

Comparison of Effectiveness of Muscle Energy Technique Versus PNF in Individuals with Hamstring Shortness

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ABSTRACT

Background: Regarding sedentary lifestyle people who watch television, computer, play games on mobile and spent less than two to three days in week performing physical activity are physically inactive. Muscle “tightness” is a result of from an increase in the muscle tension. PNF and muscle energy techniques are two most effective techniques in increasing the range of motion, increases circulation increase overall muscular performance of athletes, decreases pain and reduce the risk of injuries.

Objective(s): To determine Comparison of effect of the Muscle Energy Technique Versus PNF in Individuals having Hamstring Shortness.

Materials and Methods: A randomized clinical trial conducted at Chauhdary Muhammad Akram teaching and research Hospital, Superior University, Lahore. This trial registered at U.S clinical trial registry with reference no: NCT05376956. A total of 44 participants took part in research fulfilling the eligibility criteria after informed consent. 4 patients dropped out. Consecutive sampling technique is used. Individuals were divided in the following two groups A and B randomly by goldfish bowl method. Randomization was done by one of the assessor Randomization assignments was kept in opaque, sealed envelopes and was unsealed by researcher after a baseline treatment. Treatment session continued for 16 weeks.

Results: A total of 44 individuals participated in research. 4 patients dropped out of research study however and didn't take the treatments that are allocated to them in accordance with the investigators. It was noteworthy modification regarding the baseline characteristics of individuals between group A and B. In group A of muscle energy technique there was significant improvement in condition of patient in response to the treatment ($p < 0.05$). Hamstring flexibility is significantly improved in group A.

Conclusion(s): This study revealed that in improving hamstring flexibility and improves function of the hamstrings muscle energy technique was more effective in treating the individuals with hamstrings shortness.

Keywords: Proprioceptive Neuromuscular Facilitation; Muscle Energy Technique; Range of Motion; Hamstring Shortness

Introduction

Sedentary lifestyle is an important issue to notice because of its deleterious health implications on individuals of all age groups. It is particularly related with less physical activity, prolonged sitting in work stations, cars, communities, work sites, schools, homes and in public places [1]. The prevalence of sedentary lifestyle among the total population of 276, 26 (9.3%) were physically inactive. They did not do any physical activity after coming from work. 78 (27.7%) did physical activity less than two time per week. Regarding sedentary lifestyle, 172(61.2%) were used television, computer, play games on mobile [2]. Muscle "tightness" is a result of from an increase in the muscle tension. Thus hamstring tightness is considered as the main cause of tightness of the back muscles and low back pain. Hamstrings tightness indicates muscle weakness in other structures too [3]. Postural problems also results in the tightness of hamstrings muscle. The activation of hamstrings muscle is increased while performing the activities of daily living such as walking, stair ascending and stairs descending in individuals with weak knee muscle, inflamed knee joint due to trauma, progressing disease of knee, any systemic disease effecting knee joint and in individuals having knee osteoarthritis [4].

Hamstrings are composed of three muscles that are named semi tendinous, semi membranous as well as short and long head of Bicep femoris that are located in the posterior compartment of thigh of an individual. as it is known that hamstrings is a multi-joint muscle pass from both hip joint and knee joint extending from medial to lateral aspect [5]. Flexibility is the most important aspect of the physical performance as reduction in flexibility May leads to postural abnormality and abnormal gait patterns Reduced and limited flexibility of hamstrings leads to reduced functional level of musculoskeletal system and increases the risk of injury of muscle. Flexibility of hamstring is defined as total range of motion around a joint that it completes without any injury or tear. Joint range of motion is dependent on muscle flexibility, arthrokinematics around the joint and peri articular connections [5]. Flexibility is most essential component of physical fitness that may majorly dependent upon the improper posture that may come as the result of sedentary lifestyle of an individual and decrease in flexibility of soft tissues results in severe musculoskeletal injuries. The normal length of hamstring can be elasticized up to one-third of its length during eccentric and concentric contraction. Hamstring shortness occurs with inability of hamstrings to fully extend the knee higher than 160 degrees, when hip is 90 degrees flexed. In hamstrings shortness knee extension angle becomes greater than 20 degrees, and knee can't extend fully [6].

