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Original Research Article

Effect of Proprioceptive Neuromuscular Facilitation on Flexibility in Males with Hamstring Tightness

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ABSTRACT

Flexibility is necessary for overall health and physical condition. Reduced flexibility of muscles leads to tightness in the muscles which may be a consequence of low or inadequate level of physical activity or sedentary life style. In present study, a total of 134 male subjects (age 20-24 years) with bilateral hamstring tightness were recruited. The subjects were randomly divided into Group A and Group B. Group A was given proprioceptive neuromuscular facilitation- hold relax (PNF-HR) and Group B (Control group). The outcome measures - straight leg raise-dominant leg side (SLR-D), straight leg raise-non-dominant leg side (SLR-nD), knee extension angle –dominant leg side (KEA-D), straight leg raise- non-dominant leg side (KEA-nD), sit and reach test (SRT) were measured at first day before treatment and fifth day after treatment. The results show significant improvement in group A with p value ≤ 0.05. Whereas, no improvement was found in group B. The findings conclude that PNF-HR is effective in improving flexibility in males with hamstring tightness.

KEYWORDS: Stretching, Hold-relax, Straight leg raise, Knee extension angle, Sit and reach test.

INTRODUCTION

Flexibility is necessary for overall health and physical condition (Marban et al, 2014). Reduced flexibility of muscles leads to tightness in the muscles which may be a consequence of low or inadequate level of physical activity or sedentary life style. Reduction of flexibility limits range of motion (ROM), which causes biochemical changes in musculo-tendinous unit and mechanical factors in underlying skeletal structures (Lekinwala et al, 2015).

The hamstring muscle plays an important role in both sporting activities and daily routine activities likewise in controlled movement of trunk, walking, running, kicking and jumping (Adkitte et al, 2016). Hamstring tightness is found more in males (75%) as compared to females (35%) (Bakhtiari et al, 2014). Tight muscle compresses the blood vessels which increase decline in optimal muscle functioning (Fatima et al, 2017). There are various causes for hamstring tightness, like genetic predisposition, injury to muscle, and adaptive shortening due to some chronic conditions (Fenech et al, 2015).

Different electrotherapy and exercise therapy methods to improve hamstring flexibility which are given to attain a visible change in hamstring tightness. PNF is a positive, integrated approach, developed by Knot and Voss in 1968, is more advanced form of flexibility that involves both stretching and contraction of muscle group being targeted. The main goal of PNF techniques is to improve functional movement through facilitation, inhibition, strengthening and relaxation of muscle groups (Adler et al, 2008). Holds relax (HR)

is one of the ways of facilitating nerve-muscle proprioception and active inhibition which is used for increasing the length of muscles. It involves isometric contraction of shortened muscle against maximum resistance followed by relaxation phase (Adler et al, 2008; Hasani et al, 2014, Harshita et al, 2019). The present study aims to find the effects of proprioceptive neuromuscular facilitation on flexibility in males with hamstring tightness.

MATERIALS AND METHODS

In present study, a total of 134 subjects with bilateral hamstring tightness were recruited. Subjects included in the study were only males, within age range 20-24 years, with knee extension angle ≤160 degree with hip flexion at 90 degree, BMI within range 20 kg/m^2 to 24.9 kg/m^2. The subjects excluded having with hamstring Injury in past year, with verbal report of performing regular lower extremity muscle stretching and exercises, with the history of fracture in any part of body, with history of growth disorders, with history of neurological or orthopedic disorders, with the diagnosis of herniated disk, with low back pain in last 6 months.

The subjects were randomly divided into Group A and Group B. The subjects in both groups were asked to kick a football once, with one leg only. The leg which is preferred by subject was considered his dominant leg and the other leg is considered as non- dominant leg.

Outcome Measures

The data was collected on first day and fifth day in both groups to determine the improvement in hamstring flexibility and back flexibility.

Knee Extension Angle (KEA) – It was used to measure the hamstring flexibility. The subject was positioned in supine lying and asked to flex the hip and knee at 90^0, held in position by a stepper. The non- tested leg was secured to the table by a velcro-strap across the mid-thigh. The subject was asked to maintain the relaxed foot position and extend the knee as far as possible, while keeping posterior thigh area in contact with the stepper. The subject was asked to stop where a first feeling of stretch sensation is felt, in posterior thigh aspect. Two lines were drawn; one line joined the mark just distal to greater trochanter to the mark on femoral condyle, while another line joined the mark just proximal to fibular head to the mark on lateral mallelous. The angle between the two lines measured the knee extension angle. A total of three measurements were recorded and mean angle of extension was calculated for analysis.

