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RESEARCH ARTICLE

Comparison of two manipulative techniques on pain and function in patients with low back pain: a double-blind clinical trial

Felipe Figueiredo Moreira[1], Raissa Patel[1], Luiz Alfredo Braun Ferreira[2], Wagner Menna[2,3], Luciano Pavan Rossi[2].

[1] Campo Real University Center, Guarapuava (PR), Brazil.
[2] Midwest State University, Guarapuava (PR), Brazil.
[3] Uniguairacá University Center, Guarapuava (PR), Brazil.

Abstract:

Background: Low back pain affects a large part of the population, exerting negative impacts on the physical, social and emotional aspects of quality of life. Manipulative therapy is one of the main techniques used in the treatment, but little is known whether one technique is a more effective than another in terms of improving low back pain and functioning. **Objectives:** Compare two physiotherapeutic manipulation techniques (Maitland concept vs. osteopathy) and determine the impact on pain and functioning in patients with chronic low back pain. **Methods:** Forty-eight patients with nonspecific chronic low back pain (age: 18 to 40 years) and no contraindication for manipulation techniques participated in the study. Intervention: A single manipulation was performed in the lumbar region of the patients allocated to the Maitland group and osteopathy group. Randomization was performed using the Random Number Generator v.3.0.72 with concealed allocation. Blinding: The assessor who collected all data and the participants were blinded to the allocation to the different groups. Outcomes: Pain intensity (VAS), pressure pain threshold (algometer) and functional capacity (Roland-Morris) seven and 30 days after manipulation. **Results:** Both groups exhibited an improvement in the pressure pain threshold after seven days, which was maintained at 30 days. Likewise, the two groups exhibited an improvement in functional capacity after seven days, but this result was only maintained at 30 days in the Maitland group. No difference in pain intensity was found in either group after manipulation. No significant differences were found between the osteopathy and Maitland groups for any of the outcomes of interest. **Conclusion:** Although both methods led to improvements in the pressure pain threshold and functional capacity of the lumbar spine, no significant differences were found between the osteopathic and Maitland manipulation treatment techniques for the pain and functional capacity outcomes in patient with chronic low back pain.

Keywords: Osteopathic manipulation treatment; manual therapy; spine manipulation; pain; functional performance.

Corresponding author: Luciano Pavan Rossi.
E-mail:
lucianofisioo@yahoo.com.br

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BACKGROUND

Low back pain is a health problem that exerts a negative impact on the physical, social and emotional aspects of quality of life due to the diverse symptoms that accompany this condition. It is the most common form of pain, as described in a study involving 195 countries(1).

This condition is defined as pain or discomfort between the last rib and folds of the lower glutes, with or without radiation to the lower limbs. It is estimated that 70% to 8 5% of the population will experience low back pain at some time in life, which can give rise to anatomical-physiological changes resulting from external or psychosocial causes(2).Such changes may also result from poor postural habits and excessive load or from specific diseases(3).

Nonspecific low back pain can be defined as mechanical pain of a musculoskeletal origin with no properly defined cause. Less than 1% of patients have severe spine diseases, approximately 5% of these patients have nerve root impingement and approxi-

mately 95% of patients are in the group denominated nonspecific low back pain[4]. This is a very common condition due to the fact the lumbar spine is capable of sustaining body weight and producing movement, which, when submitted to acute or chronic excessive load, can generate symptoms[5].

Besides pain, other common signs are joint stiffness, reduced flexibility and diminished range of motion. Thus, chronic problems of low back pain cause disability, a reduction in functioning and the need to go on leave from work. Such conditions enormously affect current society due the negative impact on quality of life, treatment costs and the loss of productivity, surpassing US$ 100 billion in the United States per year with the direct costs of treatment and indirect costs due lost wages and reduced productivity[2].

Pain can exert numerous impacts on the lives of individuals, such as physical and functional disability, which implies limitations in terms of activities of daily living, disturbed sleep and constant worry. Changes in the pain threshold can also occur, as individuals with pain in the spinal column have greater nociceptive sensitivity compared to healthy individuals[6].

