effects showed that endurance, which was measured with the Cooper 12-minute walk test was significantly improved from baseline to after 24 hours in static stretching {$F=8.48(1.85,98.41)$, $p=0.001$, $\eta p^2=0.13$} and dynamic stretching {$F=88.597(1.53,81.44)$, $p<0.001$, $\eta p^2=0.62$}. The pairwise comparison showed static stretching significantly improved endurance from baseline to after 5 minutes ($p=0.019$) but no significant improvement was observed after 6 hours and 24 hours ($p\geq0.05$). However, dynamic stretch showed a significant improvement in endurance throughout the session ($p<0.001$). Agility was measured with the modified Illinois agility test and the main effects showed significant decline in the agility {$F=130.29(1.87,99.53)$ $p<0.001$, $\eta p^2=0.71$} from the baseline to after 24 hours as well as at each level of assessment. While in dynamic stretching group significant improvement was observed {$F=308.11(2.11,112.33)$, $p<0.001$, $\eta p^2=0.85$} throughout the intervention duration.

Furthermore, it was observed that the effects of both types of stretches, i.e., static stretch {$F=30.67(1.48,78.53)$ $p<0.001$, $\eta p^2=0.367$} and dynamic stretch {$F=192.79(1.69,89.81)$, $p<0.001$, $\eta p^2=0.78$} significantly improved strength. The pairwise comparison showed a significant improvement from baseline to after 24 hours in both stretches ($p=0.001$). Flexibility was also improved in both groups, static stretch {$F=81.42(1.33,70.95)$, $p<0.001$, $\eta p2=0.60$} and dynamic stretch {$F=119.74(1.26, 67.11)$, $p<0.001$, $\eta p^2=0.69$}. Pairwise comparison of both techniques showed significant improvement throughout the sessions ($p<0.001$). The balance was measured by the functional reach test, which showed no significant improvement in static stretching {$F=1.08(1.002,53.09)$, $p=0.30$, $\eta p^2=.020$} but significant improvement was observed in dynamic stretching {$F=145.14(1.28,68.03)$, $p<0.001$, $\eta p^2=0.73$} from baseline to throughout the session. The pairwise comparison showed non-significant ($p\geq0.05$) improvement in the balance from baseline to after 5 minutes in static stretching group. But a nonsignificant decline was observed from 5 minutes to 6 hours. In the last, from 6 hours to 24 hours there was a significant (p<0.001) decline in the balance in static stretching group. However, dynamic stretching showed significant improvement (p<0.001) throughout from baseline to after 24 hours as well as at each level of assessment. (Table 2)

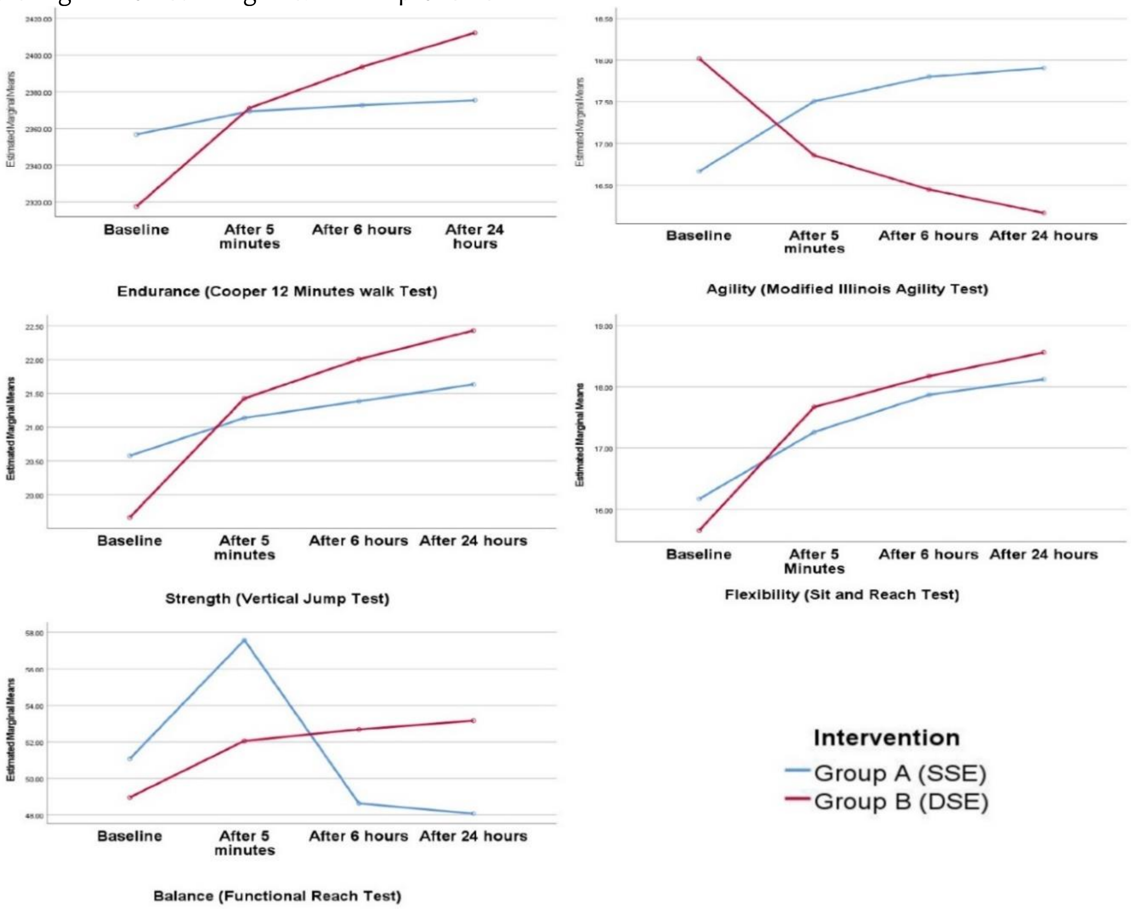

Figure 2. Interaction effect between the intervention and physical performance.

Table 2. With-in group Analysis of Physical Performance Measures.

		Static Stretching Exercises (SS) (n=27)				Dynamic Stretching Exercises (DS) (n=27)			
		Mean	SD	MD/F(df)	p-value	Mean	SD	MD/F(df)	p-value
Endurance (m)	Baseline	2356.75	91.05	-12.61	0.02*a	2317.62	71.38	-53.44	0.00***a
	After 5 minutes	2369.37	91.89	-3.27	1b	2371.07	77.78	-22.42	0.00***b
	After 6 hours	2372.64	85.28	-2.71	1c	2393.50	68.31	-18.53	0.00***c
	After 24hours	2375.38	75.67	8.48(1.85)	0.001**d	2412.03	74.51	88.59(1.53)	0.00***d
Agility (sec)	Baseline	16.66	0.74	-0.83	0.00***a	18.01	.66	1.16	0.00***a
	After 5 minutes	17.50	0.71	-0.29	0.00***b	16.85	.68	.40	0.00***b
	After 6 hours	17.80	0.77	-0.10	0.01*c	16.44	.58	.28	0.00***c
	After 24hours	17.90	0.81	130.29(1.87)	0.00***d	16.16	.53	308.11(2.11)	0.00***d
Strength (inches)	Baseline	20.57	2.17	-0.55	0.00***a	19.66	1.26	-1.76	0.00***a
	After 5 minutes	21.13	1.87	-0.24	0.04*b	21.42	1.16	-.58	0.00***b
	After 6 hours	21.38	1.66	-0.25	0.00***c	22.00	1.18	-.42	0.00***c
	After 24hours	21.63	1.63	30.67(1.48)	0.00***d	22.43	1.18	192.79(1.69)	0.00***d
Flexibility (cm)	Baseline	16.17	1.91	-1.08	0.00***a	15.65	2.16	-2.01	0.00***a
	After 5 minutes	17.26	1.42	-0.60	0.00***b	17.66	1.27	-.50	0.00***b
	After 6 hours	17.87	1.40	-0.25	0.00***c	18.17	1.26	-.38	0.00***c
	After 24hours	18.12	1.37	81.42(1.33)	0.00***d	18.56	1.49	119.74(1.26)	0.00***d
Balance (cm)	Baseline	51.08	1.99	-6.49	1.000a	48.97	2.24	-3.09	0.00***a
	After 5 minutes	57.57	61.51	8.94	1.000b	52.06	1.77	-.63	0.00***b
	After 6 hours	48.63	1.97	0.55	0.00***c	52.69	1.71	-.47	0.00***c
	After 24hours	48.08	1.83	1.08(1.00)	0.30d	53.16	1.79	145.14(1.28)	0.00***d

a baseline to after 5 minutes, b 5 minutes to 6 hours, c 6 hours to 24 hours, d baseline to 24 hours; p<0.05, p<0.01**, p<0.001***; SD-Standard deviation; MD- Mean difference.*

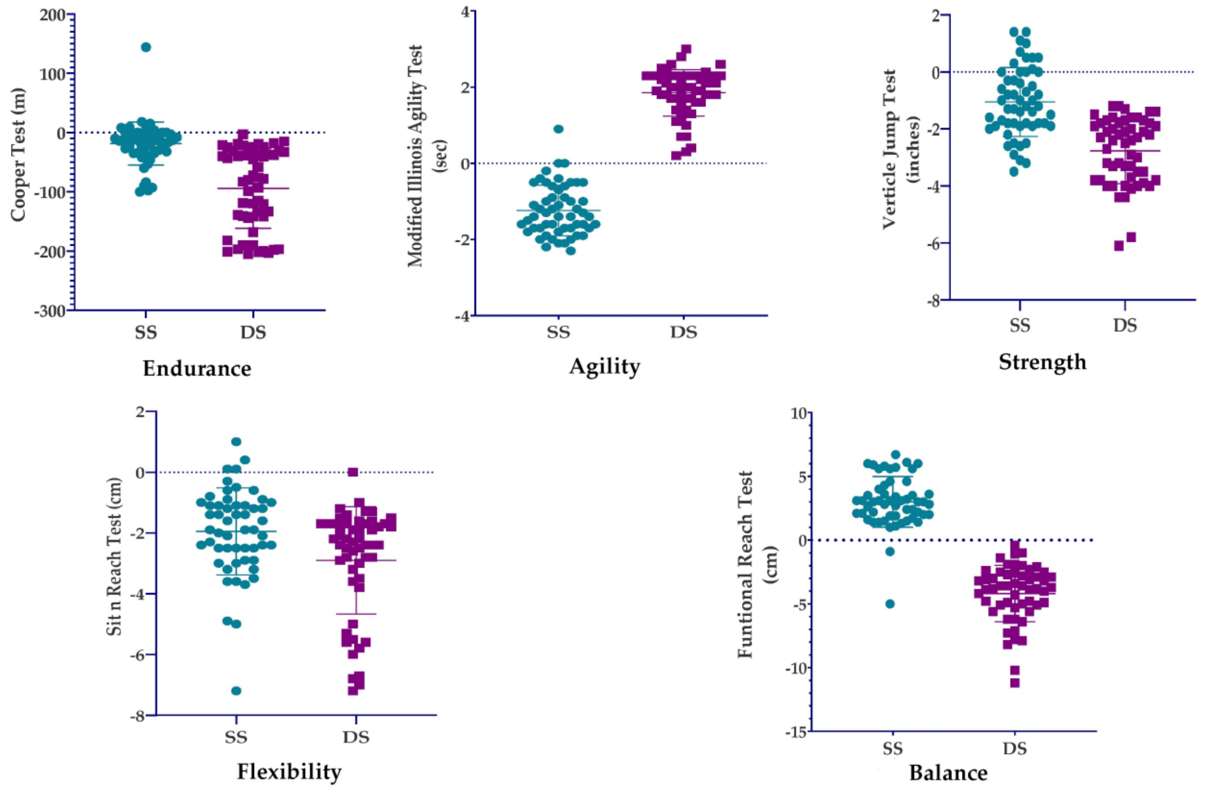

Figure 3. Comparison of mean differences (MD) of physical performance measures.

Between group analysis showed a significant difference between both types of stretching techniques (p<0.05). The mean of the mean difference showed that dynamic stretching cause significant increase in all components of physical performance with large effect size, when compared to static stretching including agility (1.85±0.60 vs -1.23±0.66, p<0.001, Cohen's d=1.06) , strength (-2.76±1.15 vs -1.05±1.20, p<0.001, Cohen's d=2.09), flexibility (-2.90±1.76 vs -1.95±1.42, p=0.008, Cohen's d=2.54), balance (-4.19±2.21 vs 2.99±1.98, p<0.001, Cohen's d=3.24) and endurance (-94.41±67.35 vs -18.63±36.24, p<0.001, Cohen's d=83.17). (Figure 3)

DISCUSSION

The current study was aimed to compare the static stretching and dynamic stretching on non-athletes' physical performance at various time points. The results suggested that dynamic stretching significantly improve all performance measures at various time points as compared to static stretching. Moreover, balance was immediately improved after stretching exercise but afterward declined, while agility declined throughout the intervention from baseline to after 24 hours.

The results showed that dynamic stretching cause significant improvement in all components of physical performance when compared to static stretching. In dynamic stretching muscles are stretched actively in variety of dynamic activities challenging ROM at a constant rate[8]. Through a combination of central and local mechanisms, including improved neural activation, increased blood flow, enhanced motor unit recruitment, increased muscle temperature, improved muscle activation, improved joint range of motion, and improved muscle compliance, dynamic stretching can enhance physical performance measures [16-19].

In the current study, endurance showed improvement in both types of stretching which is in coherence with the literature [20]. Iwata et al studied the effects of dynamic starching, where 30 second stretch had sustained effects for 90 minutes[21]. The current study measured the short-term effects to be sustained with application of dynamic stretch, the difference in endurance was significant when baseline was compared to 5 minutes, 6 hours, and 24 hours. Where in the static stretching group short term effects at different timepoints were not significant but after 24 hours endurance was improved. It was reported that reduction in maximum voluntary contraction (MVC) after static stretching (SS) which remained reduced for an hour. A possible reason for decrease was purported to be originated by neural fatigue, leads to decrease in the recruitment of motor units and reduction in the performance. The changes occurred in the aponeurosis-tendon complex, may affects the proprioceptive response thereby decreasing motor unit activation [22, 23].

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According to the results of this study, static stretching showed significant reduction agility and agility, while dynamic stretching significantly improved both at each point of assessment. So, a significant difference was observed between both types of stretching. The previous study reported the positive effects of static stretching on agility and performance [24]. however, in a study static stretching significantly reduced the agility and balance but dynamic stretching improved the both [25]. The literature shows that static stretching has been demonstrated to reduce neuromuscular activation, temporarily reduce muscle strength, and impede communication between the brain and the muscles so reducing the reaction time. These effects may have a negative impact on agility as well as balance by diminishing the force, speed, and force production capability of the muscles [18, 26, 27]. Hence dynamic stretching is more effective in improving agility, which enhances performance. So, for agility and balance measures, dynamic stretching is better to incorporate before these activities. [16-19,28]

Furthermore, strength and flexibility measured with vertical jump test and sit and reach test respectively were improved in static and dynamic stretching exercises in both groups. But dynamic stretching has more significant improvement as compared to static stretching group. The results of this study is in coherence with the previous study in which static and dynamic stretch improves vertical jump test and range of motion of hip and knee in active males college students[29]. Another meta-analysis on static stretching exercises in both athletic and non-athletic (recreationally trained) participants showed that static stretching was found to have a negative impact on maximal strength and power performance. The authors advised against using static stretching during a warm-up routine in light of these findings[30].

A study conducted by Perrier et al. stated significant improvement in flexibility after static and dynamic stretch. But there wasn't significant between group differences observed for flexibility [31]. But in current study results are contradictory to the study, which shows improvement in both measures in static stretching as well as dynamic stretching groups. A systemic review and meta-analysis stated that dynamic stretching improves vertical jump and flexibility throughout stretching sessions [32]. The results of the current study are coherent with this previous study. Dynamic stretching exercises improve muscle activation, motor unit recruitment, and coordination to build muscular strength. These stretches can also increase joint mobility gradually, decrease stiffness, and increase overall flexibility. Dynamic stretching exercises may be a useful technique to increase strength and flexibility while also lowering the risk of injury when incorporated into a warm-up regimen[33].