Flexibility is an essential key to perform the activities of daily life efficiently for both athletes and non-athletes. The more flexible the muscle is, lesser the chance of injury. Globally PNF technique is best recognized to gain the range of motion of a joint or muscle

by increasing the flexibility. There are many proprioceptive neuromuscular rehabilitation techniques. While performing the PNF, reverse myotatic reflex occurs to relax the muscle to prevent injury. Four mechanisms have been identified while performing PNF that causes muscle relaxation they are: reciprocal inhibition, stress relaxation, autogenic inhibition and pain gate theory [5]. stretching increases the range of motion, increases circulation, increase overall muscular performance of athletes, decreases pain and reduce the risk of injuries Among all PNF and MET are most effective to improve hamstring's flexibility [6]. To increase muscle active and passive range of motion and elasticity proprioceptive neuromuscular facilitation is effectively used. PNF has positive effect in increasing both muscles and joint range of motion (both active and passive).

Flexibility increases more if we target the kinetics of the body especially of the long chain muscles. These structures include side fascia, flexors of the hip joint, hamstrings, gluteus medius, gluteus maximus and gluteus minimus and back muscle. It consists of two methods; one is contract relax method and other is contract-relax antagonist contract technique. The contact relax technique causes the muscle being targeted to lengthen in that same state and position on the other hand participant contracted the targeted muscle to its full for a given amount of time isometrically. Then a shorter relaxation phase is followed by it. The targeted muscle included a passive stretch usually. The contact relax agonist contraction technique is exact same procedure as the contract relax method, moreover it was continued more [7]. Instead of mere passively stretching of the Targeted muscle area, contraction of the antagonist muscle for another given period of time is performed by participant [8]. We used these two most effective techniques comparison that is not present in literature previously for hamstrings shortness with outcome variables of pain, flexibility and function combined. Symptomatic patients were included in the research too while previous researches were based on asymptomatic patients only. People of all socioeconomic status were included in research.

The two procedures were applied at the very same time with equal gatherings and similar standards. MET and PNF were most effective stretching techniques to be compared proved by the literature above. Our research was helpful for all the physiotherapist community for giving most effective and quick treatment for the hamstring shortness as they would approach through evidence-based research treatment method that would not only be helpful for the physiotherapist but also for the patients as patient showed good prognosis in minimal sessions as required by the patient. Correct posture and ergonomics needed according to the age, profession would be guided to patient. Being a physiotherapy experimental research, would give a body of evidence to conclude the compatible effective treatment maneuver for reducing pain, improving flexibility and functional ability in patient with hamstring shortness having sedentary life style.

Materials and Methods

This randomized clinical trial was conducted at Azra Naheed Medical College, The Superior University Lahore after the approval of synopsis and data was collected at Superior University Raiwind Road Lahore and at Chauhdary Muhammad Akram teaching and Research hospital. This study was completed in 16 weeks. This trial registered at U.S clinical trial registry with reference no: NCT05376956. The sample size of this research was 44. Simple size is calculated using the open epitom. The reference of the parent article is attached [6]. Consecutive sampling technique was used. Individuals were divided into two groups randomly by Goldfish bowl randomization method. Group A received the Muscle energy technique combined with the baseline treatment. Group B received Proprioceptive neuromuscular facilitation with baseline treatment. Randomization was done by one of the assessors who was not a part of research and patient treatment. Randomization assignments were kept in opaque, sealed envelopes and were unsealed by researchers after a baseline treatment. After randomization, the participants in the study were the only one to be informed about the allocation of program by the therapist, remaining were unaware of the interventions applied in the other group. Assessor blinding was used in the research. 2 participants that are not part of the research accessed the patient and filled the assessment forms of patients. Pre and post treatment readings were noted. The assessor was a skilled and reputed person of the organization to minimize biasness in results. One assessor noted the pre readings and other took the post treatment readings. Assessor randomly divided the patient in either group A or B by gold fish bowl method and sent the patient for treatment.

