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Effect of Suboccipital Muscle Inhibition Technique on Hamstring Tightness in Healthy Adults - An Interventional Study

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ABSTRACT

Background: Hamstring tightness is a major contributing factor for low back pain, lumbar spine disorders and sports related injuries. Suboccipital muscle inhibition technique uses the steady pressure at soft tissues to induce relaxation and normalize reflex activity. Static passive stretching involves taking a limb into its fullest range of motion and holding it by use of external force.

Objective: The aim of the present study is to see the effectiveness of suboccipital muscle inhibition technique on hamstring tightness.

Materials And Method: 52 subjects between the ages of 18 to 25 years were taken for the study. Subjects were randomly divided into 2 groups. Group A received suboccipital muscle inhibition technique and static stretching. Group B received static stretching. Treatment was given for 6 days a week for 2 weeks. Pre intervention outcome measures were taken at the beginning of the 1st session and at the end of 12th session post intervention outcome measures taken.

Results: In the present study, marked improvement in the outcome measures (active knee extension and sit and reach test) were noted in both the groups, but in comparison intervention group showed more improvement in sit and reach test outcome than control group. This proves the efficacy of the treatment of suboccipital muscle inhibition technique in increasing the length of hamstring muscle in healthy adults.

Conclusion: Suboccipital muscle inhibition technique is effective in improving flexibility of hamstring muscle.

Keywords: Hamstring tightness, static stretching, suboccipital muscle inhibition technique

INTRODUCTION

Hamstring is one of the commonest muscles that often get tight. Hamstring tightness is a major contributing factor for low back pain, lumbar spine disorders and sports related injuries. [(1)] Incidence of hamstring tightness is higher in males than females. Hamstring tightness increases from childhood to 40-49 years. [(2)] Tight hamstring can have profound effect on seated postural alignment of body. [(3)(4)] Tight hamstring increases the patellofemoral compressive force because of the increased passive resistance during swing phase of gait and running. [(5)] Inadequate hamstring extensibility leads to number of problems, so treatment should be focused to reduce tightness. Increased flexibility is one of the basic concern addressed in the day-to-day practice of physical therapy. [(6)] Suboccipital muscle inhibition technique is a method of relaxing the fascia by applying soft pressure to suboccipital area. [(7)] Flexibility is the ability of a muscle to lengthen and allows one joint (or more than one joint in a series) to move through a range of motion. [(8)] The most common stretching types used prior to exercise are static and dynamic. Static stretching methods are classified as active and passive and are used to develop static flexibility. Static passive stretching involves

taking a limb into its fullest range of motion and holding it by use of external force. [9][10]

The importance of suboccipital muscle inhibition technique for cases of upper cervical spine treatment is well accepted but its relationship with other structures has not been identified. It is important to study the treatment and influence on local region where treatment is taking place and also globally in distant region. [1]

MATERIALS AND METHOD

It was an interventional study conducted at physiotherapy college, Ahmedabad. The total study duration was 1 year, each patient treated for period of 6 days a week for 2 weeks. (12 sessions).

Sample size has been decided by the following formula:

$N = 2SD^2(Z\alpha_{/2}+Z_\beta)^2/d^2$ [11][12]

Where Post SD

D = critical difference

$Z_{\alpha/2}$ = level of significance, at 95% confidence interval the value is 1.96

Z_β = power of study, at 95% power the value is 1.64

The patients were divided into two groups by simple random sampling technique.

Group A: (Interventional group): 26 subjects

Group B: (Control group): 26 subjects

Ethical approval: ethical approval was obtained by institutional ethical committee.

INCLUSION CRITERIA

1. Willingness of subjects
2. Both male and female subjects were included
3. Age group between 18-25 years
4. Active knee extension should be more than 20°

EXCLUSION CRITERIA

1. Person having history of any traumatic, non-traumatic or neurological conditions
2. Person having giddiness

WITHDRAWL CRITERIA

1. Person is not willing to continue treatment further
2. Due to any social or economic problem subject cannot be able to take treatment

MATERIALS USED IN THE STUDY

Assessment form, consent form, pen, pencil, paper, goniometer, sit and reach box, plinth, chair, stop watch, 90-90 Stabilizer

Figure 1: Materials used in study

OUTCOME MEASURES

1. Active knee extension test (AKET) [13][14]

For checking flexibility of hamstring muscle active knee extension test was done.

