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Original Article

The effect of Graston technique on the pain and range of motion in patients with chronic low back pain

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Abstract. [Purpose] Clinicians have reported the effects of various instrument assisted soft tissue mobilization (IASTM) in patients. The purpose of this study was to investigated the effects of the Graston technique and general exercise on pain and range of motion (ROM) in patients with CLBP. [Subjects and Methods] 30 patients with CLBP participated in the study (Graston technique: 15; Control: 15). Before and after the 4-week intervention program, pain was assessed using a visual analog scale (VAS). Lumbar ROM was measured using a smartphone. The main effects and interaction were analyzed by two-way repeated ANOVA. [Results] A significant time-by-group interaction was observed for the VAS and ROM. A post hoc paired t-test showed that pain decreased significantly post-intervention within the Graston group. The lumbar ROM significantly increased post-intervention in both groups. [Conclusion] The Graston technique and general exercise resulted in pain relief and increased ROM. However, the Graston group showed significantly increased VAS and ROM more than control group. These findings suggest that the Graston technique can be useful as a pain decrease and ROM increase for patients with CLBP.
Key words: Chronic low back pain, Graston technique, Range of motion

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INTRODUCTION

CLBP patients when bending forward to going back because of the balance of the posterior structures such as ligaments and erector spinae[1)]. CLBP patients had neuromuscular problem or a problem of internal muscles, muscle weakness, pain due to shortening occurs complain[2)]. A significant difference in muscular activities of erector spinae between the groups were obtained when returning to the erect position from the maximum flexion. Moreover, time lag between trunk and hip movement was much greater in patients than in healthy subjects. This study demonstrated that neuromuscular coordination between trunk and hip could be abnormal in patients with CLBP[3)].

Instrument assisted soft tissue mobilization or simply (IASTM) is a new range of tool which enables clinicians to efficiently locate and treat individuals diagnosed with soft tissue dysfunction. IASTM is a procedure that is rapidly growing in popularity due to its effectiveness and efficiency while remaining non-invasive, with its own indications and limitations. Gehlsen et al.[4)] investigated the effects of 3 separate IASTM pressures on rat achilles tendons. They concluded that fibroblast production is directly proportional to the magnitude of IASTM pressure used by the clinician. Davidson et al.[5)] supported Gehlsen et al.[4)] by concluding that intramuscular (IM) significantly increased fibroblast production in rat achilles tendons by using electron microscopy to analyze tissue samples following IM application. Davidson et al.[5)] found morphologic changes in the rough endoplasmic reticulum following IM application. Thus, indicating micro trauma to damaged tissues, resulting

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in an acute fibroblast respons[5]. The results of this study indicate that an application of IASTM to the posterior shoulder provides acute improvements in both glenohumeral horizontal adduction range of motion (ROM) and internal rotation ROM among baseball players[6].

In the present study, we determined the changes in the pain and ROM of back muscles after therapy using the Graston technique in patients with CLBP. We hypothesized that Graston technique would increase ROM and decrease pain more than the general exercise.

SUBJECTS AND METHODS

This study involved 30 patients (17 females, 13 males) with low back pain who visited B Hospital, Busan, Korea. Inclusion criteria included onset of low back pain of less than 12 weeks, CLBP (>90 days at time of enrolment)[7]. Exclusion criteria were a history of back surgery[8], patients who had spinal fracture within six months and spinal tumor or other malignancy, and medicine for psychiatric disorder and who had possibility of exaggerated complaints due to automobile or accident insurance[7]. All of the participants read and signed an informed consent form approved by the Inje University Ethics Committee for Human Investigations. Control group (n=15) age 33.0 ± 9.9, height 165.6 ± 7.9, body weight 61.8 ± 12.9, and VAS score 48.9 ± 14.6. Graston group (n=15) age 40.6 ± 14.6, height 169.3 ± 10.2, body weight 63.9 ± 15.6, and VAS score 50.6 ± 12.7.

To measure lumbar ROM, hip ROM inclinometer application, Android 4.0 phone (Samsung Galaxy S3, SHV-E210S) was used. Data were collected using an Android 4.0 phone ROM was recorded. The intraclass correlation coefficients ranged from 0.82 to 0.90[2].

The Graston group used the DR. YOUSTM (SEED Technology; Bucheon, Republic of Korea) for Graston technique. The intervention was used to provide were used to IASTM the Graston technique of subjects.