Straight Leg Raise (SLR) – It was used to measure the hamstring flexibility. The subject was positioned in supine lying. The subject was asked to lift one leg while the non-tested leg was secured with table by a velcro-strap. The subject was instructed to maintain knee extension while lifting the leg and to stop where there is first feeling of stretch sensation in posterior thigh area. The angle between the horizontal line and line between the mark just distal to greater trochanter and mark just proximal to lateral mallelous is the straight leg raise angle. A total of three measurements was recorded and mean angle of straight leg raise was calculated for analysis.

Sit and Reach Test (SRT) – It was used to measure the hamstring and back flexibility. The subject was positioned in supine lying. The subject was asked to take the shoe off. The sole of foot was kept flat against sit and reach box (flexometer) at 26 cm mark. The subject soles were placed within 2 cm of measuring scale. The subject was asked to slowly reach forward with both hands overlapping each other. The subject was asked to drop the head between the arms and exhale simultaneously, while reaching forward. The knee was remained extended but not pressed down during forward reach. The most distant point reached with the fingertips was recorded as the score of the subject. A total of three measurements will be recorded and mean distance was calculated for analysis.

The subjects within group A was given PNF-HR method. The subject was positioned in supine lying with one lower extremity strapped down with the couch by using velcro- strap which was not to be tested and treated first. The therapist flexes the hip and extends the knee, to give a stretch to hamstring muscle group without allowing any hip rotation. The leg to be a given stretch was on therapist shoulder. The hamstring muscle group was stretched until the subject first felt the mild stretch sensation and this position held for 7 seconds.

The subject was instructed to contract isometrically the hamstring muscle group for 3 seconds by pushing the same leg down towards the table against the resistance that was provided by the therapist. The subject was asked to relax for 5 seconds. Then, the therapist passively stretches the muscle until a mild stretch sensation is reported. The position was held for 7 seconds. This sequence was repeated 5 times, with 20 seconds of interval for 5 consecutive days.

The subjects in group B were in control conditions, i.e they were not provided any treatment.

Data was analyzed using a statistical package for social sciences (SPSS) for windows version 22. Paired t-test was for within group analysis and unpaired t-test was used for between group analysis for outcome measure straight leg raise-dominant leg side (SLR-D), straight leg raise-non-dominant leg side (SLR-nD), knee extension angle –dominant leg side (KEA-D), straight leg raise- non-dominant leg side (KEA-nD), sit and reach test (SRT). Results was considered significant if $p \leq 0.05$.

RESULTS

In results of the study, Table 1 shows the demographic characteristics of subjects with p value > 0.05 which depicts that subjects of group A and group B are similar at basic characteristics. Within group and between groups analysis was summarized in Table 2, Table 3, Table 4, Table 5 and Table 6. The outcome measures SLR-D, SLR-nD, KEA-D, KEA-nD and SRT shows a significant improvement in group A with p value ≤ 0.05.

Table 1 Demographic Characteristics of subjects

Demographic characteristics		GROUP A (PNF-HR)	GROUP B (Control)	F value	p-value
Age (years)		22.51 ±5.056	21.63 ±1.348	1.886	0.154
Body weight (kg)		65.18 ±4.862	64.09 ±5.542	2.316	0.101
Height (cms)		169.57 ±6.479	168.44 ±5.850	0.916	0.402
BMI (kg/m^2)		22.74 ±1.360	22.76 ±1.431	1.971	0.142
Percentage of subjects with Dominant leg (side)	Right	84%	91%	NA	NA
	Left	16%	9%	NA	NA

p value ≤ 0.05 considered as significan

Table 2 Comparison of pre and post treatment score of SLR-D between group A and group B

Values	Group A (PNF-HR)	Group B (Control)
Pre-treatment (degrees)	62.04 ±6.908	60.59 ±4.250
Post-treatment (degrees)	78.58 ±11.031	60.62 ±4.222
T value	15.827	1.425
p value	<0.001*	0.159
Mean Difference ± SD	16.53 ±8.614	0.03 ±0.170
p value	<0.001*	

p value ≤ 0.05 considered as significant

Table 3 Comparison of pre and post treatment score of SLR-nD between group A and group B

Values	Group A (PNF-HR)	Group B (Control)
Pre-treatment (degrees)	61.76 ± 6.615	59.99 ±3.823
Post-treatment (degree)	79.68 ± 7.262	60.01 ± 3.826
T value	23.091	1.425
p value	<0.001*	0.159
Mean Difference ±SD	17.91±6.397	0.03±0.170
p value	<0.001*	

p value ≤ 0.05 considered as significant

Table 4 Comparison of pre and post treatment score of knee KEA-D between group A and group B