Although the current study was a single cantered study, external validity of the result may be affected due to same population. Moreover, the current study tried to establish that cause and effect relationship between two types of stretching and physical performance measures at various timepoints based on available literature.

Conclusion

Dynamic stretch has a significant contribution in improving all physical performance measures among non-athletes, if incorporated before the activity. While static stretching negatively affects the agility and balance among this population. The effects of static and dynamic stretching exercises can differ among athletes and non-athletes with respect to individual preferences, muscular stiffness, muscle activation, injury prevention, performance enhancement, and other considerations, so further research should be these differences as well as must be focused on possible mechanism of effectiveness among non-athletes.

DECLARATIONS & STATEMENTS

Author's Contribution

SHK: substantial contributions to the conception and design of the study.
MBI and JA: acquisition of data for the study.
ZM and RK: interpretation of data for the study.
AS and AHB: analysis of the data for the study.
KK and AO: drafted thework.
SHK, MBI, JA, ZM, RK, AS, AHB, KK and AO: revised it critically for important intellectual content.
SHK, MBI, JA, ZM, RK, AS, AHB, KK and AO: final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the joint Research and ethical committee of Riphah International University (RIPHAH/RCRS/REC/Letter-01012) and Department of Allied Health Sciences, Iqra National University Peshawar Pakistan (INU/AHS/973-21).

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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personal experiences with pain.

Conflicts of Interest

The authors declare no conflict of interest

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Research Article

Non-acceptance of Low Vision Aids (LVADs) among patients presented to Eye OPD in Poly Clinic Hospital Islamabad

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ABSTRACT

Background: Vision impairment is a public health problem and every patient with visual impairment doesn't accept low vision aids (LVA's).

Objective: To explore the non-acceptability rate of low vision aids with the reasons for not opting for them.

Methods: A cross-sectional study was conducted at the Department of Ophthalmology in the Polyclinic Hospital, Islamabad. A sample of n=100 Patients in the selected age groups 20 to 80 years diagnosed with age-related macular degeneration, retinitis pigmentosa, diabetic retinopathy, high myopia/hypermetropia, optic atrophy/neuropathies, and glaucoma were recruited using non-probability purposive sampling technique. Data was collected using a predefined form to determine the willingness of low-vision patients to adopt LVAs. The non-acceptance rate was calculated as the percentage of participants declining LVA services, assessed through their responses on the form.

Results: The mean age of the participants was 43.48±14 with a range from 20 to 80 years. A total of n=100 patients out of which n=58 were males and n=42 were females. Among these n=100 patients, n=91 patients show non-acceptance with a gender distribution of n=53 male and n=38 female patients. The major reason for non-acceptance was unaffordability for LVA among males (n=19) and n=06), followed by usage difficulty, transportation, fear of losing jobs, social stigma, low necessity, and lack of awareness.

Conclusion: Non-acceptance of low vision aids among the study population due to unaffordability, compounded by social stigma, financial constraints, and limited awareness, underscores the need to address these barriers for better device utilization and enhanced quality of life for visually impaired individuals.

Keywords: blindness; vision aids; visual impairment

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INTRODUCTION

Visual impairment has become increasingly common as a primary ailment, as well because of numerous diseases including diabetic retinopathy [1]. The Visual Impairment Expert Group (VIEG) estimates that 253 million individuals around the world are blind or visually impaired [2]. Roughly 89% of the visually impaired population resides in low- and middle-income countries. Low visual impairment ranges from age-related macular degeneration, retinitis pigmentosa, diabetic retinopathy, high myopia/hypermetropia, optic atrophy/neuropathies, to glaucoma etc [3].

According to reports, people with visual impairment have a lower quality of life and experience worse health outcomes [4]. With a boom in digitalization, there has been an inevitable dependence on good eyesight to fulfill job responsibilities among people from all walks of life [5,6] Visual impairment (VI) is linked to an increased risk of falling, fracturing a bone, and death.[2,7] Compared to the general population, people who are sighted, and those who are visually impaired are more likely to experience psychological issues including anxiety and depression [8].

Visual impairment can be corrected by using low-vision aid devices. A few of the prescribed low vision aid devices include reading glasses, telemicroscope glasses, magnifiers, screen readers, and clip-on loupes. Not every patient diagnosed with a visual impairment and recommended visual aid accepts it [10]. As per the studies published, the reasons range from/are not limited to "lack of awareness, social stigma attached with using aid devices, non-seriousness in realizing the magnitude of the diagnosis, usage difficulty, and fear of loss of the job [11, 12, 13]. Furthermore, factors like profession, age, and magnitude of the problem also have a role to play in the acceptance of low-vision aid devices [11,15]. With a plethora of reasons and factors contributing to the patient's decision, there has been staggering diversity among patients belonging to different socio-economic classes. Here, factors like lack of financial power and awareness can explain the pattern of acceptance of low vision aids [14].

Patients with low vision would benefit from vision rehabilitation with LVAPs because it would improve their quality of life, lessen their reliance on family members, and cut down on the medical expenses related to the secondary and tertiary disabilities that result from their primary impairment. A study showed that the worldwide utilization of low vision services is alarmingly low, not just in Low and middle - income. Hardly 5- 10% of the visually impaired population uses these resources [16].

The present study aims to investigate the rate and reasons for non-acceptance of low vision aids among individuals with different ocular diseases causing low vision across different age groups. By understanding the factors contributing to non-acceptance, the study seeks to inform strategies for promoting awareness, reducing social stigma, and improving access to low vision aids, ultimately enhancing the quality of life for individuals with visual impairments.

METHODOLOGY

A cross-sectional study was conducted on patients visiting the Department of Ophthalmology (FGPC.1/12/2020/Ethical-Committee) in the Polyclinic Hospital, Islamabad from May 2021 to May 2022.

The study included n=100 patients diagnosed with age-related Macular degeneration, retinitis pigmentosa, diabetic retinopathy, high myopia/hypermetropia, optic atrophy/neuropathies, and glaucoma. Patients under the age of 18 were excluded from the study. The participants were thoroughly informed about the study prior to their participation. The written informed consent was taken in written form from all the patients.

The WHO validated questionnaire for LVA's entailed general, subject characteristic questions i.e., age, gender, and profession along with more specific questions regarding the diagnosis, seriousness of vision impairment, acceptance of low vision aid, and reason for the former's non-acceptance where applicable.

A scale from 1 to 5 based on WHO-ICD 10 criteria was used to rate the severity of vision loss. This measure divided visual impairment into five separate categories of escalating severity. When the best-corrected distance visual acuity in the better eye was between worse than 6/18 (0.50) and better than or equal to 6/60, it was considered to have mild visual impairment (VI). When we reached Category 2, we came across Moderate VI, which is defined as having a best-corrected distance visual acuity in the better eye that is worse than 6/60 (1.00) and better than or equal to 3/60. Severe VI was classified as Category 3 if the better eye's best-corrected distance visual acuity was poorer than 3/60 (1.30) and better than or equal to 1/60, or if the better eye's visual field was smaller than 10 degrees in radius around central fixation. When the best-corrected distance visual acuity in the better eye was worse than 1/60 but better than or equal to light perception, it was at Category 4, the most serious level, which corresponded to blindness. A complete lack of light perception was represented by the highest category of blindness, Category 5 [3].

The numerical data was presented as mean (x̄), and standard deviation (σ), while categorical data was presented as frequency (n) and percentages (%).

RESULTS

During our research, we examined a total of one hundred (n=100) clinical case files, of which n=58 was male and n=42 was female. the mean age of 43.48±14 years, while divided also into 6 categories, including 20-30, 31-40, and 41-50, 51-60, 61-70, and 71-80 years.

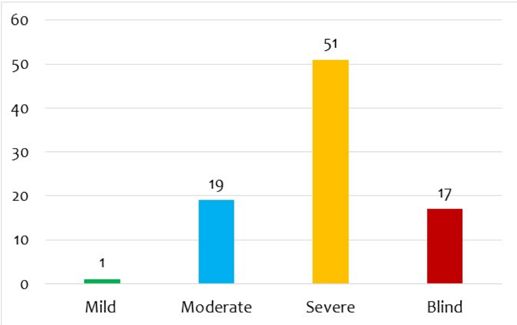

Figure 1: Severity of Visual Impairment

A total of n=1 participant mild visual impairment, n=19 have moderate, n=51 have severe while n=17 have blindness. (Figure 1)

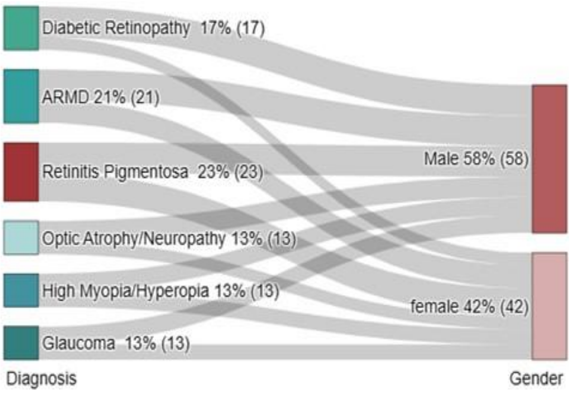

Figure 2: Gender based distribution of causes behind visual impairment.

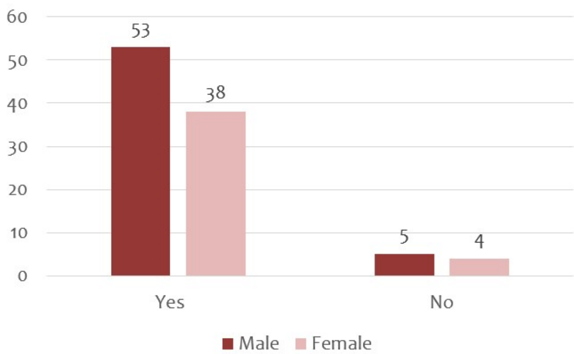

Figure 3: Genders based frequency distribution of LVAs non acceptance.

The results showed that majority of male (n=53) and female (n=38) have non acceptance of LVAs, while n=5 male and n=4 female have acceptance of LVAs. (Figure 3)

Figure 4: Reason for non-acceptance of LVA's among both genders

The major reason of non-acceptance was unaffordability for LVA among the male (n=19), remaining reasons can be seen in figure 4.

DISCUSSION

The current study was carried out on patients with low vision to investigate the rate of non-acceptance and the reasons for non-acceptance. The findings suggest that the non-acceptance rate is very high, and unaffordability was the main reason, the participant considered for non-acceptance of LVAs.

Low vision devices (LVDs) play a critical role in the field of vision rehabilitation [17]. Maximizing the utilization of assistive technology presents a practical and effective approach to reducing the reliance on individuals with low eyesight. Our study included a cohort of patients, among whom the prevailing cause of impaired vision was found to be Retinitis Pigmentosa. This was followed by Age-Related Macular Degeneration and Diabetic Retinopathy. A recently published study demonstrated findings consistent with our own research, indicating that diabetic retinopathy (DR), retinitis pigmentosa (RP), and age-related macular degeneration (ARMD) were the primary aetiologies of low vision among their patient population [18]. The findings presented in this study contradict the results of a prior investigation conducted by Khimani KS et al in 2014, when uncorrected refractive errors were identified as the primary factor contributing to low vision [19].

The current study showed that non acceptance rate was high among both male and female low-vision patients presenting to our clinic. There was a lot of barriers to avail of the low vision services including non-affordability, followed by fear of losing a job, low necessity, lack of awareness, and

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magnitude denial in male. However, in female transportation, usage, and unaffordability were the commonest barriers to avail low vision services. The possible reasons for non-acceptance of LVAs may be limited access to information about, societal misconceptions and negative stereotypes, limited financial means, coping with the emotional and psychological aspects of vision loss, geographic or socioeconomic factors, differences in cultural attitudes and the emotional impact of vision loss can influence an individual's readiness to accept and use aids[17,20,3] Previously published studies showed that transportation challenges and accessibility, affordability and social stigmas were the main reasons of non-acceptance [17,19,21,22].

Recent studies published revealed contradictory results to our study that the unaffordability rate was only 10.5%. This was because the hospital provided financial assistance to these patients [19, 23]. Another recently published study in Pakistan showed that non-acceptability was about 54.9% despite receiving financial aid [17]. Individuals diagnosed with Retinitis pigmentosa (RP) were likely the leading cause of non-acceptance of low vision aids in our study. Retinitis Pigmentosa is a retinal disease affecting the rod cells of the retina; consequently, the patient's central vision is unaffected, and he avoided low vision aids [17, 22]. The literature showed that patients with retinitis pigmentosa had the highest rate of refusal. Eighty percent to ninety percent of LVAP users rely on their devices for near vision reading, hence this result was expected [17, 26]. Patients with retinitis pigmentosa often have normal or even improved central vision well into the later stages of the illness the most probable reason for non-acceptance [17, 21].

The present study also unveiled that factors such as unemployment, social stigma, limited understanding, and low perceived necessity serve as barriers to the acceptability of LVAs among both males and females. The current study explained that the prevalence of non-acceptance among males over job loss was more pronounced, whereas for females, the societal stigma of being labeled as visually impaired served as a barrier. Literature showed that lack of awareness, social stigma, unavailability, and low affordability were the common reasons for non-acceptance among LVA patients [23, 25]. Stigma is a potent phenomenon that exerts a tremendous impact on individuals who experience it. Stigma has been found to relate to various negative outcomes, including weak physical health, poor mental health, disadvantaged socio-economic status, and academic underperformance. Studies showed that stigma plays a vital role in non-acceptance of LVAs among all patients [3, 18]. LVAs are cumbersome, complicated, and time-consuming, occupy too much space, have insufficient magnification power, and have poor ergonomics; these are some of the obstacles to their adoption and use [25].

Due to the limited population size, the primary reason for the non-acceptance of LVADs cannot be ascertained, this is the limitation of our study.

CONCLUSION

The study highlights a notable rate of non-acceptance of low vision aids among patients, primarily due to unaffordability. Barriers like social stigma, financial constraints, and limited awareness contribute to this non-acceptance trend. Future analytical studies on the topic are needed with large sample size and diversity, to determine actual reasons of non-acceptance among the study population. Moreover, realizing the economic conditions of majority of the population of Pakistan, improving the affordability of these devices has the potential to impact the acceptance rate.

DECLARATIONS & STATEMENTS

Author's Contribution

QAM: substantial contributions to the conception and design of the study.
CMM and AA: acquisition of data for the study.
SA and MS: interpretation of data for the study.
MS: analysis of the data for the study.
MS and SU: drafted the work.
QAM, CMM, AA, SA, MS and SU: revised it critically for important intellectual content.
QAM, CMM, AA, SA, MS and SU: final approval of the version to be published and agreement to be accountable for all aspects.
of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study was conducted in patients visiting the department of Ophthalmology (FGPC.1/12/2020/Ethical-Committee) in the Polyclinic Hospital, Islamabad from May 2021 to May 2022.

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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Conflicts of Interest

The author(s) have declared no conflicts of interest with each other.

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Research Article

Effects of task-oriented balance training with sensory integration in post stroke patients

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ABSTRACT

Background: Balance and functional mobility is greatly affected in stroke patients. Balance training integrated with sensory input is more beneficial for improving balance and mobility in stroke patients.

Objective: To determine the effects of task-oriented balance training with and without sensory integration on balance, postural stability, and mobility in post-stroke patients.

Methods: A randomized control trial was conducted at RHS Rehabilitation Centre, Islamabad. A total of n=60 post-stroke patients were included in the study through a non-probability purposive sampling technique. Male and female stroke patients above 40 years of age, having the ability to maintain a standing position without aid for at least 5 minutes, and patients on Grades II, III, IV on the Functional Mobility Scale were included in this study. They were randomly allocated into Group A (n=30) and Group B (n=30). Both groups received Task oriented balance training while group B was treated with additional sensory integration. The Berg Balance Scale, Dynamic Gait Index, Activities Specific Balance Confidence Scale, and Balance Error Scoring system were used for balance assessment. The assessment was done at baseline and after 6th week.

Results: The mean age of the participants was 54.47 years. After 6 weeks of intervention, a significant difference was found in group A as compared to group B for Dynamic mobility measured by Dynamic gait index with p-value (p=0.06) and for balance measured by BBS with p=0.05.

