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Can Myofascial Release Techniques Reduce Stress Hormones in the Subject of Short Hamstring Syndrome? A Pilot Study

Background: The myofascial release technique is known to be an effective technique for increasing posterior fascia flexibility in short hamstring syndrome (SHS) subjects. But therapeutic mechanism of myofascial relaxation remains unclear. Recently, the theory of autonomic nervous system domination has been raised, however, a proper study to test the theory has not been conducted.

Objectives: To investigate whether the application of the myofascial release technique can induce changes in the autonomic nervous system and affect the secretion of stress hormones and myofascial relaxation.

Design: Quasi-experimental study.

Methods: Twenty-four subjects with SHS were randomly divided into two groups. In the experimental group, the suboccipital muscle inhibition (SMI) technique was applied to the subjects for 4 min in supine position, and in the control group, the subjects were lying in the supine position only. A forward flexion distance (FFD) was conducted, blood pressure, heart rate, and cortisol levels were measured before and after the intervention and 30 min after intervention to determine myofascial relaxation and stress hormone levels. The evaluation was conducted separately in blind by an evaluator.

Results: A FFD decreased in the experimental group, no change in cortisol was observed. On the contrary, a decrease in cortisol appeared in the control group after 30 minutes.

Conclusion: The myofascial release technique is an effective treatment to increase the range of motion through posterior superior myofascial chain, but there is no evidence that myofascial release technique can control the autonomic nervous system.

Keywords: *Myofascial release; Suboccipital muscle inhibition; Stress hormone; Cortisol*

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INTRODUCTION

Myofascial pain syndrome (MPS) is a symptom of chronic pain of the musculoskeletal system. Trigger points within taut bands in the local skeletal muscle cause pain, motor dysfunction, and autonomic phenomena in surrounding tissues.[1] In the treatment of MPS, various methods, such as stretching, massage, and fascial relaxation, are usually applied.

Myofascial relaxation facilitates the flow of mucus by continuous application of gentle compression to limited fascia tissues. Additionally, it is a manual therapy that induces piezoelectric phenomenon and improves pain relief and joint mobility.[2] The hypothesis on the therapeutic mechanism of myofascial relaxation in current literature is unclear. There is the hypothesis that the collagen state of the trigger point is changed from a gel–sol state to induce the removal of pain–producing chemicals.[3] Moreover, there is a myofascial relaxation theory by Golgi based on tendon reflexes.[4] More recently, the theory of autonomic nervous system domination has been raised.

Staubesand and Li[5] analyzed the cellular components in the fascia and found smooth muscles, sensory nerve endings, and nerves. Intramuscular excitability regulates the smooth muscle, causing pretension of the fascia. The nerve is likely to be autonomic and suggests a correlation between the autonomic nervous system and fascia.[6] Additionally, Kim et al.[7] reported that myofascial relaxation induced reduction in stress hormone levels by activating parasympathetic nerves. Other studies also showed that parasympathetic nerves were enhanced through heart rate variability because of myofascial relaxation.[8]

However, contrary to previous studies that reported that fascial relaxation activates parasympathetic nerves, some studies showed that there is no correlation between fascial relaxation and the autonomic nervous system.[9] In the analysis of the change in biochemical markers to confirm the change in the autonomic nervous system after myofascial relaxation, no significant change was found. This shows that there is a lack of evidence that myofascial relaxation activates the parasympathetic nerves.[10] Thus, the cause of parasympathetic hyperactivity is unclear, whether it is due to mechanical fascial relaxation or psychological stress relief.

Therefore, the purpose of this study is to determine whether the effect of the fascia relaxation technique is due to the relaxation of the fascial line or the reduction of the stress hormone caused by contact stimulation in the suboccipital area. To examine the effect of the fascia line relaxation, the subject was selected as short hamstring syndrome (SHS) subject with a limitation of the superficial posterior fascial line. It also aims to determine if SMI can affect the autonomic nervous system, increase the range of motion, and reduce stress hormone levels.

SUBJECTS AND METHODS

Subjects

This study was conducted with 24 men and women in their 20s who had SHS (Table 1). The SHS criteria used was a forward flexion distance (FFD) 〉 5 cm and presence of Trigger Point (TrP) in the hamstring muscles. Other criteria used was a straight leg raise test grade ≤ 80° and popliteal angle ≥ 15°.[11] Different intervention dates were set for in blind individuals. The study was approved by Kaya University's Bioethics Committee (Kaya IRB–256).

