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Original Article

The comparison of the immediate effects of application of the suboccipital muscle inhibition and self-myofascial release techniques in the suboccipital region on short hamstring

Sung-Hak Cho, PhD, PT[1)], Soo-Han Kim, PhD, PT[2)], Du-Jin Park, PhD, PT[2)*]

[1)] *Department of Physical Therapy, Graduate School, Catholic University of Pusan, Republic of Korea*
[2)] *Department of Physical Therapy, College of Health Medicine, Kaya University: 208 Samgye-ro, Gimhae, Kyongnam 609-757, Republic of Korea*

Abstract. [Purpose] The purpose of this study was to research the effect of performing the suboccipital muscle inhibition (SMI) and self-myofascial release (SMFR) techniques in the suboccipital area on the flexibility of the hamstring. [Subjects] Fifty persons with short hamstrings participated in this research. According to the results of the finger-floor distance (FFD) test, the subjects were allocated to SMI and SMFR groups of 25 subjects each. [Methods] The SMI and SMFR techniques were applied to the groups. For the analysis, we used the FFD test and the straight leg raise (SLR) test for the flexibility of hamstring. The evaluator was blindfolded. [Results] In the SMI group, FFD, SLR, and PA were significantly changed after the intervention, and in the SMFR group, there was a significant change in SLR after the intervention. In a comparison between the groups, FED was found to be significantly increased in the SMI group. [Conclusion] Application of the SMI and SMFR to persons with short hamstrings resulted in immediate increases in flexibility of the hamstring. However, we could see that the SMI technique was more effective.

Key words: Suboccipital muscle inhibition, Self-myofascial release, Short hamstring

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INTRODUCTION

Shortening of the hamstring has a negative impact on the posture of the pelvic region. The increase in stiffness of the hamstring may serve as a cause of low back pain (LBP)[1)], and it is also a common characteristic of back pain patients[2)]. The increase in stiffness of the hamstring produces more burdens on the back and causes improper motion patterns in the lumbopelvic region[3, 4)]. Shortening of the hamstring can be examined by the finger-floor distance (FFD) and straight leg raise (SLR) test, and if a person cannot touch the floor with his/her fingertips in the bent-forward position or the SLR is lower than 80°, the person is considered to have reduced hamstring extensibility[5)].

Recently, it has been reported that the flexibility of the hamstring increased as a result of an intervention targeting the suboccipital muscles[6)], and the suboccipital muscle inhibition (SMI) technique is a method of relaxing the tension in the four muscles located between the occiput and axis, which regulates the upper cervical vertebra (rectus capitis posterior major, rectus capitis posterior minor, obliquus capitis inferior, and obliquus capitis superior) ; these muscles are known to be associated with regulating body posture as well as rotation of the head[7, 8)]. When the tone of suboccipital muscles falls, it has been reported that the tone of knee flexors such as the hamstrings also decreases due to relaxation of the myofascia[6)]. This is because the hamstrings and suboccipital muscles are connected by one neural system, which passes through the dura mater[9)]. Myers[10)] called this the superficial back line.

The SMI technique is a method of inducing relaxation of the fascia by applying soft pressure to the suboccipital area of the patient while he/she is lying comfortably, and it can be easily applied by a therapist. However, the disadvantage is that it cannot be done by patients themselves.

On the other hand, self-myofascial release (SMFR) is a technique that can be applied at home or in the office by patients themselves, without any help from a therapist or limitations regarding time or space, and recently, the effect of SMFR using a foam roller on the hamstring has been studied[11, 12)]. However, most of the known research results have been for cases of applying MFR directly[13)], and research in which SMFR was applied to the original part of the shortened area, such as the suboccipital muscles, has been rare.

Therefore, in this study, we applied the SMI and SMFP techniques to the suboccipital area of the short hamstring of subjects and compared the effects on the flexibility of the hamstring.

*Corresponding author. Du-Jin Park (E-mail: djpark35@kaya.ac.kr)

SUBJECTS AND METHODS

In this study, 50 subjects with short hamstrings attending C University and K University were recruited, and according to the results of an FFD test, they were equally divided into SMI and SMFR groups of 25 subjects each. The criteria for selection of subjects were as follows. 1) In the FFD test, in which the subject stands and bends down without bending his/her knees and the distance between the fingertips and the floor is measured, the distance between the fingertips and the floor should be more than 5 cm. 2) The angle in the SLR test should be less than 80°. 3) In the popliteal angle (PA) test, in which the subject maintains the angle of the hip at 90° and tries maintain the angle of the knees as straight as possible in the supine position, the angle of the knees should be more than 15°.

The criteria for exclusion of subjects were as follows. 1) Those who experienced whiplash syndrome caused by traffic accidents. 2) Those who had the symptoms of disc herniation or low back pain. 3) Those who had had neck or back surgery or indicated they felt pain when an experimental intervention was applied. The assessments and interventions were conducted in separate spaces, and the evaluators were blindfolded so that they could not see the status of the subjects. All assessments were conducted 10 minutes before the intervention and 5 minutes after the intervention, and each assessment was conducted 3 times; the mean values of the results were used. Written informed consent has been obtained from each subject. This study was approved by the Ethics Committee of the Catholic University of Pusan (CUPIRB-201-018).