Conclusion: The task-oriented balance training with sensory integration is effective in improving dynamic balance and mobility in stroke patients.

Keywords: balance training; sensory integration; stroke rehabilitation; task-oriented balance exercises.

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INTRODUCTION

Stroke is the most common cause of mortality and morbidity [1]. That affects the individual's functional abilities and health status with compromising their quality of life [2]. According to World stroke organization Over 110 million people in the world have experienced stroke. The low- and middle-income countries have high incidence of stroke. In Pakistan its recurrence is 250/100,000 that is expected to 350 frequencies every year [3].

Stroke is a chronic condition having major impacts on patients, society and health care systems [3]. Stroke is the often cause of prolong disability in middle age population with disturbance of both lower and upper extremity functional activities [4]. In 80% of stroke survivors has recorded with limbs functional limitation. Impairment of extremity in stroke survivors leads the patients to limitations in activity of daily living, balance disturbance ambulation, and quality of life [5] . The Patients face difficulties in standing, walking and functional activities [6].

Stroke frequently causes balance problems, which can affect the level of independence. Additionally, the primary predictor of falls is balance issues, which can cause a fear of falling and a reduction in daily activities. To reduce the risk of falls in post-stroke patients, especially those residing in society, a balance needs to be improved [7,8]. Numerous interventions for improving balance are suggested in the literature, including neurodevelopmental weight shifting technique, gait training, visual reality balance training, task-specific training, obstacle stepping, and task-oriented balance training [9] .

Task oriented balance training is a goal-oriented practice of motor task for improving functional capabilities. It is an effective method for improving lower limb functions including balance, gait and gait speed. Task oriented balance training has been used for the lower extremity functional improvement in stroke patients [2, 4, 10].

Besides motor impairment sensory impairment in both upper and lower extremity is also an important contributor that affects the patient's recovery after stroke. It is already suggested in literature that if sensory training incorporated along with traditional training, then the better recovery can be achieved as sensory signals affects motor functions in stroke patients. Different types of sensory training have been used for stroke rehabilitation [11, 12].

Despite of the evidence that task-oriented training and sensory training can be beneficial to induce plasticity and improve motor recovery. However, limited evidence exists on combined effectiveness of these techniques in stroke rehabilitation. In this study we propose the hypothesis that combining the sensory stimulation with task specific training would yield more substantial benefits in terms of balance, postural stability, and mobility in post stroke patients. This research aims to explore the potential synergistic effects of combining these interventions, with the goal of introducing enhanced rehabilitative strategies to improve patient care and outcomes.

METHODOLOGY

This double blinded parallel armed randomized controlled trail (NCT-04468269) was conducted in RHS Rehabilitation Centre, Islamabad from 15th August 2019 to 29th January 2020 (RHS/EC/08/7/2019). Ethical approval was taken from Research Ethical Committee of Riphah College of Rehabilitation and Allied Health Sciences, Islamabad (Riphah/RCRS/REC/00558).

Male and female patients aged 40-65 years who had stroke from more than six months, had ability to understand and perform exercises, at grade II, III and IV on functional mobility scale were included in this study. Participants who had deficit of somatic sensation, presence of severe hemiplegia, vestibular disorder and presence of orthopaedic disease that involve the lower limb such as arthritis were excluded. Nonprobability convenience sampling technique was used for sample collection.

Sample size was n=60 calculated by using the effect size=0.56 of berg balance scale while keeping power at 80% and level of significance 0.05. A total n=72 participants were evaluated for eligibility criteria, n=12 was excluded due to not fulfilling it. Then n=60 participants were randomly divided into Control (n=30) and Experimental group (n=30) through flip coin method. There was n=6 dropouts in experimental group n=4 dropped out due to unwilling to continue, n=1 drop out due to head injury and n=1 due to leg fracture. There was n= 4 drop out in control group due to unwilling to continue. Finally, a total n=50 participants were included in the analysis. (Figure 1).

Subjects were evaluated at baseline after 4th and 6th week. The assessments were made through four outcome measures, Berg balance scale was used for the assessment of stability and balance (ICC =.98) [13], Activities specific balance confidence (ICC=0.82) [14] was used to assess confidence of participants while performing different mobile activities without fear of fall. Balance error scoring system was used to assess postural stability, participants are guided to perform single, double leg and tandem stance on hard surface and then on soft surface (ICC=0.82) [15]. Dynamic gait index was used to assess balance during gait and mobility in stroke patients (ICC=0.80) [16].

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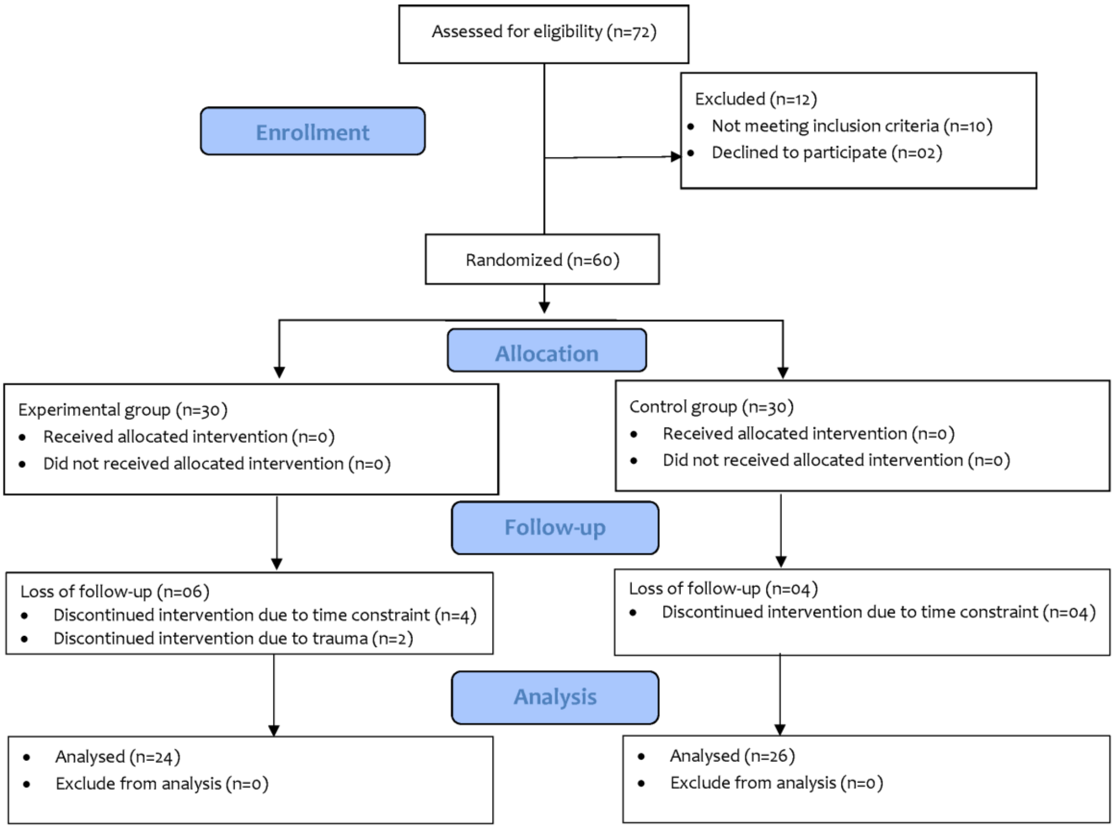

Figure 1: CONSORT diagram

Table 1: Intervention Protocol

<table>
<tr><th>Group A
(40 Minutes)</th><th>Group B
(40 Minutes)</th></tr>
<tr><td>In this group exercises performed with eyes open and hard surface.</td><td>In this group exercises for 1^{st} and 2^{nd} week performed under normal condition (with eyes open and hard surface).
Exercises for 3^{rd} and 4^{th} week performed with eyes open and on soft surface (Foam 2.5 cm thick)
Exercises for 5^{th} and 6^{th} weeks performed with eyes closed and on soft surface.</td></tr>
<tr><td colspan="2">Sitting position: (7 Minutes)
Sit in a chair without backrest while keeping the feet on floor.
Sit on a ball while keeping the feet on the floor.
Sit to stand: (7 Minutes)
Sit in a chair without a backrest with and perform the sit-to-stand motion repeatedly.
Sit on a ball and perform the sit-to-stand motion repeatedly.
Standing position: (8 Minutes)
Perform bipedal standing
Control of Weight Shifting.
Perform a semi-tandem stance.
One Foot Standing.
Walking: (8 Minutes)
Walk forward
Walk forward cross an obstacle, and then continue to walk.
Walk Lateral
Walk Backward
Tandem walk
Conventional treatment : (10 Minutes)
Static stretching exercises such as trunk rotation, flexion, and extension; hip flexors stretch, standing hamstring stretch; plantar flexors stretch, shoulder, elbow and wrist flexors and supinator.
Stretching applied for 30 sec hold with 30 sec rest. 5 times for each muscle group.</td></tr>
</table>

Group A received task-oriented balance training (TOBT) alone. In this group the patients performed exercises for 40 minutes, 3 times/ week for 6 weeks. Intervention time consisted of 10 minutes of conventional training and 30 minutes of balance training. In this group the patients performed balance exercises under normal condition, eye open and on the hard surface.

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Group B received task-oriented balance training (TOBT) with sensory integration therapy Subjects performed 40 minutes exercises 3 times/ week for 6 weeks. That includes 10 minutes of conventional training and 30 minutes of balance training. In this group the patients performed balance exercises initially under normal condition (eye open and hard surface) and progression were made after two weeks and patient performed exercises under the eye closed and on a hard surface. (table 1)

Analysis was done through SPSS. Version.22. Normality of data assessed and according to Shapiro-Wilk test data was non normally distributed (p<0.05) for BBS, DGI, ABC Scale and normally distributed for BESS (p≥0.05), Mann-Whitney U test and independent sample t test were applied for between group analysis. While Wilcoxon Sign rank test and paired sample t test were applied for within group pairwise comparison of BBS, DGI, ABC and BESS respectively.

RESULTS

The mean age of group A was 54.12±5.42 years and group B was 54.82±5.04 years. The n=17(67.7%) males and n=8(32.3%) females were in group A, while n=18(72%) males and n=6(27.6%) females were in group B. The mean of post stroke duration was 11.12 ±2.96 and 11.44±3.30 months for control and experimental group respectively.

Between groups comparison showed that there was no statistically significant difference between groups at base line but there was statistically significant difference between groups after 6 weeks of intervention for balance and mobility with greater improvement in experimental group for BBS and DGI (p<0.05). (Table 2)

Table 2: Comparison group A and group B (BSS, DGI, ABC, BESS)

		Baseline				After 6th week			
Outcome measures	**Groups**	**Md(IQR)/ x̄±σ**	**MR/MD**	**U-test**	**p-value**	**Md(IQR)/ x̄±σ**	**MR/MD**	**U-test**	**p-value**
Berg Balance Scale (BBS)	Group A	34(10)	29.19	409.00	0.53	36(10)	26.15	314.50	0.05
	Group B	34(7)	31.90			38(6)	35.16		
Dynamic Gait Index (DGI) for Mobility	Group A	14(5)	30.11	437.50	0.86	16(4)	24.55	265.00	.006*
	Group B	14(4)	30.91			18(3)	36.86		
Activities-Specific Balance Confidence Scale (ABC) for balance confidence	Group A	39(8)	30.84	449.00	0.99	36(5)	29.11	406.50	0.52
	Group B	38(5)	30.52			32(6)	31.98		
Balance Error Scoring System (BESS) for Postural Stability	Group A	37.61±6.99	-.042		0.99	34.16±5.61	2.02		0.50
	Group B	37.65±3.67				32.13±3.04			

*Significance level: p<0.05*p<0.01**, p<0.001****

Md-Median; IQR-Inter Quartile Range; x̄-Mean; σ-Standard deviation; MR-Mean Rank; MD-Mean difference

Within group analysis of experimental group showed statistically significant improvement from baseline to sixth week for balance and postural stability and mobility (p<0.05). Control group also displayed significant (p<0.05) improvement from baseline to sixth week for balance. (table 3)

Table 3: With-in group changes from baseline to 6th week in Group A and B:

		Group A (n=26)			Group B (n=24)		
Outcome measures	**Duration**	**Md(IQR)/ x̄±σ**	**MR/MD**	**p- value**	**Md(IQR)/ x̄±σ**	**MR/MD**	**p- value**
Berg Balance Scale (BBS)	0 week	34(10)	10.00	0.00***	34(7)	9.50	0.00***
	6 weeks	36(10)	16.00		38(12)	15.00	
Dynamic Gait Index (DGI) for Mobility	0 week	14(5)	10.22	0.00***	14(4.5)	11.79	0.00***
	6 weeks	16(4)	15.50		18(3)	14.94	
Activities-Specific Balance Confidence Scale (ABC) for balance confidence	0 week	41(23)	13.00	0.00***	43(20.5)	12.50	0.00***
	6 weeks	47(10)	16.00		51(21)	15.00	
Balance Error Scoring System (BESS) for Postural Stability	0 week	37.61±1.25	1.38	0.00***	37.65±0.68	2.10	0.00***
	6 weeks	34.16±1.01	3.45		32.14±0.56	5.51	

*Significance level: p<0.05*p<0.01**, p<0.001****

Md-Median; IQR-Inter Quartile Range; x̄-Mean; σ-Standard deviation; MR-Mean Rank; MD-Mean difference

DISCUSSION

The study aimed to determine the effects of task-oriented balance training with and without sensory integration in post stroke patients. The results of this study suggest that task-oriented balance training with sensory integration yielded greater effectiveness than task-oriented balance training alone. Notably, the experimental group exhibited significant improvements in balance as assessed by the Berg Balance Scale (BBS), Activities-specific Balance Confidence (ABC) scale, and Dynamic Gait Index (DGI) scales.

Balance is a multifactorial process that heavily relies on input from the sensory system, encompassing the visual, vestibular, and somatosensory systems. Following the stroke, the relative dependence of the sensory changes undergoes re-weighted in response to changes in the sensory environment, particularly when sensory information is integrated. This adaptive process may play a critical role in functional recovery of Stroke patients during balance training.

The finding of this study aligns with the previous research, such as that of Choi J-U et al., which supports the efficacy of task-oriented training as an intervention to improve not only balance but also activities of daily living (ADL) performance and self-efficacy in stroke patients. This emphasizes the broader implications of task-oriented training as a valuable approach in rehabilitation of lower extremity in stroke[17]. Ahn et al. concluded that task-oriented training for chronic stroke patients significantly improve balance and symmetrical weight bearing and lower extremity function [18].

Recent literature has reported that sensory integration is a critical factor for improving balance in stroke patients. It is reported that healthy individuals stand on a firm surface under good light conditions, they rely 70% on somatosensory information, 10% on visual information, and 20% on vestibular information. However, stroke patients rely particularly on visual information to maintain balance this is perhaps due to their inability to make accurate use of proprioceptors and somatosensory system. Therefore, stroke patients should be trained with altered sensory 'visual, vestibular, and somatosensory' inputs during balance exercises [17] .Hence, this study was conducted to target the somatosensory system through balance training with and without sensory integration, and effect of this type of training was assessed on the balance recovery, dynamic mobility and postural stability in patients with stroke.

Similarly the findings of this study are in accordance with studies conducted by, Jang SH et al. that balance training with sensory integration is more effective for improvement of balance and mobility in stroke patients by increase in muscle activity of gluteus medius and trunk extensors and also increase the limits of stability [19], Moreover, Bayouk et al. reported significant balance and mobility improvements in post stroke patients with task-oriented training program including sensory inputs after 8 week of intervention [2] .Similarly, study by Yelnik et al. and Morioka S et al also concluded that task-oriented exercises performed with altered sensory input had greater effects on patients balance than task-oriented exercises alone [10, 20]. Another study by Peterka RJ et al. reported that, the significant decrease in the medio-lateral sway during standing for the control condition (eyes open, firm surface) after sensory training was likely to be the result of the increased use of somatosensory, visual, and vestibular information when performing the various exercises under sensory deprivation conditions. This sensory compensation might have improved sensorimotor integration of postural control in the central nervous system, serving to activate and coordinate motor processes [21]. Additionally, Kuberan P et al. conducted that Task oriented training, known to be very effective in rehabilitation of stroke patients, when incorporated with altered sensory input are challenging in nature and progressively induce the patients to use lower limb somatosensory inputs to maintain balance [22].