Despite the numerous treatment options for this condition, manipulation therapy has stood out in the physiotherapeutic scenario[7]. This is an intervention with fast application and has been generating satisfactory results in terms of low back pain[2,7-10]. Manipulative physiotherapy can be defined as a set of techniques involving the hands as the work instrument, the various types of which include the Maitland concept[11], Mulligan concept[12], osteopathy[13] and chiropractic[14]. Like any other treatment, manipulation physiotherapy should be based on evidence with regards to its safety and effectiveness for patients[7].

The Maitland concept is an option based on specific spinal column assessment and treatment methods. The physical examination is crucial for the clinical diagnosis and the choice of the best application technique for each specific case[11]. The intervention is characterized by mobilization and manipulation techniques involving oscillatory passive movements graded on five levels of amplitude and velocity[15-16]. Mobilization is performed within the normal range of motion, in which the patient has control regarding mobility. The manipulation movement is high velocity and short duration such that the patient can neither control or impede. The aim of the method is the recovery of joint movement, resulting in improvements in pain and function[17].

Osteopathy is another intervention option and is characterized by a diversity of manual techniques of assessment, diagnosis and treatment[13]. An important element is osteopathic manipulation treatment (OMT), which is a variety of manipulation techniques with the aim of resolving somatic dysfunctions. OMT can be applied to different regions and tissues of the body, at times distancing from the somatic area, but always within the clinical diagnosis of the therapist[4,18].

Different forms of assessment are found in manipulation physiotherapy, depending on the technique to be used. In osteopathy, a detailed assessment is employed to define the most adequate intervention, as vertebrae may be in non-physiological positions, which are defined as Neutral/Side Bending/Rotation (NSR), Flexion/Rotation/Side Bending (FRS) and Extension/Rotation/Side Bending (ERS)[13]. These positions in which the vertebra is biomechanically positioned in an inadequate way could be associated with pain that could affect muscles, fascia, nerve roots and circulation[9].

In contrast, the assessment in the Maitland concept is simpler and does not consist of specific vertebral positioning, as occurs in osteopathy[15]. With the Maitland method, the posteroanterior pressure maneuver ("spring test") is used on the vertebra, seeking pain and/or joint stiffness as a sign of dysfunction[11].

Based on the literature, it is difficult to state whether one technique is more effective than another at reducing pain and improving lumbar functioning. Is a method that involves a richer, more detailed assessment, as in osteopathy, with different treatment po-

sitionings in lumbar manipulation, superior or equal to other manipulation techniques, such as the Maitland method and chiropractic?

Thus, the aim of the present study was to compare two manipulation techniques (osteopathy and Maitland) to determine whether both are effective at reducing pain and improving function in patients with chronic low back pain and whether there is an important clinical difference between the techniques in term of the variables analyzed.

METHODS

Type of study

A two-arm randomized clinical trial was conducted with blinded assessors and participants (double-blind) (Figure 1).

