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Acute effects of Maitland's central posteroanterior mobilization on youth with low back pain

Efeitos agudos da pressão pósterio-anterior central de Maitland em jovens com dor lombar crônica

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ABSTRACT

Introduction: The low back pain is the most prevalent between the musculoskeletal disorders, and it is the most common reasons of absence from work. The flexibility, mobility, strength and endurance of the low back stability influence and the disharmony between these factors may result in low back pain. One of Maitland's technique, which alter these factors, is posteroanterior (PA) mobilization.

Objective: To analyze the posterior chain's flexibility, low back's mobility, trunk extensor's endurance and low back extensors' muscle strength after performed one treatment session using the Maitland method on youth with low back pain. **Method:** For this research, sixteen women (22 ± 3.03 years) with chronic low back pain participated. All volunteers were evaluated according to their perception of pain, flexibility, mobility, muscular strength and muscular endurance. The treatment protocol was the application of PA mobilization on the five lumbar vertebrae, from caudal direction to cranial, of three series of one minute in each vertebra. The same procedures of the initial evaluation were performed after the immediate application of PA mobilization technique (reevaluation 1) and 7 days after the protocol (reevaluation 2). The data were analyzed by the Shapiro-Wilk's normality test; analysis of variance (ANOVA) repeated measures one-way with pos-hoc Bonferroni and Friedman's ANOVA with pos-hoc Wilcoxon, with the level of significance of 5% ($p < 0,05$).

Results: After PA mobilization application, there were significant improvements in muscular strength (immediate post-treatment and past seven days) and muscular endurance (immediate post-treatment). There were no significant improvements in the other variables, such as, level of pain, and lumbar flexibility and mobility. **Conclusion:** The lumbar PA mobilization was effective for increasing muscular strength and endurance, with stabilization of the level of pain, flexibility and mobility.

Keywords: Physical endurance; Muscular strength; Low back pain; Range of joint motion; Spinal manipulation.

RESUMO

Introdução: A dor lombar é a mais prevalente entre as doenças musculoesqueléticas e é o motivo mais comum de falta no trabalho. A flexibilidade, mobilidade, força e resistência da coluna lombar influenciam na estabilidade lombar e a desarmonia entre esses fatores podem levar ao aparecimento da dor lombar. Uma técnica de Maitland, que altera esses fatores, é a Pressão Pósterio-Anterior Central (PAC). **Objetivo:** Analisar a flexibilidade da cadeia posterior, mobilidade da região lombar, resistência dos extensores de tronco e força muscular dos extensores lombares após a realização de uma sessão de tratamento com método Maitland em jovens com dor lombar.

Métodos: Participaram do estudo dezesseis mulheres ($22 \pm 3,03$ anos) com dor lombar crônica. Todas voluntárias foram avaliadas quanto à percepção de dor, flexibilidade, mobilidade, força e resistência muscular. O protocolo de tratamento foi com a aplicação da PAC sobre as 5 vértebras lombares da direção caudal ao craniano, três séries de um minuto em cada vértebra. Os mesmos procedimentos da avaliação inicial foram realizados após a aplicação imediata da PAC (reavaliação 1); e após 7 dias do protocolo (reavaliação 2). Os dados obtidos foram analisados através do teste de normalidade Shapiro-Wilk; testes estatísticos Análise de Variância (ANOVA) medidas repetidas one-way com pos-hoc Bonferroni e ANOVA de Friedman com pos-hoc Wilcoxon com nível de significância de 5% ($p < 0,05$).

Resultados: Após a aplicação da PAC houve melhora significativa da força muscular (pós imediato e pós 7 dias) e da resistência muscular (pós imediato). Não houve melhora significativa nas demais variáveis, como o nível de dor, flexibilidade e mobilidade lombar. **Conclusão:** A PAC lombar foi efetiva para o aumento da força e resistência muscular, com estabilização do nível de dor, flexibilidade e mobilidade.

Palavras-chave: Resistência física; Força muscular; Lombalgia; Amplitude de movimento articular; Manipulação da coluna.