Only six months post stroke patients were recruited in this study, potentially limiting the generalizability of the findings to acute and subacute stroke patients. To enhance the comprehensiveness of future research, it is recommended to include other patient groups in further studies.

The study did not focus on the retention effects of the intervention after the termination of treatment. To gain a more inclusive understanding of the long-term benefits of the task-oriented balance training with sensory integration, future studies should explore the retention effects of this training in post-stroke patients.

The scales used for assessment in this study were not subjective which might have introduced biasness in assessing the intervention's effects on balance and gait. Future research could employ objective assessment tools to provide more accurate and reliable measurements of the intervention's impact on post-stroke patients' balance and gait.

The study did not extensively explore the optimal duration and intensity of the task-oriented balance training with sensory integration. Further research could investigate into these aspects to determine the most effective parameters for maximizing the intervention's benefits.

CONCLUSION

This study concluded a significant improvement in task-oriented balance training with sensory integration group as compared to task-oriented balance training alone. The observed improvements in balance outcomes, as indicated by the BBS, ABC, and DGI scales, underscore the importance of integrating sensory information during rehabilitation exercises. Stroke patients' heavy reliance on visual information for balance emphasizes the need to incorporate altered sensory inputs during balance training. These findings contribute to the growing body of evidence supporting task-oriented training as an effective intervention to improve balance, ADL performance, and self-efficacy in stroke rehabilitation.

DECLARATIONS & STATEMENTS

Author's Contribution

AS: substantial contributions to Concept, Article review, Statistical Analysis
SI: Data collection, Draft preparation
SI and SB: interpretation of data for the study. Draft preparation
SW and HGK: draft review
AS, SI, SB, SW, HGK and HJ: revised it critically for important intellectual content.

HJ: Review and Editing
AS, SI, SB, SW, HGK and HJ: final approval of the version to be published and agreement to be accountable for all aspects.
Of the work of ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study conducted in RHS Rehabilitation Centre, Islamabad from 15th August 2019 to 29th January 2020 (RHS/EC/08/7/2019). Ethical approval was taken from Research Ethical Committee of Riphah College of Rehabilitation and Allied Health Sciences, Islamabad (Riphah/RCRS/REC/00558).

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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Funding Sources

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Conflicts of Interest

None to declare.

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Research Article

Effects of positional release technique on myofascial trigger points of the upper trapezius in computer users having forward head posture

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ABSTRACT

Background: Forward head posture is associated with the upper trapezius myofascial trigger points and cause pain, restricted range of motion, and referred pain in the arm. The positional release technique is likely to focus on evaluating the efficacy of this manual therapy approach.

Objective: To determine the effects of positional release technique for myofascial trigger points of the upper trapezius with forward head posture

Method: A randomized control trial study was conducted in the Physiotherapy Department of THQ Hospital Wazirabad, Pakistan, from February 2021 to June 2021 with a sample size of n=32 male participants. Participants were recruited with pain intensity of at least 3 points on the Visual Analogue Scale at baseline, at least one active TrP in the upper trapezius that was diagnosed using the method described by Travel and Simon, and computer users who spend at least 6 hours per day in a sitting posture and are between the ages of 18 and 45. All subjects were randomly and equally allocated into the Positional Release Therapy (PRT) group and a conventional Physical Therapy group. A total 12 treatment sessions were given with 3 days a week for consecutive 4 weeks. The data was collected at the baseline and after the 12th session. The outcome measures for trigger point sensitivity were pain pressure threshold (PPT), visual analogue scale (VAS), active contra lateral flexion (ACLF), cranio-vertebral angle (CVA), and neck disability index (NDI). Data analysis was done through SPSS version-27.

Results: The mean age of 34.3±6.57 years. The positional release therapy post-intervention results showed more significant improvement ($p \leq 0.05$) in all outcomes PPT, VAS, ACLF, CVA, and NDI between the groups with large effect size.

Conclusion: Positional release therapy (PRT) is superior to conventional therapy in decreasing pain intensity and threshold with disability in patients of upper trapezius trigger points

Keywords: cranio-vertebral angle; forward head posture; neck disability index; pain pressure threshold; positional release therapy; trigger points; upper trapezius; visual analogue scale.

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INTRODUCTION

Forward head posture (FHP) is defined as a postural abnormality in which forward positioning of the cervical spine from the centerline of the body[1]. Females are more prone to develop FHP than males as females usually keep their cervical position in slight 20 -30 flexion[2]. The prevalence of FHP in male and female students was 63.96%. [3] Almost the same percentage 63% was found among students aged 12-16 with equal gender distribution[4]. Neck pain is increasing day by day and in adults up to 45 to 54 % of people experience cervical and shoulder pain. One of the causes of neck pain is having a myofascial trigger point (MTrP) in the neck muscles[5]. The MTrPs are the hyper-irritable points present in muscles that can be responsible for referred pain patterns to other parts of the body[6]. If the head posture is untreated for a long duration, it leads to unusual stress on the neck, which causes pain, tightness, and faulty posture. All these factors affect not only the upper body but also induce adverse effects on the whole body by reducing joint proprioception which leads to posture imbalance[7]. The upper trapezoidal TrPs are more commonly occurring TrPs, thus causing painful patterns in the posterior laterally cervical and ear. TrPs develop in the trapezius due to immediate injury by falling down through a great highness, abnormal position of the body, inadequate ergonomic furniture, and immovability for a long time[8].

The patients with neck pain had a markedly increased forward head positioning (FHP) combined with increased upper trapezius stiffness. Links between FHP and work-related neck disorders (WRNDs) cervical spine curvature, muscle length, and load of intervertebral discs and joints have been reported in the literature. There are pathophysiologic mechanisms that could have contributed to the increased muscle tissue stiffness in the studied subjects with work-related neck pain. The accumulation of muscle metabolites in homo- and heteronymous muscles during prolonged static postural contractions of neck muscles which in turn increases muscle tone and perhaps stiffness. [9]. The individuals aged between 30-50 years with forward head posture have decreased cervical flexion and other ROM. The evidence shows that FHP is also responsible for carpal tunnel syndrome headaches and neck pain[10]. The forward head posture altered rib cage mechanics that decreased thoracic mobility. This reduced mobility of the thorax reduces the effectiveness of the diaphragm, intercostals, and abdominal muscles in terms of ventilation[11].

The literature reported the beneficial outcomes of non-invasive therapy for MTrPs of the upper trapezius treating separately or combined with electrical muscle stimulation, therapeutic ultrasound, electrical nerve stimulation, repetitive magnetic stimulation, hot packs, cervical range of motion exercises, ischemic compression, spray and stretch, transcutaneous electrical nerve stimulation, sustained stretching, massage, cervical manipulation, and trigger point pressure release. Manual therapy is one of the main treatment options for managing myofascial trigger points. Continuous manual pressure is known as "manual pressure release" (MPR). Another manual therapy method used to treat trigger points is positional release therapy (PRT)[12].

The main effects of PRT are to remove the restriction to body movement by reducing pain, inflammation, MTrPs, and stiffness and enhancing muscle power and blood circulation. Studies have shown that Positional Release Therapy (PRT) has a wide range of advantages. PRT increases blood flow and muscle strength while reducing pain, inflammation, and stiffness. It improves motor performance by triggering muscular stretch reflexes and preventing spasms. PRT also lowers referred pain by lowering chemical transmitters and muscle stretch reflex activity, assisting in the elimination of inflammation, and enhancing biomechanical function[13]. According to published research, a 90-second therapy in a comfortable position improves blood circulation and lessens ischemia processes[14]. Through pressure release, done uniformly and consistently, TrPs can be directly targeted[15].

In this modern era, everyone is connected to technology in many ways, which indirectly alters the overall posture of our bodies. This in turn causes various pathologies including muscle imbalance and abnormal posture. There is much research done on trigger point management by different techniques. The aim of this study is to find out the efficacy of positional release therapy versus conventional therapy in male computer users with MTrPs of upper trapezius with forward head posture.

The aim of this study is to compare the effects of the position release technique with conventional therapy on myofascial trigger points of the upper trapezius of patients with a forward head posture.

METHODOLOGY

The randomized control trial (RCT) was conducted at Tehsil Head Quarter Civil Hospital Wazirabad (THQ/ERB-0119) after approval from the Research Ethical Committee of the Riphah College of Rehabilitation and Allied Health Sciences with Ref: RIPHAH/RCRS/REC/Letter-00865 from February 2021 to June 2021. The sample was calculated by the Open epi tool comparing mean values of post-intervention of VAS (Group A=1.36 & Group B= 1.93). The calculated sample size was n=32[16].

In this study for sample selection and randomization of groups, the non-probability convenient sampling was used. The recruitment of participants was based on the criteria. There must be pain intensity of at least 3 points on the Visual Analogue Scale at baseline. Participants should have at least one active TrP in the upper trapezius, which was diagnosed by the method explained by Travel & Simon. According to this, the TrPs should have a taut band with hypersensitive spots causing local twitch response, referred pain, and jump signs when pressure is applied manually. The participants were male computer users, doing their duty of at least 6 hours in sitting posture per day, aged between 18 and 45 years. Participants were excluded from having fibromyalgia, Rheumatoid arthritis, and radiating pain to upper limbs from the neck. History of whiplash injury and surgery of neck or shoulder.

The n=32 participants were randomly divided into two treatment groups, the Positional Release Therapy (PRT) group (n=16) and the Conventional Physical Therapy (CPT) group (n=16). Randomization of the participants was done through the sealed envelope method by using a computerized random number generator. The sequence of random allocation was done by an individual who was not directly involved in the study. Consecutive random numbers were written on index cards and placed in thick and opaque sealed envelopes before the study. After obtaining consent from the participants' legal guardians/next of kin, the treating physiotherapist opened the envelope and gave the respective treatment to the patient. The study was single-blinded as the assessing physiotherapist was blinded to the participants' intervention.

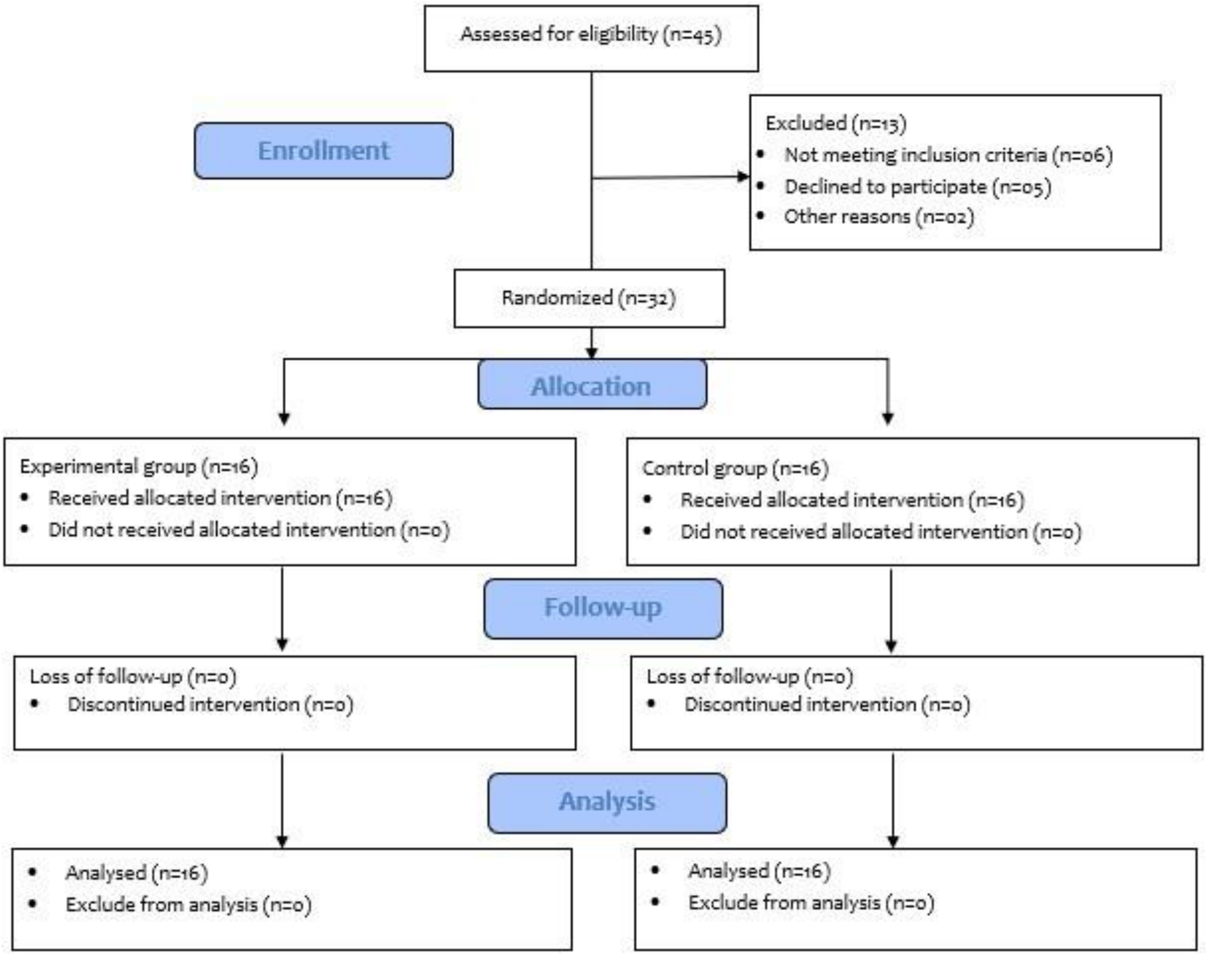

Figure:1 Consort Diagram

The outcome measures included the Neck Disability Index (NDI), Visual Analog Scale (VAS), Active Contra Lateral Flexion (ACLF), Cranio-Vertebral Angle (CVA), and Pain Pressure Threshold (PPT). The NDI is 10 10-item questionnaires, which includes specific functional tasks of daily living. It was used for evaluation before and after treatment. The total score was 50; each section was scored from 0 to 5, where 0 means "No Disability" and 5 means "Complete Disability". It had high reliability and validity r=0.93[17].

A visual analog scale (VAS) was a measuring tool that attempted to quantify pain which was likely to encompass a range of quantitative numbers and was not directly simply measurable. It could easily be attempted by participants because it was simple, efficient, and had validity. It ranks as 0 to 10, where "0" stands for "No Pain" and "10" means "Severe pain".

Both ACLF and CVA were measured by goniometer in degrees (unit). It is a reliable tool for measuring active cervical ROM[18]. The side bending occurs in the frontal plane and the normal range is 450. For measuring ACLF, the patient was in a seated position, palpated the C7 spinous process for placing the fulcrum, the stationary arm was perpendicular to the ground along with the moving arm of the goniometer placed in line with an external protuberance of the occiput, then ask the patient to touch his right ear to the right shoulder and vice versa. For measuring CVA, the patient was in a seated position, palpated the C7 spinous process and drew an imaginary horizontal line, then drew another imaginary line from the neural spine (spinous process) of C7 to the tragus of the ear. Where these two lines meet forms the craniovertebral angle. The normal CVA angle is 49.90, and less than normal is considered a Forward Head Posture. The analogue Baseline model algometer was used which be measured either in kilograms or pounds. It was used to measure the pain sensation by applying perpendicular pressure on a specific muscle. Algometer is highly reliable and valid [19].

Three treatment sessions were given per week for consecutive 4 weeks. Each session lasted for 30 minutes. The position-release therapy was applied to the experimental group and conventional therapy (Passive Stretching Technique) to the control group and moist heat (Hot Packs) was applied to each group before applying position-release therapy and conventional therapy.

