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Effect of simultaneous application of positional release technique and Maitland mobilization technique on sciatica: a randomized controlled trial

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Abstract

Background: Low back pain (LBP) associated with sciatica is considered the primary cause of seeking medical and physical therapy advice. Treating sciatica symptoms is the main goal in the physical therapy practice, and the literature supports the use of manual therapy techniques in management of patients with sciatica.

Objectives: This study aimed to assess the effect of simultaneous application of positional release technique and grade-4 Maitland mobilization technique on sciatic nerve sensory nerve conduction velocity (NCV) in patients with LBP associated with sciatica.

Methods: A randomized controlled trial was performed among 50 patients (mean age 41.86 ± 7.90) diagnosed with LBP with sciatica. Patients were randomly assigned to two groups: experimental "group A, $n = 25$" and control "group B, $n = 25$." Patients were tested twice, before and after a 6-week period, during which group A received a traditional physical therapy program along with piriformis muscle positional release technique and grade-4 Maitland mobilization technique, while group B received a traditional physical therapy program along with a sham mobilization technique.

Results: Statistical analysis revealed a significant increase ($p < 0.05$) in the sciatic nerve sensory NCV in the post-test condition compared with the pre-test in group A with no significant difference ($p > 0.05$) in group B.

Conclusion: Simultaneous application of the piriformis muscle positional release technique and grade-4 Maitland mobilization technique on lower lumbar spine may improve sciatic nerve function in patients with LBP associated with sciatica.

Keywords: Sciatica, Low back pain, Positional release technique, Maitland mobilization, Nerve conduction velocity

Introduction

Sciatica is considered one of the most common forms of pain in patients with LBP. It is caused by nerve root compression at the lower lumbar spine [1, 2]. Nerve root entrapment is the primary source of sensory and motor manifestations in patients with lumbosacral radiculopathy [3]. Compression of the sciatic nerve is mostly caused by a herniated disc, foraminal stenosis, and osteophytes [4]. Pelvic floor tumors, inflammation, or irritation of piriformis muscle can also cause it. The sciatic nerve enters the lower limb through piercing the piriformis muscle. Inflammation or spasm of the piriformis muscle can induce sciatic nerve compression. The sciatic nerve

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can be compressed between the piriformis muscle and the bone of the sciatic notch, and in 15% of patients, it is compressed through the muscle itself [1–6].

Several conservative treatments have been introduced by the clinical practice guidelines and systematic reviews as the initial treatments for patients with sciatica with the first aim is to reduce pain and improve function. Positional release technique of the piriformis muscle is an effective manipulative treatment in the management of patients with LBP. It involves relaxation of the piriformis muscle and reducing pressure on the sciatic nerve. Targeting of the piriformis muscle is very crucial to reduce sciatic symptoms since the sciatic nerve passes between the two heads of the muscle in 20% of people. Maitland mobilization technique has been thought to reduce pain and stiffness in patients with LBP by providing passive and accessory oscillatory movements to the spinal and vertebral joint.

Despite their clinical popularity, there is no research work that investigates the effect of simultaneous application of positional release technique and Maitland mobilization technique on sciatic sensory NCV in patients with LBP associated with sciatica. Therefore, the main purpose of this study was to investigate the effect of simultaneous application of piriformis muscle positional release technique and grade-4 Maitland mobilization technique on sensory NCV of sciatic nerve in patients with LBP associated with sciatica.

Materials and methods

Participants

The sample size of the current study was determined based on power analysis of pilot data. The effect of simultaneous application of positional release technique and Maitland mobilization technique was measured in four patients. An ANOVA was used to calculate the effect size. The calculated effect size (ES) was 0.4 for two independent variables and one dependent variable. With a power of 80% and an alpha value of 5% using F-test for all hypotheses, a priori compute required a sample size of 50 subjects (G*Power statistical software, version 3.03).

A randomized, controlled trial, with two parallel groups (experimental and control), was used to assess the effect of simultaneous application of positional release technique and Maitland mobilization technique on sensory NCV of sciatic nerve in patient with LBP associated with sciatica. Fifty-five patients diagnosed with LBP associated with sciatica were referred by a physical therapist at Faculty of Physical Therapy, Cairo University, outpatient clinic. Five patients were excluded from the study, two patients did not return after initial enrollment, and three patients were excluded because they did not meet inclusion criteria. Therefore, data from fifty patients were considered for analysis (Fig. 1). To be included in the study, patients were to be diagnosed with chronic low back pain lasting more than 3–6 months associated with sciatica. Patients were excluded from the study

