J Int Acad Phys Ther Res 2019; 10(1): 1746~1749
ISSN 2092-8475

www.iaptr.org
https://doi.org/10.20540/JIAPTR.2019.10.1.1746

The Impact of Joint Mobilization and Transcutaneous Electrical Nerve Stimulation on Pain in Patients With Lumbar Spinal Stenosis

Background: Surgery has been known as an inefficient approach to reduce back pain in patients with lumbar spinal stenosis; therefore, non-surgical treatments are necessary. However, there has been little research to analyze the effect of non-surgical treatments on lumbar spinal stenosis pain.
Objective: To identify the effectiveness of 2 physiotherapeutic treatment approaches to relieve pain due to lumbar spinal stenosis.
Design: Randomized controlled trial
Methods: The participants were
36 lumbar spinal stenosis patients who were randomized in the joint mobilization group (JMG) and transcutaneous electrical nerve stimulation group (TENSG). Joint mobilization (JM) was conducted at the posteroanterior joint in the spinous process of the lumbar spine with stenosis. Transcutaneous electrical nerve stimulation (TENS) was applied on the lumbar spine with stenosis at a high frequency and intensity.
Results: Visual analog scale (VAS) pain score significantly decreased in both groups, and the VAS value decreased more after JMG than that after TENSG. The pain thresholds of both groups also significantly increased, and that of JMG increased more compared to TENSG. In both the groups, significant improvements in VAS and pain thresholds were found, and JMG showed better results than TENSG.
Conclusions: JM and TENS showed significant relief in both pain threshold and painpain, and JM showed more advanced relief compared to TENS.

Key words: *Lumbar stenosis; Joint mobilization; TENS; Pain*

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Received : 15 January 2019
Revised : 27 February 2019
Accepted : 07 March 2019

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INTRODUCTION

Lumbar spinal stenosis is a disease that causes pain and hypoesthesia in the back and lower body by oppressing the nerve root because the spinal canal, nerve root, and intervertebral foramen become narrowed [1]. The incidence of pain attacks in lumbar spinal stenosis has increased by 28.4% from 2012 to 2017 [2]. If the back pain becomes chronic, muscle atrophy due to lack of normal exercise occurs close to the back bone [3]. This muscle atrophy causes an increase in internal pressure in the spinal canal; therefore, it aggravates pain by oppressing the nerve and by causing poor blood circulation [4]. Various kinds of interventions have been attempted to diminish the pain of lumbar spinal stenosis, including surgery, joint mobilization (JM), transcutaneous electrical nerve stimulation (TENS), exercise, nonsteroidal anti-inflammatory drugs, ultrasonic waves, hot pack, and massage [5, 6, 7]. Theoretically, JM blocks the gateway of the pain nerve to the brain by stimulating the joint receptors involved in proprioception [8], relieving arthrodynia in the joint and surrounding muscles [9]. TENS decreases pain by stimulating the transcutaneous nerves that restrain pain from being delivered to the transmitting cells by administering neural stimulations in the substantia gelatinosa in the dorsal horns of the spinal cord [10].

Most researches on the treatment of lumbar spinal stenosis have focused on surgery; however, after the surgery for lumbar spinal stenosis, 17% of the patients had to undergo the surgery again and 30% of the patients complained of severe, chronic pain [11]. Therefore, nonoperative treatments need to be investigated. However, researches on these nonoperative treatments and their relative analysis are infrequent. This research aimed to compare JM and TENS, which are well known methods of pain relief, with respect to the immediate effect on lumbar spinal stenosis pain using instruments that gauged Algometer and VAS.

METHODS

Subjects

This research included 36 subjects who visited the H and S care hospitals in Gyeong-gi-do, South Korea (10 men and 26 women) and were diagnosed with lumbar vertebral canal or intervertebral foramen stenosis due to degenerative stenosis. We used a computer program to randomly categorize the 36 subjects in the JM (JMG) and TENS (TENSG) and implemented the treatments from October to November 2018. No subjects had skin damage or disease in the treatment area, used synchronous cardiac pacemakers, or had ever participated in this kind of research before. Table 1 shows the descriptive statistics of the subjects.

Measurement Methods

Algometerusing a

We measured pain threshold using an Commander AlgometerTM (J-TECH Medial, Ohio, USA)a, which is widely used to gauge the sensitivity of pressure pain in electronic figures. First, we marked the belly of the erector spinae muscles where patients complained of pain due to spinal stenosis. The algometer investigator was erected in that area, and pressure was applied gradually. We recorded the first location of pain reported by the subject during this process and calculated the average of 5 measurements [12]. These measurements were taken before and after the interventions.

using Visual analog scale (VAS)

To measure pain, we used the visual analog scale, which is an instrument that measures pain [13]. Subjects indicated their pain due to lumbar spinal stenosis on a bar of 10 cm with 0 (no pain) at the left edge and 10 (maximum pain) at the right. We measured subjective painVAS before and after the treatments and marked the point on the bar data by measuring the length between the point and 0.

