ORIGINAL ARTICLE

Immediate effect of suboccipital muscle stretching on hamstring flexibility among young adults

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Abstract:

Suboccipital muscle inhibition technique (SMI) and suboccipital static stretching (SS) is an indirect approach to possess immediate effect on flexibility of the hamstring but less practice compared to direct stretching. This study aimed to investigate the immediate effect of SMI compared to SS on hamstring flexibility among adults without backache. A quasi-experimental study of fifty-four university healthy students with hamstring tightness, measured by popliteal Angle Test (PAT) >15° and without back pain. The students were randomly divided into intervention group (n = 24) received 5 minutes of SMI and control group (n = 24) performed self SS. The hamstring flexibility was measured by Finger to Floor distance test (FFD) and PAT pre- and immediately post-treatment. The results showed no significant ($p > 0.01$) different in hamstrings flexibility pre and post treatment. The SMI group showed ($p < 0.01$) improved in FFD by 3.41 cm for right leg and 3.26 cm for left leg compared to control group ($p < 0.05$) with 2.62 cm for right leg and 2.74 cm for left leg. In PAT measurement, SS scored higher changes in left leg (6.11 cm). Both SMI and SS may improve hamstring flexibility in healthy young adults.

Keywords: Hamstring tightness, low back pain, suboccipital muscle inhibition technique, suboccipital static stretching

1. INTRODUCTION

Flexibility of muscle is a crucial component for most optimal musculoskeletal functioning and physical performance in healthy adults [1]. Reduce in hamstring flexibility may predispose to low back pain LBP in young population [2]. High prevalence of hamstring tightness is ranging from 62% to 82% among young adults [3,4,5]. Hamstring tightness is claimed can be developed in early age and it prone to worsen with age. The progressive muscle tightness with age has been attributed to change in flexibility and reduced level of physical activities [6]. In addition, hamstring tightness elevate risk of lower limb injury and patellofemoral pain [7].

Prolonged hour of sitting is partly contributed to hamstring tightness [3]. Sedentary lifestyle may affect the elasticity of the hamstring resulting in reduce of lumbar lordosis [8] and alteration of biomechanics of spine [9]. Alteration in the rhythm of lumbar-pelvic has increase lumbar kyphosis, affect lumbar and thoracic flexion, induced low back pain [10]. Thus, a good posture with spinopelvic alignment is important for maintaining an energy-efficient posture in daily task [11].

Although heat therapy improved hamstring tightness, argument of superficial effect on the fatty layer rather than muscle fibers of hamstrings was reported [12]. Dynamic stretching is widely practice among athletes, however, several studies favour static stretching compared to dynamic stretching in reducing hamstring tightness [13,14]. A two weeks of high intensity stretch program showed a positive results of hamstring flexibility although some argument on the improvements effect in hamstring elasticity [15]. In a review by Page [16] concluded that three to six weeks of hamstring flexibility training program using static stretching have effectively increased hamstring flexibility.

Despite, a remote intervention such as suboccipital muscle inhibition (SMI) was employed to modulate myofascial chain "superficial back line" on the hamstring elongation [8]. Studies reported few minutes of SMI abled to relax the fascia resulting in lengthening on hamstrings Also, SMI release of β-endorphins, which decrease the perception of pain [17]. In Korea, a study among fifty university students with hamstring tightness employed SMI technique and the result was observed more effective than myofascial release in improved flexibility of hamstring [8]. The authors explained that SMI offers more traction compared to self-MFR technique. SMI is a cost effective practically as immediate effect, less time consuming as well as beneficial to those with tight myofascial. Thus, this study aimed to examine the immediate effect of remote treatment SMI and static suboccipital stretching on hamstring flexibility on hamstring flexibility in young adult.

2. METHODOLOGY

A quasi-experimental study of fifty- four physiotherapy students aged 18 to 25 years old who have hamstring tightness measured by popliteal angle test (PAT) with cut-off point 15 degree [18] was recruited from UiTM Puncak Alam Campus. Students would be excluded if they have any co-morbidity of back pain such as neuropathic pain and spinal stenosis; history of hamstring injury within last 2 years; history of low back pain in last 2 months; history of fracture of lower limb; medication such as muscle relaxant.

After granted the ethic approval from Ethic committee UiTM (600-IRMI(5/1/6REC/497/18). The eligible students were explained the purpose and procedure of the study and consented to the study. A list of conservative numbers (from 1 to 54) generated before recruitment, and each of these numbers was assigned randomly to one of two groups (intervention group and control group) using a computer program (www.random.org). After signed the consent form, the participants randomly picked one enveloped containing the group allocation. One assessor was blinded from the allocation of the participants was performed the measurement flexibility of the hamstring with Finger-to-Floor Distance Test (FFD) and PAT pre and immediately post-intervention.