The goniometer measured the angle of knee extension in degree giving an indication of hamstring muscle length.

The reliability coefficients for test and retest measurements were 0.99 for the left extremity and 0.99 for the right extremity. [13]

The interrater reliability intraclass correlation coefficients were 0.87 for the dominant knee and 0.81 for the non-dominant knee. In addition, the intrarater (test-retest) reliability values range between

0.78–0.97 and 0.75–0.84 for raters 1 and 2 respectively.[14]

2. Sit and reach test[15][16]

The subjects sat with their feet approximately hip wide against the testing box. They kept their knees extended and placed the right hand over the left and slowly reached forward as far as they could by sliding their hands along the measuring board. Three trials were performed by the subjects, the averages of the trials were taken as measurement.

There was no difference in concurrent validity between the two tests. However, the traditional SR was preferred because it reached better concurrent validity than the BS.

PROCEDURE

Ethical clearance was obtained from the institutional ethical committee prior to the study. 80 subjects were screened for the eligibility. Form that 52 subjects fulfilled the inclusion and exclusion criteria, were included in the study.

The purpose and nature of the study was thoroughly explained to the subjects. Subjects were verbally described the procedure to be undertaken in the study. Written informed consent was obtained from all the subjects. Subjects were allocated randomly into two groups viz Group A and Group B. On the first visit, a complete assessment was done which include descriptive data for age, sex, presence of any medical, neurological or traumatic condition. PAR-Q (patient activity readiness – questionnaire) was taken which is a simple self-screening tool that can and should be used by anyone who is planning to start an exercise program. Subject who filled the questionnaire and the answer was no for all the questions were the subjects for the study. Range of motion (ROM) and flexibility were checked using valid instruments. The outcome measures were taken before giving the treatment. Active knee extension and sit and reach test were the outcome measures. The following treatment was given to the groups:

1) GROUP A (INTERVENTION GROUP) : received suboccipital muscle inhibition technique along with static stretching of hamstring 3 repetitions with 30 seconds hold for 6 days a week for 2 weeks.

SUBOCCIPITAL MUSCLE INHIBITION TECHNIQUE [1] :

Figure 2: Suboccipital muscle inhibition technique

With the patient supine, therapist sat at the head end of the table and places the palms of hands under the subject's head, pads of the therapist's fingers on the projection of the posterior arch of the atlas which is palpated between the external occipital protuberance and spinous process of axis vertebra. The therapist locates with the middle and ring fingers of both the hands the space between the occipital condyles and the spinous process of the C2 vertebra. Then with the metacarpophalangeal joints in 90º flexion, therapist rests the base of the skull on hands. Pressure was exerted upward and toward the therapist. The pressure was maintained for 2 minutes until tissue relaxation had been achieved. During the SMI technique, the subject is asked to keep his eyes closed to avoid eye movements affecting the suboccipital muscle tone. The treatment was given for 6 days a week for two weeks.

Group A also received static stretching of hamstring 3 repetitions with 30 seconds hold.

After 2 weeks outcome measures were taken. [17]

2) GROUP B (CONTROL GROUP) : received static stretching of hamstring 3 repetitions with 30 seconds hold. [(17)]

Figure 3: Stretching of hamstring muscle

STATISTICAL ANALYSIS

Data of total 52 Subjects were analysed using SPSS version 16.

1) Active knee extension test
2) Sit and reach test

Data were analysed at baseline and after 2 weeks of treatment. Confidence interval was kept at 95% and level of significance was kept at 0.05.

Kolmogorov- Smirnov and Shapiro-Wilk test were applied to check whether the data follows normal distribution or not.

Baseline data was calculated by using Mann-Whitney test for Age, Sex, PreAKErt and unpaired t-test was used for PreAKElt and PreSR

RESULTS

Total 52 subjects were included in the study; conventional treatment hamstring muscle static stretching was given to the 26 subjects and suboccipital muscle inhibition technique along with hamstring muscle static stretching was given to the 26 subjects.

Data analysis was performed on the following outcome measures:

Table 1 shows the Demographic characteristics of the both groups.