JM

For JM, we applied posteroanterior Grade III Maitland mobilizations on the spinous process of lumbar spinal stenosis diagnostic segment the eto mitigate the pain due to lumbar spinal stenosis [14]. Each session had 60 JMs in 1 minute, and there were 8 sessions, with a 1-minute break after each session.

TENS

TENS of high frequency and high load was applied to the lumbar spinal stenosis diagnostic segment using alternatives. The frequency was 75-125 Hz, load 30-80 mA, pulse period 30-200 μs, pulse frequency 50-100 pps, and total treatment time 15 minutes 15).

Data analysis

The normality of the subjects was tested using the Shapiro-Wilks test. The homogeneity of pain strength before the treatment between the groups were

Table 1. General characteristics of the subjects

Classification	JMG	TENSG	p
Gender (male/female)	6/12	4/14	.15
Age (years) (mean±SD)	61.72±6.60	64.88±4.49	.11
Weight (kg) (mean±SD)	61.16±10.22	60.33±8.36	.27
Height (cm) (mean±SD)	161.22±7.55	161.88±7.92	.97

*p<.05
JMG: joint mobilization group
TENSG: transcutaneous electrical nerve stimulation group
SD: standard deviation

investigated using the independent t-test, and the differences before and after the treatment in each group were compared using the paired t-test. To identify the differences before and after the intervention between the groups, the independent t-test was used. The statistics were considered significant at α=.05 using the Statistical Package for the Social Sciences software version 20.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Ex-ante test for identifying homogeneity

Ex-ante independent t-tests were implemented on pain threshold and pain measured with algometer and VAS before the treatment to check if there was a significant difference between the groups in pain threshold and pain. For pain threshold, the values recorded by algometer in the two groups were used, and their t-value was .28 ($p<.74$), which was insignificant. FortThe VAS values were used, and their t-value was −.16 ($p<.28$), which was also insignificant. Therefore, there was no significant difference in pain threshold or pain between the groups JMG and TENSG.

Changes in pain threshold after intervention

The post-intervention pain threshold was higher than the pre-intervention pain threshold in both groups (JMG: $p<.05$; TENSG: $p<.05$). Between the groups, the increase in post-intervention pressure pain threshold was more in JMG compared to TENSG ($p<.05$).

Changes in VAS after intervention

In both the groups, the VAS values were less after the intervention (both groups: $p<.05$). Between the groups, the increase in post-intervention VAS value was more in JMG compared to TENSG ($p<.05$).

Table 2. Changes in objective pain between the groups after intervention (mean±SD)

Variable	JMG		JMG	
	Pre	Post	Pre	Post
Pain threshold †	5.24±1.22	7.80±.83*	5.32±1.61	5.86±1.86*

*p<.05
† Independent t-test for inter-group differences(p<.05)
JMG: joint mobilization group
TENSG: transcutaneous electrical nerve stimulation group
SD: standard deviation

Table 3. Changes in subjective pain between the groups after intervention (mean±SD)

Variable	JMG		JMG	
	Pre	Post	Pre	Post
VAS †	7.50±1.20	3.55±1.09*	7.38±1.14	6.00±1.02*

*p<.05
† Independent t-test for inter-group differences(p<.05)
JMG: joint mobilization group
TENSG: transcutaneous electrical nerve stimulation group
VAS: visual analog scale
SD: standard deviation

DISCUSSION

We hypothesized that JMG and TENSG would relieve pain and one of them would have a higher impact than the other. In our research, we referred to Elly and Kevin (2014) for JM and Park and Song (2012) for TENS. Through this research, we found that both JM and TENS had a significant impact on pain relief in the area of maximum pain due to lumbar spinal stenosis. Additionally, JM showed a more significant improvement in pain compared to TENS, which was similar to the report by Georgios et al. (2017) on conventional physiotherapy by JM and TENS on pain relief in subjects with chronic back pain.

chronic back pain. JM provides better results because it stimulates the joint receptors, and the activity of the joint receptors lowers tension in the surrounding area [17]. Moreover, JM relieves the trapped nerves by widening the gap between the vertebral canal and intervertebral foramen [18]. However, JM can control the pain transmission through nerves by stimulating the proprioceptive nerves and by increasing joint circulation [9] similar to TENS controlling the pain transmission through nerves by stimulating the Aβ and Aδ fibers on skin receptors [10].

The limitation of this research was that the number of subjects was only about 40 and that the patients fulfilled certain pre-requisites; therefore, the results cannot be applied to all patients of lumbar spinal stenosis. Moreover, we studied only the immediate and not the long-term improvement in pain. Therefore, we need to increase the size and diversity of the study cohort and conduct follow-ups to identify the durability of treatments in future studies.

CONCLUSION

We investigated the impact of JM and TENS on pain due to lumbar spinal stenosis by randomly classifying 36 patients into 2 groups: JMG and TENSG. After the treatment, the two groups showed significant relief in both pain threshold and pain, and JMG showed a more advanced relief in pain threshold and pain compared to TENSG.

According to our results, non-operative interventions such as JM and TENS could be good alternatives to surgery in lumbar spinal stenosis patients who do not prefer surgery or show no improvement through surgery. Moreover, JM is better than TENS for immediate pain relief in lumbar spinal stenosis.

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