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Original Article

Immediate effects of Graston Technique on hamstring muscle extensibility and pain intensity in patients with nonspecific low back pain

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Abstract. [Purpose] The purpose of this study was to analyze the effect of Graston Technique on hamstring extensibility and pain intensity in patients with nonspecific low back pain. [Subjects and Methods] Twenty-four patients with nonspecific low back pain (27–46 years of age) enrolled in the study. All participants were randomly assigned to one of two groups: Graston technique group (n=12) and a static stretching group (n=12). The Graston Technique was used on the hamstring muscles of the experimental group, while the static stretching group performed static stretching. Hamstring extensibility was recorded using the sit and reach test, and a visual analog scale was used to measure pain intensity. [Results] Both groups showed a significant improvement after intervention. In comparison to the static stretching group, the Graston technique group had significantly more improvement in hamstring extensibility. [Conclusion] The Graston Technique is a simple and effective intervention in nonspecific low back pain patients to improve hamstring extensibility and lower pain intensity, and it would be beneficial in clinical practice.

Key words: Nonspecific low back pain, Hamstring, Graston Technique

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INTRODUCTION

Low back pain (LBP) is a condition experienced at least once by more than 80% of the human race the world over[1)]. More than 85% of cases of LBP in the USA are classified as nonspecific LBP defined by tension, soreness, and/or stiffness of the lower back with unknown origins of pain[2)]. Back pain causes decreased lumbar extensibility, limited range of motion (LOM) and gait ability, and change of rhythm in the pelvis, limitations that can restrict social activities[3)]. One of the most widely studied outcomes in LBP patients is the reduction of hamstring extensibility[4)].

The hamstring is responsible for hip extension and knee flexion along with providing stability of the hip and knee joints during walking[5)]. A shortening of the hamstring may result in LOM of the knee joint, restricting a person's ability to walk and run. In addition, it increases posterior pelvic tilting and reduces lumbar lordosis, contributing to a flat back that can result

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in back pain[6].

Objective evaluation tools to easily assess the extensibility of the hamstring include the sit and reach test (SRT), the passive toe touch test, and the straight leg raise (SLR) test. The SRT is the method most commonly used in clinics[7].

Methods for increasing the length of the shortened hamstring include stretching, eccentric resistance exercise, Graston instrument soft tissue mobilization, and self-myofascial release[8–10].

Recently, Graston instrument soft tissue mobilization has been reported to be effective in promoting the extensibility of the shortened hamstring[11]. Graston Technique (GT) is a soft tissue mobilization treatment method using a tool that generates mechanical micro-traumatic damage to the treated area. It thus creates an inflammatory response to accelerate the healing process and restore flexible, normal tissue. This technique seems to have the therapeutic effects of inhibiting the adhesion of tissue, increasing the number of fibroblasts, and promoting collagen synthesis[12].

Although there are several studies related to Graston instrument soft tissue mobilization and shortened hamstrings, only healthy volunteers have been included in these studies[11]. Therefore, in this study, nonspecific low back pain (NSLBP) patients with shortened hamstrings were monitored.

The purpose of this study was to examine the effects of the GT on hamstring extensibility and pain intensity in patients with NSLBP.

SUBJECTS AND METHODS

This study included 24 patients with LBP selected from the staff and student population of Gachon university (except to the department of physical therapy and occupational therapy), located in Incheon. For more information about participants, refer to Table 1. Prior to the experiment, the gender, age, and hamstring length of all subjects were recorded after an interview and screening test. Participant selection criteria were as follows: the patient should have (1) a history of NSLBP for at least 2 months (2) a finger-to-ground distance greater than 0 cm (3) a passive SLR angle of 70° or less (4) most of the knee touching the chest in the passive hip-flexion test for those with normal movement of the hip joint (5) no neurological signs, and (6) a visual analog scale (VAS) score of more than three. Furthermore, all patients who participated in this trial provided a signed written consent form after having the expected outcomes and side effects fully explained. This study was approved by the Gachon University Institutional Review Board.

The SRT was used along with the Sitting Trunk Flexion Meter (TAKEI, Japan). This test involves sitting on the floor with the legs stretched out straight in front of the body. Shoes are removed. The soles of the feet are placed flat against a box, and the trunk flexed forward. With both knees locked and the back of the legs pressed flat to the floor, the subject reaches forward along the measuring line as far as possible. After some practice reaches, the subject holds that position for 5 seconds while the distance is recorded. The measurement was taken three times at the same time and place, and the average was recorded. No vigorous exercise was performed prior to the measurement. The SRT for hamstring flexibility is likely to have moderate criterion-related validity (0.39–0.89)[7].

A VAS was used to assess the level of LBP in the subjects. A VAS is usually a horizontal line, 100 mm in length, anchored by word descriptors at each end. The patient marks on the line the point that subjectively matches his or her pain level and is thus scored from 0 to 10 points[13].

All participants were randomly assigned to one of two groups: the graston technique group (GT group, n=12) or the static stretching group (SS group, n=12). The GT was used on the hamstrings of the GT group, while the SS group performed static stretches on the hamstring muscle. The experiment involved one mediator and one evaluator. During the course of the experiment, the mediator was unaware of the evaluation results. Additionally, the evaluator did not know to which group the subjects were assigned. Both before and after training, flexibility and pain levels were assessed by the evaluator. The SRT was performed three times with the subjects taking 5-minute breaks between each test. Then, each group received or performed the intervention for 60 seconds and was retested after a 5-minute break.