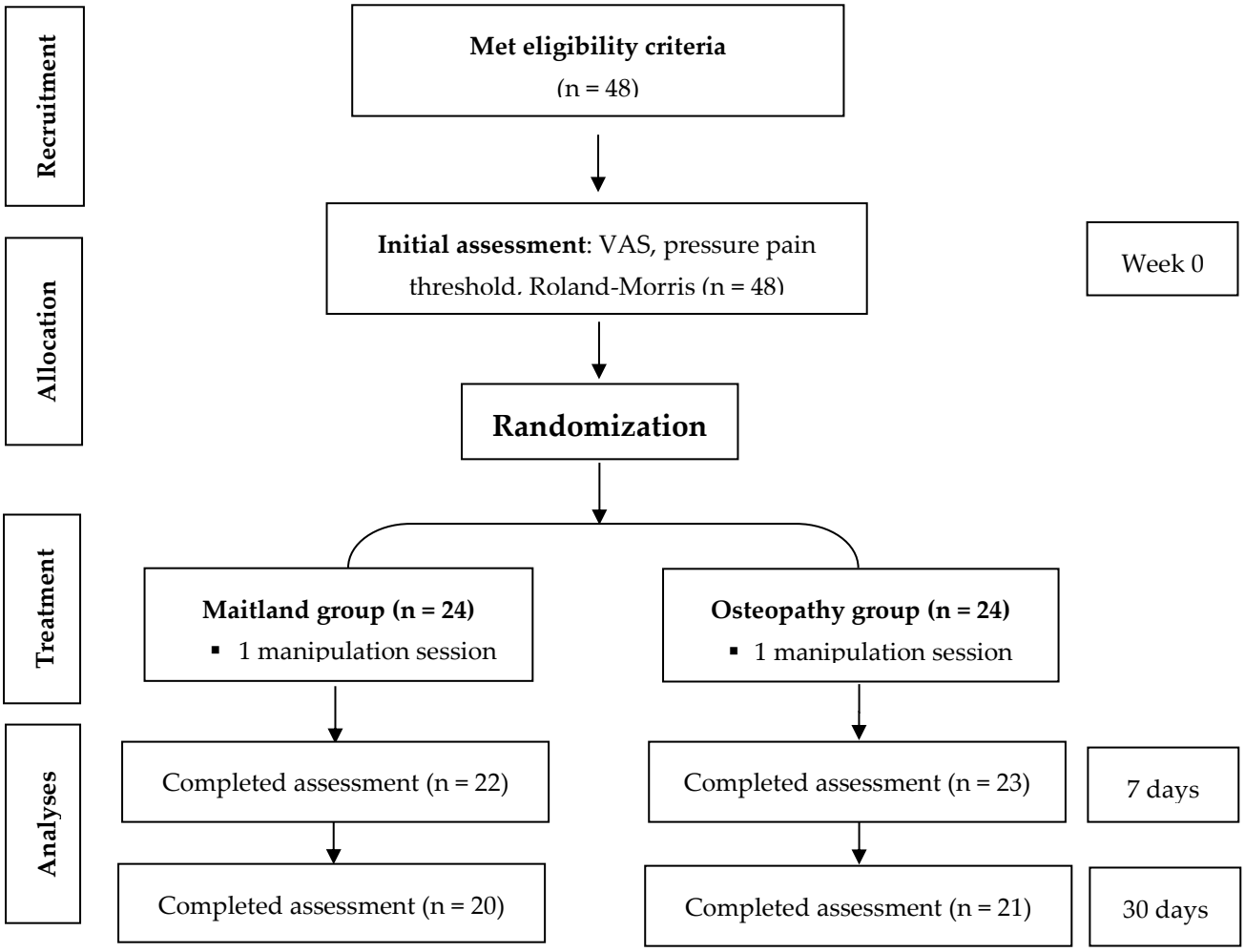

Figure 1. Experimental design of study (Consort)

Study setting

The study was developed at the Physical Therapy Teaching Clinic of Universidade Estadual do Centro-Oeste (UNICENTRO) (CEDETEG campus) located in the city of Guarapuava in the state of Paraná, Brazil. This study received approval from the ethics committee of UNICENTRO (approval number 4.643.855) and was registered at The Brazilian Clinical Trials Registry.

Sample and selection of participants

Forty-eight young male and female adults between 18 and 40 years of age with low back pain were initially selected (completing the study: n=41). The participants were randomly allocated to two groups: Maitland group (n = 15; mean age: 25,1 ± 4,8; total body fat: 65,6 ± 9,79; body mass index: 24,3 ± 3,4 kg/m2), in which the participants received manipulation treatment based on the assessment and treatment of the Maitland concept, and osteopathic group (n = 16; mean age: 23,8 ± 5,2 years; total body fat: 65,5 ± 11,8; body mass index: 23,4 ± 4,4 kg/m2), in which the participants received manipulation treatment based on osteopathic assessment and treatment. Volunteers were recruited from the university community through invitation. All participants were informed of the existence of two study groups, but were unaware to which group they would be allocated, thus remaining blinded with regards to the intervention. Informed consent has been obtained from all individuals included in this study.

Eligibility criteria (inclusion and exclusion)

The inclusion criteria were age 18 to 40 years, low back pain for more than one month with intensity equal to or greater than 3 on the Visual Analog Scale (VAS) and signed statement of informed consent. Minors and individuals older than 40 years of age, individuals with back pain for less than one month, those with any contraindication to the treatments (spinal canal stenosis, vertebral fracture, spondylolisthesis with spondylolysis, cancer, acute infection, advanced osteoporosis, rheumatic conditions in acute phase, hemorrhagic disease, active tuberculosis and recent deep vein thrombosis), pregnant women, individuals with nerve root impingement, those having been submitted to back surgery, those in physiotherapeutic treatment and those in medicinal treatment for pain were excluded from the study.

