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ORIGINAL RESEARCH

Relationship between therapeutic alliance and deep abdominal muscle recruitment in nonspecific low back pain sufferers

Relação entre aliança terapêutica e recrutamento dos músculos abdominais profundos em pacientes com dor lombar não específica

Relación entre alianza terapéutica y reclutamiento de los músculos abdominales profundos en pacientes con dolor de la región lumbar no específico

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ABSTRACT | Chronic low back pain is a difficult condition to be treated. As some patients respond positively to treatment and others do not present any improvements, one can think there are others conditional factors that need to be elucidated. By means of this study, we sought to investigate the association between the occurrence of the formation of a positive relationship between patient and therapist, assessed by the therapeutic alliance inventory, and the adequate recruitment of the deep abdominal muscles, as well as to verify the effect of a protocol intervention based on motor control exercises on levels of pain and disability. The recruitment of the transverse abdominal and internal oblique muscles was examined by ultrasound imaging in 12 subjects with nonspecific chronic low back pain before and after implementation of a protocol for motor control exercises, with subsequent application of the therapeutic alliance inventory questionnaire. No association was found between the level of therapist/patient alliance and muscle recruitment. The proposed protocol was effective in reducing the levels of pain and disability; however, recruitment of transverse abdominal and internal oblique muscles showed no significant changes in the end of the intervention. Based on these findings, we verified that the therapeutic alliance has no association with muscle recruitment in the short term. However, although there were no changes in muscle recruitment after the intervention program, the level of pain and disability was reduced.

Keywords | Low Back Pain/ultrasonography; Abdominal Wall; Physical Therapy Modalities.

RESUMO | A dor lombar crônica é uma condição difícil de ser tratada. Como alguns pacientes respondem de forma positiva ao tratamento e outros não apresentam melhora, pode-se pensar na existência de outros fatores condicionantes que precisam ser elucidados. Por meio deste estudo, buscou-se averiguar a ocorrência de uma associação entre a formação de um vínculo positivo entre paciente e terapeuta, avaliada por meio do inventário de aliança terapêutica, e o recrutamento adequado dos músculos abdominais profundos, além de verificar o efeito de um protocolo de intervenção baseado em exercícios de controle motor sobre os níveis de dor e incapacidade. O recrutamento muscular do transverso abdominal e oblíquo interno foi analisado por meio da ultrassonografia de imagem, em 12 sujeitos com dor lombar crônica não específica, antes e após a aplicação de um protocolo de exercícios de controle motor, com uso subsequente do questionário de aliança terapêutica. Não foi encontrada relação entre nível de aliança terapeuta/paciente e recrutamento muscular. O protocolo proposto foi eficaz na redução dos níveis de dor e incapacidade; no entanto,

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o recrutamento dos músculos transverso abdominal e oblíquo interno não apresentou nenhuma alteração significativa ao final da intervenção. Baseando-se nestes achados, verificou-se que a aliança terapêutica não tem relação com o recrutamento muscular a curto prazo. Entretanto, embora não tenham sido observadas mudanças no recrutamento muscular após o programa de intervenção, o nível de dor e incapacidade foi reduzido.

Descritores | Dor Lombar/ultrassonografia; Parede Abdominal; Modalidades de Fisioterapia.