Pain level was evaluated using visual analog scale (VAS; 100 mm)[1, 8, 9]. Zero indicated no pain and 100 mm indicate the worst pain level. The VAS score of 17 mm is reported as minimal clinically important difference[10]. Lumbar, hip ROM was measured with an inclinometer application. To measure lumbar flexion/extension, the neutral position, with feet 15 cm apart and heels aligned with floor tape. Smartphone placement were used at the T12–L1 between interspinous junction and S1 tubercle[11]. The patient was asked to maximally flex/extend, keeping the knees straight, at which points readings were taken from inclinometer application. The method purport to record true lumbar flexion/extension without sacral involvement[12]. To measure lumbar lateral bending, smartphone placed at T12–L1 between over the sacrum according. The patient in full lateral bending right/left. Hip flexion ROM was measured with participants in the supine position smartphone was firmly attached with adhesive tape to the anterior aspect of the thigh, two centimeters proximal to the superior pole of the patella. The reading on the smartphone held against the skin laterally at the midpoint of the thigh (determined as midway between the lateral femoral condyle and greater trochanter) with the leg relaxed in neutral hip rotation, were recorded[13]. Maximal active hip flexion was then performed with the knee in flexion and recorded at the point at which a pain was experienced. This position was then maintained for three seconds to allow the smartphone to record the measurement[13]. We measured each motion in three trials and recorded the average.

The Graston group performed IASTM using the DR. YOUSTM during 4 weeks: posterior fascia, sacrum, hip lateral rotators, and hamstring bilaterally and general exercise. In the first, subjects were asked to kneel directly on the bed. The posterior fascia IASTM was microtrauma to stimulation lumbar posterior muscle erector spinae (iliocostalis, longissimus), and multifidus. The sacrum IASTM, subjects were asked to kneel directly on the bed. The hip lateral rotators IASTM was applied to kneeling prone position with knee and hip flexion sidelying position at gluteus maximus and gluteus medius. The hamstring bilaterally IASTM was applieded to prone position at biceps femoris, semitendinosus, and semimembranosus. The IASTM treatment was applied for approximately 20-seconds in a direction parallel to the muscle fibers being treated with the instrument at a 45° angle. Followed immediately by treating the muscles in a direction perpendicular to the muscle fibers with the instrument at a 45° angle for an additional 20-seconds, resulting in a total treatment time of approximately 40 seconds.

The control group was applied general exercise. General exercise were applied with stretching exercises and stationary bicycling for 10–15 minutes[14, 15]. Three sets of fifteen repetitions were performed, with rest times of 1 minute between sets during 4 weeks.

We expressed the mean and standard deviation (SD) of the VAS scores and ROM. Statistical analyses were performed with the SPSS software (ver. 22.0 for Windows; SPSS Inc., Chicago, IL, USA). A two-way repeated-measures analysis of variance (ANOVA) was used to determine the main effect and any interaction between the VAS score and ROM. The within-group factor was time (pre-intervention vs. post-intervention) and the between-group factor was group (Graston vs. Control). A p-value<0.05 was considered statistically significant. If a significant main effect or time-by-group interaction effect was detected, a post hoc independent and paired t-test was used.

RESULTS

Significant main effects of time were observed in pain. VAS scores significantly decreased post-intervention versus pre-intervention in Graston groups (Table 1; Graston: 25.5 ± 7.3 mm vs. 50.6 ± 12.8 mm, p<0.001; Control: 44.6 ± 12.9 vs. 48.9 ± 14.6, p=0.334).

Significant main effects of time were observed in ROM. ROM of lumbar flexion significantly increased post-intervention

Table 1. Change in pain between pre- and post-intervention (N=30)

Variable	Group	Pre-intervention	Post-intervention
		Mean ± SD	Mean ± SD
VAS (mm)	Graston (n=15)	50.6 ± 12.7	25.5 ± 7.3*
	Control (n=15)	48.9 ± 14.6	44.6 ± 12.9

*p<0.05. VAS: visual analog scale.

Table 2. Change in range of motion between pre- and post-intervention (N=30)

Variable	Group	Pre-intervention	Post-intervention
		Mean ± SD	Mean ± SD
Lumbar flexion	IASTM (n=15)	74.5 ± 14.1	89.3 ± 10.5*
	Control (n=15)	78.2 ± 8.7	75.5 ± 17.5*
Lumbar extension	IASTM (n=15)	13.0 ± 3.2	19.8 ± 2.4*
	Control (n=15)	13.3 ± 2.4	14.6 ± 2.3*
Lumbar lateral bending (Rt)	IASTM (n=15)	22.1 ± 4.4	25.6 ± 4.7*
	Control (n=15)	22.9 ± 3.3	23.6 ± 3.3*
Lumbar lateral bending (Lt)	IASTM (n=15)	21.3 ± 4.2	25.7 ± 4.6*
	Control (n=15)	23.2 ± 3.3	24.2 ± 3.3*
Hip flexion	IASTM (n=15)	110.2 ± 6.6	118.1 ± 8.1*
	Control (n=15)	110.6 ± 6.8	111.8 ± 5.5*