In the experimental group, the therapist located the trigger point in the upper trapezius by using pincer palpation and marking a circle around it, then for applying the Positional Release Technique the patient was asked to lie in the supine position. The patient was asked to fully relax his body and the therapist applied a gradually increasing pressure on the trigger point by thumb to the extent that the patient became uncomfortable and felt a pain sensation. There, the therapist modified the posture of the patient in such a way that the pain was reduced by up to 60-70%. The position formed by the therapist was to make neck extension, with the side bending to the involved side or towards the trigger point and then the neck rotated to the opposite side. The patient's shoulder was then placed passively in abduction and the new position was adopted for 90 sec. This technique was continued for 3 repetitions with a 10-second relaxation period in between them, three sessions per week for consecutive four weeks[20].

In the control group, the therapist performed passive stretching of the upper trapezius. To perform stretching the therapist asked the patient to sit fully body relaxed, the therapist supported one shoulder and then passively placed the head in a side bending position opposite to the involved side for stretching the upper trapezius muscle. Slow and gentle stretches are applied with a 10-second hold, and 5 repetitions are performed with a 10-second relaxation time between them[21].

The data included lateral flexion of cervical and CVA angle in degrees (unit), PPT in pounds (lbs), and questionnaires of VAS and NDI. The data analysis was made through SPSS-27. The data was checked for normality by using the Shapiro-Wilk Test and then the mean and standard deviations were calculated. As data was normally distributed, an independent sample t-test was used for the analysis of the difference between the two groups, and a paired t-test was performed for within-group analysis. $p<0.05$ was considered significant and Cohen's d was used to determine the effect size.

RESULTS

The mean ± SD of the age of participants was 34.3 ± 6.57 with age ranges from 18 to 45 years. It was observed that the group analysis showed significant improvement in the experimental group which received positional release therapy (PRT) as compared to the conventional physical therapy group when comparing the active contra lateral cervical flexion, cranio-vertebral angle (CVA), pain on VAS and neck disability on NDI. (Table 1)

When observing the changes between pre-post assessment, PRT and CPT both groups showed significant improvement ($p<0.001$) in PPT, active contra lateral cervical flexion, cranio-vertebral angle, and neck disability. (Table 2)

DISCUSSION

The primary objective of this study was to compare the effectiveness of Positional Release Therapy (PRT) and Conventional therapy in the treatment of Myofascial Trigger Point of Upper Trapezius with Forward Head Posture. The results of the present study showed a significant difference while comparing the outcome measures between groups experimental or control group and making a comparison within the group. During pre-post-intervention results showed that both the groups had improvement in pain, range of motion, cranio-vertebral angle, PPT, and NDI. However, results revealed that Positional Release Therapy is superior to conventional therapy.

Table 1: Analysis Between Groups

Variable	Intervention	Group		Mean Difference	P value	Effect Size
		Experimental	Control			
PPT (Lbs)	Pre	3.10± 0.69	3.79± 0.59	0.69	0.006**	0.90
	Post	5.78± 0.73	5.10± 0.77	0.68	0.02*	
VAS	Pre	6.93± 1.09	6.80± 1.08	0.13	0.74	1.00
	Post	1.46± 0.99	2.46± 0.99	-1.00	0.01*	
ACLF (Degree)	Pre	25.53± 5.95	25.06± 4.58	0.46	0.81	0.78
	Post	40.20± 4.73	36.53± 4.59	3.66	0.04*	
CVA (Degree)	Pre	35.40± 3.94	33.26± 4.16	2.13	0.16	1.28
	Post	44.73± 2.93	40.53± 3.58	4.20	0.00***	
Total NDI	Pre	29.80± 7.47	31.86± 7.98	-2.06	0.47	1.56
	Post	4.53± 3.79	10.46± 3.77	-5.93	0.00***	

*Level of significance: p<0.001***, p<0.01**, p<0.05*; ACLF: Active Contra Lateral Flexion, CVA: Cranio-vertebral Angle, NDI: Neck Disability Index, PPT: Pain Pressure Threshold, VAS: Visual Analog Scale*

Table 2: Within Groups Analysis

Variable	Group	Intervention		Mean Difference	P-value
		Pre	Post		
PPT (Lbs)	Experimental	3.10± 0.69	5.78± 0.73	2.68	0.00***
	Control	3.79± 0.59	5.10± 0.77	1.31	0.00***
VAS	Experimental	6.93± 1.09	1.46± 0.99	-5.47	0.00***
	Control	6.80± 1.08	2.46± 0.99	-4.34	0.00***
ACLF (Degree)	Experimental	25.53± 5.95	40.20± 4.73	14.67	0.00***
	Control	25.06± 4.58	36.53± 4.59	11.47	0.00***
CVA (Degree)	Experimental	35.40±3.94	44.73± 2.93	9.33	0.00***
	Control	44.73± 4.16	40.53± 3.58	-4.2	0.00***
Total NDI	Experimental	29.80± 7.47	4.53± 3.79	-25.27	0.00***
	Control	31.86± 7.98	10.46± 3.77	-21.4	0.00***

*Level of significance: p<0.001***, p<0.01**, p<0.05*.*
ACLF: Active Contra Lateral Flexion, CVA: Cranio-vertebral Angle, NDI: Neck Disability Index, PPT: Pain Pressure Threshold, VAS: Visual Analog Scale

Regarding PPT in this study, there was a significant increase in PPT and pain reduction because trigger point sensitivity decreased in response to the application of the PRT. In this method, following the release of pressure on TrP, tissue blood and lymphatic circulation of that area increases which eliminates hypoxic conditions and results in cellular metabolism leading to the removal of inflammatory chemical substances such as prostaglandins, histamine, and bradykinin; therefore, reduction of sensitization of nociceptors occurs. Also, one of the advantages of PRT is breaking the cycle of pain-spasm pain, so PRT is effective in increasing PPT and pain reduction [20, 22].

Our study reported that PRT was more effective than conventional therapy in significant pain reduction and improvement in ACLF. It's possible that the benefits of muscular stretching exercises are what led to the improvement in conventional treatment as in the current study. The stretching paravertebral muscles and other soft tissues in the back may have lowered muscular tension and released pressure on nociceptors in the muscles and on the nerve root, breaking the cycle of pain and resulting in a considerable reduction in pain level. It also reduced paravertebral muscles' cellular connective tissues and muscular stiffness, both of which reduced discomfort.[23, 24]. The positional release technique's analgesic effects can be credited to Bailey and Dick. He put up the nociceptive notion that PRT's positional release mechanism might lessen tissue damage in malfunctioning muscles. They proposed that patients be placed in a comfortable position to facilitate local fluid perfusion (such as blood and lymph) and promote the elimination of sensitizing inflammatory mediators in order to relax the injured tissues.[23, 24]. Meseguer et al. indicated that the use of PRT may be successful in creating hypoalgesia and lowering the responsiveness of sensitive spots in the upper trapezius in participants with neck pain. This finding supports the pain reduction in the PRT group. Meseguer et al. observed in their study that there were modest differences in the VAS for pain intensity between pre and post-intervention measurements after PRT application[24]. The literature has reported that positional release therapy has significantly reduced pain and improved cervical ROM in patients of upper trapezius with MTrPs [8, 25].

The results of the current study showed that there was a significant improvement in disability scores, but PRT was more effective than conventional therapy. A study conducted by Khyati Varshney et al stated that the patients with non-specified cervical pain, the positional release was more effective than the conventional therapeutic program with (p<0.00) in pain reduction and disability[26]. Data from previous Literature support the importance and effectiveness of positional release therapy but some research showed a difference to the result of the present study. So, the importance of PRT is not negligible. The present study showed prominent positive effects of positional release therapy as compared to conventional therapy in reducing pain and disability. Varshney K et al. 2019 reported that both treatment Positional release technique and conventional Physiotherapeutic program were effective in reducing pain and disability in patients with non-specific neck pain. However, the Positional release technique was more effective than the conventional Physiotherapeutic program in order to decrease pain and disability[27].

Participants were recruited with an age limit of 45 years, so the results are not generalized for older with similar conditions.

CONCLUSION

Positional Release Therapy showed superior beneficial effects as compared to conventional therapy. The PRT showed significant improvement in terms of total neck disability index, craniovertebral angle, visual analog scale, pain pressure threshold, and active contralateral flexion.

DECLARATIONS & STATEMENTS

Author's Contribution

AU: substantial contributions to the conception and design of the study.
AU and ZM: acquisition of data for the study.
ZM and ZA: interpretation of data for the study.
RK and MA: analysis of the data for the study.
SKK, AW and AA: drafted the work.
AU, ZM, ZA, RK, MA, SSK, AW and SS: revised it critically for important intellectual content.
AU, ZM, ZA, RK, MA, SSK, AW and SS: final approval of the version to be published and agreement to be accountable for all aspects.
of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study was conducted at Tehsil Head Quarter Civil Hospital Wazirabad (THQ/ERB-0119) after approval from Research Ethical Committee of the Riphah College of Rehabilitation and Allied Health Sciences with Ref: RIPHAH/RCRS/REC/Letter-00865

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Due to privacy or ethical considerations, the data presented in this study are available upon request from the corresponding author.

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None to declare.

Conflicts of Interest

The authors declare no conflict of interest.

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Research Article

Cases of spinal cord injury: correlation among resilience, social support and psychological well-being

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ABSTRACT

Background: Spinal injuries are highly prevalent and are a major cause of disability. Studying resilience, perceived social support, and psychological well-being in persons with spinal cord injury is important for better managing patients with spinal cord injury.

Objectives: To analyze the correlation among resilience, perceived social support, and psychological well-being in persons with spinal cord injury.

Methods: This cross-sectional correlational study was conducted at Riphah International University, Lahore Pakistan from September 2019 to February 2020. The study utilized a sample of 100 patients with spinal cord injury using purposive sampling. The sample included paraplegic patients 6 months following SCI, of both genders above 18 years of age who were active wheelchair users. A demographic sheet, scale of psychological well-being, resilience scale, and multi-dimensional scale of perceived social support (MSPSS) were used for data collection. SPSS Version 22 was utilized for data analysis & correlation was analyzed using bivariate statistics with $p < 0.05$ was considered statistically significant.

Results: The study revealed a positive correlation ($\gamma=0.57$, $p<0.001$) between Resilience with Perceived Social Support; Resilience and Psychological well-being ($\gamma=0.55$, $p<0.001$); and Perceived Social Support and Psychological Well-being ($\gamma=0.57$, $p<0.001$).

Conclusion: There is a positive relationship between resilience perceived social support and psychological well-being.

Keywords: perceived social support; psychological wellbeing; resilience; spinal cord injury

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INTRODUCTION

Spinal injuries are highly prevalent with 60% occurring among young men 15-35 years of age [1]. Injuries of spinal column and spinal cord injuries (SCI) are major causes of disability. Literature reveals that 95.8% of cases of SCI have one or more health-related issues [2], which involve financial consequences for care and rehabilitation over the lifetime of the individuals [1]. The most common issues of SCI individuals are pain (77%); issues of musculature (73%), bowel (70%), sexual (71%), & sensorium (29%); and respiratory problems which are the least common (28%) [2].

Patients with SCI need comprehensive health coverage since they must endeavor to bear different problems related to their healthcare as well as social needs. These include psychological and emotional requirements to ensure mental health. Individuals with SCI face serious emotional issues including depression, pity, lack of dignity lack of care of oneself, sexual problems, job and educational issues, loss of proper support from financial institutions and sponsorships, etc [3].

Resilience has an important role in dealing with adversities which results in the formation of skills that are necessary to deal with hardships. On the other hand, social support is a multidimensional concept that includes emotional support, close relationships, help with information, and personal help in the form of physical activity perceived social support points to a person's sense that people will be at hand if help is needed [4].

A relationship may exist between resilience, social support, and psychological well-being, and revealed that social support intervention enhances resilience and mental wellbeing [5]. The subjective well-being (SWB) of these patients with spinal cord injury is related to several factors and steps to improve resilience, self-efficacy, and social support can enhance SWB, however further research is needed for validation of these findings [6]. Also, resilience in crisis situations is essential because its reduction and need for medical care, finances, and social segregation can result in an increase in depression and affect the quality of life [6]. Similarly, improved knowledge of social support in patients with SCI could be helpful in establishing targets as well as interventions to improve functions in SCI by enhancing resources [7].

Hence a current study was conducted to determine the correlation between resilience, perceived social support, and psychological well-being in persons with spinal cord injury (SCI) the study hypothesis states that there exists a relationship between resilience, perceived social support, and psychological wellbeing. The present research is very important and beneficial since results can help better manage patients with SCI enhancing the wellbeing of SCI individuals. It could also be used by clinicians, counselors, etc., to assess the mental condition of these individuals. It could also prove helpful for policy-making for the SCI individuals.

METHODOLOGY

This cross-sectional correlational study was conducted at Paraplegic Centre, Peshawar Khyber Khyber Pakhtunkhwa, Pakistan after obtaining ethical approval (REC/RCR & AHS/19/1111) from Riphah College of Rehabilitation & Allied Health Sciences, Riphah International University Lahore, Pakistan over six months from 1st September 2019 to 29th February 2020. The nonprobability purposive sampling technique was used for sample collection.

The sample included paraplegic patients due to spinal cord injury within 6 months following SCI, of both genders above 18 years of age who were active wheelchair users. Cases with tetraplegia, bedridden patients, and patients with pressure ulcers and bed sores were excluded from the study.

A sample of n=114 was calculated using Open Epi online sample size calculator with a confidence level of 95%, Design Effect (DEFF) = 1, prevalence 8%±5 [8], and population of 1000000. The n=14 cases dropped out of the study and refused consent hence a sample of n=100 was utilized.

Tools used for data collection included a demographic sheet with details regarding age, gender, duration, and type of injury & neurological level.

The psychological well-being scale (PWS) is used for the assessment of six aspects of well-being and happiness. It is a 42-item reliable scale (α>0.70) composed of six including environmental mastery, positive relations with others, autonomy, personal growth, self-acceptance, and purpose in life. It uses a 6-point Likert scale with 1 for strongly disagree 6 for strongly agree and a score range from 42 to 252[9].

The *resilience scale (RS)* developed by Wagnildand Young is 25 items scale valid and reliable scale with α=0.863 indicating excellent internal consistency. It is scored on a 7-point Likert scale with score ranges between 25 and 175 with higher scores indicating higher resilience. It is composed of a unifactorial structure that includes items referring to aspects related to self-esteem, independence, mastery, resourcefulness, perseverance, adaptability, balance, flexibility, and a balanced perspective on life [10].

The *Multidimensional Scale of Perceived Social Support (MSPSS)* is a valid and reliable (α=.93), brief research tool designed to measure perceptions of support from 3 sources: family, friends, and a significant Other. The scale is comprised of a total of 12 items, with 4 items for each subscale with a greater score indicating greater perceived social support [11].

Data was collected from the admitted patients directly and through online forms from those discharged from the facility. The SPSS Version 22 was utilized for data analysis. Pearson's moment correlation coefficient was utilized to determine the correlation between the variables. The $p<0.05$ is set as a level of significance.

RESULTS

The current study sample N=100 comprised males mostly with a male-to-female ratio of 9:1 and a mean age of 30.3±11.56 years. The majority 77% presented within 50 days post-injury only 6% presented between 151-200 days post-injury and the majority 77% received post-injury physical rehabilitation (Figure 1).

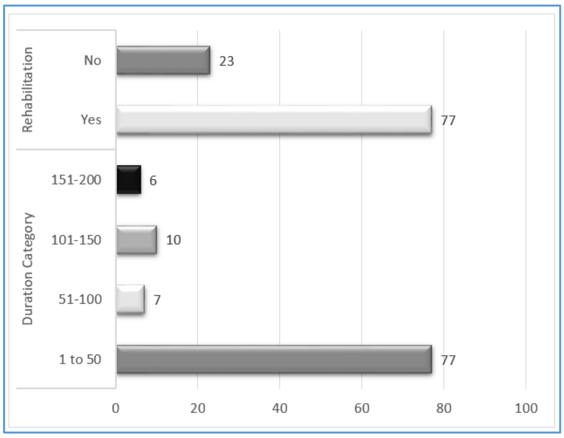

Figure 1: Descriptive statistics for duration at presentation & rehabilitation (n=100)

The study revealed a resilience scale mean score of 136.87±18.79 indicating a high resilience. The multidimensional scale of perceived social support scale mean score was 69.55±13.63) indicating adequate perceived social support. The psychological wellbeing scale result revealed a mean score of 171,79±24.98 indicating good psychological wellbeing.

