Efficacy of Pnf Stretching Techniques on Hamstring Tightness in Young Male Adult Population

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Abstract: To find out the efficacy of different PNF stretching techniques in improving Hamstring muscle flexibility. Study Design included pre- post test control group design. Participants were 30 male students from King Saud University between the age group of 18 to 24 years having Hamstring tightness and without any musculoskeletal disorders formed the sample of this study. Subject’s age, height and weight were matched. Informed consent was taken from all the subjects. Group I acts as a Control group consisting of 15 subjects who receives Self stretch Group II acts as a Experimental group consisting of 15 subjects who receives Therapist PNF stretch. Outcome Measures included straight leg raising test (SLRT) measured by Universal goniometer.. Results revealed that both the groups performed stretching 5 times a week for 6 weeks. Four repetitions per session with relaxation period of 15 sec and stretch period of 15 sec. Pre test and Post test values of the Control group and Experimental group were statistically analyzed by means of t-test. The Post test values of Experimental and Control group were analyzed by Chi square test ($\chi^2$ test). The Significance level used for this study is $P<0.05$. This study concluded that though statistically there is no significant difference between self stretch and therapist applied PNF stretch, both are effective treatment methods but Therapist applied PNF stretch is clinically more significant over self stretch.

Key words: Flexibility - Stretching - Proprioceptive Neuromuscular Facilitation (PNF) - Hamstring Tightness

INTRODUCTION

In the literature, the terms “flexibility” and “muscle length” are often used synonymously when referring to the ability of muscles to be lengthened to their end range [1]. Flexibility refers to the total range of motion of a joint or group of joints. The structural characteristics of the joints and the mechanical properties of the connective tissues of the muscle tendon structures largely affect the extent of movement around a given joint. The specificity of movement that a person performs in regular physical activities and stretching methods often define the development and improvement of the body’s range of motion.

Stretching techniques are used in clinical practice to increase flexibility with some support for their use [2]. The flexibility of the hamstring muscles is important in the prevention of injury, muscular and postural imbalance and maintenance of full range of joint movement, optimal musculoskeletal function and enhanced performance in day to day activities.

Stretching techniques can be categorized as static, ballistic, slow active and Proprioceptive Neuromuscular Facilitation. Scientific Stretching for Sport (3S) describes a modification of PNF. Numerous investigations establish PNF techniques as more efficacious treatments than traditional static stretching exercise for range of motion or flexibility enhancement. [3,12-14]

The Straight leg raising (SLR) test is of great value in assessing normality of the roots of the sciatic nerve and tightness of the hamstring muscles [4]. The Value of the SLR test can be determined with the goniometer, a gravity type goniometer or a tape measure [4-6].

The goal of all stretching programs is to optimize joint mobility while maintaining joint stability. Concern should always be focused on the systematic, safe and effective application of the range of motion techniques utilized.
MATERIALS AND METHODS

Procedure: Previous history of hip or knee or spine injuries, any contractures or deformities. Neuromuscular, cardiovascular disorders, any subject missing 4 days without stretching, subjects involving in any other physical fitness program were excluded. Prior to assignment to group each subject who met the inclusion criteria in the study was measured for flexibility of the right hamstring muscle. Subjects were randomly assigned to two groups following the initial measurement of hamstring tightness (measured by passive straight leg raise test range between 40° and 70°).

Subjects assigned to Group I [N=15, age =20.3 ± 2.32 range 18 - 24 years] served as control group and performs PNF self-stretching.

Group II (N=15, age = 19.8 ± 2.94, range = 18-24years) served as experimental group and undergone therapist applied PNF stretch.

Both the groups performed stretching 5 times a week for 6 weeks. Four repetitions per session with relaxation period of 15 sec and stretch period of 15 sec.

The subjects wearing unrestricted clothing were asked to lie supine with the right side of the body parallel with the edge of the height adjustable plinth. The trunk and pelvis were placed in the anatomical position determined by visual inspection.

To avoid compensatory movements (4.5 cm) wide straps were positioned across the anterior superior iliac spine and proximal third of the left thigh ensure that the lumbar spine was in contact with the plinth, the subject was required to posterior tilt the pelvis in order to fix a towel placed between T_{12} and L_{4} against the plinth. A standardized explanation and demonstration was given to each subject.

Intervention: Group I was instructed to perform and active straight leg rise applying all three components of motion to the point of tightness in the hamstrings muscles. This included inversion and dorsiflexion of the right foot and toes, raising the right leg by turning the heel towards the opposite shoulder and clasping their hands around the back of the thigh. Thereafter, the subject performed a hold contraction by attempting to push the straight leg down towards the plinth against maximal self induced resistance through the hands for 15 sec while the right heel pointed to the right lower edge of the plinth followed by a 15 sec relaxation period when the knee was allowed to bend. Thereafter, the leg was straightened and the procedure was repeated four times.

Group II received the PNF technique applied by the physiotherapist starting from the agonistic pattern of hip flexion, adduction and external rotation (with knee extension) at the point of tightness in the hamstring muscles. Thereafter, a ‘hold contraction’ was performed when the subject attempted isotonic contraction of the antagonistic pattern; hip extension, abduction and internal rotation which was maximally resisted by the physiotherapist for 15 sec except the rotational component of eversion and planter flexion of foot and toes which was allowed to occur voluntary relaxation period of 15 sec was followed by a resisted contraction of the agonistic pattern moving the leg through the lengthened range to the point where tightness in the hamstring muscles was felt. This procedure was performed four times. Each intervention took 2 minutes consisting of four repetitions of 15 sec contraction and 15 sec relaxation period. This procedure was done 5 days a week for 6 weeks.