Variable	Group A	Group B	U value	Z value	t- value	p value
Age	21.23±1.39	21.19±1.29	337.50	-0.009	-	0.992
Sex	1.58±0.50	1.69±0.47	299.00	-0.856	-	0.392

p value for Age and Gender are more than 0.05, so null hypothesis is accepted, which suggests that there was no significant difference in variables between two groups at baseline

WITHIN GROUP ANALYSIS

GROUP A

In interventional group analysis of pre and post Active knee extension right side and active knee extension left side was done by using paired t-test because the data was normally distributed.

Analysis of pre and post sit and reach test was done by using Wilcoxon sign ranked test, because the data was not normally distributed.

There was significant difference ($p<0.05$) between pre and post treatment AKE (RT), AKE (LT) and sit and reach test score.

Table 2: Pre and post means of AKE(RT) and AKE(LT) within group A

variable	Pre-Mean ± sd	Post Mean ± sd	t-value	P value(<0.05 =significant)
AKE(RT)	55.38±5.17	27.73±6.83	29.278	0.000
AKE(LT)	55.08±5.38	24.42±7.51	27.668	0.000

Table 3 Pre and post means of SRT Within group A

Variable	Pre-Mean ± sd	Post Mean ± sd	Z-value	P value(<0.05 =significant)
SRT	24.69±4.59	35.04±4.36	-4.466	0.000

GROUP B:

In control group analysis of pre and post Active knee extension right side and active knee extension left and sit and reach test side was done by using paired t-test because the data was normally distributed.

There was significant difference ($p<0.05$) between pre and post treatment AKE (RT), AKE (LT) and sit and reach test score.

Table 4: Pre and post means of AKE(RT), AKE(LT) and Sit and reach test within group B

Variable	Pre-Mean ± sd	Post Mean ± sd	t- value	Significance p value (<0.05 =significant)
AKE(RT)	52.08±6.22	26.46±9.10	20.230	0.000
AKE(LT)	50.77±6.97	23.04±9.96	16.122	0.000
SRT	28.35±6.57	35.81±6.11	-11.124	0.000

BETWEEN GROUP ANALYSIS

- Between group analysis of the difference in Active Knee Extension right side, left side in both the groups was done of 52 subjects and total of 104 data of bilateral legs using unpaired t-test. Analysis showed no significance difference between the differences in Active Knee Extension right side and Active Knee Extension left side.

Table 5 : Pre-post mean difference of AKE(RT), AKE(LT) AND SRT between group A and group B

Variable	Group A	Group B	U value	t value	p value
AKE(RT)	27.65±4.81	25.62±6.45	-	1.290	0.203
AKE(LT)	30.65±5.64	27.73±8.77	-	-1.393	0.160
SRT	10.35±3.23	7.58±3.48	190.00	-	0.006

DISCUSSION

Lack of Flexibility is known as a predisposing factor to muscle injury, especially with regard to the hamstring muscle. These injuries can be avoided by maintaining adequate flexibility and strength. Very often static stretching is incorporated in to the flexibility programs but use of suboccipital muscle inhibition technique for increasing flexibility has been still a novice perceptive.

Present study was conducted to see the effect of suboccipital muscle inhibition technique to improve hamstring flexibility in healthy adults. An interventional study was conducted on 52 healthy adults. Subjects were divided in 2 groups. Group A (Suboccipital muscle inhibition technique + static stretching) and Group B (static stretching). AKE (Active Knee Extension) and Sit and reach test were used to measure flexibility of hamstring muscle. There was no significant difference in age and gender among two groups.

A statistically significant improvement was noted in pre and post treatment Active Knee Extension and Sit and Reach test in Group A (Intervention group) as well as in Group B (control group) ($p<0.05$) and a statistically significant difference was also noted between the groups for Sit and Reach ($p<0.05$). A statistically significant difference was not noted in both the groups for Active Knee Extension ($p>0.05$).

The present study shows that Suboccipital muscle inhibition technique and static stretching both improves hamstring flexibility. Suboccipital muscle inhibition technique and static stretching both improved Active Knee extension and Sit and Reach test. Suboccipital muscle

inhibition technique with static stretching showed more significant improvement in Sit and Reach test outcome measure compared to static stretching alone, but no significant improvement was noted in Active Knee Extension compared to static stretching only.