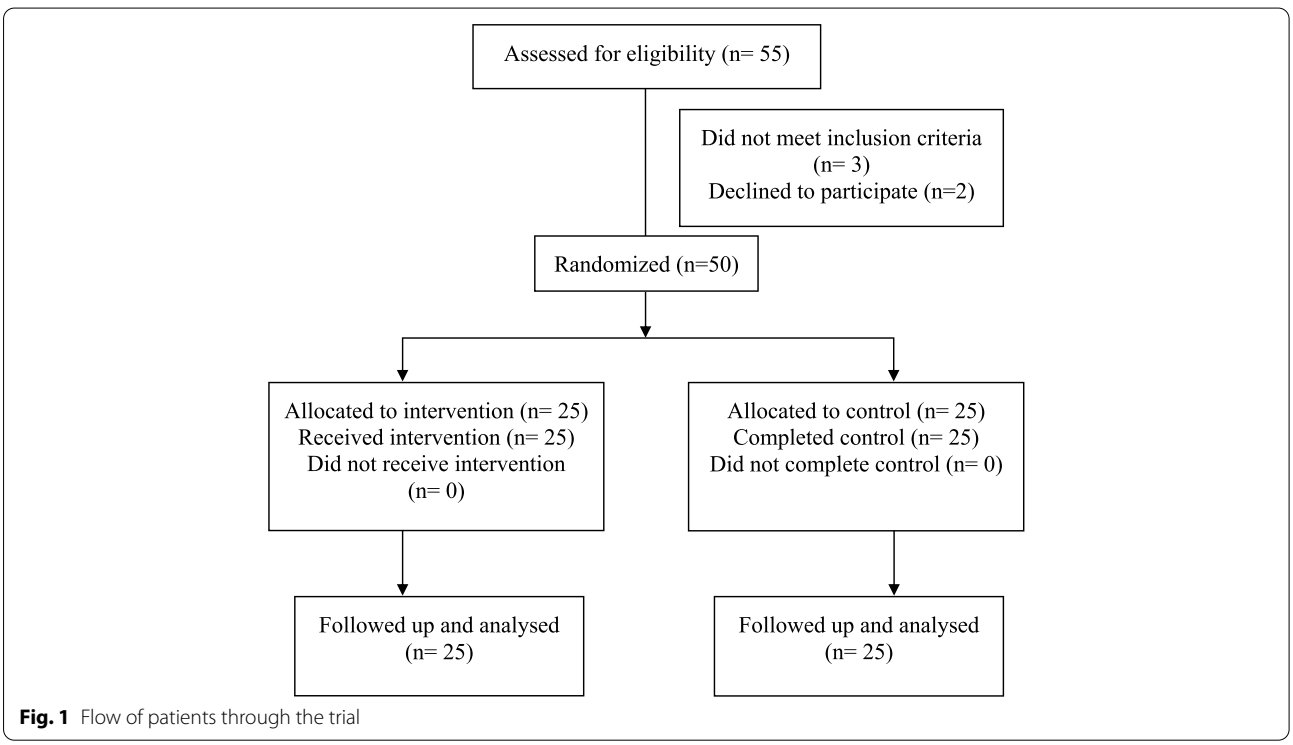

Fig. 1 Flow of patients through the trial

if they had a surgery in the lumbar spine and a motor manifestation in the lower limb such as drop foot, diabetes mellitus, rheumatoid arthritis, previous history of tumor, and pregnancy. Patients were also excluded if they had an acute attack of LBP in the last 48 h or had undergone rehabilitation or exercise therapy in the previous 3 months. Patients were randomly assigned to two groups (experimental: group A and control: group B). To assure random assignment of the patients to either of the tested groups, patients were asked to select one of two folded papers (designated experimental or control) from a container. This study conforms to all consort guidelines and is registered in Pan African Clinical Trials Registry (PACTR202009541417744).

Procedures

Participants in both groups were tested twice before and after a 6-week period, during which group A received a traditional physical therapy program along with positional release technique of the piriformis muscle and grade-4 Maitland mobilization technique. Group B received a traditional physical therapy program and a sham mobilization technique. Upon arrival, procedures were explained, and an informed consent, as approved by Cairo University's Supreme Council of Postgraduate Studies and Research and Human Research Ethics Committee (P.T.REC/012/002962), was obtained. A medical history was collected from patients, and sciatic sensory NCV was performed. Following testing, group A and group B received the treatments described below, and then they were scheduled for a follow-up appointment in 6 weeks.