All the students, Patients, faculty with sedentary lifestyle and with hamstring shortness were eligible for research fulfilling the inclusion/exclusion criteria. Subjects with age group between 20 to 60 years with sedentary lifestyle were included [9]. both males and females were included. Patients with diagnosed Tight hamstrings having knee extension less than 160° with the hip at 90° flexion [9]. Patients with decreased ROM at the knee joint [10]. Patients with reduced straight leg raise. Patients with pain in posterior compartment of thigh [9]. Asymptomatic patients will be included. Patients with restricted mobility of lower limb due to Hamstring shortness [10]. Symptomatic patients with hamstring tightness like low back pain, pelvic tightness, knee osteoarthritis (grade 1 and 2) are included in the research. Patients with prolapsed disc were excluded [9]. Patients with lower extremity injuries (strain, sprain, ligament injuries, etc.) in the last 6 months were excluded. Patients with severe hamstring injury either acute or chronic were excluded [10]. Patients with visual acute swelling in the region of hamstring muscle. Patient recommended for TKR of knee joint. [10] Patients with any neurological disease like lumbar/cervical herniation, polyneuropathy, scoliosis etc [9].

Muscle Energy Technique Group

Group A included 22 patients fulfilling the inclusion/exclusion criteria and was given muscle energy technique with a baseline treatment of heat pack and Passive range of motion. This intervention was conducted 3 times a week for a duration of 16 weeks. Principles of muscle energy techniques were applied to patient. Each session lasted in 30 to 40 minutes. Exercise was performed in sitting to lying position. Lower limb was targeted area [10].

Consort Flow Diagram

Consort Flow chart showing enrollment, intervention allocation and follow up of the patients (Figure 1).

Proprioceptive Neuromuscular Facilitation Group

Group B included 22 patients fulfilling the inclusion/exclusion criteria and received proprioceptive neuromuscular rehabilitation technique with a baseline treatment of heat pack and passive range of motion. This exercise was conducted 3 times a week for a period of 16 weeks. Principles of PNF included gentle stretching of hamstring and resisting the stretching by contracting the muscle for about 5 seconds. The force of contraction required depended on the condition of muscle of patient. Then at rest of 30 seconds this process was repeated several times on patients. More attention was paid on improving patient pain, flexibility and functional ability of hamstrings so that patients were able to perform the activities of daily life efficiently. Each session lasted in 30 to 40 minutes. Lower limb was the targeted area [11].

Data Collection Procedure

Total 44 students, patients or staff fulfilling the inclusion criteria/exclusion criteria were selected from all the departments of superior university and Chauhdary Muhammad Akram teaching and research hospital. Informed consent forms were taken from the subjects under study. Self- Administered Questionnaire forms with scales and tests interpretations were filled by the assessor of pre and post treatment. Visual analogue scale was used to assess the pain. Active knee extension test was used to check the flexibility of the hamstrings and functional assessment scale was used to check functional ability.

Statistical Procedure

SPSS software version 25 was used for entering and analysis of data. Mean and standard deviations of the outcome measures were calculated. Parametric/nonparametric tests were applied for within the group and across the group comparisons. Data was analyzed at 5 % level of significance. p value less than 0.05 was considered significant. p value greater than 0.05 was not considered significant. Categorical data was presented in the form of frequency(percentage). Independent sample T-test was used to analyze the data in between the groups. After checking the normality repeated ANOVA was used to compare the outcome variables