Static stretching improved hamstring flexibility in both the outcome measures (AKE and Sit and Reach test). Mechanism of this improvement can be explained in terms of neural and mechanical properties of muscle fiber. Effect of stretching on GTO is assumed that during passive stretching, GTO monitors tension created by stretch of a muscle-tendon unit which may contribute to muscle fiber elongation by over-riding any facilitative impulses from the primary afferents of muscle spindle (Ia afferent fibers) and may contribute to muscle relaxation by inhibiting tension in the contractile units of the muscle being stretched. Static Stretching may be effective in increasing the length of the muscle due to the prolonged stretching, which may allow muscle spindle to adapt over time and cease firing. This adaptation of the muscle spindle results in increased length of the muscle. [18]

Volkert C. De Weijer et al.(2003) [17] studied effect of static stretch and warm up exercise on hamstring length over the course of 24 hours. Static stretching consisted of a single session of three 30 second passive stretches of the hamstring. The study concluded that a single session of 3 repeated 30 second passive stretches is adequate in young healthy subjects to improve hamstring flexibility for at least 24 hours.

Davis D. et al(2005) [19] studied the effectiveness of 3 stretching techniques on hamstring flexibility using consistent stretching parameters and found that static stretching when given 1 repetition for 30 seconds 3 days per week increases hamstring length in young healthy subjects.

Suboccipital muscle inhibition technique improved hamstring flexibility significantly for which the underlying cause can be explained in terms of various mechanisms. When the tone of suboccipital muscles falls, the tone of hamstrings also decreases due to relaxation of the myofascia. This is because the hamstrings and suboccipital muscles are connected by one neural system, which passes through the dura mater which is called the superficial back line.

According to Schleip, If the tone of the suboccipital muscles is decreased either passively, with a fascial treatment or with active movements, the length of the hamstring would be greater due to relaxation of the myofascia. This can be associated with the hamstrings and suboccipital muscles being part of a continuous link of the neural system which passes through the dura mater. [20]

In SMI, the Superficial back line was relaxed through relaxation of the suboccipital muscles. The suboccipital muscles are the 'Proprioceptor Monitors' that contribute significantly to regulation of head posture and they have the most muscle spindles in the human body. The rectus capitis posterior minor muscle has composition of 32 muscle spindles per gram and contributes to regulation of posture and the degree of tension. [21]

Pratap Jagtap did a study on "Effect of suboccipital muscle inhibition technique on hamstring tightness patients". 52 healthy adults having hamstring tightness were taken. SMI technique was given for 5 minutes for 5 consecutive days. AKE and Forward flexion distance test were the outcome measures. The study concluded that Suboccipital muscle inhibition technique is effective in improving hamstring tightness.

Sung Hak did a study on "The comparison of the immediate effect of application pf the suboccipital muscle inhibition and self-myofascial release techniques in the Suboccipital region on short hamstring". 50 persons with short hamstring were taken. Straight leg raise, finger floor distance test, popliteal angle were the outcome measures .SMI treatment was given for 2 minutes to 1 group, whereas SMFR was given for 5 minutes to other

group. The study concluded that the SMI technique is more effective in improving the hamstring flexibility.

In group A there was no additional significant improvement in AKE as compared to group B. Various confounding factors may be responsible for that. In male prevalence of hamstring tightness is more compared to female. Hence, gender can influence the result.

Chellapillai et al. (2019) [(22)] did a study on Predisposing factors for hamstring tightness among university students. The study concluded that extended sitting and hamstring tightness has the association.

Null hypothesis is accepted ($H_0$1) and Alternate hypothesis is rejected ($H_1$1).

CONCLUSION

From the present study it can be concluded that suboccipital muscle inhibition technique has statistically improved the hamstring flexibility in subjects with hamstring tightness.

CLINICAL IMPLICATION

Suboccipital muscle inhibition technique along with static stretching can be used to improve the hamstring flexibility.

FUTURE SCOPE

- The study can be done for different age group, with different duration of SMI technique application.
- Further study can be done with using different outcome measures for hamstring flexibility to see the effect of SMI technique on them.

Ethical approval: The B.J Medical College, Civil, Hospital, Ahmedabad Ethics Committee(s) approved this study. All participants gave written informed consent before data collection began.

Competing interests: No

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