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THE EFFECT OF SUBOCCIPITAL MUSCLE INHIBITION TECHNIQUE ON HAMSTRING TIGHTNESS PATIENTS

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ABSTRACT: BACKGROUND: Hamstring tightness is a major contributing factor for lower back pain, lumbar spine disorders and sports related injuries. Sub-occipital muscle inhibition technique describes the steady pressure to soft tissues to effect relaxation and normalize reflex activity. **OBJECTIVE:** Our aim in this present study is to find out the effectiveness of sub-occipital muscle inhibition technique for improving tightness in hamstring muscle. **MATERIALS AND METHODS:** Fifty subjects between the ages of 18 and 25 years were enrolled in the study. All 50 subjects were included to determine height, weight, BMI (body mass index) and outcome measures noted at the beginning of the treatment session i.e (pre-intervention), immediately after treatment (post-intervention) and at the end of 5th session. **RESULTS:** In the present study, marked improvement in the outcome measures i.e. Active knee extension (AKE) and Forward flexion distance test (FFD) were found in sub-occipital muscle inhibition technique. This proves the efficacy of treatment of sub-occipital muscle inhibition technique in increasing the length of hamstring muscles in normal healthy individuals. **CONCLUSION:** Sub-occipital muscle inhibition technique is effective in improving the flexibility of hamstring muscle.

KEYWORDS: hamstring tightness, sub-occipital muscle inhibition technique, lower back pain, hamstring flexibility.

INTRODUCTION: Hamstring is one of the commonest muscles that often get tight.¹ Hamstring tightness increases apparently from childhood up to age 40-49 years and its incidence is higher in males than females.² Tight hamstrings can have profound effect on seated postural alignment of body and number of studies showed positive correlation between decreased hamstrings flexibility and low back pain of lumbar intervertebral disc pathology.^{3,4} Tight hamstring muscles increases the patello-femoral compressive force because of the increased passive resistance during the swing phase of ambulation and running.⁵ In addition hamstring cross over two joints when tight muscle fails to pass through full physiological amplitude under rapid and stressful situations. This results in varying degree of muscle damage and ultimately various hamstring injuries.⁶

Various treatment techniques are available to treat hamstring tightness such as muscle energy technique, position release technique, myofascial release techniques and different stretching techniques. The importance of sub-occipital muscle inhibition technique for cases of upper cervical spine treatment is well accepted but its relationship with other structures has not yet been identified. Erika Quintana Aparicio et al, studied the effectiveness of the sub-occipital muscle inhibition technique for treating hamstring tightness.⁷ The study suggested the possible hypothesis that hamstring muscle act as postural control of sub-occipital muscles. Connection of sub-occipital muscles with duramater and presence of myofascial chains that links the connective tissue fascia and muscles along specific lines in the body. It is important to study the treatment and influence on local region where treatment is taking place and also globally in distant region.

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Role of sub-occipital muscles in postural control is proved by study done by Robert Scleip in 1996.⁸ Hence the aim of present study is to find out the efficacy of sub-occipital muscle inhibition technique in improving flexibility of tight hamstring muscles.

MATERIAL AND METHODS:

PARTICIPANTS FLOW: The study was approved by Institutional Ethical Committee of MGM Institute of Physiotherapy, Aurangabad, Maharashtra. Detailed and signed informed consent was obtained from the subjects in the presence of witness, after oral reading of the protocol in verbatim and explaining it in the subject's own language. Total 80 individuals were screened for tightness of hamstring. Out of those 18 were excluded who were not satisfying the inclusion criteria, 8 individuals were not willing to participate in study and 4 individuals were discontinued during the study. Individuals who satisfied the inclusion criteria were selected from the normal healthy population. A total of 50 healthy subjects of both genders between the age of 18 and 25 years were recruited in this study. Any possible bias of gender and activity level was minimized by taking subjects from different sources i.e. MGM Institute of Physiotherapy, Mother Teresa Collage of Bsc Nursing and Institute of Nursing Education Aurangabad, Maharashtra.

INCLUSION CRITERIA:

1. Normal healthy individuals with Active knee extension (Popliteal angle) $<125^\circ$.
2. Both genders within the age group of 18-26 years, with hamstring tightness.