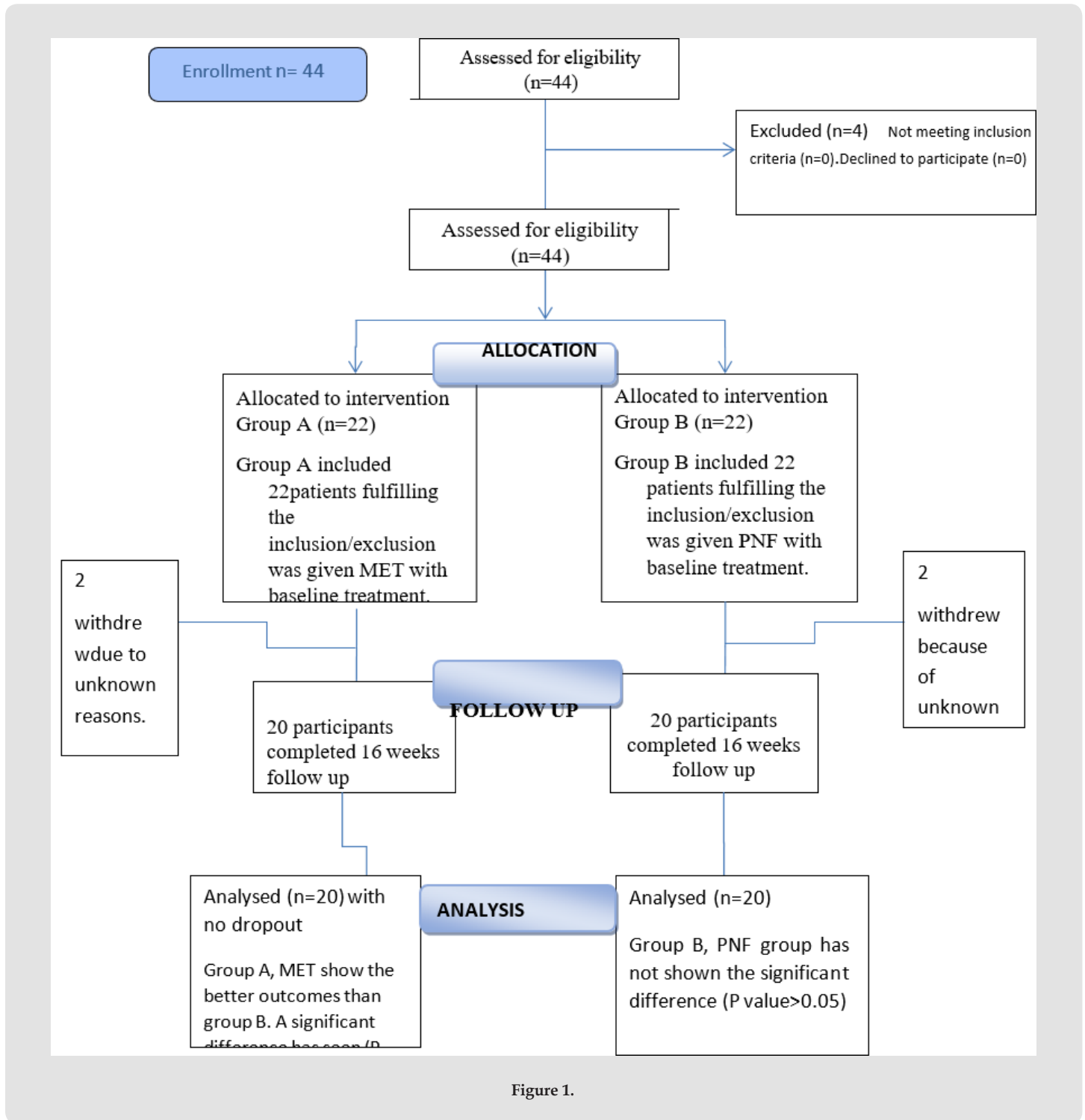


Figure 1.

Results

A total of 44 individuals participated in research. 4 patients dropped out of research study however and didn't take the treatments that are allocated to them in accordance with the investigators. Among the subjects there were 22 males and 22 females. Both males and females were allocated randomly in group A and B. Descriptive statistics shows that mean gender is 1.5, age is 40.5, and height is 5.4, weight 70.4 above normal and BMI is 26.43. It was noteworthy modification regarding the baseline characteristics of individuals between group A and B. In group A of muscle energy technique there

was significant improvement in condition of patient in response to the treatment ($p < 0.05$). Hamstring flexibility is significantly improved in group A. (Table 1): ANOVA test within group comparison shows significance difference in each comparison with p value 0.05. (Table 2). Independent T Test Between group comparison shows significance differences in each comparison with (p value 0.05) in Muscle Energy Technique as compared to Proprioceptive Neuromuscular Facilitation are not significant. Results show that Muscle Energy Technique is way more effective as compared to Proprioceptive Neuromuscular Facilitation for patients having hamstring shortness.

Table 1: Showed the Mean square value and significance value of Anova Test.