The GT group received soft tissue mobilization of the hamstring muscle with the Graston instrument using GT number 1 (GT-1). First, the subject lay prone and bent the knee joint to around 30° to 60°. After applying massage cream on the hamstring muscle, the Graston instrument was rubbed on each subject 30 times for 60 seconds from the gluteal line to the popliteal fossa[11].

Table 1. General characteristics between two groups

	GT group	SS group	p
Gender (Male/Female)	8/4	8/4	1.000
Age (years)	34.17 ± 4.91	35.25 ± 5.86	0.629
Height (cm)	169.25 ± 9.18	168.50 ± 8.68	0.839
Weight (kg)	61.92 ± 9.87	61.83 ± 11.37	0.985

Values are expressed as mean ± SD.

The SS group performed static stretching of the hamstring. In the supine position, it was fixed at opposite leg and hip joint bending posture of the subject, the direction of the stretch was a knee joint extension direction. The procedure started with initial stretching, where the posture was maintained for 5 seconds. This was followed by three subsequent increases in knee extension, each with a 5-second hold. The final increase in the knee extension angle was maintained for 45 seconds, and then the antagonist muscle was stimulated. The hip joint and lumbar motion were fixed[14)].

All statistical analyses were performed using SPSS ver. 18.0. The SRT and VAS differences within a group before and after the treatment were tested using the Mann-Whitney U test. For all data, statistical significance was accepted at values of $p<0.05$.

RESULTS

The changes in SRT and VAS scores before and after application of GT are shown in Table 2. After the GT, a significant increase in SRT and VAS scores was observed ($p<0.05$). The GT group had a significant difference in SRT measurements before and after the intervention ($p<0.05$). There were no statistically significant changes in the VAS assessments (Table 3).

DISCUSSION

This study aimed to identify the effect of the GT on hamstring extensibility and pain intensity in patients with NSLBP and shortened hamstrings.

After the GT, a significant increase in SRT and VAS scores was observed. The GT group had a significant difference in SRT measurements before and after the intervention ($p<0.05$). There were no statistically significant changes in pain intensity.

In a study by Kim et al., using GT on hamstrings in healthy young adults was reported to increase the range of motion (ROM) of the knee joint[11)]. Since the target population in this study was individuals with NSLBP with hamstring shortening, this study will be more clinically applicable.

As indicated by the above results, the two interventions were found to have positive effects on extensibility of the hamstring and pain intensity. However, the GT group had more significant changes in the extensibility of the hamstring than the SS group did. In a study by Hammer and Pfefer, the hamstrings of subjects with LBP were treated with soft tissue mobilization using GT six times, which significantly increased the ROM of the knee joint[15)]. In our research, GT was only applied once for 60 seconds and hamstring extensibility increased in the short term.

The static stretching used in the control group is a common physical therapy treatment technique for ROM and physical function improvement, and it has a positive effect on pain and extensibility in the hamstring after application[16–18)]. Bandy et al. reported an increase in ROM when subjects performed static stretches on the hamstring, but there were differences depending on the length of the stretches. Since 30 to 60 seconds was found to be most effective, the SS group held static stretches for 60 seconds[17, 18)].

Clinically, a shortened hamstring limits the flexion of the hip joint or causes lumbar hyperextension, resulting in back pain. Therefore, it is essential to improve hamstring extensibility in the recovery of back pain patients[6)]. Thus, if LBP occurs with shortening of the hamstring, knee arthritis, or functional limitation, soft tissue mobilization using the Graston instrument is a simple and effective intervention for restoring hamstring extensibility.

One limitation of this study is that it is difficult to generalize the results due to the low number of subjects. Second, it did not use tests with the highest level of reliability and validity. Finally, the effect was not confirmed by the long-term applica-

Table 2. Difference for SRT, VAS between groups and within groups

	GT group		SS group		p-value		
	Pre-test	Post-test	Pre-test	Post-test	p1	p2	p3
SRT	−5.51 ± 2.54	5.51 ± 3.18	−6.08 ± 1.79	2.54 ± 2.78	0.506	0.002	0.002
VAS	4.33 ± 1.30	3.42 ± 0.79	4.83 ± 1.34	4.25 ± 1.29	0.326	0.005	0.008

Values are expressed as mean ± SD. SRT: sit and reach test; VAS: visual analog scale; GT: graston group; SS: static stretching group
p1=difference at baseline; p2=differences pre/post tests for experimental group; p3=differences pre/post tests for control group

Table 3. Difference change value for SRT, VAS between two groups

	GT group	SS group	p-value
SRT	11.03 ± 1.80	8.62 ± 1.60	0.002
VAS	−0.92 ± 0.67	−0.58 ± 0.51	0.210

Values are expressed as mean ± SD. SRT: sit and reach test; VAS: visual analog scale; GT: graston group; SS: static stretching group tion. Future studies will need to include various disease groups to address this limitation.

In this study, the GT proved to be a more effective intervention to improve hamstring extensibility in NSLBP patients than static stretching did. We look forward to its use in clinical practice because of its simplicity and efficacy.

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