EXCLUSION CRITERIA:

1. Individuals with neck pain.
2. Individuals with history of neck trauma [whiplash injury].
3. Individuals with herniated disc, lumbar protrusion.
4. Individuals with low back pain.
5. Individuals with fracture of lower limb.
6. Individuals with cervical ligament instability.
7. Individuals with vertebra basilar artery syndrome.

Only if the subjects were found to have positive Active knee extension (Popliteal angle) test, then all inclusion and exclusion criteria were checked. The subjects were told about all the interventions and procedure in detail to be followed in the study and thereafter consent was obtained. Throughout the treatment procedure the patient was instructed to inform about the pain and other discomfort.

HEIGHT MEASUREMENT: Measurement was done standing up against wall surface and measuring height with a measuring tape and recording the reading.

BODY WEIGHT MEASUREMENT: Body weight was measured using a portable weighing scale. Each subject mounted the scale barefooted with minimal clothing, looking straight ahead. Weight was recorded to the nearest kilograms. The accuracy of the scale was checked using a known metal weight after every 10 measurements. The scale was also checked and corrected for zero before each measurement.

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BMI CALCULATION: Body mass index (BMI) was calculated by dividing the subject's weight by the square of his or her height: $\text{BMI (kg/m}^2\text{)} = \text{Weight (kg)} / \text{height}^2 \text{ (m)}$.

The participants were taken to other room for the treatment purpose by other therapist. Again after these, participants were send to the other room for post treatment assessment of outcome measures by the same observer.

OUTCOME MEASURES: Outcome measures were noted at the beginning of the treatment session i.e. (pre-intervention), immediately after treatment (post-intervention) and at the end of 5th session.

1. Active knee extension (Popliteal angle): AKE test.

Active knee extension (Popliteal angle) test has been demonstrated to be a reliable and accurate when using with hand held goniometer. Active knee extension (Popliteal angle) has advantage of being relatively simple to use particularly in clinical setting and is good measure of physiological range of motion.⁹

Fig. 1: Active knee extension (Popliteal angle) test

2. Forward flexion distance test: FFD test.

The subject is standing on the box, now ask the subject to perform a maximum and progressive anterior flexion of the trunk, maintaining the knees straight and lengthening the arms with the palms parallel and the fingers extended. The measuring tape is used to determine the distance from the distal part of the fingers to the top of the box.¹⁰

Fig. 2: Forward flexion distance test

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Treatment technique: Sub-occipital Muscle Inhibition (SMI): With the patient supine, the therapist sat at the head of the table and places the palms of hands under the subject's head, pads of 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 hands the space between the occipital condyles and the spinal process of the second cervical vertebra. Then, with the metacarpophalangeal joints in 90° 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 sub-occipital muscle tone.¹¹ The treatment was continued for 5 consecutive days and at the end of 5th session post treatment assessment was done with Active knee extension (Popliteal angle) test and forward flexion distance test.

Fig. 3: Sub-occipital muscle inhibition technique

STATISTICAL ANALYSIS: Wilcoxon's Signed Rank Test within a group was made by Mann-Whitney U- Test. (Non-parametric tests were used due to presumed non-normality of the measurements within individual cases). For all the tests a p-value of 0.01 or less was considered for statistical significance.

RESULTS:

Sex		No. of Patients	Percentage (%)
	Male	20	40
	Female	30	60
	Total	50	100
Age (years)	22.3 ± 2.5 (Mean± standard deviation)		
BMI (Kg/m ²)	25.11 ± 3.01 (Mean± standard deviation)		

Table 1: Distribution of patients according to gender, age and BMI

Table 1 depicts out of 50 patients, 20 patients were males (40%) and 30 were females (60%). The mean age of patients was 22.3±2.5 years and mean BMI was 25.11±3.01 kg/m².

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Fig. 4: AKE on Right side in pre-treatment, post-treatment and after 5th session

In the Table 2, statistical analysis showed a significant difference ($p < 0.01$) in baseline parameters in AKE of Right side and immediate after treatment and also after 5th session.