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INTRODUCTION

The spine is the bony axis of the human body and its stability occurs from the performance of passive systems (ligaments, vertebrae, intervertebral discs and joints), active (muscles and tendons) and neural.⁽¹⁾ If the performance of systems generating stability is changed with its operation, for example by mechanical damage,⁽¹⁾ may cause spinal instability and lead to pain. Other consequences caused by dysfunctions of the three systems are changing the flexibility, endurance, strength and mobility of the spine.⁽¹⁾ The harmony between resistance, strength,⁽²⁾ flexibility⁽³⁾ and mobility of the spine⁽⁴⁾ leads to increased probability of having pain in the lower back.⁽²⁾

Low back pain (LBP) reaches 70% of the population in industrialized countries, and in the range of 45 years is the most common reason for missing work,⁽⁵⁾ and is responsible for 26-37% of absences in the work⁽⁶⁾ and is the most prevalent among musculoskeletal diseases, representing 50.78% of them.⁽⁷⁾

Having isometric resistance and strength of the spine erector muscles compromised means a greater overload on passive elements, which leads to plastic deformation of these elements, possible distension and, consequently, to low back pain.⁽⁸⁾

Flexibility indicates the range of each joint and depends on how the muscle can be stretched and on the joint anatomy.⁽⁹⁾ When reduced ends up limiting the mechanical efficiency of the joint and increasing energy expenditure.⁽³⁾ With regard to spine's mobility, when it is reduced indicates higher possibility of back pain, and 90% of patients with LBP present motion restriction in at least one of these tests: finger-ground extension/flexion/lateral flexion of the trunk, modified test Schober and knee extension.⁽¹⁰⁾

Therefore, it is necessary to use techniques to increase the mobility of the lumbar region, such as the spinal mobilization of Maitland which is between the central posteroanterior pressure (PA), which has the action of reducing muscle spasm and reduce LBP, especially when it is present with the same intensity on both sides.⁽¹¹⁾ The PA is performed on the spinous process,⁽¹¹⁾ can interfere with some factors such as lumbar mobility⁽⁴⁾ and trunk extensor muscle strength.⁽⁴⁾ The PA mobilization was performed twice a week for four weeks, for 30 seconds on each vertebra in patients with chronic LBP, proved to be effective in improving range of motion and strength of the trunk extensor muscles.⁽⁴⁾

Thus, the aim of the study was to analyze what are the acute effects of the PA mobilization in the flexibility of the posterior chain, mobility of the lower back, trunk extensor strength, muscle strength of lumbar extensors and level of pain after conducting a session treatment.

METHODS

This study was approved by the Research Ethics Committee, No. 1007/2014. The participants were informed about the study objectives and the collection procedure. By agreeing to participate, they signed the free and informed consent.

The study included 16 women with chronic low back pain, 22 ± 3.03 years of age, 59.5 ± 12.55 kg, 1.67 ± 0.08 m in height. Women with back pain for more than six months were included, able to perform all the tests proposed and which have not changed the level of physical activity in the last month.

The evaluation consisted of an evaluation form with personal data (name of the volunteer, body mass, height) and specific tests: resistance of the extensor muscles (Biering-Sorensen test), the posterior chain flexibility (sit and reach test), extensor muscle strength (dorsal dynamometer), mobility of the lumbar spine (Traditional Schober test and modified) and lumbar pain (Visual Analogue Scale - VAS). After the initial evaluation was carried out PA mobilization of the lumbar vertebrae and the same procedures as the initial evaluation were performed after the immediate implementation of the PA (revaluation 1); and after 7 days of the protocol (revaluation 2) to monitor the acute effect of the maneuver.

Resistance evaluation of the trunk extensor muscles

The Biering-Sorensen test is used to evaluate the isometric endurance of trunk extensor muscles.⁽¹²⁾ The subject, prone on the wooden crate on a stretcher, with his body suspended above the iliac crest with crossed arms over his chest was fixed on the litter with three stripes: the height of the greater trochanter of the femur, malleolus and the knee line with pillow under your feet (Figure 1). This test measures how many seconds he can remain in this position without support.⁽¹³⁾

Flexibility assessment of chain rear trunk

The test measures the sit and reach flexibility of lumbar spine and ischio muscles.⁽¹⁴⁾ voluntary testing should sit on the floor in front of Wells' bench with the knees extended and together, totally leaning feet on the bench, flexing the trunk with the intention of achieving the pin ruler and taking it as far as possible with the superposed hands, head between the



Figure 1. Realization of the Biering-Sorensen test.



arms and holding position for about 2 seconds.⁽¹⁵⁾ The test was conducted once.

Column lumbar muscle strength assessment

The test was performed with the back dynamometer of Crown® brand to measure the static strength of the lower back muscles, in which the subject, with outstretched legs and arms and secure semi-inflated trunk in the instrument bar and carries a maximum contraction of the lumbar muscles at the therapist command (Figure 2). Before the test the subject applied a submaximal strength of the trunk extension to familiarize yourself with the unit.⁽¹⁶⁾ The voluntary realized this test once.