Outcome measures

Sensory NCV of sciatic nerve was measured to assess the integrity and function of the sciatic nerve before and after application of the treatment programs. The sensory NCV of sciatic nerve was collected at testing time points on day 1 and after 6 weeks by the same examiner. The examiner was blinded from the allocations process and the intervention programs. Measurements of sensory NCV of sciatic nerve were performed at the unit of electromyography (EMG) in the outpatient clinic at Faculty of Physical Therapy Cairo University.

Interventions

Patients in group A received a traditional physical therapy program and a combination of piriformis muscle positional release technique and grade-4 Maitland mobilization technique at L5-S1 level. The traditional physical therapy program involved application of hot pack and transcutaneous electrical nerve stimulation (TENS) for 15 min followed by static abdominal exercises 3 sets of 15 repetitions and stretching of hamstring muscle 4 sets each set 30 s [7]. After that, the piriformis muscle positional release technique was performed. This technique was done to induce immediate relaxation of the piriformis muscle and enhance blood supply to nourish the muscle fibers efficiently by passively moving the muscle to a relaxed position and holding it for 90 s.

In piriformis muscle positional release technique, the patient was positioned prone on a stretcher. The therapist stood at the pelvis of the affected side. The patient's leg was moved outside the bed with the hip and knee kept in a flexed position. The hip joint was then abducted and flexed until a comfortable position was achieved. After that, the leg was rested on a small chair beside the bed for 90 s (Fig. 2), and grade-4 Maitland mobilization was applied at L5-S1 level. This position puts the affected leg in a gravity-dependent position and relaxes the piriformis muscle which reduces the pressure on the sciatic nerve and increases its blood supply [8].

In grade-4 Maitland mobilization technique, the therapist first located L5-S1 by palpating both iliac crests and then moved medially to rest on the L4-L5 intervertebral disc. The therapist's hands then moved further

Fig. 2 Positional release technique of piriformis muscle

down to palpate L5 spinous process. The therapist placed the ulnar surface of the hand over L5 spinous process with the wrist in full extension, elbow slightly flexed, and the other hand placed on top of the hand to reinforce. The therapist then applied a posterior anterior force on L5 spinous process by leaning body over arms to provide a posterior anterior pressure (Fig. 3) and maintained it for 10–15 s [9]. The grade-4 Maitland mobilization was repeated five times. Patient was rested for 10 s, and then the whole technique was repeated ten times. The traditional physical therapy program, piriformis muscle positional release technique, and grade-4 Maitland mobilization technique were conducted three times per week for 6 weeks.

Patients in group B received the same traditional physical therapy program as group A as well as a sham positional release and a sham mobilization. During the sham positional release and sham mobilization, the patient was positioned prone on a stretcher, and the therapist stood at the pelvis of the affected side. The patient's affected leg was rested on a chair with the knee and hip bent to control for the perform positional release technique. The therapist palpated the lower lumbar spine without applying any form of mobilization for 30 s and repeated this procedure three times. Patients in the group B received the same procedures three times per week for 6 weeks.

Fig. 3 Application of grade-4 Maitland mobilization technique

Data and statistical analysis

Statistical analysis was performed through the Statistical Package for Social Science (SPSS) version 17 for windows. Initially, data were screened for normality assumption using Kolmogorov-Smirnov and Shapiro-Wilk normality tests. Additionally, data were screened for homogeneity of variance assumption. Once data were found not to violate the normality and homogeneity of variance assumptions, parametric analysis was conducted. Paired *T*-tests were conducted to compare the sensory NCV of sciatic nerve between the pre-test and post-test conditions in each of the tested groups. Unpaired *T*-tests were conducted to compare between group A and group B for sensory NCV of sciatic nerve in each of the pre-test and post-test conditions. The level of significance was set at $p < 0.05$ for all tests.

Results

Patients' demographic data are presented in Table 1. When compared to the pre-test condition, sensory NCV of sciatic nerve increased ($p < 0.05$; Table 2) in the post-test condition in group A but not in group B ($p > 0.05$; Table 2). No significant difference ($p > 0.05$; Table 2) was observed between groups in the pre-test condition for sensory NCV of sciatic nerve, while there was a significant difference ($p < 0.05$; Table 2) between them in the post-test condition.