*p<0.05

versus pre-intervention in both groups (Table 2; Graston: 89.3 ± 10.5° vs. 74.5 ± 14.2°, p<0.001; Control: 75.5 ± 17.5° vs. 78.3 ± 8.8°, p=0.492). ROM of lumbar extension significantly increased post-intervention versus pre-intervention in both groups (Table 2; Graston: 19.8 ± 2.42° vs. 13.0 ± 3.2°, p<0.001; Control: 14.6 ± 2.3° vs. 13.3 ± 2.4°, p=0.026). ROM of lateral bending (right) significantly increased post-intervention versus pre-intervention in both groups (Table 2; Graston: 25.6 ± 4.7° vs. 23.6 ± 3.3°, p<0.001; Control: 23.6 ± 3.3° vs. 22.9 ± 3.3°, p=0.002). ROM of lateral bending (left) significantly increased post-intervention versus post-intervention in both groups (Graston: 25.7 ± 4.6° vs. 21.3 ± 4.2°, p<0.001; Control: 24.2 ± 3.3° vs. 23.2 ± 3.3°, p=0.014). ROM of hip flexion significantly increased post-intervention versus post-intervention in both groups (Graston: 118.1 ± 8.1° vs. 110.2 ± 6.6°, p<0.001; Control: 111.8 ± 5.5° vs. 110.6 ± 6.8°, p=0.021). There were significant differences in lumbar and hip ROM between groups.

DISCUSSION

Many researchers have investigated the effects of soft tissue mobilization in patients[9, 15–17]. However, few studies have investigated the effect of soft tissue mobilization on ROM, pain in patients with CLBP. We investigated the effects of the Graston technique compare with general exercise in patients with CLBP. Our results show that the Graston technique decreased pain and increased ROM in patients with CLBP. These results confirm that both methods lead to pain relief and increased ROM. These findings indicate that the Graston technique could be recommended in the rehabilitation of patients with CLBP.

The Graston group showed improvements decreased pain and increased ROM. In this study, pain significantly decreased in Graston group. Our results are consistent with other reports[15, 18]. Previous studies explained that pain decreases could be affected erector spinae activity[1, 19, 20], and back muscle activity was decrease[21, 22]. Our results demonstrated that after performing the Graston technique pain significantly decreased. Thus, Graston technique may help to decrease lumbar pain in patients with CLBP. Graston technique more than general exercise under these conditions may drcrease muscle activities, leading to decreased back pain. A VAS score of 17 mm is the minimal clinically important difference[10]. Mean differences in VAS score reduced pre- and post-intervention were 25.1 mm in the Graston group and 4.3 mm in the control group. We propose that both the Graston technique compare with general exercise contributed to decrease pain in patients with CLBP.

Active lumbar flexion, extension, lateral bending and hip flexion were increased both in the Graston technique and control group. Graston technique and general exercises are used to increase ROM and may do nothing more; a meta-analysis indicated that pain modality did not significantly increase ROM[22]. This was because the Graston technique helped to prevent muscle atrophy and restored muscle balance and general exercise included stretching for improving ROM. Thus, the hypothesis of the present study was confirmed, as Graston technique increased lumbar and hip ROM more significantly than the general exercise. However, both the Graston and control groups showed significantly increased lumbar and hip ROM after the interventions. Consequently, the Graston technique may be a useful intervention for ROM of lumbar and hip.

The present study had several limitations. First, it only investigated changes in pain, ROM after the Graston technique, and did not measure the muscles activity. Thus, further studies are required to investigate changes in back muscle activity after the Graston technique. Second, the duration of intervention was short. Usually, a 6–8 week or longer intervention period has been used because the most significant progress may be made after at least 6 weeks[23, 24]. However, what is the optimal exercise period remains unclear[25]. Our results showed that after 4 weeks, the Graston technique significantly increased ROM and decreased pain. Further research is needed to investigate the long-term effects of the Graston technique on pain muscle activity and ROM in patients with CLBP.

We investigated the effects of the Graston technique on pain and ROM in patients with chronic low back pain. Both the Graston technique and general exercise induced increased ROM. However, only the Graston group showed more pain relief and increased ROM. These findings suggest that the Graston technique can be useful as a pain relief and ROM increasing program for patients with CLBP.

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