Lumbar mobility assessment

It used the traditional Schober test and modified Schober, consisting in measuring the amplitude of the lumbar spine flexion. To carry out the therapist made a mark with a pen in the lumbosacral joint and another mark 10 cm (Traditional Schober) and 15 cm (modified Schober) above the first mark, with the individual in orthostatic position. The measuring tape was placed on the spinal column between the two marks, he was asked to perform the anterior trunk flexion, and soon after



Figure 2. Test with back dynamometer.

was conducted measuring the range of motion and should have been an increase that distance.⁽¹⁷⁾ The normal value this increase is 4 to 5 cm,⁽¹⁷⁾ below it may be due to a muscle shortening, biomechanical and physiological factors.⁽¹⁸⁾

Level assessment of pain

The Visual Analogue Scale (VAS) was used to measure pain. The therapist drew a 10cm line on paper with two ends, one of which represented “no pain” and the other, “the worst pain you could feel.” We asked the voluntary to score in the line the intensity of pain during the evaluation time. Then, the pain was scored by measuring the distance from that point chosen by the voluntary to the end “without pain”.⁽¹⁹⁾

Spinal mobilization of maitland

The technique used was the PA and the subject was positioned prone on a stretcher, his arms beside the body and the head positioned for the most comfortable side. The PA was performed with the therapist on the left side of the subject and for convenience, with the left hand in the volunteer back to the ulnar edge of the hand between the pisiform and hamate, stay on the spinous process of the vertebra to be mobilized. During the maneuver, with ascending and descending oscillatory movements on the trunk, the therapist used his weight and his right fist also remained extended, and the elbows were slightly flexed (Figure 3).⁽¹¹⁾ This study elected grade III that it is broad movement⁽¹¹⁾ which was performed on the 5 lumbar vertebrae caudal to cranial direction by three sets of each vertebra one minute with a one minute rest between them.

Data analysis

Data were analyzed by exploratory statistical techniques, using the SPSS® software. After verification of the data normality and homogeneity by the Shapiro-Wilk test, it was made the comparison of parametric data (muscle flexibility and strength) using Analysis of Variance (ANOVA) one-way repeated measures with post-hoc Bonferroni and non-parametric (pain intensity, Mobility and resistance) Friedman ANOVA with post-hoc Wilcoxon. The significance level of 5% ($p < 0.05$) was adopted.

RESULTS

Muscle strength was significantly different between assessments ($F = 3.358$; $p = 0.048$), showing that the initial assessment and the immediate end showed significant differences ($p = 0.032$), the same occurred when comparing the initial assessment and the final, after 7 days of the intervention ($p = 0.026$), these results showed that after the PA mobilization there was an increase in muscle strength. The results of strength showed no significant difference between the immediate final assessment and evaluation after 7 days of the intervention (Table 1). As for flexibility results showed no significant



difference between the evaluations analyzed by ANOVA repeated measures one-way ($F = 2.667$, $p = 0.086$) (Table 1).

The results for pain intensity ($p = 0.296$), mobility assessed by traditional Schober test ($p = 0.774$) and modified ($p = 0.082$) showed no significant difference when analyzed by ANOVA Friedman (Table 2).

Muscular endurance showed significant difference between the evaluations analyzed by Friedman ANOVA test ($p = 0.047$), showing that when comparing the baseline to the immediate end there is a significantly different ($p = 0.016$), indicating that when making the PA maneuver there was an increase in muscle strength immediately after the intervention (Table 2).



Figure 3. Central posteroanterior pressure Maitland mobilization.

Table 1. Results of strength and muscle flexibility.

| | Initial | Final immediately | After 7 days |
|-------------------------|---------------|-------------------|---------------|
| Strength (F) | 0.81 ± 0.16 | 0.89 ± 0.15* | 0.89 ± 0.18* |
| Flexibility (cm) | 24.03 ± 12.33 | 26.55 ± 11.46 | 25.33 ± 11.34 |

* Significantly different when compared with the initial assessment ($p < 0,05$).
Subtitle: F= Streight; cm= centimeters.

Table 2. Intensity results in pain, lumbar mobility and muscle strength.

| | Initial | Final immediately | After 7 days |
|---------------------------------------|---------------|-------------------|---------------|
| Pain intensity (cm) | 1.67 ± 1.92 | 1.12 ± 1.73 | 1.43 ± 1.56 |
| Schober mobility (cm) | 15.3 ± 1.51 | 15.22 ± 0.98 | 15.25 ± 0.73 |
| Modified Schober mobility (cm) | 21.69 ± 1.38 | 21.80 ± 1.38 | 21.81 ± 0.94 |
| Resistance (s) | 49.24 ± 28.76 | 65.49 ± 34.45* | 65.52 ± 38.23 |

* Significantly different when compared with the initial assessment ($p < 0,05$).
Subtitle: cm= centimeters; s= seconds.