Anthropometric measures

The methods used for the anthropometric measures were performed in accordance with the Anthropometric Standardization Reference Manual. Height was measured in centimeters (cm) using a Cardiomed® stadiometer with precision of 0,1 cm. The volunteer remained in the standing position, barefoot, feet together at the heels, pelvic girdle, scapulary girdle and occipital region in contact with the stadiometer, head on the horizontal Frankfort plane at the end of maximum inspiration. Weight was measured in kilograms (kg) on a platform-type Plenna® scale with a maximum capacity of 150 kg and precision of 100 grams. The volunteer was barefoot in light clothing, with no objects in the pockets, positioned in the center of the platform with arms alongside the body. Body mass index expressed in kg per meter squared (kg/m2) was calculated as recommended by the World Health Organization.

Assessment and procedures

All volunteers received clarifications regarding the objectives and procedures of the study and those who agreed to participate signed a statement of informed consent. The participants were then assessed by a therapist blinded to the allocation to the different groups. The assessor collected the anthropometric data, pain intensity (VAS) and pressure pain threshold (measured using an algometer) at the more painful region of the spinous process of the lumbar vertebra. After the assessment, functioning of the lumbar spine was measured with the aid of the Roland-Morris Disability Questionnaire, which classifies (through scores) the individual based on his or her limitations[19].

The Random Number Generator v. 3.0.72 was used for the random allocation of the participants to the osteopathy group or Maitland group in two phases. After the initial assessment of the variables used in the study, the participants were conducted to the treatment room in which the therapist determined the specific positioning of the segment to be manipulated in accordance with the technique used. Physical examination, specific assessment and treatment using the Maitland method and osteopathy.

The two therapists who participated in the study have more than 10 years of clinical experience in the treatment of patients with low back pain as well as specialization in osteopathy and training in the Maitland concept. Both work with manipulation techniques at the Physical Therapy Teaching Clinic in the city where the study was developed. Each physiotherapist was in charge of only one manipulation technique: Maitland or osteopathy.

The "spring test" was used for the assessment in the Maitland group, which is based on vertebral pressure of approximately 4 kg[4] in the posteroanterior (PA) direction on the spinous processes (central PA) and bilateral articular facets of each segment (unilateral PA) using passive, cyclical movements on the spinal column and seeking possible movement limitations (stiffness) and/or pain. Central PA was performed with the patient in the prone position and contact between the therapist's pisiform bone and spinous process of the vertebra being assessed. For unilateral PA, the therapist made contact with the transverse process of the vertebra with the thumbs overlapping and performing perpendicular force. After the assessment, the therapist defined the ideal level to be manipulated based on stiffness and/or reported pain and the assessment of the vertebral levels. In cases for which more than one vertebral level was symptomatic, the therapist determined the most painful level.

Grade 5 manipulation of the Maitland concept is based on the "lumbar roll" technique in lateral decubitus, palpating the spinous process of the vertebra with pain and/or stiffness detected during the "spring test" and rolling the upper trunk while securing the patient's arm until the detection of the movement of the palpated vertebra. Next, a high velocity, low amplitude thrust is performed, allowing the center of gravity to drop toward the floor and, at the same time, increasing the rotation movement imposed by the therapist, fixing the upper trunk with the therapist's hand and moving the lower trunk in the rotational direction at the end of deep expiration to take advantage of the relaxation of the tissues[11].

For the osteopathic assessment, all movements of the lumbar spine (flexion, extension, latero-flexion and rotation) were performed for the determination of the occurrence of pain and restrictive movement. The spinous processes of the lumbar vertebrae and the articular processes were palpated[20].