Suboccipital Muscle Inhibition technique (SMI)

SMI was performed by musculoskeletal trained physiotherapist. Participants is required to lie on back with his or her eyes closed. The therapist placed her hand below the participant's occiput and apply pressure to the area below the atlas (SMI)[8]. The pressure is sustained for 5 minutes, in an upward direction toward the participant's nose and in the direction of the head [8]. This technique is applied once.

As for suboccipital static stretching group, therapist demonstrated the suboccipital muscle stretching recommended by American College of Sports Medicine (2014)[19] target on reducing muscle-tendon unit stiffness and increasing stretch tolerance [20]. The participant was asked to perform the self-stretching exercise, began with chin tuck in and followed by nodding the head was held in a lengthened position for 15 seconds, 5 repetitions. While tipping the head forward, add self-pressure under the occiput region using the palm to reinforce the motion.

Outcome Measures

Sociodemographic data

Self-reported sociodemographic data such as age, weight and height, then BMI was calculated for each participant.

Screening: Popliteal angle test (PAT)

The participants was positioned in supine position, with the leg to be assessed is placed in 90 degree of hip and knee flexion. The participant is asked to perform extension of the knee while maintaining the angle of hip flexion and avoiding pelvic movement. The goniometer was used to assess the angle of knee extension. The reliability testof goniometry test among young adults was 0.87-0.94 [21]. The angle for full extension of the knee reflected the degree of the hamstring tightness.

Flexibility of Hamstring Muscles: Finger-to-Floor Distance Test (FFD)

Finger-to-Floor Distance Test (FFD) test was measureed the flexibility of the hamstring muscles. The participants stood in erect position with feet apart on a stepper; then the participants bent down the trunk as far as possible while maintaining the knee, arms, and finger fully extended. Final flexion position was indicated by the feeling of muscular tension that caused discomfort over posterior region of the thighs. The distance between the third fingertip and floor was measured using the measuring tape. If distance between the third fingertip of each finger and floor less than 5 cm it classified as normal flexibility. But if the distance of third fingertips was more than 5 cm from the ground it classified as hamstring tightness [8]. The reliability test FED among young adults (mean age 23-26 years) was 0.89 [8].

Statistical analysis

Statistical analysis was carried out using SPSS 23.0. Descriptive analysis was used to analyze the demographic data. Kolmogorov-Smirnov test showed a normal distribution of the data. Independent t-test was used to compare the effect of suboccipital muscle inhibition technique and self-suboccipital muscle stretching technique on hamstring flexibility (PAT and FFD test) between the groups. Paired T-test was used to compare the effects of pre and post-intervention on hamstrings length within group

3. RESULT AND DISCUSSION

Characteristics of the participants

The mean aged ($p > 0.05$) for SS and SMI group were 21.11 ± 1.67 and 22.04 ± 2.00 years old respectively (Table 1). At baseline, there was no significant different between group in term of age, height, BMI and hamstring flexibility (all $p > 0.05$). This shows the characteristic and comparison of participants between SMI and SS group.

Comparison of hamstring flexibility between groups

Table 2 displayed comparison of hamstring flexibility between groups. The means FFD test was higher in SMI group compare to SS group for right (3.44 ± 2.72) and left (3.30 ± 2.33) leg in As for the PAT, mean for right leg (7.41 ± 7.12) was higher compared to left side for participants in SMI group (5.93 ± 5.00).

Table 1. Characteristic of participants.

Variables	SMI (n=27) mean ± SD	SS (n=27) mean ± SD	*p* alue
Age (years)	22.04 ± 2.00	21.11 ± 1.67	0.72
Height (cm)	158.81 ± 6.92	155.93 ± 6.00	0.78
Weight (kg)	65.44 ± 22.46	54.63 ± 12.18	0.32
PAT Right leg	42.22 ± 12.42	38.33 ± 12.55	0.25
Left leg	40.74 ± 9.67	41.48 ± 12.69	0.81
FFD Right leg	9.74 ± 7.03	5.81 ± 6.19	0.34
Left leg	10.11 ± 7.25	6.07 ± 5.98	0.30

SMI:suboccipital muscle inhibition, SS:suboccipital static stretching, FFD:Finger-to-Floor Distance Test, PAT:Popliteal Angle Test

Comparison effect of SMI and SS on flexibility of hamstrigs

This present study showed there was no significant (both $p > 0.05$) different in flexibility of hamstring measured by FFD or PAT after intervention of SMI and SS approach. The scores of FFD and PAT were both significantly ($p < 0.01$) improved

in both SMI and SS group for right and left hamstring flexibility respectively.