Values	Group A (PNF-HR)	Group B (Control)
Pre-treatment (degrees)	139.51 ±6.585	140.32±7.697
Post-treatment (degrees)	156.15 ±6.853	140.35 ±7.674
T value	59.021	1.000
p value	<0.001*	0.321
Mean Difference ±SD	16.63±2.324	0.03±0.243
p value	<0.001*	

p value ≤ 0.05 considered as significant

Table 5 Comparison of pre and post treatment score of KEA-nD between group A and group B

Values	Group A (PNF-HR)	Group B (Control)
Pre-treatment (Degrees)	139.28±6.039	139.94 ±7.557
Post-treatment (Degrees)	155.46 ±6.452	139.71 ±7.884
T value	61.242	0.794
p value	<0.001*	0.430
Mean Difference ±SD	16.18 ±2.178	-0.24±2.444
p value	<0.001*	

p value ≤ 0.05 considered as significant

Table 6 Comparison of within and between group SRT scores between group A and group B

Values	Group A (PNF-HR)	Group B (Control)
Pre-treatment (degrees)	23.18 ±5.733	21.81 ±3.746
Post-treatment (degrees)	39.15 ±5.818	21.85 ±3.734
T value	55.159	1.982
p value	<0.001*	0.058
Mean Difference	15.97 ± 2.388	0.04 ± 0.157
p value	<0.001*	

p value ≤ 0.05 considered as significant

DISCUSSION

The present study aims to evaluate the effect of proprioceptive neuromuscular facilitation technique-hold relax on flexibility in males with hamstring tightness. Within group analysis shows that there was significant difference in pre and post treatment scores in group A with p value ≤0.05, whereas, there was no significant difference was found in pre and post treatment scores in group C with p value ≥0.05 in all outcome measures (SLR-D, SLR-nD, KEA-D, KEA-nD and SRT). Between groups analysis shows that there was significant improvement for SLR-D, SLR-nD, KEA-D, KEA-nD and SRT in group A after giving treatment as compared to group B.

The findings of current study were similar as previous studies. Zakaria et al. (2012) in a study, on males subjects (18- 24 years) with hamstring tightness found that PNF-HR and self stretch are effective treatment methods with PNF-HR being more clinically superior over self stretch in increasing SLR thus, improving hamstring flexibility.

Hasani et al. (2014) in a study which was conducted on males subjects (18 to 25 years) with hamstring tightness found that PNF-HR and static stretching have significant have significant effect in increasing KEA, thus improving hamstring flexibility. Khalili et al. (2014) compared the effects of ultrasound with stretch and PNF-HR in male subjects (18-24 years) with bilateral hamstring tightness. It was found that both ultrasound with stretch and PNF-HR were equally effective in increasing SLR and KEA score thus, improving hamstring flexibility.

Navega et al. (2014) in a study assessed and compared the effects of two stretching in females (18-28 years) and found that both techniques were effective in increasing SRT and KEA score thus, improving hamstring flexibility. Mustaffa et al. (2014) conducted a study to find out more effective stretching method among preadolescence. It was found that PNF stretching was effective treatment compared to static or dynamic stretching, showing increase in SRT and KEA score, thus improving hamstring flexibility and back flexibility.

The PNF increases ROM by voluntary muscle contraction and promoting muscle relaxation before stretching in order to reduce the reflexive components which cause muscle contraction. Hold relax is a type of PNF stretching which make passive elongation of muscles more comfortable (Lim et al 2014). The improvement by PNF-HR may be attributed to fact that autogenic inhibition through activation of group I fibers, there by muscle relaxation of tight muscles, thus increasing ROM (Rani et al 2015).

The present study found significant improvement in group A (PNF-HR) in

increasing SLR and KEA thus, improving hamstring flexibility. Additionally, the results from the present study show no significant difference in group B in SLR, KEA and SRT score. Thus, there is no significant improvement in hamstring flexibility and back flexibility in male subjects with hamstring tightness in group B. Therefore, the study concludes that PNF-HR is effective in improving flexibility in males with hamstring tightness.

Future Suggestions

More experimental study need to be explored to evaluate the effectiveness of PNF-HR on hamstring flexibility and back flexibility in male subjects with hamstring tightness.

Follow up should be taken to see the effectiveness of PNF-HR on hamstring flexibility and back flexibility in male subjects with hamstring tightness.

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