Pearson's correlation Matrix revealed a statistically significant moderate positive correlation (γ=0.57, $p<0.001$) of Resilience with Perceived Social Support indicating that resilience enhances the perceived social support. Similarly, Resilience and Psychological Well-being also show a statistically significant moderate positive correlation (γ=0.55, $p<0.001$) hence, resilience improves psychological well-being. Also Perceived Social Support and Psychological Well-being have a statistically significant moderate positive correlation (γ=0.57, $p<0.009$) thus perceived social support enhances psychological well-being. Hence the study hypothesis that states that there exists a relationship between resilience, perceived social support, and psychological well-being is proved. (table 1)

DISCUSSION

The current study determined the correlation between resilience, perceived social support, and psychological well-being in persons with spinal cord injury (SCI). Utilizing a predominantly male population with SCI study revealed that Resilience and perceived Social Support; Resilience and psychological Well-being; and Perceived Social Support and psychological Well-being are positively correlated with each other.

Table 1: Correlation among Resilience, Perceived Social Support and Psychological Wellbeing.

	Resilience (136.87±18.79)		Perceived Social Support (69.55±13.63)		Psychological Wellbeing (171,79±24.98)	
	γ	p-value	γ	p-value	γ	p-value
Resilience	-		-	-	-	-
Perceived Social Support	.57	0.000***	-		-	-
Psychological Wellbeing	.55	0.000***	.57	0.009**	-	

Significance level- p<0.05, p<0.01**, p<0.0001***; γ- correlation*

Literature reveals that methods to positively cope with the post-traumatic effects partly mediate the influence of resilience on post-traumatic growth [12]. Similarly, the current study revealed a positive correlation between Resilience with Perceived Social Support indicating that resilience greatly enhances perceived social support. A reported that the enhanced levels of optimism, with perceived social support resulted in advanced levels of resilience, however, the subscales of perceived social support did not significantly correlate to resilience [13]. This might be because the resilient person negates the need for social support. For social desirability, the participants scored lower on it. Similarly, literature revealed that the perceived social support moderates the effect of the frequency and severity of Post-Traumatic Stress Disorder (PTSD), thus promoting resilience[14]. In contrast, a study by Zhang M et al [15] revealed that resilience was not significantly related to perceived social support in females, rather it was significantly associated with psychological distress because gender moderates this relationship [15], hence the results contrast with current study with a predominantly male population.

In compliance with the literature [16, 17], the current study also revealed a significant moderate positive correlation between Resilience and psychological well-being. Similarly, Haddadi & Besharat reported that resilience was positively linked with mental well-being and negatively linked with psychological distress [18]. In contrast, Smith & Yang [19], reported that Resilience was negatively associated with psychological well-being in nursing students. This difference in this relationship might be due to coping strategies to deal with different sources of stress.

Literature reveals that Perceived social support has a significant positive relation with psychological well-being [20], This complies with our study results in which Perceived Social Support and Psychological Well-being were found to be positively correlated. This follows a study by Liu H et al., [21] and Bergeman CS et al., who reported a positive association between the perceived capability of social care and psychological well-being and partly mediated by hereditary factors [22]. Social support can be a shielding utility for psychological well-being through different samples, and it compensates for the negative relationship between accumulative healthcare load and psychological well-being. Hence, perceived social support is significantly linked with better psychological well-being [23].

CONCLUSION

There is a clear positive connection between resilience, the perceived social support, psychological wellbeing among individuals with spinal cord injuries.

DECLARATIONS & STATEMENTS

Author's Contribution

The following format should be used for author's contribution.
SA: substantial contributions to the conception and design of the study.
SN and MK: acquisition of data for the study.
SN: interpretation of data for the study.
SN: analysis of the data for the study.
SUR: drafted the work.
SA, SN, SN, SUR, GS and MK: revised it critically for important intellectual content.
SA, SN, SN, SUR, GS and MK: final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

This study received approval from Riphah College of Rehabilitation & Allied Health Sciences, Riphah International University Lahore, Pakistan Research Ethical Committee (REC/RCR & AHS/19/1111). Subsequently, Paraplegic Centre, Peshawar Khyber Khyber Pakhtunkhwa granted permission for data collection based on the approved ethical protocol from Riphah International University.

Consent Statement

Informed consent was taken before inclusion in the study

Data Availability Statement

Data related to the study is available on request form the principal author.

Acknowledgments

None to declare

Conflicts of Interest

Authors declare that there is no conflict of interest, no source of funding, as well as data collection, preparation for manuscript and publication funding.

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Research Article

Effects of transcutaneous tibial nerve stimulation for overactive bladder symptoms in adults: a randomized controlled trial.

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ABSTRACT

Background: Overactive bladder (OAB) is characterized by urinary urgency, frequency, and nocturia, often accompanied by urinary incontinence. OAB significantly impacts the quality of life of affected individuals. Transcutaneous Tibial Nerve Stimulation (TTNS) is a non-invasive treatment option used to manage overactive bladder (OAB) symptoms. Objective: to determine the effects of Transcutaneous Tibial Nerve Stimulation on overactive bladder symptoms in adults.

Methods: A randomized controlled trial was held at the Sindh Institute of Physical Medicine and Rehabilitation with a non-probability purposive sampling technique. After screening for inclusion criteria 60 patients were randomly allocated into two Group A received Transcutaneous tibial nerve stimulation (TTNS) combined with traditional physiotherapy, while Group B just received traditional physiotherapy. Both interventions were given for six weeks. The overactive Bladder Symptom Score was used as an outcome measure tool.

Results: Group A improved in all OAB parameters, including daytime frequency (p=0.008), nocturia (p=0.006), urinary urgency (p=0.002), and urge urinary incontinence (p=0.008) with a significant improvement p<0.05. All OABSS parameters in group B also showed a considerable improvement (p<0.05), except for urge urinary incontinence (p=0.08).

Conclusion: the daytime frequency, nocturia, and urgency parameters of the overactive bladder symptoms score significantly decreased in both the TTNS+PFM group and the Traditional physiotherapy group. However, urge urinary incontinence showed significant improvement only in the TTNS+PFM group.

Keywords: Lower urinary tract symptoms; neuromodulation therapy; nocturia; overactive detrusor; pelvic floor disease; urge incontinence.

Trial Registration: NCT05464589.

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INTRODUCTION

More than 400 million individuals are affected by overactive bladder (OAB), all over the world. Its prevalence makes it a major health concern[1]. OAB is diagnosed symptomatically in the presence of urgency, with or without urge urinary incontinence (UUI), which commonly interrelates urinary frequency and nocturia, as defined by the International Continence Society (ICS) [2]. Epidemiological surveys done in 11 Asian countries, including Pakistan, concluded a high frequency of OAB in both males and females, while fewer treatment-seeking responses of the individuals because of the perception of the condition as a social taboo[3].

The normal bladder fills and empties in cycles. During the filling phase, the detrusor (bladder muscle) is relaxed and the bladder neck, sphincter complex, and pelvic floor muscles (PFM) are contracted to maintain continence[4]. During the emptying or voiding phase, the bladder neck, sphincter complex, and PFM relax, and simultaneously, the detrusor muscle contracts. Detrusor overactivity (DO) results in an urge to urinate and urinary incontinence. DO is known to be associated with pelvic floor relaxation or weakness. It is suggested that during relaxation or weakness of PFM, there is decreased afferent nerve activity that can cause involuntary detrusor contractions leading to OAB [5, 6]. Urination is a physiological process that involves the lower urinary tract's anatomical components and, the higher cortex of the brain, the pons, the spinal cord, and the lower urinary tract's peripheral autonomic, somatic, and sensory afferent innervation[7]. Any of these systems or structures may have issues that lead to the OAB [8].

For individuals with urinary symptoms, including OAB symptoms of neurogenic or idiopathic origin and incontinence, standard physical therapy (Pelvic Floor Muscles (PFM) training-Kegels) is an effective treatment[9]. The American Urological Association (AUA) advises PFM training as the initial therapy for all people with OAB[10]. Voluntary PFM contractions can effectively inhibit involuntary bladder contractions and improve the symptoms of OAB[11]. The electrical stimulation of the tibial nerve (Peripheral application of TTNS) is also one of the treatment alternatives for OAB symptoms. TTNS, often referred to as retrograde stimulation, is a procedure that includes stimulating the nerve's distal branch to indirectly stimulate the nerve roots. The tibial nerve, a posterior distal branch of the sciatic nerve originating in the pelvis (L4–S3 spinal roots), is the target of this treatment. The pelvic floor's nerve supply also originates from this site (S2-S3). The sacral plexus is the target of tibial nerve stimulation. The function of the sacral plexus is to contract the PFM and the regulation of bladder function [12, 13]. Internationally, studies were carried out by physical therapists for the therapy of OAB patients through peripheral electrical stimulation, including TTNS or percutaneous tibial nerve stimulation (PTNS) with or without PFM strengthening and they majorly included elderly women only[14, 15].

As far as the authors' knowledge is concerned, in the local population, only sacral neuromodulation is evaluated to treat children with OAB. There is no local literature found to date regarding the TTNS to manage OAB symptoms (neurogenic or idiopathic origin) in adults including both males and females despite being a prevalent condition. The objective of this study is to determine the effects of TTNS on overactive bladder symptoms in adults. **So**, the hypothesis of the study is that there is a statistically significant difference between the effects of TTNS along with PFM strengthening and PFM strengthening alone to treat OAB symptoms in adults..

METHODOLOGY

This study is a two-armed, parallel-group, single-blinded, randomized controlled trial (NCT-05464589). The study was conducted at the Institute of Physical Medicine and Rehabilitation and Urology Department of Dow University Hospital, Karachi, Pakistan within the duration of eight months, from August 2021 to March 2022. Ethical Approval was obtained from the Institutional Review Board, with Ref. No. IRB-1997/DUHS/Approval/2021/414.

A sample size of n=52 participants was estimated using Open Epi version 3.0. The confidence interval was 95% and the power of the test was 80% with after intervention mean of 2.55 and a standard deviation of 1.23 in group A and after treatment mean of 1.65 and a standard deviation of 1.04 in group B using an Overactive Bladder Symptom Score (OABSS) of previous study [15]. Due to the small sample size to ensure sufficient statistical power, n=60 subjects were considered after including approximately 12% of the drop rate due to any reason. A total of n=68 participants were evaluated on selection criteria, out of which n=8 participants did not fulfill the criteria. So, n=60 participants were randomly allocated to Group A (n=30) and Group B (n=30). There was no loss of follow-up, and all participants were included in the data analysis. (Figure 1)

The inclusion criteria were patients of both genders who were 30-65 years old, clinically diagnosed with Overactive Bladder (OAB) by Urologist symptoms for at least one month or more than one month, with a total OABSS score of 3 or more and an urgency score of 2 or more. Patients who are pregnant or have acute urinary tract infection within 15 days, any surgical procedure for urinary incontinence, Genito-urinary cancer history, stage II pelvic organ prolapse according to pelvic organ prolapse-quantification system, skin lesion on the site of stimulation or around it, pelvic pacemakers, lower limb prostheses, patients not be able to perform Kegel's exercises, impaired sensation at the site of the stimulation, impaired mental status, high blood pressure, benign prostatic hyperplasia, diabetes mellitus, patients receiving any treatment other than the prescribed medications by the referring physicians were excluded.

Before the start of the study written informed consent was obtained from all participants. All the participants were randomly allocated into the interventional group A and the control group B. The simple randomization was done through SPSS by an independent biostatistician who was unaware of the interventions and was not involved in the study. The outcome assessment was done by another physiotherapist assessor who was blinded to the interventional group of patients who were assessed.

The OABSS was used as an outcome measure to measure the symptom severity of OAB at baseline and after six weeks of treatment. The outcome measure used in this was the Overactive Bladder Symptom Score (OABSS). OABSS is a validated instrument that evaluates the four cardinal symptoms including day and nighttime frequency, urgency, and urge incontinence) of OAB in one score[16]. The intra-class correlation coefficient of the total OABSS score was 0.74 (weighted kappa coefficients of individual item score, 0.55-0.84), and the Cronbach coefficient was 0.56 [17]. The cut-off value recommended to diagnose OAB is a total OABSS of at least 3 or more with an urgency score of at least 2 or more. The total score is 15, while 3-5 will be considered mild, 6-11 moderate, and 12 or more severe OAB [18].

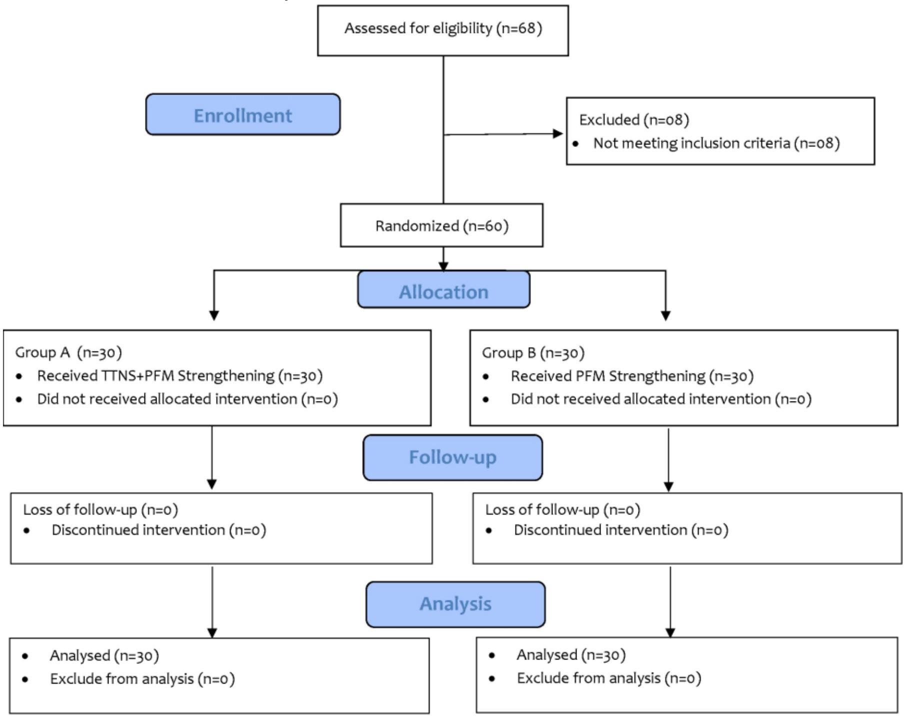

Figure 1: CONSORT diagram

Pelvic floor muscle strengthening (PFM) – Kegel exercises: The patient was instructed to lie supine with the knee flexed. Then, the patient was requested to contract PFM and maintain the position for 5 seconds, for ease of understanding, the patient was asked to contract the muscles which helps to avoid passing out the gas. Then, the patient was asked to relax for 3-5 seconds and repeat the contraction. In this way, the patient was instructed to do 15 contractions at a time and repeat this thrice daily for three weeks.

Electrical Stimulation – TTNS: Electrical stimulation was given through the Transcutaneous Electrical Nerve Stimulator (TENS Model Comfy Stim EV-806) once a week. Two electrodes were used, one electrode was applied on the medial malleolus of the right foot, and the other electrode was placed 5-10 cm proximal to the first electrode ipsilateral along the pathway of the tibial nerve. When stimulation was given, in some patients right big toe started to mobilize while some patients felt sensations at the sole of the foot showing that the nerve had started to be stimulated. The tibial nerve was electrically stimulated for 30 minutes; the pulse duration was 200 ms while the frequency was 10 Hz in continuous mode.11 No side effects related to treatment were reported by the patients.

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Data were stored and analyzed using IBM-SPSS version 23.0. The frequency with percentages were reported for the baseline qualitative characteristics including gender and type of overactive bladder based on cause. The means with standard deviations were given for age, height, weight, Body mass index, and parameters of OAB symptoms in each treatment group. The normality of data was checked with the Shapiro-Wilk test which shows a value >0.05 suggesting that data is normally distributed that's we used a parametric test which is a t-test. The data assume the assumptions of the parametric tests, so a paired sample t-test was used to compare the within-group treatment effect, and between groups analysis was done using an independent sample t-test. The p<0.05 was considered statistically significant, bar diagrams were also used to give a graphical presentation of data.