The diagnostic palpation test on the transverse plane was used to determine vertebral positioning and movement (Mitchell test). The therapist performs bilateral palpation on the transverse processes of the vertebral level being assessed, with the hand supported on the paravertebral musculature to determine any hypomobility with the patient in the prone position and lumbar extension with the trunk supported on the forearms. If the therapist notes similar mobility in both transverse processes, this vertebral positioning is classified as Extension/Rotation/Side Bending (ERS)[13]. The test is then repeated in the prone position in trunk flexion with the knees flexed and seated on the heels with the upper limbs extended along the examining table. If the therapist notes similar mobility in both transverse processes, this vertebral positioning is classified as Flexion/Rotation/Side Bending (FRS)[20]. Lastly, if no similarity in the mobility of the transverse processes is found after palpation in the two previous tests, the positioning is classified as Neutral/Side Bending/Rotation (NSR). Thus, at the end of the examination, the therapist determines the vertebral level to be treated and if the vertebra in dysfunction was in NSR, FRS or ERS. The reliability of diagnostic palpation tests on the transverse plane (such has the Mitchell test) is considered moderate (Kappa correlation coefficients ranging from 0,56 to 0,72) for examiners with ample clinical experience (more than three years).

The osteopathic technique used for the correction of the dysfunction determined during the Mitchell test is the "lumbar roll". The aim of this technique is the closure of vertebrae in FRS dysfunction or opening of the vertebrae in ERS dysfunction[13]. For both techniques, the therapist should seek the maximum tissue barrier (reduction of slack) by increasing the rotational parameters of the trunk. Next, a high velocity, low amplitude

thrust is performed, allowing the center of gravity drop toward the floor (body drop) and, at the same time, increasing the rotational movement imposed by the therapist. The thrust can be applied at the end of deep expiration to take advantage of the relaxation of the tissues[17].

After the intervention, all patients were reassessed for the outcomes of pain intensity, pressure pain threshold and functioning (Roland-Morris questionnaire) at seven and 30 days in accordance with the study design (Figure 1). The follow-up assessment was performed by two researchers blinded to the allocation of the participants to measure possible changes and so that no interference in the results (measurement bias) occurred.

Pain assessment

Visual Analog Scale

The VAS was used to measure pain intensity (primary outcome of the study) of the participants. This is an 11-point scale ranging from 0 (absence of pain) to 10 (worst pain possible).

Pressure pain threshold

A pressure algometer is a device used to measure the pressure or force applied to any part of the body and was developed for clinical use in a simple, valid, reliable, low-cost way. A pressure algometer can be used for the assessment of the pressure pain threshold as well as other protocols, such as temporal summation and conditioned pain modulation, providing objective data for the assessment of patients[21].

The pressure pain threshold (secondary outcome of the study) was measured by the blinded assessor using the MED.DOR© pressure algometer (Figure 2) with a Core microprocessor and maximum load of 50 Kg (500 N). The MED.DOR© algometer has been investigated in terms of its capacity to provide reliable data, which was validated using a force plate, the gold standard for measuring compressive (vertical – z axis) forces. Jerez-Mayorg et al.[21] presented comparison values of the MEDDOR© algometer and force plate (ICC = 0,94; Cronbach's α = 0,99; SEM = 0,06 g; r = 0,99; r2 = 0,99), intra-examiner reliability (ICC = 0,77 to 0,87) and inter-examiner reliability (Cronbach's α = 0,87).