ANOVA			
		Mean Square	Sig.
PRE-VAS	Between Groups	.688	.918
	Within Groups	64.724	
	Total		
POST-VAS	Between Groups	6145.455	.000
	Within Groups	179.113	
	Total		
PRE-KKNEE EXTENSION	Between Groups	84.568	.001
	Within Groups	6.534	
	Total		
POST-KNEE EXTENSION	Between Groups	6480.818	.000
	Within Groups	233.807	
	Total		
Pre-Patient Specific Activity Score	Between Groups	1.566	.056
	Within Groups	.405	
	Total		
Post Patient Specific Activity Score	Between Groups	72.090	.000
	Within Groups	1.589	
	Total		

Table 2: Showed the Values of significance, Mean Difference and Standard error Difference.

Independent Samples Test	Sig.	Df	Sig. (2- tailed)	Mean Difference	Std. Error Difference
PRE-VAS	.468	42	.918	-.25000	2.42570
		41.368	.918	-.25000	2.42570
POST-VAS	.078	42	.000	-23.63636	4.03521
		35.673	.000	-23.63636	4.03521
PRE-KKNEE EXTENSION	.410	42	.001	-2.77273	.77069
		41.687	.001	-2.77273	.77069
POST-KNEE EXTENSION	.000	42	.000	24.27273	4.61034
		23.594	.000	24.27273	4.61034
Pre-Patient Specific Activity Score	.676	42	.056	.37727	.19196
		39.282	.056	.37727	.19196
Post Patient Specific Activity Score	.542	42	.000	2.56000	.38009
		38.373	.000	2.56000	.38009

Tests of Normality

After the test of normality parametric tests Repeated Anova, and independent- T tests are used (Table 3).

Table 3.

Tests of Normality						
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
AGE	.103	44	.200*	.936	44	.017
HEIGHT	.118	44	.136	.960	44	.131
WEIGHT	.085	44	.200*	.985	44	.818
BMI	.096	44	.200*	.967	44	.231

Discussion

The aim of this study is to observe the comparison between the effect of muscle energy technique v/s PNF in individuals with hamstring shortness in improving pain, flexibility and functional ability. At the end of the treatment program both individuals treated in PNF group and muscle energy technique group showed improvement in pain and flexibility and their functional mobility is improved in their VAS, PSFS scores. When we applied the between group comparison and analysis was done, Group B showed more significant results than group A, so our recent study shows that muscle energy technique was more effective in treating pain and improving the flexibility in individuals with hamstring shortness. It has been observed that after the weeks of the continuous follow up and plan, individuals who were given muscle energy technique showed a more improved lifestyle, daily routine and physical fitness and their quality of life has been improved. Their pain perception measured by VAS scale is reduced and they showed better hamstring flexibility. Statistical analysis also showed that there was a significant difference between the pretreatment values of two groups. Independent T tests between group comparisons showed significant differences in each comparison with (p value 0.05) in Muscle Energy Technique as compared to Proprioceptive Neuromuscular Facilitation are not significant.

It shows that Muscle Energy Technique is way more effective as compared to Proprioceptive Neuromuscular Facilitation in treating hamstring shortness. This was coherent with the study of H Yadav A. Lehri researched in October 2020, conducted a randomized controlled trial and compared the effect of muscle energy technique with passive stretching on hamstring flexibility to check which technique is more effective and will give efficient results. After weeks of follow up it was concluded that significant increase in hamstring flexibility is noted in both the groups and both groups resulted in considerable increase in hamstring flexibility. However, muscle energy technique was more effective in treating the hamstring flexibility statistically as compared to the passive stretching [12]. In independent T test results

of hamstring flexibility active knee extension test results shows mark increase in flexibility using the proprioceptive neuromuscular rehabilitation as post value in group B (proprioceptive neuromuscular rehabilitation) was -20.01 ± 2.782 and post p value in group B (proprioceptive neuromuscular rehabilitation) was 0.000 ($p < 0.05$) is considered significant.