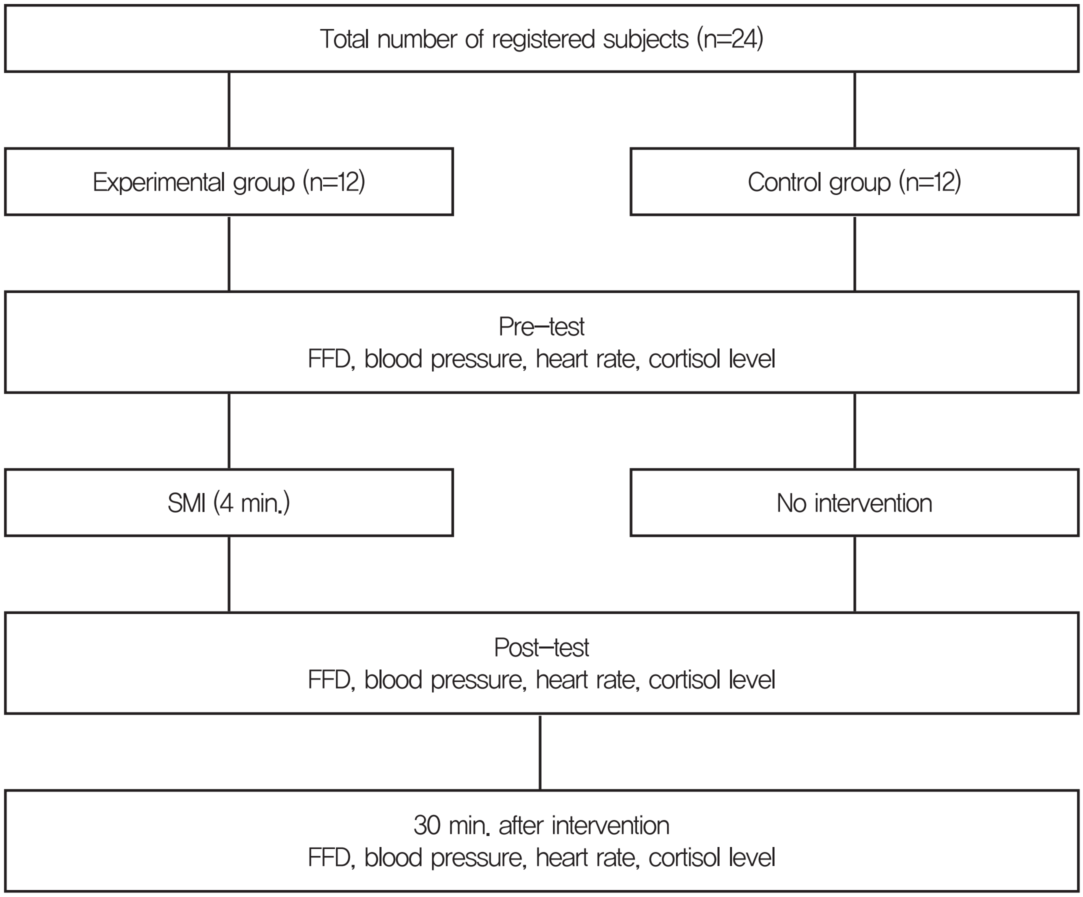
The selection criteria were as follows: SHS, without any pain or range of motion in the lower back and pelvis and no lesions due to trauma, such as traffic accidents, no drugs, including food containing caffeine, used within 48 hours prior to measurement.

Research procedure

This study was a randomized controlled trial (CRIS number, KCT0004032). Twenty–four subjects with SHS were divided random draw into two groups. To stabilize the autonomic nervous system, both groups lie in bed and rest 30 for minutes. All subjects were evaluated the flexibility of the hamstring muscles, salivary cortisol level, heart rate, and blood pressure by a blind evaluator. Immediately after the evaluation, the experimental group was applied the SMI technique for 4 minutes, and the control group rested by lying in bed. Immediately after intervention, a blind evaluator measured the flexibility of the hamstring muscles, salivary cortisol level, heart rate, and blood pressure. To observe the persistence of the interventional effect, one more measurement was performed 30 minutes after intervention (Figure 1).