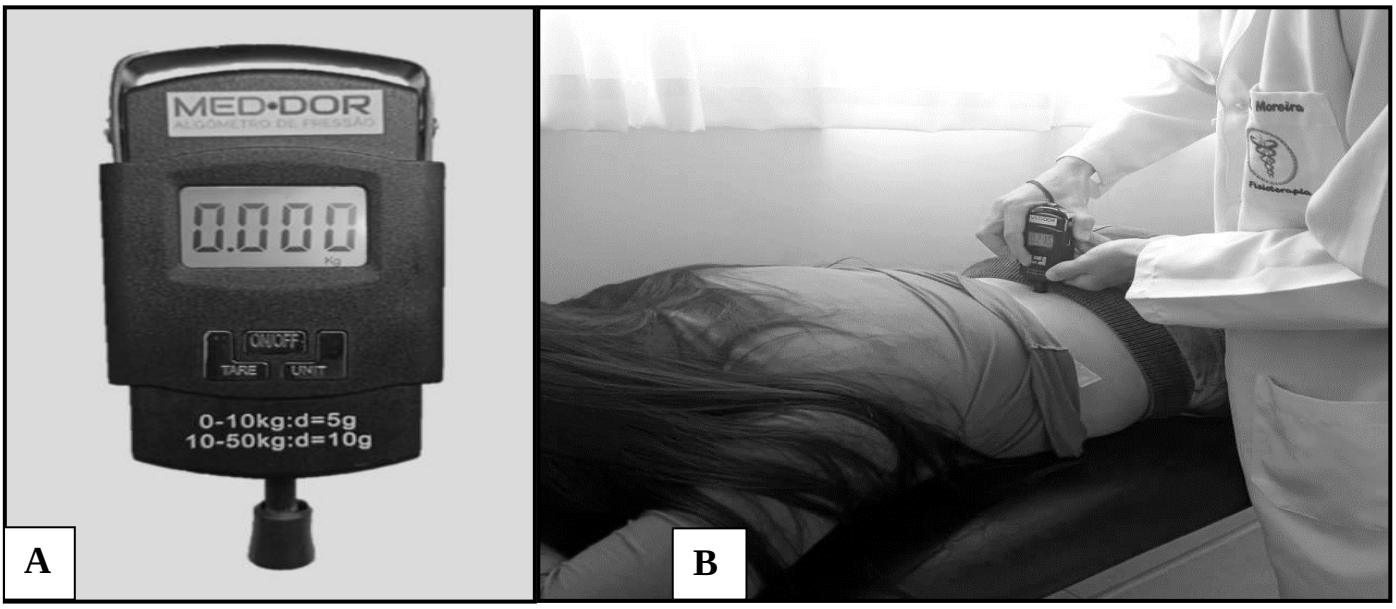

Figure 2. A) MED-DOR© pressure algometer; B) Determination of pressure pain threshold on lumbar spinous process

For the determination, the participant remained in the prone position and the reading was performed on the spinous process of the most painful vertebra in the lumbar region (L1, L2, L3, L4, L5 or posterosuperior iliac spine). During the reading, the circular probe of the algometer, which has an area of 1 cm^2, was positioned perpendicular to the skin. The assessor was trained to exert pressure at a velocity of approximately five Newtons/second[4].

The participants were instructed to say "stop" when the sensation of pressure or discomfort became a clear sensation of pain. Three readings (in Newtons) were performed and the mean was used in the data analysis. When a participant did not report pain at a force equivalent to 50 kg (500 N), the test was interrupted and this value was considered the pressure pain threshold[4]. Two demonstrations of the procedure were performed on the dominant deltoid muscle to ensure the understanding of the test. If any question persisted, a third demonstration was given. Mean values in Newtons (N) were used for the analysis of the pressure pain threshold data.

Roland-Morris Disability Questionnaire

This questionnaire is used to investigate the effects of low back pain on work activities and activities of daily living, with an average response time of five minutes and easy application. The score ranges from 0 (no disability) to 24 (severe disability). Scores higher than 14 points are indicative of physical disability. The difference in the score to indicate a clinical change is 5 points[19].

Statistical treatment

Descriptive and inferential statistics were performed with aid of the SPSS® 20.0 program for Windows. The Shapiro-Wilk and Levene tests were respectively used to determine the normality and homogeneity of the data. As normal distribution was determined, parametric statistical tests were used. The independent Student's t-test (intergroup analysis) and paired Student's t-test (intragroup analysis) were used for the interpretation of the results.

RESULTS

Both groups exhibited an improvement in the pressure pain threshold at seven days, which was maintained at 30 days. Likewise, the two groups exhibited an improvement in functional capacity at seven days, but this result was only maintained at 30 days in the Maitland group. However, no difference in pain intensity (VAS) was found in either group at seven or 30 days. No significant differences were found between the osteopathy and Maitland groups for any of the outcomes of interest (Table 1). Moreover, no adverse effects were found in any of the participants.

Table 1. Mean and standard deviation (SD) values for pain intensity, pressure pain threshold and functional capacity index measured before and after vertebral manipulation.