RESUMEN | El dolor crónico de la región lumbar es una condición difícil de ser cuidada. Como algunos pacientes responden positivamente al tratamiento y otros no presentan mejoras, fue posible pensar en la existencia de otros factores condicionantes que precisan ser elucidados. A través de eso estudio, se intentó averiguar la ocurrencia de una asociación entre formación de vínculo positivo entre paciente y terapeuta, evaluada por medio de un inventario de alianza terapéutica y reclutamiento de los músculos abdominales profundos, y también verificar el efecto de un protocolo de intervención basado en ejercicios de control motor en los niveles de dolor e incapacidad. El reclutamiento muscular de los músculos transverso del abdomen y oblicuo interno fue analizado por medio de la ultrasonografía de imagen en 12 personas con dolor crónica de la región lumbar, antes y después de la aplicación de un protocolo de ejercicios del control motor con uso posterior de un cuestionario de alianza terapéutica. No fue encontrada relación entre lo nivel de alianza terapeuta/paciente y el reclutamiento muscular. El protocolo propuesto fue eficaz en la reducción de los niveles de dolor e incapacidad, pero el reclutamiento de los músculos transverso del abdomen y oblicuo interno no presentó ninguna alteración significante al final de la intervención. Con base en esos hallazgos, se verificó que la alianza terapéutica no tiene relación al reclutamiento muscular a corto plazo. Sin embargo, a pesar de que no fueron observados cambios en el reclutamiento muscular después del programa de intervención, el nivel de dolor e incapacidad se disminuyó.

Palabras clave | Dolor de la Región Lumbar/ultrasonografía; Pared Abdominal; Modalidades de Fisioterapia.

INTRODUCTION

Despite the large number of studies involving lumbar pain, the mechanisms that lead to its development remain poorly understood, with 90% of cases classified as non-specific, since a definitive diagnosis cannot be achieved[1]. However, there is evidence (level A) that psychosocial variables generally have greater impact than biomedical and biomechanical factors in the disability associated with low back pain[2]. From a clinical point of view, low back pain is a complex multifactorial process, which relies on somatic, psychological and environmental characteristics[2], and is often considered a difficult condition to be treated by the classical approach to health, which focuses primarily on somatic factors, not being able to avoiding its chronicity[3] that may be associated with significant levels of depression[4,5], disability and poor quality of life[6].

Studies with depressed patients, but who did not present low back pain, indicated that the therapeutic alliance seems to influence positively toward lasting cognitive changes, as well as in anticipating improvements in treatment[7]. The concept of therapeutic alliance, originated in the field of psychotherapy, was proposed by Bordin[8], in which he argues that the therapeutic alliance between the person seeking change and anyone who is willing to be an agent of change is one of the keys, if not the key in the change process.

Thus, it is possible to assume that, in patients with non-specific chronic low back pain, the establishment of a positive therapeutic alliance is able to promote proper muscle recruitment, contributing to the success of physical rehabilitation. The objective of this study was to investigate the impact of the therapeutic alliance in the recruitment of the deep abdominal muscles in patients with non-specific chronic low back pain.

METHODOLOGY

The research protocol was registered in the Australian New Zealand Clinical Trails Registry, under number ACTRN12610000829011, and approved by the Research Ethics Committee of Universidade Estadual Paulista "Julio de Mesquita Filho" (UNESP), campus Presidente Prudente, (process no. 53/2009).

Sample

Twelve volunteers were involved in the study (50% males, 50% females), with homogeneous anthropometric and clinical characteristics and having pain or discomfort in the area between the costal margin and the inferior gluteal fold, with or without mentioning pain in the legs, for more than three months (Table 1).

The selected participants met the following criteria: absence of structural changes of the lower limbs (LL) and/or lumbar spine; negative history of surgery in spinal segment; absence of red flags (tumors, infections, inflammatory processes) or clear signs of radiculopathy with abnormal reflexes, dermatomes and/or miotomes; absence of rheumatic disease of the lumbar spine or urinary incontinence or cognitive impairment; Body Mass Index (BMI) <35 kg/m^2, allowing the visualization of the deep muscle layer; not in pregnancy or postpartum period and not involved in another treatment program.

Procedures

The volunteers were interviewed to fill the McGill questionnaire[9], which reports the level of pain; the TAMPA Scale for Kinesiophobia[10], which quantifies the fear of movement and physical activity; the Multidimensional Health Locus of Control (MHLC) scale[11], which verifies the voluntary's beliefs on their own health condition and the Rolland Morris questionnaire, which assesses the degree of disability[12]. After completing these questionnaires, the recruitment of the transverse abdominis (TrA) and internal oblique (IO) muscles was assessed by ultrasound imaging. By completing the initial assessment, participants began a lumbar stabilization program, as described by Costa et al.[13].