The FFD and SLR tests were used to evaluate the flexibility of the hamstring. 1) In the FFD test, the subjects stand on a flat box that has a vertical grid, and bend forward and down as much as they can without bending their knees, and the distance between the floor and the fingertips is measured. 2) In the SLR test, the subject is in a supine position, and the evaluator lifts the subject's right leg. The leg should be maintained straight, and if the evaluator feels resistance or the subject reports pain, the evaluator stops at that point and measures the angle of the hip and lower leg using goniometry. When measuring the angle, the evaluator needs to be cautious to ensure that the subject's ankle or pelvis does not rotate. When measuring the angle, the axis of goniometry needs to be located at the greater trochanter of the thigh, the moving arm needs to be positioned to be parallel with the outer epicondyle of the fibula, and the fixed arm needs to be maintained horizontal to the floor. 3) In the PA test, the subject is in a supine position, and the right hip and the knee are bent at 90°. In this state, the evaluator straightens the knee within the pain-free range and measures the angle of the knee. The axis of the goniometer is located at the outer epicondyle of the thigh, the fixed arm is positioned vertically relative to the floor, and the moving arm is positioned parallel to the outer epicondyle of the fibula. The PA is a good indicator for evaluating the shortening of the hamstring[14].

The intervention techniques were as follows. The SMI technique was conducted while each subject was in a supine position with his/her eyes closed. The experimenter places his/her hands below the subject's occiput and applied pressure to the area below the atlas, which was the first cervical spine, in the upward direction, toward the subject's nose, toward himself/herself, and in the direction of the head, and this induced relaxation of the suboccipital muscles[15]. The SMI technique was applied for 5 minutes. SMFR was conducted while each subject was in a supine position with his/her eyes closed. A triangle-shaped pillow was placed under each subject's occiput to apply pressure to the suboccipital area of the subject's head, and to prevent the head from reclining, an air cushion was used to maintain the parallel position of the neck. In addition, the subject was allowed to rotate the head to the right or left with the range of the pillow so that he/she could relax the suboccipital muscles in the desired area. SMFR was applied for 5 minutes.

Results were analyzed using SPSS 18.0, and the significance level was set at 0.05. To compare the effects of application of the SMI and SMFR techniques, the pared t-test was conducted, and to compare the effects between the groups, independent t-test was conducted.

Table 1. Characteristics of the subjects (N=50)

Description	SMI (n=25)	SMFR (n=25)
Gender (m/f)	10/15	9/16
Age (y)	24.8 (4.3)	25.3 (4.1)
Height (cm)	168.4 (10.1)	167.6 (9.7)
Weight (kg)	61.5 (10.6)	60.2 (9.6)

Values are means (standard deviations).

RESULTS

General characteristics of the subjects are shown in Table 1. After the intervention, a significant change in FFD, SLR, and PA was found in the SMI group, and a change in SLR was found in the SMFR group. In intergroup comparison, we found an increase in FFD in the SMI group (Table 2).

DISCUSSION

This research was conducted to examine the difference between the effects of the SMI and SMFR techniques in subjects with shortening of the hamstring. Regarding the SMI group, a significant increase in FFD and SLR was found after the intervention and an increase of flexibility of the hamstring was confirmed. This matches the research results of Aparicio[6] and supports his empirical hypothesis. In the SMFR group, FFD and PA were found to have increased after the intervention, although the increases were not statistically significant. Regarding the SLR test, the results showed a significant increase after the intervention compared with before the intervention, and it was confirmed that the SMFR technique contributes to increased flexibility of the hamstring.

The fact that both techniques could increase the flexibility of the hamstring may be because the superficial back line was relaxed through relaxation of the suboccipital

Table 2. Flexibility changes in the hamstring (post-pre)

	Values				Change values	
	SMI		SMFR		SMI	SMFR
	Pre	Post	Pre	Post	Post-pre	Post-pre
FFD	12.6 (4.3)	8.1 (4.0)*	12.0 (4.7)	10.2 (4.7)	−4.5 (2.4)*	−1.8 (2.1)
SLR	58.7 (6.6)	67.2 (7.1)*	60.2 (5.3)	65.5 (6.3)*	8.5 (6.3)	5.2 (5.5)
PA	37.4 (6.9)	42.9 (7.1)*	38.0 (7.4)	40.3 (6.5)	5.5 (6.6)	2.3 (5.0)

Values are means (standard deviations). * Significant difference between groups ($p<0.05$).
FFD, finger-floor distance test; SLR, straight leg raise test; PA, popliteal angle test

muscles[10]. 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[16]. Among them, in particular, the rectus capitis posterior minor muscle, which has 36 muscle spindles per gram, is known to contribute greatly to regulation of posture and the degree of tension[17].

However, the results of this study indicated that SMI was more effective in increasing flexibility of the hamstring than SMFR, and this was probably because SMI provides more traction compared with SMFR. One of the features of SMI is application of soft traction to feel the tension of the soft tissues and remove the muscle barrier by repeatedly relaxing and straining, which has been compared to "peeling an onion"[16]. Though SMFR allows the subject to move his/her neck to the right or left against the wooden pillow to apply pressure to the tensed area around the suboccipital muscles and it can lead to relaxation, it is somewhat difficult to apply traction.

What is needed for effective relaxation of the fascia is proper pressure and soft extension on the area where fascia limitation is felt. Manheim[18] specified that "in myofascial release, when the fascia is extended, never ignore the end-feel" and emphasized the importance of soft extension. Application of SMFR to the suboccipital muscles are a good technique that individuals can use to apply appropriate pressure to relax muscles by giving feedback to him/herself, but in terms of extending soft tissues, it is difficult for the subject to apply it him/herself without the intervention of a therapist, and this is probably why SMFR is less effective than SMI in myofascial release.

According to the results of this research, SMI and SMFR, which were applied to subjects with shortening of the hamstring, resulted in immediate increases in flexibility of the hamstring, and it was confirmed that SMI was more effective.

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