Discussion

Low back pain associated with sciatica is one of the most debilitating conditions in patients who suffer from pain and or paresthesia in the sciatic nerve distribution [1]. Results from the current study found an increase in sciatic nerve sensory NCV in a cohort of patients with LBP-associated with sciatica following treatment using piriform muscle positional release technique and grade-4 Maitland mobilization technique. To the best of the authors' knowledge, this is the first study that investigated the effect of simultaneous application of positional release technique and grade-4 Maitland

Table 1 Mean (SD) for the participants' demographic data

Characteristic	Experimental ($n = 25$)	Control ($n = 25$)
Gender *n*= female %	19/25 (54.3%)	16/25 (51.3%)
Age (years), mean ± SD	35.9 ± 13.5	32.6 ± 13.6
Body mass index (BMI)	25.26 ± 7.39	24.33 ± 3.53
Symptoms duration	60.8 ± 87.0	70.6 ± 165.8

Table 2 Mean (SD) of groups and mean (SD) within groups for sensory NCV of sciatic nerve in the experimental and control groups in the "pre" and "post" test conditions

Outcome measures	Experimental ($n = 25$)	Control ($n = 25$)	Between-group *p*-value
Sciatic sensory NCV			
Pre	47.2 ± 0.90	47.3 ± 0.87	0.747
Post	51.2 ± 0.99	47.3 ± 0.91	−.000*
Within-group *p*-value	.000*	0.951	

* Significant at alpha level < 0.05

mobilization on sciatic nerve sensory NCV in patients with LBP with sciatica. The results of this study indicate that those treated with positional release technique and Maitland mobilization technique over a 6-week period had improved sciatic nerve function. This improvement was not seen in group B who received a sham positional release technique and a sham mobilization technique over the same period.

Although manual therapy techniques still do not have a full support from literature to be used in management of lumbar spine disorders compared with exercise therapy, there is a growing evidence that supports the use of manual therapy as a short-term tool for treating patients with LBP associated with sciatica [3, 9]. Improvement in the sciatic nerve integrity and function following treatment using simultaneous application of piriformis muscle positional release technique and grade-4 Maitland mobilization technique was evident by increase in sciatic nerve sensory NCV. This improvement may be attributed to the decompression of the sciatic nerve after releasing the tension from the piriformis muscles using positional release technique [1, 6, 10]. Further decompression had been enhanced by applying the Maitland mobilization technique on L5-S1 level, which had been recommended to induce decompression on nerve roots [11–15].

The finding of the current study is supported by that reported by Khan et al. (2018). They studied the effect of SNAGS and Maitland mobilization on pain, range of motion, and Oswestry Disability Index in patients with LBP. They declared that both SNAGS and Maitland mobilization were effective in improving symptoms of chronic LBP with better improvement was demonstrated in the SNAGS group [8]. Through measuring pain and functional status score, Gupta [16] also approved the effect of nerve mobilization along with conventional physical therapy on pain and function in patients with sciatica. The researcher concluded that adding neve mobilization technique to standard care had improved pain and function in patient with sciatica [16].

Additionally, Danazumi et al. investigated the effect of integrated neuromuscular inhibition technique and positional release technique on pain, sciatica, functional mobility, quality of life, hip abduction, and internal rotation in patients with piriformis syndrome. They found a significant improvement in all outcome measures in the integrated neuromuscular inhibition group and the positional release group. However, the integrated neuromuscular inhibition was more effective than the positional release technique in treating patients with piriformis syndrome [17]. In the present study, adding Maitland mobilization technique to piriformis muscle positional release technique had improved sciatic nerve function in patients with LBP associated with sciatica. This improvement may be attributed to the relaxation and decompression effects that had been provided by simultaneous application of those two manual techniques [3, 17].

Limitations

This study was conducted to examine the effect 6 weeks of simultaneous application of piriformis muscle positional release technique and grade-4 Maitland mobilization technique on sensory NCV of sciatic nerve in patients with LBP associated with sciatica. Future studies should be performed to examine the long-term effect of these manual techniques and on motor conduction velocity of the sciatic nerve along with more functional outcome measures. Additionally, interpretation of these data may be limited to the population tested. Only patients with strict inclusion criteria were included in the study which limits the generalizability of the results to all populations with LBP.

Conclusion

Piriformis muscle positional release technique and grade-4 Maitland mobilization technique successfully increased sensory NCV of sciatic nerve in patients with LBP-associated with sciatica.

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Disclosure statement
No author has any financial interest or received any financial benefit from this research.

Authors' contributions
All authors conceived and designed the study, conducted the data collection, and analyzed and interpreted the data in addition to reviewing the final draft and results. The authors read and approved the final manuscript.

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Declarations

Ethics approval and consent to participate
The study was approved by Cairo University's Supreme Council of Postgraduate Studies and Research and Human Research Ethics Committee (P.T.REC/012/002962). All participants signed written informed consents before starting the study.

Competing interests
The authors declare that they have no competing interests.

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