Revaluation of the level of pain, degree of disability and muscle behavior, as well as analysis of the therapeutic alliance, occurred between the first and second stages of intervention and at the end of treatment. All study participants were informed about the procedures and objectives of the study and were asked to sign a free and informed consent form.

Table 1. Anthropometric data and characteristics of the sample during the baseline

Variable	Occurrence (mean, 95%CI)
Gender Male	6 (50%)
Age (years)	37.2 (31.2-43.7)
Weight (kg)	72.8 (64-82)
Height (cm)	167.7 (162.6-173.7)
Time with pain (months)	60 (41-82)
McGill (0-93)	27 (22.9-30.2)
RM (0-24)	7 (5.5-8.9)
Kinesiophobia (68)	40 (31.1-43.4)
Locus of control	
Internal (36)	26 (23.4-28.1)
External (36)	23 (21-25)

McGill: McGill pain level questionnaire; RM: Rolland Morris disability questionnaire; kinesiophobia: TAMPA scale of kinesiophobia; locus of control: multidimensional health control questionnaire

Analysis of therapeutic alliance

The analysis of the therapeutic alliance was verified by an independent evaluator by applying the WAI questionnaire[14] (patient version) in the transition from the first to the second phase of the intervention program and at the end of the study. This questionnaire consists of 36 questions directed to the patient, which allow evaluation of the three areas proposed by Bordin[8] for the formation of the alliance. The alliance is a relationship based on the sense of working together in a fight against what ails the patient. Its construction is based on the agreement between therapist-patient regarding the objectives, the commitment to the proposed intervention and the emotional bond between patient and therapist[8]. The quality of the therapeutic alliance is established by adding the patient's personal characteristics prior to therapy, the therapist's personal characteristics, as well as technical skill, and the behavior between patient and therapist when addressing the patient's needs and characteristics[15].

Ultrasonography

Muscle recruitment was measured using ultrasound imaging, a noninvasive and reliable method[16] that allows the visualization and quantification of changes in muscles of the superficial and deep abdominal layers[17].

The ultrasound imaging was performed with a 13.5 MHz transducer coupled to an ultrasound machine from Siemens (Issaquah, WA, USA), Sonoline Sienna model. For image acquisition of the recruitment of TrA and IO muscles, the protocol proposed and validated by Ferreira et al.[18] was used, in which study participants were put in a supine position on a bed with their arms crossed over the chest, with hip and knee flexion at 50º and 90º, respectively, with force transducers affixed in the lower limbs (Figure 1).

The examiner responsible for obtaining images with ultrasonography was previously trained, and the intra-examiner reliability of the measurements was verified in a pilot study, in which the recording of the images was performed on different days with a 24-hour interval between measurements.

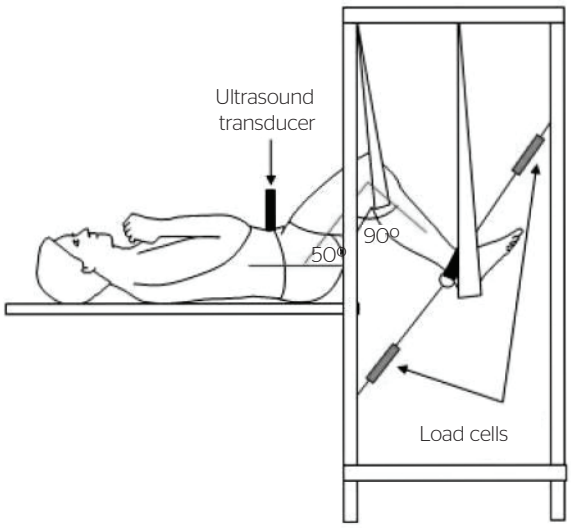
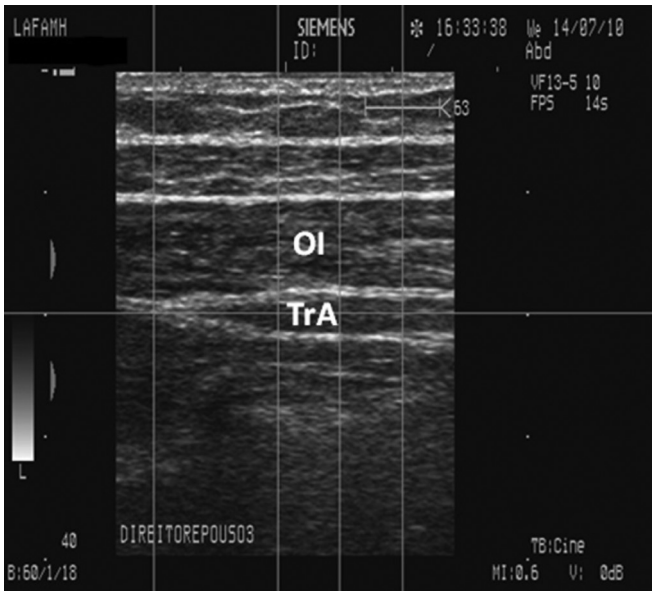