This result is coherent with the research of Sutantar Singh and Kavita in 2020. In the research the effectiveness of three techniques were done and comparison was made between post isometric relaxation, proprioceptive neuromuscular facilitation and maximum voluntary isometric contraction. The result concluded that all the three techniques showed effect in increasing the hamstring flexibility but maximum volumetric isometric contraction is most effective in treating hamstring flexibility. Proprioceptive neuromuscular facilitation is the second most effective technique in increasing the flexibility of the hamstring muscles. There is significant increase in patient hamstring flexibility using the proprioceptive neuromuscular facilitation and post isometric showed the least results in increase in hamstring flexibility statistically [13].

Within the group results the test showed the mean and standard deviation of VAS scale in pre value was 15.0227 ± 2.88934 and post value within the group comparison was 31.7273 ± 19.47015 . The mean difference between pre and post VAS scale values was calculated as 12.13336 ± 16.58081 . This result is coherent with the study done by Mohammad Reza Moradi on July 27, 2020 studied the effect of muscle energy technique in increasing the extension of knee and increasing the flexibility of posterior muscle of thigh. It was concluded that there is no viscoelastic change in the hamstrings. The application of a session of muscle energy therapy (MET) has been able to significantly improve the range of motion of the knee compared to before treatment and be effective in hamstring muscle flexibility [14]. The mean and standard deviation of pre active knee extension test in group A (muscle energy technique) was 13.6364 ± 2.66450 . The mean and standard deviation post values in group A (muscle energy technique) was 43.8636 ± 20.98366 and post value in group B (proprioceptive neuromuscular rehabilitation) was 19.5909 ± 5.22505 .

This result was in accordance with the research conducted on August 29, 2019, by Nityal Kumar Alagigni and reported that muscle energy technique and the static stretching technique are effective in treating knee osteoarthritis patients with decrease hamstring flexibility. He concluded that both the techniques showed significant difference in treating patients with knee osteoarthritis in the female population. In addition, it is concluded that muscle energy method is way more effective and shows significant increase than static stretching and improves flexibility of the hamstrings in less duration and results are statistically more using the muscle energy technique [15].

The mean difference in pre and post value of group A (muscle energy technique) was -30.2272 ± 18.31916 . The p value between the pre values of group A (muscle energy technique) was 0.01. p value ($p > 0.05$) is considered significant. This result is in accordance with the research done on June 6, 2021, by Rooju Vachhani and Himanshi Sharma conducted on comparison of Muscle energy technique with Sub-occipital muscle inhibition technique in gaining hamstring flexibility. It is concluded that both muscle energy technique and Sub-occipital inhibition technique are effective in treating hamstring tightness, while muscle energy technique is more effective in increasing hamstring flexibility and show more good results statistically [16].

Conclusion

This study revealed that both treatments proprioceptive neuromuscular rehabilitation and muscle energy technique were effective in treating pain, improve hamstring flexibility and improve function of the hamstrings. The Muscle energy technique was more effective in treating the individuals with hamstrings shortness.

Limitation

This research should be conducted on a global level on a large population. Males and females should be kept in equal number to avoid biasness in results because males and females have different musculatures and could have different effect of treatment in improving pain, flexibility and function. Moreover, athletes' population should also be included in further researches.

Ethical Approval Letter and Consent to Participant

All the study protocol was applied to conduct this study in accordance to the relevant guidelines and regulation. Data was collected from the Parkinson's patient fulfilling the inclusion criteria after the informed consent. It has not affected patient's cultural norms, values and ethics. This study was approved by the ethical committee of the superior university and participants in this study has given their proper consent before the start of the study. The Consent form is also available and will provide on request.

Consent of Publication

Consent from all the patients was taken including the study publication.

Availability of Data and Materials

The datasets used and/or analyzed during the current study and available from the corresponding author or reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors Contribution

- Faisal Ghafoor: Conception, data collecting, and writing; revising and holding responsible for all aspects.
- Ramsha Tabassum: Conception, Revised and accountable for all aspects.
- Sikandar rehman: Evaluation and analysis of data, Revised and accountable for all aspects.
- Iram Naz: Data evaluation, revision, and accountability for all aspects.
- Aisha Munawar: Revised and accountable for all aspects.
- Syeda Aqsa Waseem: Data Collection, Spss Analysis and revised.

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