RESULTS

The total number of participants was n=60 Adults with Overactive Bladder Symptoms, out of them, n=33 were male and n=27 were female. The mean BMI of Group A was 23.5± 5.1 and in Group B was 24.4± 2.7 (Table 1).

Table 1: Baseline Characteristics of Studied Samples (n=60)

Characteristics		Group A (n=30)		Group B (n=30)		p-value
		n/ x̄	%/ σ	n/ x̄	%/ σ	
Gender	Male	17	56.7	16	53.3	0.79
	Female	13	43.3	14	46.7	
Age (years)	-	43.4	8.0	45.3	10.7	0.45
Height (m)	-	1.6	0.09	1.6	0.11	0.50
Weight (kg)	-	65.4	16.6	66.6	10.0	0.74
BMI (kg/m²)	-	23.5	5.1	24.4	2.7	0.43
Type of OAB on the Basisof Cause	Idiopathic	24	80.0	23	76.7	0.74
	Neurogenic	6	20.0	7	23.3	

Significance level- p<0.05, p<0.01** & p<0.001***; n- frequency; x̄- Mean; σ-standard deviation; OAB-overactive bladder*

All components of OABSS including daytime frequency, Nocturia, Urinary urgency, urge urinary incontinence, and overall OABSS were significantly improved (p<0.05) in both groups after a 6-week intervention. While in group B which only received PFMS, urge urinary incontinence did not significantly (p=0.08) improve after the 6-week intervention. (Table 2)

Table 2: Mean Comparison of OABSS in Group A & B (TTNS Group)

Parameters	Group A (n=30) Baseline	after the 6-week	t-value(29)	p-value	Group B (n=30) Baseline	after the 6-week	t-value(29)	p-value
	x̄ ± σ	x̄ ± σ			x̄ ± σ	x̄ ± σ		
Day time frequency	1.3±0.59	0.43 ±0.50	9.35	0.008**	1.23±0.43	0.93 ±0.36	3.52	0.004**
Nocturia	2.1±0.59	1.0±0.37	10.79	0.006**	2.1±0.66	1.5±0.67	5.75	0.006**
Urinary urgency	3.1±0.80	1.8±0.71	9.41	0.002**	3.0±0.78	2.4±0.85	4.26	0.005**
Urge Urinary Incontinence	1.4±1.0	1.0±0.82	-1.71	0.06	0.73±0.94	0.63±0.85	-8.11	0.08
Total score of the OAB	7.9±1.9	4.3±1.42	13.72	0.007**	7.0±1.7	5.4±1.71	7.95	0.004**

Significance level- p<0.05, p<0.01** & p<0.001***; x̄- Mean; σ-standard deviation; OAB-overactive bladder; df= degree of freedom.*

The result of the independent t-test showed that group A showed significantly (p<0.05) better results than group B in all components except urinary urgency, which was not statistically different (p=0.051) between both groups. (Table 3)

Table 3: Mean Comparison of OABSS parameters and Total Score between Groups after Treatment

Parameters	Group A	Group B	MD (95% CI)	t-value (58)	p-value
	x̄ ± σ	x̄ ± σ			
Day time frequency	0.43 ±0.50	0.93 ±0.36	-0.50 (-0.72, -0.27)	-4.40	0.002**
Nocturia	1.0±0.37	1.5±0.67	-0.56 (-0.84. -0.28)	-4.01	0.007**
Urinary urgency	1.8±0.71	2.4±0.85	-0.60 (-1.00, -0.19)	-2.95	0.051
Urge UrinaryIncontinence	1.0±0.82	0.63±0.85	-0.43 (-0.00, -0.86)	2.00	0.004**
Total score of the OAB Symptoms	4.3±1.42	5.4±1.71	-1.13 (-1.94, -0.34)	-2.78	0.021*

Significance level- p<0.05, p<0.01** & p<0.001***; x̄- Mean; σ-standard deviation; OAB-overactive bladder; df= degree of freedom; MD-Mean Difference; CI- Confidence Interval.*

DISCUSSION

This study was conducted to evaluate the effectiveness of TTNS to treat OAB symptoms in adults including both males and females. It was found that both PFM strengthening lone and TTNS along with PFM strengthening were effective for reducing OAB symptoms but the TTNS along with PFM strengthening showed more improvement in OAB symptoms comparatively.

The comparison between the two groups from the baseline to the sixth week showed the most improvement in urinary urgency in the favour of the TTNS group. TTNS along with PFM strengthening was also more effective than PFM strengthening alone for reducing daytime urinary frequency and nocturia. The previous study conducted by Polat Dunya in which fifty-five patients of mean age 43.49 with overactive bladder symptoms were included. One group received TTNS for six weeks while the other group received pelvic floor muscle training exercises twice a day for six weeks. This study showed TTNS and PFMT as equally effective for overactive bladder symptoms. When both groups were compared from baseline to six weeks of intervention, the TTNS more effectively improved daytime frequency, nocturia, and urgency[19]. However current study found that the TTNS combined with the PFMT was more effective in treating UUI when compared with PFMT alone. This finding was different from Polat Dunya's findings. In this study, there were more patients with less severe UUI, which can be a possible reason for these findings.

A meta-analysis of 16 studies conducted by Wibisono and Rahardjo concluded that more than one session a week of percutaneous electrical stimulation of the tibial nerve is not an indicator of the success of the treatment or more benefits from the technique [20]. It was also supported by the study done by Pierre ML in which they applied TTNS once a week to treat OAB symptoms. Their study showed that only once-a-week application of TTNS did not alter the outcomes of the treatment or impede the recovery of the symptoms [21].

Schreiner L and fellows conducted a study in which they included 52 females of 60 and more than 60 years of age with the complaint of urge urinary incontinence. Their study had two groups, one received PFM training while the other received PFM training along with TTNS. They used a three-day bladder diary, Kings Health Questionnaire (KHQ), and International Consultation on Incontinence Questionnaire–Short Form (ICIQ-SF) as outcome measures to evaluate symptom severity, health-related quality of life and frequency, severity, and impact on quality of life (QoL) of urinary incontinence, respectively[11]. Their results showed improvement in symptoms in both groups, but more significant improvement was seen in the TTNS group. Similar improvements were observed in the current study which may be because of the application of two treatments with different mechanisms at the same time.

In the current study TTNS was applied once a week for 6 weeks and found statistically significant improvement in OAB symptoms. Similarly, Surbala L and Patrícia Lordêlo applied TTNS for less than twelve weeks and reported good results like our study. It has been established that TTNS can be effective for OAB symptoms within six weeks of application as well [22].

We used non-invasive (transcutaneous) electrical stimulation to treat OAB symptoms and yielded good results as a previous study by Pierre and colleagues reported that invasive (percutaneous) electrical stimulation significantly treated OAB symptoms [21]. The effectiveness of TTNS in the current study established that transcutaneous application of electrical stimulation can be preferred over percutaneous stimulation for OAB symptoms because it is more comfortable for the patients. It is also in correspondence with the conclusion drawn from the systematic review conducted by Gonzalez in which they concluded that both TTNS and percutaneous tibial nerve stimulation (PTNS) were equal in terms of outcome variables. However, TTNS is preferred over PTNS as it is more comfortable for patients. They also concluded that it should be the treatment of choice due to being cost-effective as well [23].

Both genders were included in the study, as there are gender differences may exist, so the results can be influenced by these differences.

CONCLUSION

This study concluded that both PFM strengthening and TTNS ensured patient safety and easy application. Also, both methods reduced the severity of OAB symptoms. The effectiveness of TTNS for OAB symptoms makes it considerable as a first-line treatment for OAB along with PFM strengthening as TTNS was easy to apply, cost effective and showed no systemic or local side effects.

DECLARATIONS & STATEMENTS

Author's Contribution

SS: substantial contributions to the conception and design of the study.
SS and SIA and MAS: acquisition of data for the study.
MHAM and AAMB: interpretation of data for the study.
MK: analysis of the data for the study.
SS, MK, SIA and MAS: drafted the work.
MK and MAS: revised it critically for important intellectual content.
SS, SIA, MHAM, AAMB, MK and MAS: final approval of the version to be published and agreement to be accountable for all aspects.
of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study was conducted after ethical approval from the Institutional Review Board of Institute of Physical Medicine and Rehabilitation, Karachi and Urology Department of Dow University Hospital, Karachi, Pakistan (IRB-1997/DUHS/Approval/2021/414).

Consent Statement

The written informed consent was obtained from patients to participate in the study.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author.

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Conflicts of Interest

The authors declare no conflict of interest.

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Research Article

Effectiveness of muscle energy techniques and friction massage in hamstring tightness amongst young athletes of Pakistan

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ABSTRACT

Background: compromised hamstring flexibility is a risk factor to sports-related injuries, as muscular tightness is believed to reduce athletic performance. Different muscle energy techniques and friction massage are commonly practiced by manual therapists to improve hamstring flexibility.

Objectives: To compare the effectiveness of muscle energy technique and friction massage in hamstring tightness among young athletes in Pakistan

Methodology: A randomized controlled trial was conducted at Helping Hand Institute of Rehabilitation Sciences (HHIRS), Mansehra, and Neurological Orthopaedic and Sports Injury Services Mansehra (NOSIS). A total of n=60 young athletes between 18-25 years with hamstring tightness and limited straight leg raise range of motion (<110⁰) were included in the study. The non-probability purposive sampling was used for data collection then the participants were randomly divided into Group A (n=20) received Post facilitation stretch (PFS), group B (n=20) received post-isometric relaxation (PIR), and Group C (n=20) which received deep friction massage through electronic massager. The athletic performance of the participants was assessed using the YMCA sit and reach test (S&RT) for flexibility, agility run test (ART) for agility, vertical jump test (VJT) for explosive power, and 100-meter run test (RT) for speed and explosive power at baseline, 10th day, and 20th day of the intervention.

Results: The participants had a mean age of 21.55±2.05 years. The result showed that participants who received PFS showed significant ($p<0.05$) results as compared to PIR and FM after the 10th day, regarding VJT ($p=0.006$), ART ($p=0.015$), S&RT ($p<0.001$) and 100m RT ($p<0.001$). After the 20th day, PFA showed better results than PIR and FM after the 10th day. The participant who received FM showed less improvement than the remaining two groups but statistically significant $p<0.05$.

Conclusion Muscle energy techniques, particularly PFS and PIR, proved effective in enhancing athletic performance parameters, including vertical jump, agility, and flexibility, among young athletes with hamstring tightness. These findings support their use in sports rehabilitation and injury prevention.

Keywords: friction massage; hamstring tightness; manual mobilization technique; muscle energy technique; soft tissue mobilization post isometric relaxation; post facilitation stretch.

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INTRODUCTION

Flexibility is a muscular attribute that affects an individual's ability to move smoothly and promotes the optimal and safe performance of physical activity [1]. It is regarded as a crucial component of healthy biomechanical performance in sports. The studies found that flexibility has a number of benefits associated with it, including improved athletic performance, reduced risk of injury, the avoidance or reduction of soreness after exercise, and improved coordination [2, 3].

Three muscles collectively known as the hamstrings have a propensity to contract quickly. As the most frequent type of sports injury, hamstring strain is what causes hamstring injuries [4]. The range of motion and flexibility of the pelvic, hip, and knee joints are diminished when these muscles are tight. Muscle tightness limits physical performance, including daily tasks, and is a significant intrinsic component in sports injuries, which in turn affect athletic performance due to extended recovery durations, high expense of treatment, and injury Severity [2, 5]. The literature suggests that Reduced hamstring flexibility has been linked to an increased risk of patella tendinopathy, hamstring strain injuries, and muscle damage after eccentric activity [6].

Numerous clinical circumstances, including poor posture, systemic illness, persistent mild muscular strain, and neuromusculoskeletal lesions, can lead to muscle inflexibility [7]. Previous Literature reports that sports like football, rugby, and soccer are prone to hamstring injuries. Instead of force, excessive strain during eccentric contraction is what causes damage, and the length of the activation phase prior to eccentric contraction affects how severe the injury is [6, 8]. Reduced maximum muscle length, lack of flexibility, strength imbalance, inadequate warm-up, exhaustion, lower back injury, poor lumbar posture, and increased muscle neural tension are modifiable risk factors; however, muscle compositions, age, race, and prior injuries are non-modifiable risk factors [9].

Improved hamstring flexibility has been the subject of several studies. The approach, level of effort, length of time, and frequency that is most advantageous or produces the best outcomes, however, are still up for debate. Numerous techniques in manual therapy including different stretching methods and Friction massage are currently being practiced improving flexibility and range of motion [10]. Stretching has been regarded as an essential component of a physical training program to increase the range of motion [11].

A manual approach called muscle energy technique (MET); invented by osteopaths, is currently practiced by many manual therapy specialists to stretch, and strengthen, as a lymphatic/venous pump, and extend the range of motion. MET is a biomechanics-based diagnostic system used to identify and qualify an articular range of motion restriction [12]. Contract relax strategies have been studied for their impact on hamstring flexibility [12]. The efficacy of MET is evident by the number of studies conducted on the performance of athletes that It can be used to enhance a joint's range of motion, thus enhancing the athletic performance of hamstrings in fields [13-16]. Although the individual efficacy of enhancing athletic performance by improving hamstring flexibility has been proved by many research studies, providing evidence in favor of both techniques; MET and friction Massage[10, 15-17].

Hamstring tightness is a common issue among young athletes and is considered a potential risk factor for sports-related injuries. While Muscle Energy Techniques (MET) and friction massage are commonly used by manual therapists to address hamstring tightness, there is a lack of research specifically investigating their effectiveness among young athletes in Pakistan. Therefore, a study in this context is necessary to fill the existing gap in literature. So, the objective of the current study was to determine the effectiveness of muscle energy technique and friction massage in hamstring tightness among young athletes in Pakistan.

METHODOLOGY

This randomized clinical trial (NCT03680300) was conducted after approval from research and ethical committee of the Helping Hand Institute of Rehabilitation Sciences (HHIRS/REC/2017/08/29/01), Mansehra, and the private clinic Neurological Orthopaedic and Sports Injury Services (NOSIS) (NOSIS/Research/2017/08/25/03), Mansehra August 2017 till February 2019.

Athletes having hamstring tightness with straight leg raise (SLR) <110^0, ages ranging from 18 to 25 years were included in the study, through the lottery method and were randomly allocated into two groups. Athletes not fulfilling the inclusion criteria or having hamstring injury or any other lower extremity-related injury or presenting with LBP or with any deformity were excluded from the study. A total sample size of n=60, and n=150 athletes were screened out for hamstring tightness through a nonprobability convenience sampling technique. (Figure 1)

General demographic data including, age, gender, occupational history, and sports played was obtained. The athletic performance of the participants was assessed using the YMCA sit and reach test (S&RT) for flexibility, agility run test (ART) for agility, vertical jump test (VJT) for explosive power, and 100-meter run test (RT) for speed and explosive power at baseline, 10th day, and 20th day of the intervention.