DISCUSSION

This study analyzed the PA acute impact on flexibility, mobility, strength, endurance and level of pain in young women with chronic LBP. The results showed improvement in muscle strength comparing both the initial assessment and the immediate end, which is 7 days after the initial assessment. In addition, there was improvement in muscle strength immediately after the intervention and maintenance of the level of pain, flexibility and mobility.

One research found that spinal mobilization (PA in L3, 3 times for 1 minute) is related to the immediate increase in the threshold of the local pressure pain in asymptomatic subjects.⁽²⁰⁾ Pain reduction promoted by joint mobilization may be involved with mechanisms plants, which activate the inhibitory pathways of the spinal cord or brain stem descending inhibitory.⁽²¹⁾

In a study, from the 140 volunteers with non-specific LBP who received lumbar mobilization techniques (PA, Unilateral posteroanterior or Transverse pressure) was possible to observe significant improvement in reducing the immediate pain by VAS when applied in the low lumbar spine (L4- L5) when compared to the high lumbar spine (L1-L3) and no significant difference between techniques (1 minute each vertebra twice in one session).⁽²²⁾ The results obtained in this study showed no significant difference, it is believed this may be due to differences of the protocols.

The muscle co-contraction, increased in subjects with low back pain^(23,24) leads to reduced range of motion⁽²⁵⁾ and occurs by increased muscle activity to try to avoid injuries and aches,^(23,24) but can not be the long term optimal strategy.⁽²⁴⁾ In addition to pain, muscle hyperactivity may be inhibited due to stimulation or modulation of the somatosensory system and neuromuscular reflexes promoted by manual pressure therapy, which leads to improved function of the column.⁽²⁶⁾

One research obtained reduction of pain, but no significant improvement in mobility assessed by finger-ground test and lumbar inclinometer after PA (3 sets of 1 minute in symptomatic vertebra in a single session). One hypothesis for this result is the low accuracy of the devices used.⁽²⁷⁾ In relation to this study there was no significant increase and perhaps the mobility of most of the volunteers are already within the normal range.

The implementation of the PA for 30 s in each lumbar vertebra, twice a week for 4 weeks, increased strength and mobility, and reduced pain significantly in the 2nd and 4th week of reevaluation during the intervention,⁽⁴⁾ corroborating our results of muscle strength. Due to a better articular position, promoted by joint manipulation, there are better movement and greater muscular torque⁽⁴⁾ and probably this is a possible cause of the significant increase in the strength and endurance of this study. A study, with the participation of volunteers 30-50 years reveals that staying in Biering-Sorensen test for less than 58 s have 3 times more likely to have nonspecific LBP in a year compared to 104 s (man) and at 110 (woman). In the present study it was observed that before the PA the average



stay was 49.24 shortly after the PA has increased to 65.49 s, a value above 58 s quoted by Luoto et al. (1995).⁽²⁸⁾

Regarding flexibility, no improvement was noticed in this study. One hypothesis is that the sit and reach test evaluates the flexibility of the muscles of the lower back and ischio muscles.⁽¹⁴⁾ The correlation between this test with the extensibility of isquiocruais is average, while the correlation with lumbar extensibility is low.⁽²⁹⁾ Another possible explanation for the flexibility not showing significant difference is the large standard deviation found.

The limitations found in this study were those used mobility and flexibility tests do not have sufficient accuracy to find significant differences after applying the PA technique. From the foregoing, it can be noticed that further studies are needed, using different valuation methods and proposed a higher number of interventions to assist in elucidating the effects of spinal joint mobilization in patients with chronic low back pain.

CONCLUSION

The study showed that the application of a PA session contributed to the increased strength (post immediately and after 7 days) and muscle strength (immediately after). This article shows the importance of research in clinical approach, since a large number of people suffering from low back pain.

AUTHORS CONTRIBUTION

KYA performed the design and planning of the research project, collecting, analyzing and interpreting data and writing. BMT performed the design and planning of the research project, data interpretation and critical review. MTN has made the design and planning of the research project, data interpretation and critical review. All authors read and approved the final manuscript.

COMPETING INTERESTS

The authors declare no conflicts of interest.

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