Figure 1. Patient position during the recording of the measures of muscle behavior through ultrasound imaging



TrA: transverse abdominis muscles; IO: internal oblique muscles. The first vertical line on the left indicates the edge of the transverse abdominis

Figure 2. Ultrasound image obtained during the collection

Treatment of ultrasound images

The images obtained through ultrasonography were analyzed in a software developed to provide the values corresponding to the thickness of TrA and IO muscles. After establishing a reference point, the program automatically overlaid a grid of vertical lines separated at a distance of 5, 10 and 15 mm from a vertical reference line that was drawn along the fascia that defines the medial edge of the TrA (Figure 2).

After calculating the thickness at each of these points, the arithmetic mean of muscle thickness was calculated for each image. From this measurement, the percentage of change between rest and contraction was calculated using Equation 1:

$$\frac{C - R}{R} \times 100 = (\%) \quad (1)$$

where C is the mean thickness of the muscle during contraction and R shows the average resting value of TrA and IO muscles.

Statistical analysis

The intra-examiner reliability when examining the ultrasound measurements was previously observed in the beginning of the collections, in a pilot test, by calculating the intraclass correlation coefficient ($ICC_{3,1}$).

To check the behavior of the therapeutic alliance between the transition from the first to the second stage of the treatment protocol and at the end of the study, the nonparametric Friedman test was used.

To analyze the disability of muscle recruitment of TrA and IO muscles pre and post-intervention, nonparametric Kruskal-Wallis test was used, while the variation in the level of pain in different stages of the study was verified by one-way analysis of variance (ANOVA).

In order to verify the association between continuous variables, two forced models of multiple linear regression were constructed. Each of them used change in the recruitment of TrA and IO muscles pre- and post-intervention as the dependent variable and the therapeutic alliance after the first phase of the intervention, disability, pain and muscle recruitment during baseline as explanatory variables.

The regression models built were:

- change in the recruitment of TrA = - α- β1 x disability + β2 x pain – β3 x TrA + β4 x WAI;
- change in the recruitment of OI = α + β1 x disability + β2 x pain – β3 x OI – β4 x WAI.

All statistical analysis were performed using the PASW® statistical package for Windows, version 18.0, considering a significance level of 5% (α<0.05).

RESULTS

The study of intra-examiner reliability for the ultrasound examination of the TrA recruitment showed

excellent agreement, according to the classification proposed by Fleiss[19] ($ICC_{3,1}$=0.88; 95%CI 0.61–0.96) for the image captured during the extension movement and 0.82 (95%CI 0.39–0.95) for flexion.

The analysis of muscular behavior after the intervention period revealed no improvement in the recruitment of TrA and IO muscles with the intervention (p=0.5).

Pain and disability levels showed a statistically significant reduction (p=0.04 and p=0.03, respectively) after the application of the intervention protocol, revealing the occurrence of clinical improvement after the study.