Table 1. Characteristics of subjects

	Control group	Experimental group	*P*
Sex (male/female)	5 / 7	5 / 7	.830
Age (years)	24.33 ± 3.52	24.69 ± 3.59	.803
Height (cm)	169.25 ± 910.05	167.62 ± 9.69	.683
Weight (kg)	60.50 ± 10.72	60.00 ± 9.60	.903



FFD: Forward flexion distance

Figure 1. Schematic diagram of the study design

Measure

Hamstring flexibility

The flexibility of the hamstring muscle was evaluated through the forward flexion distance (FFD) test. Subjects bend their trunk toward the floor with their knees fully open and arms naturally stretched. Currently, the head and upper limbs remain relaxed. The subjects bent the trunk forward until there was a tight discomfort in the hamstring, then the vertical distance between the fingertips and floor was measured using a tape measure.[12] This test method has high reliability and validity.[13]

Cortisol

To reduce errors on the cortisol level, the subjects were asleep at approximately 10 o'clock the night before the experiment. No food was consumed in the morning, the subjects were kept on an empty stomach, consuming nothing but water. Approximately 2 mL of saliva was collected three times using Salivette for saliva collection under the subject's tongue. Subjects rested for 30 minutes after arriving at the laboratory. Saliva samples were collected immediately before and after intervention and 30 minutes after intervention and then subjects were referred to the Red Cross for analysis of salivary cortisol levels. Salivary cortisol samples were collected between 8 and 9 a.m., when change is minimal.[14]

Blood pressure and heart rate

The blood pressure and heart rate of the subjects were measured using the cuff of an automatic electronic blood pressure monitor (BP170, Co. Inbody, Korea), which can measure blood pressure and heart rate at the lower third of the upper right arm in the supine position. Measurements were obtained immediately before and after the intervention and 30 minutes after the intervention.

Intervention

To apply the SMI technique, the subjects were placed in the supine position on the bed, and their eyes were closed. The investigator sat in a chair at the edge of the subject's head and placed both palms on the subjects' suboccipital area. The tips of the investigator's hands were placed under the subject's cervical spine (atlas) with traction for 4 min. by applying pressure in the subject's nose (anterior) and head directions (upward).[15] The subjects in the control group were asked to lie supine in bed with eyes closed (Figure 2).

Figure 2. Apply of suboccipital muscle inhibition

Data and Statistical Analysis

The results of this study were analyzed using SPSS 19.0, and the significance level was set to .05. In this study, a repeated measures ANOVA was used to compare the flexibility of the hamstring muscles and changes in salivary cortisol level, blood pressure, and heart rate according to the SMI technique. An independent t-test was performed to compare and analyze the flexibility of the hamstring muscles and changes in salivary cortisol level, blood pressure, and heart rate between two group.

RESULTS

There was a significant difference in cortisol levels with time in the control group. Particularly, cortisol level was significantly decreased immediately after the intervention and 30 min. after the intervention. Blood pressure, heart rate, and FFD results were not significantly different. In the experimental group, FFD results significantly decreased after intervention compared to those before intervention, and increased flexibility remained until 30 min. after intervention.

DISCUSSION

The aim of this study was to investigate whether SMI application can affect the control of muscle flexibility and stress hormone secretion through the regulation of the autonomic nervous system. In the results of the study the FFD was significantly decreased in the experimental group when SMI was applied. SMI increased the range of motion of the lower limbs, and the fascia-releasing effect persisted for 〉 30 min.

The SMI technique is a fascial relaxation technique that provides continuous and gentle pressure and elongation in the suboccipital region. It is an effective treatment technique to control systemic posture and muscle tone by stimulating the densely packed spindle cells under the suboccipital area. This SMI application is thought to increase the flexibility of the lower extremity muscles that are far from the suboccipital area by affecting fascia tension of the superficial back line connected by a chain.[2,16,17]

Aparicio et al.[11] found that the application of the SMI technique significantly affected the fascia elasticity of the superficial backline, resulting in a significant decrease in FFD. In addition, Jeong et al.[18] reported that the SMI application in patients with cervical pain improved the range of motion and pain relief of the cervical spine. However, the same results were found in the Craniocervical Flexion exercise group, suggesting that it may have influenced systemic fascial relaxation, not because of SMI but because of the specificity of the posterior suboccipital region.

In contrast, Rodríguez-Huguet[19] showed a decrease in pain and increase in pain threshold in the group receiving myofascial relaxation in the suboccipital region but not in the group undergoing TENS (Transcutaneous Electrical Nerve Stimulation), ultrasound, and massage. These findings suggest that myofascial relaxation is more effective in muscle flexibility and pain relief than other modalities. Several studies have suggested that the specificity of the occipital region does not affect systemic fascial relaxation.[20,21]

Table 2. Results of cortisol level, blood pressure, heart rate, and hamstring muscle flexibility in two groups