Outcomes	Osteopathy	Maitland	Difference in adjusted means (95% CI)	p
Pain intensity (VAS) ***(0 to 10)***				
Pre-treatment	4.4 (2.3)	2.9 (1.1)		
Post-treatment (7 days)	3.3 (2.4)	2.0 (1.6)	1.3 (-0.58 to 3.18)	0.083
Post-treatment (30 days)	3.5 (2.6)	2.2 (1.3)	1.3 (-0.65 to 3.25)	0.092
Pressure pain threshold (N)				
Pre-treatment	40.5 (24.3)	38.6 (8.6)		
Post-treatment (7 days)	51.4 (22.2)[a]	48.6 (13.5)[a]	2.8 (-14.46 to 20.06)	0.369
Post-treatment (30 days)	55.0 (13.0)[b]	52.9 (23.2)[b]	2.1 (-15.59 to 19.79)	0.403
Functional capacity index (*0 to 24*)				
Pre-treatment	8.0 (6.0)	5.9 (2.8)		
Post-treatment (7 days)	6.5 (5.6)[a]	3.2 (2.1)[a]	3.3 (-1.04 to 7.64)	0.106
Post-treatment (30 days)	6.1 (5.2)	3.7 (2.6)[b]	2.4 (-1.48 to 6.28)	0.215

(a) Significant different between pre and post 7 and (b) pre and post 30 (paired t-test). p-values between osteopathy and Maitland groups (independent t-test).

DISCUSSION

This study analyzed the immediate effects of two manipulation techniques performed in a specific vertebral region defined during the clinical examination according to the principles of osteopathy and the Maitland concept in patients with chronic nonspecific low back pain considering the outcomes of pain intensity, pressure pain threshold and functional capacity.

There is evidence with high methodological quality that lends support to the use of manipulation techniques in such cases. Such techniques are widely recommended in clinical practice guidelines for the treatment of chronic low back pain[2] as well as other musculoskeletal disorders[17].

The present results are in agreement with the positive results of a systematic review with meta-analysis on manipulation therapy for the treatment of low back pain[8-9], especially the pressure pain threshold and functioning outcomes with both techniques.

The physiological effects of vertebral manipulation are not yet fully understood. However, a model has been proposed for a possible effect mechanism. This model suggests that a mechanical stimulus produces neurophysiological effects that generate the relief of symptoms and includes peripheral mechanisms, spinal cord mechanisms and supraspinal mechanisms[22]. With regards to peripheral mechanism, musculoskeletal injuries can produce an inflammatory response in the affected region, initiating a healing process that may exert an influence on the processing of pain. Thus, the stimulation of spinal manipulation could modulate pain processing through chemical modulators. Moreover, there is evidence of changes in blood levels of β-endorphin, anandamide, N-palmitoylethanolamide, serotonin[23] and endogenous cannabinoids[24] after vertebral manipulation. Didehdar[25] showed that N-acetyl aspartate (NAA) in thalamus, insula, dorsolateral prefrontal cortex regions, as well as choline (Cho) in the thalamus, insula, and somatosensory cortex regions, had increased significantly in the manipulative treatment group compared with the sham group.

Manipulation therapy may exert an effect on the spinal cord, acting as a counter-irritant to modulate pain through the "bombarding of the central nervous system" with sensorial information from joint and muscle proprioceptors. Other findings, such as hypoalgesia, a reduction in afferent discharge, reduction in the activity of the motoneuron and changes in muscle activity, may indirectly imply an effect mediated by the spinal cord[22].

The gate control theory of pain is a concept put forth by Melzack and Wall (1965), which proposes that small diameter A-delta nociceptive fibers and C sensory fibers conduct pain stimuli to the dorsal horn and "open" the layer of gelatinous substance, whereas large diameter A-beta non-nociceptive fibers inhibit the transmission of pain by blocking the input from A-delta and C fibers. As the mechanical stimulus applied during spinal manipulation can alter the peripheral sensory input from paraspinal tissues, manipulation may exert an influence on the closing mechanism of the gate, stimulating A-beta fibers of muscle spindles and mechanoreceptors of the facet joints[26].

With regards to supraspinal mechanisms, structures such as the anterior cingulate cortex, amygdala, periaqueductal grey matter and rostral ventromedial medulla modulate the pain experience. Thus, vertebral manipulation may generate an effect on the central nervous system, reducing the activation of supraspinal regions responsible for the central processing of pain[25].