The regression model proposed and adjusted for TrA (Table 2) represented 41% of the variance, but did not explain the recruitment of TrA (R^2=0.7; F=2.9; p=0.1). On the other hand, the model for IO (Table 3) indicated 54.9% of the variance, significantly explaining IO recruitment (R^2=0.8; F=4.3; p=0.04). However, there was no association between the recruitment of IO at the end of the study and the therapeutic alliance.

DISCUSSION

The analysis of the recruitment of TrA and IO muscles occurred through a protocol proposed in the literature[18], which showed a reproducible technique[16], as long as the person responsible for registering the images is properly trained in the procedure[20].

Table 2. Forced regression model for the transversus abdominis muscle

Variable	Standardized β	p-value	95%CI
Constant	-92,693	0.087	-202.910–17.524
WAI_T1	0.475	0.102	-0.168–1.477
Disability_T0	-0.338	0.344	-8.827–3.529
Pain_T0	0.746	0.058	-0.113–5.378
TrA_T0	-0.613	0.049	-1.137–-0.002

WAI: therapeutic alliance scale; TrA: transversus abdominis; T0: baseline; T1: intervention phase 1

Table 3. Forced regression model for the internal oblique muscle

Variable	Standardized β	p-value	95%CI
Constant	4,99	0.659	-20.662–30.645
Disability_T0	0.405	0.221	-0.570–2.068
Pain_T0	0.234	0.483	-0.428–0.818
IO_T0	0.522	0.065	-0.012–0.292
WAI_T1	-0.322	0.222	-0.290–0.080

WAI: therapeutic alliance scale; IO: right internal oblique muscle; T0: baseline; T1: intervention phase 1

The presented regression models only allowed to explain the recruitment of IO; however, its association with the therapeutic alliance cannot be affirmed. So far, we are not aware of any study that aims to evaluate the association between therapist/patient alliance and muscle recruitment. However, a recent systematic review study[21] showed that the positive alliance between therapist and patient appears to have a favorable effect on the result of physical treatments involving general exercise, spinal manipulation and physiotherapy, while Ferreira et al.[22] demonstrated its value in the treatment of low back pain.

The analysis of the level of pain using the McGill questionnaire at the end of the intervention showed a reduction in pain. This finding was similar to the result of systematic reviews[23-26], which suggested the effectiveness of motor control exercises in relieving pain, although there is also a report showing the absence of clear effects of the use of motor control exercises in pain intensity in the short term[13].

At the end of the intervention, there has been a significant reduction in disability. The behavior of disability after exercise programs have generated conflicting results, with studies reporting no difference between stabilization exercises and usual care[27] or general exercise[28] to reduce disability in the short term. However, in the medium and long term, stabilization exercises stand out[23,26]. Recent research found results similar to the present study, showing improvement in activity limitation in the short term[13].

The participation of the TrA muscle in stabilizing the lumbar spine was observed in several studies[27-31]. Ferreira et al.[32] observed that the improvement in the recruitment of TrA muscles in subjects with chronic low back pain contributes to the reduction of disability. Although our results reveal the same, no significant improvement in muscle recruitment was observed. This finding may be due to the fact that subjects were involved in a program in which they were submitted to a maximum of 12 sessions (mean≈10), since the dosage shown a capacity of interfering with the response to treatment[33]. Thus, it is believed that the decrease in pain and disability may be associated with a possible balance in the joint recruitment of TrA/IO muscles and not only with their individual recruitment, since O'Sullivan et al.[34] observed that the difference between subjects with and without a history of low back pain is not that of activity between the superficial and deep muscles, but the percentage of

activation of deep muscles due to the more superficial muscles.

The results presented in this study provide limited information mainly due to the sample size. Therefore, a larger study on the subject can provide information to help clarify this issue.

CONCLUSION

The recruitment of TrA and IO muscles was not related to the therapeutic alliance. The performance of motor control exercises for eight weeks is able to reduce disability and pain in the short term without necessarily causing changes in the recruitment of deep abdominal muscles.

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