		Control group	Experimental group	*P*
Cortisol	Pre	.83 ± .29	.78 ± .24	.68
	Post	.96 ± .20	.81 ± .29	.14
	30 min. after	.67 ± .33**	.68 ± .22	.90
	P	.01**	.09	
Systolic blood pressure	Pre	106.42 ± 12.76	104.15 ± 11.68	.64
	Post	101.42 ± 14.59	103.54 ± 10.19	.67
	30 min. after	105.17 ± 14.45	103.62 ± 7.93	.74
	P	.08	.92	
Diastolic blood pressure	Pre	65.17 ± 9.76	62.31 ± 8.99	.45
	Post	62.58 ± 11.53	65.77 ± 6.55	.40
	30 min. after	63.50 ± 11.23	63.85 ± 7.48	.92
	P	.26	.26	
Heart rate	Pre	72.83 ± 12.45	75.92 ± 9.85	.49
	Post	69.92 ± 10.02	71.46 ± 6.57	.65
	30 min. after	71.33 ± 10.44	72.15 ± 7.36	.82
	P	.38	.08	
FFD	Pre	11.56 ± 4.65	11.43 ± 4.31	.94
	Post	10.23 ± 4.74	8.69 ± 4.04**	.44
	30 min. after	9.80 ± 5.04	8.13 ± 6.02**	.46
	P	.08	.00**	

*$P<.05$, FFD: Forward flexion distance

Blood pressure and heart rate were measured to determine whether this increased muscle flexibility was the result of parasympathetic nerve hyperactivity. There was no significant change in blood pressure and heart rate in both SMI and control groups. Hyperactivity of the parasympathetic nerve decreases blood pressure and heart rate, but it does not seem to affect the autonomic nervous system because no change was observed in SMI application in this study.

Kim et al.[10] also found that autonomic nervous system activity could be evaluated by measuring blood pressure, heart rate, and catecholamine levels during myofascial relaxation. No change in blood pressure and heart rate in both the experimental and control groups were found. In both groups, changes in catecholamine levels were found to increase after the intervention, which was interpreted because of psychological strain on the experimental situation. Kim[7] reported that cortisol levels decreased after myofascial relaxation, but the cortisol levels also decreased in the control group. Walton[22] explained that symptom improvement was caused by parasympathetic nerve progression after applying fascial relaxation to patients with Raynaud's disease. However, it was only inferred to draw conclusions, because there was insufficient evidence to conclude that the mechanism of fascial relaxation was regulated by the autonomic nervous system.[23]

In the present study, the stress hormone levels following myofascial relaxation were significantly decreased in the control group, but not in the experimental group. In the control group, the cortisol level increased immediately after intervention and significantly decreased 30 min. after intervention. However, there was no significant difference between these periods in the experimental group.

A study by Niddam et al.[24] found that the stress hormone levels in individuals with chronic fascia pain syndrome (MPS) were comparable to those without pain, but the pain threshold was lower. This suggests that myofascial pain does not affect the release of stress hormones. However, Nadendla et al.[25] showed that cortisol levels were higher in patients with MPS and had a higher anxiety index than normal individuals. This shows that the addition of psychological stress to physical stress can affect systemic stress hormone secretion. Cortisol levels are also psychologically dependent. However, in this study, the intervention time was a very short 4 minutes, during this short period of time the psychological variables did not appear to work in both groups, as they were lying still and resting. Therefore, there was no change in cortisol level when SMI was applied because there was no intervention on psychosocial stress. Cortisol is a hormone that is sensitive to sudden pain or stress.

Therefore, persistent myofascial pain may have been difficult for the mediation of stress hormone regulation, following intervention.[26,27] Moreover, interception of the heart requires a sensitive response to change the blood cortisol level, which is correlated with heart rate.[28] However, in this study, both groups had no significant change in heart rate, which may not affect cortisol levels. Moreover, relaxation therapy that stimulates skin receptors, such as massage, did not lead to changes in cortisol levels and heart rate variability.[29] These results indicate that local endothelial irritation of skin and fascial relaxation alone cannot affect the endocrine system.[30] However, in the control group, there was a change in cortisol level although there was no significant difference in heart rate. Since these results could not explain the reduction in cortisol levels, they need to be verified through another study with stricter subject control in the future.

CONCLUSION

This study examined whether SMI can regulate the autonomic nervous system and affect stress hormone secretion with increased hamstring muscle flexibility. As a result, when SMI was applied, the proprioceptor was stimulated by tractioning the fascia of the suboccipital region, which contributed to fascial relaxation of the superficial back line and resulted in an increase in the range of motion of the lower limbs. However, in this study, autonomic nervous system regulation was not possible because SMI application did not affect the heart rate and stress hormone secretion.

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