Subject Position for Passive SLRT: With subjects lying on their left sides, the greater trochanter of the right femur, lateral femoral condyle were identified and marked with black marker to help ensure proper alignment for goniometric measurements. The goniometer was placed with stationary arm parallel to the edge of the table, the moving arm along the lateral midline of the thigh and the axis over the superior half of the greater trochanter. The investigator slowly raised the extended right leg with the foot relaxed to the point where the subject felt tightness in the hamstring muscles.

Before measuring right hip flexion range, the investigator ensured that the lumbar spine was in contact with the plinth by checking that the towel placed under the subject’s lumbar spine could not be removed.

Pilot Study: Before going for the main study a pilot study was conducted with 10 subjects the purpose was to overcome the practical difficulties in the treatment.

Data Analysis: Data analysis was performed manually Pre test and Post test values of the Control group and Experimental group were statistically analyzed by means of t-test.
Table 1: Comparison of range of motion with in groups

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>Pre test</th>
<th>Post test</th>
<th>S.E</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>60.06±4.98</td>
<td>82.2</td>
<td>1.31</td>
<td>16.90</td>
<td>highly significant</td>
</tr>
<tr>
<td>II</td>
<td>60.90±6.55</td>
<td>87.8</td>
<td>1.75</td>
<td>15.37</td>
<td>highly significant</td>
</tr>
</tbody>
</table>

Table 2: Comparison of range of motion between two groups by using chi square

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre test</th>
<th>Post test</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>60.06±4.98</td>
<td>82.2</td>
<td>0.045</td>
</tr>
<tr>
<td>II</td>
<td>60.90±6.55</td>
<td>87.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>120.96</td>
<td>170</td>
<td></td>
</tr>
</tbody>
</table>

The Post test values of Experimental and Control group were analyzed by Chi square test ($\chi^2$ test). The Significance level used for this study is P<0.05

RESULTS

A total of 30 subjects between 18 - 24 years were included in this study with their mean age group of [20.3 ± 2.32] in Control group and mean age group of [19.8 ± 2.94] in Experimental group.

The study consists of two groups (I and II). Group I consisted of 15 subjects (N=15) who performed PNF self stretch. Group II consisted of 15 subjects (N=15) who were given therapist applied PNF stretch

DISCUSSION

This study is an attempt to find out any significant difference between therapist applied PNF stretch and self stretch groups. The results in this study suggest that there is significant difference in the Pre test and Post test scores of therapist applied PNF stretch and self stretch groups. The post test scores of both stretches did not show a significant difference.

Wallin et al found an increase of 6.2° of hip flexion range after 14 sessions of a contract - relax method. Sady et al found an increase of 9.4° in hip flexion range after 18 sessions of a contract - relax - antagonistic - contract method. In both studies modified PNF-techniques were used. The stretching regimes in this study were only performed once for 2 minutes yet appeared to result in greater changes than the published studies described previously. [1]

Bandy et al who applied static stretching to hamstring muscles found that one stretch session with duration of 30 sec and with a follow up of 5 days a week for 6 weeks is the best intervention method [7-10]. Boone et al suggested an increase of 3 - 4° measured by the same evaluator to determine real change [9]. There the results of this study may be considered to be clinically important as a range increase beyond 3 - 4° was found. However, although the PNF technique applied by the physiotherapist produced a greater mean change in range than the self stretch incorporating the PNF components the difference was not significant

Limitations of Study: The optimal stretch parameters for stretching exercises are not known. The results of existing research on the effect of duration, frequency and repetitions of stretching regimes vary considerably. The variation in the change in range of hip flexion amongst the subjects indicates that the effectiveness of the stretching regimes varied across individuals, which was also found by other investigators. This may have been influenced by the physical activity level or other characteristics of the sample.

It was not possible to quantify the force applied by the physiotherapist although the point of cessation of stretch was governed by the subjects, which was shown to have an acceptable level of error. The generalisability of the study results is limited and the small sample size means that the results should be interpreted with care.

The subjects taken were only males so the generalisability will be limited to only males. The small sample size reduced the statistical power increasing the risk of a type II error. Although an attempt was made to stabilize the pelvis by placing straps across the left thigh and asking the subject to fixate a towel by posterior tilting the pelvis, pelvic movements could not completely be eliminated.

The increase in flexibility of the hamstring muscles should not be extrapolated to other muscle groups as fusiform muscles produce large range than pinnate muscles.

The Universal goniometer used in this study has scope for error; an electronic goniometer would have prevented this aspect of error.

CONCLUSION

Both stretching regimes, which incorporated the facilitator components of PNF-techniques, achieved a significant increase in hip flexion range. As both stretching regimes achieved clinically significant improvement in range so individual or organizational factors can be considered when deciding which stretching regime to use.
The findings of the present study are important to physiotherapists who commonly use stretching regimes and teach them to patients as part of the self management programme.

This study concluded that though statistically there is no significant difference between self stretch and therapist applied PNF stretch both are effective treatment methods but therapist applied PNF stretch is clinically more significant over self stretch.

REFERENCES