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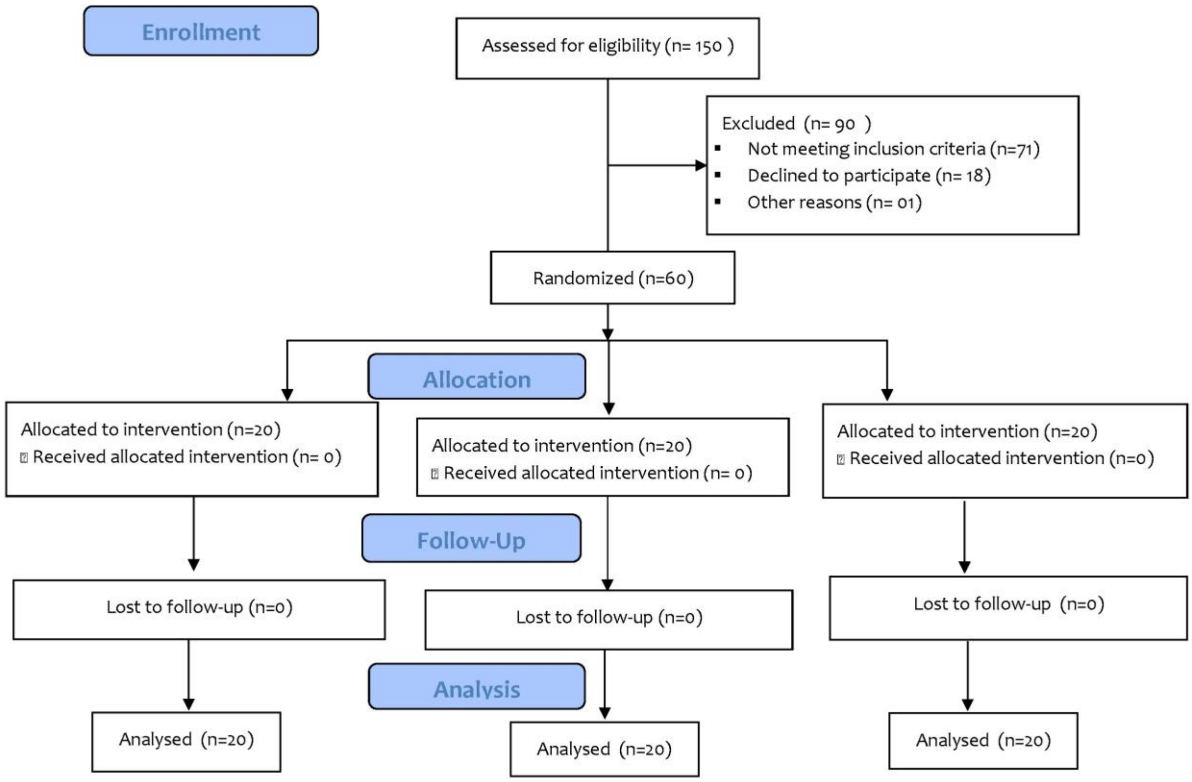

Figure:1 Consort Diagram

The intervention procedure for each of the three athlete groups included a pre-treatment phase that was standardized, followed by individualized therapy. Each participant had a 20-minute session that started with Transcutaneous Electrical Nerve Stimulation (TENS) and the application of a heat pack. The athletes from the three groups received different therapy following this initial phase, according to their placement in the groups. Group A received a facilitation stretch (PFS), for this, the hamstring muscle was placed in a position that was halfway between totally relaxed and fully stretched. For 5-10 seconds, the patient contracts the agonist against the therapist's opposing force with the greatest effort. After 5-10 seconds, the patient was advised to relax and relinquish the effort, while the therapist stretched the muscle to a new barrier and held it for 10 seconds. The technique was repeated 3-5 times or more, with a relaxing pause of around 20 seconds between each repetition. Unlike the PIR approach, it was held in between totally relaxed and fully stretched positions every time, rather than starting from a new barrier.

Group B received Post Isometric relaxation (PIR), which was performed by stretching the hamstring muscle to the point where the initial resistance to movement was felt, or to the length where discomfort was minimal. While the therapist applied resistance opposite to the motion, the hypertonic muscle was contracted submaximally (10-20%) for 5 to 10 seconds away from the barrier. The athlete was instructed to inhale while completing the contraction, and then relax and exhale afterward. Then, to take up the slack for the new barrier, a passive mild stretch was performed. This method was repeated 2–3 times from the new barrier.

Group C therapist used a thrive massager to deliver a 20-minute friction massage to the hamstrings. Introducing the "Thrive Massager" by Thrive Wellness, a revolutionary electronic handheld massager designed to provide unparalleled relaxation and muscle relief. The TM-5000 model comes equipped with advanced technology, offering a range of massage techniques, including percussive and vibration modes, tailored to suit different muscle needs. Its ergonomic design ensures a comfortable grip during application, making it easy to use for anyone seeking therapeutic relief.

To begin the massage session, ensure the Thrive Massager is fully charged for optimal performance. Familiarize yourself with the various massage heads and settings to select the most suitable one for your needs. Find a quiet and comfortable space to perform the massage, and if using massage oils or lotions, apply a small amount to the targeted area, ensuring it is clean and free from any cuts or abrasions.

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Holding the Thrive Massager firmly but not too tightly, position the chosen massage head against the muscle area requiring attention. Maintain a slight angle of around 30 degrees to the skin's surface. Start the massager at the lowest intensity setting and gradually increase it to a comfortable level. Apply the massager in slow and controlled motions, focusing on tight or sore muscles. Follow the muscle fibers, moving in a circular or linear direction, avoiding excessive pressure and prolonged focus on one spot.

During the massage, continuously adjust the intensity and experiment with different massage modes to find the most effective one for your needs. The duration of each massage session should typically be 5 to 10 minutes per muscle group, and if any discomfort or pain arises during the process, stop immediately.

After the massage, take a few minutes to relax and allow your muscles to rest. Store the Thrive Massager in a cool and dry place for future use. However, it is crucial to note that this protocol serves as general guidance and does not replace professional medical advice. Prior to using any electronic massager or embarking on a new health regimen, consult with a healthcare professional, especially if you have any pre-existing medical conditions or concerns. The Thrive Massager offers a promising tool for relaxation and relief, and with proper application and care, you can replicate this protocol for a rejuvenating experience.

The descriptive statistics for demographics and normality index were evaluated, as per statistical analysis the data was non-parametric therefore, for between-group analysis Kruskal Wallis test with post hoc analysis, and for within-group analysis Friedman test, along with the Wilcoxon sign rank test for pairwise comparison were applied. The level of significance was set at $p<0.05$, and SPSS ver 28 was used for data analysis.

RESULTS

All the Participant included in the study were Male, with mean age of 21.55±2.05 years, the average heights of athletes was 171.33±7.9 cm, their Mean weight was 67.16±7.04 kg, and reported BMI was 22.9±2.7 kg/cm2, the average playing hour of these athletes on daily basis was 2.22± 1.59 hours.

Within group analysis, the Friedman test and pairwise changes with Wilcoxon signed ranked test showed significant ($p<0.001$) improvement in all variables, including VJT, ART, S&RT and 100m ST from overall and each assessment level from baseline to 10th day and after 20th day. (Table 1)

Table 1: Within-group Analysis

		PIR				PFS				FM			
		Friedman test			Wilcoxon Sign Rank	Friedman test			Wilcoxon Sign Rank	Friedman test			Wilcoxon Sign Rank
		Median (IQR)	Mean rank	X^2(df)	p-value	Median (IQR)	Mean rank	X^2(df)	p-value	Median (IQR)	Mean rank	X^2(df)	p-value
Vertical Jump	Baseline	14(4.7)	1.0	40(2)	0.00***[a]	17(10)	1.0	40(2)	0.00***[a]	16(3)	1.02	38.5(2)	0.00***[a]
	10^{th} day	20(3)	2.0		0.00***[b]	22.5(9.5)	2.0		0.00***[b]	18(3)	2.03		0.00***[b]
	20^{th} day	26(5)	3.0		0.00***[c]	29(12.5)	3.0		0.00***[c]	20(3)	2.95		0.00***[c]
Agility Run Test	Baseline	19.7(2.8)	3.0	40(2)	0.00***[a]	18.4(1.7)	3.0	40(2)	0.00***[a]	18.9(2.28)	3.0	40(2)	0.00***[a]
	10^{th} day	17.2(1.7)	2.0		0.00***[b]	16.1(2.3)	2.0		0.00***[b]	18.1(1.74)	2.0		0.00***[b]
	20^{th} day	15.4(2.0)	1.0		0.00***[c]	14.2(2.4)	1.0		0.00***[c]	17.4(1.20)	1.0		0.00***[c]
YMCA sit and reach	Baseline	3(2.0)	1.0	40(2)	0.00***[a]	3(1.7)	1.0	40(2)	0.00***[a]	3(1)	1.02	39.2(2)	0.00***[a]
	10^{th} day	7(2.0)	2.0		0.00***[b]	8(3)	2.0		0.00***[b]	4(1)	1.98		0.00***[b]
	20^{th} day	12.0(3.7)	3.0		0.00***[c]	15(2.75)	3.0		0.00***[c]	7(1)	3.0		0.00***[c]
100-meter sprint	Baseline	18.7(2.0)	3.0	40(2)	0.00***[a]	18.2(2.02)	3.0	40(2)	0.00***[a]	18.3(1.81)	2.9	20.2(2)	0.00***[a]
	10^{th} day	16.2(1.7)	2.0		0.00***[b]	15.2(1.36)	2.0		0.00***[b]	17.2(1.81)	1.9		0.00***[b]
	20^{th} day	14.5(2.1)	1.0		0.00***[c]	12.5(0.87)	1.0		0.00***[c]	16.8(0.76)	1.20		0.00***[c]

[a]baseline to 10^{th} day, [b]0th to 20^{th} day & [c]baseline to 20^{th} day; PIR-Post Isometric Relaxation, PFS-Post Facilitation Stretch, FM-Friction Massage
Level of significance: $p<0.05$, $p<0.01$** & $p<0.001$****

The Kruskal Wallis H test showed that, all groups were comparable at the baseline, so after 10^{th} day and after 20^{th} day there were significant difference among groups regarding the vertical jump test, agility run test YMCA sit and reach test and 100 meter sprint. The post hoc analysis showed that participant received PFS showed significant ($p<0.05$) result as compare to PIR and FM after 10^{th} day, regarding VJT (MR=42.5 vs. MR=30.33 vs. MR=18.77, p=0.006), ART (MR=20.2 vs. MR=32.5 vs. MR=38.8, p=0.015), S&RT (MR=43.25 vs. MR=34.8 vs. MR=13.45, $p<0.001$) and 100m ST (MR=17.05 vs. MR=30.85 vs. MR=43.6, $p<0.001$). After 20^{th} day, PFA showed better results than PIR and FM as after 10^{th} day. The participant received FM showed least improvement than remaining two group but statistically significant. (Table 2)

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Table 2: Between-group comparison

		Baseline					10th day					20th day				
		Kruskal Wallis				Post hoc	Kruskal Wallis				Post hoc	Kruskal Wallis				Post hoc
		Median (IQR)	Mean rank	X^2(df)	p-value	p-value	Median (IQR)	Mean rank	X^2(df)	p-value	p-value	Median (IQR)	Mean rank	X^2(df)	p-value	p-value
Vertical Jump	PIR	14(4.75)	24.5	3.7(2)	0.147	0.105[a]	20(3)	30.33	18.5(2)	0.006**	0.010*[a]	26(5)	33.10	37(2)	0.00***	0.003**[a]
	PFS	17(10)	34.73			0.49[b]	22.5(9.5)	42.4			0.013*[b]	29(12.5)	45.85			0.00***[b]
	FM	16(3)	32.23			0.103[c]	18(3)	18.77			0.00***[c]	20(3)	12.55			0.00***[c]
Agility Run Test	PIR	19.7(2.8)	35.6	2.6(2)	0.085	0.10[a]	17.2(1.7)	32.50	11.7(2)	0.015*	0.02*[a]	15.4(2.0)	30.08	3.39(2)	0.00***	0.00***[a]
	PFS	18.4(1.7)	26.30			0.32[b]	16.1(2.3)	20.20			0.22[b]	14.2(2.4)	14.78			0.00***[b]
	FM	18.9(2.28)	29.90			0.512[c]	18.1(1.74)	38.80			0.001**[c]	17.4(1.20)	46.65			0.00***[c]
YMCA sit and reach	PIR	3(2.0)	29.58	3.3(2)	0.231	0.250[a]	7(2.0)	34.8	31.7(2)	0.00***	0.027*[a]	12.0(3.7)	33.45	38.9(2)	0.00***	0.00***[a]
	PFS	3(1.7)	35.60			0.068[b]	8(3)	43.25			0.00***[b]	15(2.75)	45.98			0.00***[b]
	FM	3(1)	26.13			0.547[c]	4(1)	13.45			0.00***[c]	7(1)	12.08			0.00***[c]
100-meter sprint	PIR	18.7(2.0)	33.60	1.4(2)	0.549	0.279[a]	16.2(1.7)	30.85	23(2)	0.00***	0.008**[a]	14.5(2.1)	30.73	43(2)	0.00***	0.00***[a]
	PFS	18.2(2.02)	27.05			0.43[b]	15.2(1.36)	17.05			0.00***[b]	12.5(0.87)	12.25			0.00***[b]
	FM	18.3(1.81)	30.85			0.565[c]	17.2(1.81)	43.60			0.012*[c]	16.8(0.76)	48.53			0.00***[c]

[a]PIR Vs PFS, [b]PFS Vs FM & [c]PIR Vs FM; PIR-Post Isometric Relaxation, PFS-Post Facilitation Stretch, FM-Friction Massage
Level of significance: p<0.05, p<0.01** & p<0.001****

DISCUSSION

The primary goal of this study was to compare the efficacy of Muscle Energy Techniques (MET), specifically Post-Isometric Relaxation (PIR) and Post-Facilitation Stretch (PFS), versus Friction Massage (FM), in improving hamstring flexibility and preventing sports injuries in young amateur athletes. In comparison to FM, PFS considerably increased hamstring flexibility and athletic performance, according to the study. The study assessed athletic performance using a variety of variables, including vertical leap, agility run test, YMCA sit and reach test, and 100-meter sprint test. The statistical analysis confirmed that MET, particularly PFS, was beneficial in alleviating hamstring tightness and improving athletic performance. This finding was consistent with an earlier study that found MET to be beneficial to hamstring flexibility and muscle function [2, 12].

According to the study, PFS entails tightening the hamstring isometric ally and then actively stretching it. This mechanism stimulates Golgi tendon organs and results in autogenic inhibition, which reduces the activity of muscle spindles, which is responsible for the muscle's stretch reflex [18]. PFS has been proven to increase hamstring flexibility and improve the muscle's length-tension relationship, which is important for generating force during exercises such as vertical jumping and sprinting [19].

Another MET employed in the study was these impacts aided athletic performance, especially in the vertical jump and sprint. This procedure relaxed the muscles, lowered muscular tone and stiffness, and optimized the hamstring length-tension relationship. These impacts aided athletic performance, especially in the vertical jump and sprint [20].

FM, a soft tissue manipulation technique, on the other hand, is primarily designed to break down adhesions and scar tissue, enhance blood flow, and stimulate healing. While it did provide some temporary muscle relief, it was not as beneficial as MET in improving hamstring flexibility and athletic performance [21].

The agility run test findings revealed that the PIR and PFS groups performed significantly better than the FM group. PFS was especially helpful in improving agility because it increased hamstring flexibility while decreasing muscle stiffness and resistance, allowing for smoother transitions between activities and faster changes of direction. The YMCA sit and reach test also revealed that PFS and PIR improved hamstring flexibility significantly. In this regard, PFS beat FM. Athletes were able to reach further during the test due to increased hamstring flexibility, resulting in better scores. In the 100-meter sprint test, all three groups improved, with the PFS group improving the most significantly. PFS's ability to improve sprint performance and lower the risk of injury by increasing hamstring flexibility, stride length, and force generation, contributed to Improved sprint performance and reduced the risk of injury during explosive sprint movements [22].

In the current study baseline BMI differences were not considered during data collection. Which may affect the results of intervention on the performance of non-athletes.

CONCLUSION

The METs, particularly PFS, was more effective than FM in improving hamstring flexibility and optimizing muscle length-tension relationships. This enhanced performance in a variety of athletic tests, such as the vertical jump, agility run, YMCA sit and reach, and 100-meter sprint. The study's findings backed up the use of MET as an effective technique for reducing sports injuries and improving athletic performance in amateur athletes.

DECLARATIONS & STATEMENTS

Author's Contribution

KH: substantial contributions to the conception and design of the study.
SR: acquisition of data for the study.
NIB: interpretation of data for the study.
SS: analysis of the data for the study.

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NIB and SS: drafted the work.
KH, SR, NIB, SB and SS: revised it critically for important intellectual content.
KH, SR, NIB, SB and SS: final approval of the version to be published and agreement to be accountable for all aspects. Of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

This randomized clinical trial (NCT03680300) was conducted after approval from research and ethical committee of the Helping Hand Institute of Rehabilitation Sciences (HHIRS/REC/2017/08/29/01), Mansehra, and the private clinic Neurological Orthopedic and Sports Injury Services (NOSIS) (NOSIS/Research/2017/08/25/03)

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Due to privacy or ethical considerations, the data presented in this study are available upon request from the corresponding author.

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None to declare.

Conflicts of Interest

The authors declare no conflict of interest.

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