The FFD scored in SMI group has greater increased for right leg (3.41 cm) and left hamstring (3.26 cm) compared to SS group (2.62 & 2.74 respectively). This result consistented with study by Cho et al. [8] and Aparicio et al. [18] that participants in SMI group improved about 4.5 cm of FFD test immediately after the treatment was implemented. The result reported by the aforementioned studies were higher than present study even though they only implement the SMI for two minutes compared to our present study which was five minutes. Conversely, Jangtap and Mandale [22] employed five repetitions of SMI and found remarkable changed of 6.75 cm in FFD test for those who received SMI. This implies that more repetition sessions of SMI is better compared to one repetition .

Table 2. Comparison of FFD and PAT between groups.

		SMI (n=27) mean± SD	**SS (n=27) mean ± SD**	**p value**
FFD	Right	3.41 ± 2.72	2.62 ± 2.06	0.20
	Left	3.26 ± 2.33	2.74 ± 2.16	0.33
PAT	Right	7.41 ± 7.12	5.37 ± 6.78	0.28
	Left	5.67 ± 5.00	6.11 ± 6.09	0.90

SMI; suboccipital muscle inhibition technique), SS; suboccipital static stretching, FFD; Finger-to-Floor Distance test, PAT; Popliteal Angle Test

Table 3. Comparison of FFD and PAT within groups

		SMI (n=27) mean ± SD		**SS (n=27)** mean ± SD	
		pre test	**post test**	**pre test**	**post test**
FFD	®	9.74 ±7.03	6.33 ± 6.25**	5.81±6.19	3.19 ± 5.17**
	L	10.11±7.25	6.85 ± 6.68**	6.07±5.98	3.33 ± 5.29**
PAT	®	42.22±12.42	34.81±10.32**	38.33±12.55	32.96±12.34**
	L	40.74 ± 9.67	34.07 ± 9.30**	41.48±12.69	35.37±12.55**

*$p < 0.05$, ** $p < 0.01$

SMI; suboccipital muscle inhibition technique), SS; suboccipital static stretching, FFD; Finger-to-Floor Distance test, PAT; Popliteal Angle test

As for PAT test, our present study found both SMI and SS group have an increment range at the right and left knee extension post intervention. The SMI group have an increment range at both knee extension which was agreed with the finding by Aparicio et al. [18] and Cho et al. [8]. However, our present studies have better result based on PAT compared to those have SMI performed with one repetition for two minutes [18] and five repetitions of the SMI [22]. Our studies suggested that one repetition of five minutes SMI has shown a better outcome measured by PAT.

There was limited study employed SS approaching the tightness of the hamstring. Our recent study found SS has remarkable altered the tightness of the hamstring immediately after the intervention. Our present result of post treatment knee extension (6.11° for left leg and 5.37° for right leg) is comparable to the measurement of active knee extension (7.0°) by Nishikawa et al. [23]. This result suggested that remote treatment has positive effected on the flexibility of the hamstring. Conflicting to the study conducted by Taylor et al. [24] was attributed to the hetereogenes of static stretching. Taylor et al. employed cervical isometric contract-relaxed technique which has not significant changed in flexibility of hamstring. Conversely, the similar technique at cervical (suboccipital muscles) has positively improved the flexibility of the hamstring [25].

The positive effect of remote treatment on hamstring flexibility measured by FFD and PAT in present study showed the PAT test showed more increase in flexibility of right leg than left leg by 17.5% and 13.9% in SMI group, whereas 13.9% and 14.7% in SS group respectively. For FFD test showed greater changes in right and left leg, 45.9% and 45.15% in SS group compare to SMI group (35% and 32% respectively).

The possibility of improved flexibility of the hamstring was attributed to reduce of tone suboccipital muscle tone by passive or active approach [26]. Although Page [16] argued that static stretching manifested an increase in ROM because of an increase of stretch tolerance (ability to withstand more stretching force), but not extensibility (increased muscle length). The recent studies demonstrated that the immediate effect of remote treatment was attribute to the transmission of forces through intramuscular connective tissue pathway and intermuscular tissue pathway [27,28].

The present result showed that SS technique emitted lower changes compared to the SMI technique. This might be due to the intensity of the treatment. Whereas SMI performed by trained therapist manually possessed larger effect than self-treatment [27]. Also, our present study proved that suboccipital stretching using passive approach namely SMI and active approach by SS has possed positive result on flexibility of hamstrings. SS technique can be easily instructed to participants, is practical to be included as home exercise program (HEP) for those with acute condition compare to local site stretching techniques which may cause aggravation of the local inflammatory response and inducing muscle spasm or guarding [22], and skin damage or scarring [29].

In the future study, further exploration of long-term effect of remote technique in respect of duration and repetition of SMI and SS compare to local site stretching in the larger sample size clinical trial.

4 CONCLUSION

The findings of our study are significant to the literature related to screening and prevention and further tightness of hamstring. Based on our present result, both remote interventions SMI and SS can be considered as management tightness of hamstring in adults with sedentary lifestyle.

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