Findings from current literature support that vertebral manipulation has a profound influence on nociceptive stimulus via the possible activation of the descending inhibitory pain mechanism. It seems that the application of this technique activates the periaqueductal gray region area of the midbrain, stimulates the noradrenergic descending system and at the level of the spinal cord, the nociceptive afferent barrage is reduced and mechanical hypoalgesia is induced[27].

Another mechanical hypothesis states that the improvement in pain after vertebral manipulation may be explained by the improvement in arthrokinematics due the vertebral adjustment, with the correction of the joint positioning and gain in mobility[28].

Both techniques are believed to have generated neurophysiological effects regarding the improvement in some of the variables of the study. Thus, the merely mechanistic and biomechanical format needs to be rethought, as the more detailed assessment and treatment of the vertebral position in osteopathy (mechanical hypothesis) was not superior to a simpler assessment technique, such as the Maitland concept, demonstrating that neurophysiological effects may be the main mechanism for the improvement in pain and functioning rather than merely vertebral positioning. In addition, Legaspi and Edmond[29] performed a critical review of the literature and showed inconsistency in patterns related to coupled motion (Fryette's laws), stating that physiotherapists should be careful when applying couple motion concepts for the assessment and treatment of patients with low back pain.

The key point of the present study is the comparison of techniques with regards to their effectiveness in terms of relieving pain and improving functioning in patients with low back pain. The results show no significant differences between groups for the three outcomes. Thus, one may question the need for a thorough, detailed assessment and treatment, which is widely recommended by the main authors and schools of manual therapy[20], as the different forms of assessment and manipulation generate the same results.

Some factors may have occurred for the lack of a significant change in pain assessed using the Visual Analog Scale following manipulation. Some studies state that joint manipulation is very effective in the acute phase but less so in the chronic phase, requiring the combination of specific therapeutic exercises[8]. Another factor that may explain the small change in self-reported pain intensity in the present study is the small stimulus generated by a single manipulation session, as a similar study involving 10 lumbar spine manipulation sessions over a four-week period reported improvements in pain intensity, the pressure pain threshold and perceived global change[4]. No previous study was found that compared two or more Grade 5 manipulation techniques. In a comparison of different mobilization techniques (Maitland vs Mulligan), both were equally effective for cervicogenic vertigo[16,30], but no differences were found between the two techniques.

All possible care was taken so that this study had the lowest possible risk of bias, such as an adequate randomization procedure, concealed allocation, blinding of the assessors and participants, follow-up assessments and similarity between groups at the onset of the study. This care was taken using a sufficient sample contingent so that our conclusions would be interpretable and valid.

This study has important implications for clinical practice. Although no clinically important difference was detected between groups, improvements were found in the pain pressure threshold and functioning. Based on these discoveries, shared decision making in the selection of treatment should be encouraged considering the preferences and perspectives of the patient as well as the skills and preferences of the therapist. Thus, therapists can choose either of the techniques in which they are more skilled and have more experience and perform the assessment and treatment in a simpler manner or more detailed manner. For osteopathic vertebral manipulation, the therapist needs to perform various palpation tests that require different positioning of the patient, whereas many of these procedures are unnecessary with the Maitland concept.

This study has limitations that should be considered, such as the small number of participants (although the study is ongoing) and the lack of a control group. However, divergent opinions are found in the literature regarding this aspect, as leaders in low back pain research do not know how to establish the ideal sham procedure for vertebral manipulation[4]. Other limitations regard the cross-sectional design and the use of only one vertebral manipulation session.

As a suggestion for future studies, the adoption of several joint manipulation sessions with a longer duration would be important and closer the real-world practice of physiotherapists. These techniques should be used on patients with acute or subacute low back pain to determine the effects. Moreover, studies are needed to test the measurement properties (reliability, sensitivity/specificity and reproducibility) of the palpatory tests used by manual therapies in clinical practice.

CONCLUSION

No significant differences were found between the osteopathic and Maitland manipulation techniques for the outcomes of pain and functioning in patients with chronic low back pain. The need for a thorough, detailed assessment and treatment recommended by some schools of manual therapy should be questioned, as less detailed forms of assessment and treatment generate the same results for the outcomes analyzed in the present study.

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