AKE test	Z-value	Difference	p-value
Pre-treatment Vs post-treatment	5.017	4.2	0.0000 SS
Post-treatment Vs After 5 session	5.46	5.02	0.0000 SS
Pre-treatment Vs After 5 Session	6.1	9.22	0.0000 SS

Table 2: AKE on Right side in pre-treatment, post-treatment and after 5th Session

SS: statistically significant ($p < 0.01$).

Fig. 5: AKE on Left side in pre-treatment, post-treatment and after 5th session

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The statistical analysis showed a significant difference ($p < 0.01$) in baseline parameters in AKE of left side and immediate post-treatment and also after 5th session.

AKE test	Z-value	Difference	p-value
Pre-treatment Vs post-treatment	6.12	2.96	0.0000 SS
Post-treatment Vs After 5 th session	5.98	3.86	0.0000 SS
Pre-treatment Vs After 5 th Session	6.107	6.08	0.0000 SS

Table 3: AKE on Left side in pre-treatment, post-treatment and after 5th Session

SS: statistically significant ($p < 0.01$).

Fig. 6: FFD in pre-treatment, post-treatment and after 5 session

The statistical analysis showed a significant difference ($p < 0.01$) in baseline parameters in FFD test and immediately after treatment and also after 5th session.

FFD test	Z-value	Difference	p-value
Pre-treatment Vs post-treatment	6.16	3.56	0.0000 SS
Post-treatment Vs After 5 th session	6.1	3.27	0.0000 SS
Pre-treatment Vs After 5 th Session	6.16	6.75	0.0000 SS

Table 4: Statistical analysis of FFD test

SS: statistically significant ($p < 0.01$).

DISCUSSION: In the present study, 80 individuals with hamstring tightness were screened and 50 individuals with mean age of 22.3 ± 2.05 (60% female and 40% male) were selected. The subjects were matched on the basis of age, height and BMI representing matched subject design. The results

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obtained showed a marked improvement in Active knee extension test (AKE) on both right and left side, immediately after the treatment technique and after 5th session of treatment. In our study, a significant improvement was achieved in outcome measures with the treatment of sub-occipital muscle inhibition technique. Forward flexion distance test (FFD) showed the improvement of 6.75 cm. These findings showed that the interventions localized at a distance from the musculature i.e. treating the sub-occipital muscles for increasing the hamstring length was found to be effective. This is of special importance in this treatment approach for hamstring tightness.

Treating the hamstring in patients with acute lower back pain for increasing hamstring length such as local site stretching techniques may cause aggravation of the local inflammatory response and may cause further muscle spasm and guarding. Pollard and Ward (1997)¹² suggested a different approach i.e. cervical spine treatment that might avoid compressing or stretching irritable structures but still produce an increase in hip flexion range of motion and hamstring extensibility. Pollard and Ward reported change in the extensibility of hamstring muscle following application of cervical isometrics contract relax technique. They found significant increase in remote hip flexion range of motion. They also reported that this finding seems to be only short term in duration and did not report how long altered extensibility remained. This uncertainty about duration of this reported effect leads to difficulties in assessing this approach for therapeutic merit. Pollard and Ward studies find out the remoteness of the site of treatment to the region of effect but there was lack of explanation for this effect.

The present study along with these studies suggested new approach to the treatment of impaired hamstring extensibility and encouraged further investigation of remote effect of cervical treatment favoring the authors who concluded that manual therapy of neck may have a role to play in treatment of extra spinal lower limb musculoskeletal conditions. Schleip (1997)¹³ et al also performed proprioceptive neuromuscular facilitation techniques on the sub-occipital muscles and on the hamstring muscles, measuring the elasticity of the latter with the SLR test. The present study is supported by study done by Schleip¹³ whose findings revealed an increase in hamstring elasticity by 9%. Glen noted the presence of Myodural Bridge connecting rectus capitis posterior minor muscles to the duramater.¹⁴

CONCLUSION: This study implies that sub-occipital muscle inhibition technique can be used to treat hamstring tightness in lower back pain patients in order to avoid aggravation of pain caused by stretching of hamstring muscle. The athletes with hamstring strain may benefit from sub-occipital muscle inhibition technique. Very limited studies are done to prove this distance muscle relationship. So future studies are needed in order to find out long term effect of sub-occipital muscle inhibition technique and justify the exact cause of effect of sub-occipital muscle inhibition technique on hamstring muscle tightness.

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