



Functional taping effects on pain and electrical activation in patients with low back pain

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ABSTRACT

Background: Low back pain (LBP) is a high prevalence health problem and it has several treatments available, among them it is the functional taping. **Objective:** To evaluate the influence of functional taping on the electrical activation of the erector spinae muscle, the degree of pain and the functionality in subjects with LBP. **Methods:** Twenty female with LBP participated in the study, and were divided in two groups: with and without the use of the functional taping. The electrical activity of the erector spinae muscle was obtained bilaterally by electromyography (EMG). The root mean square (RMS) value of the EMG was calculated for three maximum voluntary contractions (MVC) obtained before and 48 hours after the application of the taping. The RMS value of each MVC was normalized by the mean RMS value of the first test for each group. The visual analog pain scale was used to measure the pain, and the Roland Morris questionnaire to evaluate the functionality. Comparisons between groups ($\alpha=5\%$) were performed using the Mann Whitney test, and intra-group using the Wilcoxon test. **Results:** There was no decrease in muscular electrical activation, a significant decrease in pain, and an improvement in functionality. **Conclusion:** The use of functional taping in the lumbar spine promoted positive effects related to pain and functionality.

Keywords: Electromyography; Low Back Pain; Physiotherapy; Physiotherapy modalities.

INTRODUCTION

Low back pain (LBP) is a common painful disorder and a frequent cause of morbidity and disability, being considered one of the most costly and prevalent health problems, affecting between 50% and 80% of the general population^(1,2). Since the second half of the 20th century, LBP had become one of the biggest problems for public health systems worldwide. Nevertheless, only 15% of back pain has a known cause, and it is estimated that 23% become chronic, disabling 11 to 12% of the population^(3,4). Several risk factors for the development of LBP are pointed out such as overweight or obesity, sedentary lifestyle, smoking and psychosocial factors. Mechanical factors are also considered risk, however, studies indicate that they are causative when combined with other characteristics, such as the genetic constitution, and not alone^(3,5). Numerous treatments for LBP have been proposed in the literature, although a consensus has not been established to which is the most efficient. Functional taping is one treatment that can be an efficient resource, since it promotes sensorial feedback for the patient⁽⁶⁾, which can contribute to a biomechanical rebalancing, reducing muscular hyperactivity and sensorial alteration present in LBP⁽⁷⁾. Among the expected effects of

taping application are the restriction of joint range of motion and alignment⁽⁷⁾. Functional taping can be used for postural control, relieving pain associated with inadequate trunk posture. Studies have shown improved posture, reduced muscle hyperactivity and reduced pain⁽⁷⁻⁹⁾.

In order to evaluate effectiveness of the use of functional taping in the treatment of LBP, electromyography (EMG) may be useful. It is a resource widely used for evaluation of the neuromuscular system behavior, enabling the understanding of muscle function and identification of normal and pathological conditions^(10,11). Several studies have been carried out to investigate the effect of functional taping on the joint alignment and stabilization⁽¹²⁻¹⁴⁾. Despite the reduction of muscle hyperactivity and consequently of LBP, are effects described in the literature⁽⁷⁻⁹⁾, studies that approach the effect of rigid functional taping on LBP are incipient. Therefore, the objective of this study was to measure pain, functionality and electrical activation of erector spinae muscles before and after the application of rigid functional taping in order to elucidate the efficacy of this technique for the treatment of LBP.

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METHODS

This is a quasi-experimental study, approved by the Research Ethics Committee from the 'Centro Universitário La Salle' (number 09/010). It was included 20 female patients with complaints of LBP without a clinical history of neuromuscular disease; with no musculoskeletal trauma on the spine, wrist, shoulder and elbow; who had not undergone any surgical procedure in the lumbar spine; without the use of continuous drug therapy; or in the menstrual cycle period; by signing the Informed Consent Form. The participants were divided in two groups of 10 subjects each, being a control group (CG), who did not use the taping, and an experimental group (EG), who were submitted to the application of functional taping. The mean age in EG was 38.0 ± 15.8 years, and in CG it was 31.7 ± 13.9 years. The visual analog pain scale (VAS)⁽¹⁵⁾ was used to evaluate the intensity of pain in the lumbar spine, and the Roland-Morris questionnaire (RM) was used to assess the physical limitations resulting from the pain reported in the lumbar spine⁽¹⁶⁾. A surface EMG system (Miotool, Miotec Equipamentos Biomédicos Ltda., Brazil) of four channels (common rejection mode with 126 dB and input impedance of $10G\Omega$) was used for the acquisition of electromyographic signals. The EMG signal from the erector spinae muscles was monitored by pairs of Kendall passive surface electrodes (MEDITRACE – 100, São Paulo, Brazil) with Ag/AgCl; diameter of 20 mm, inter-electrodes distance of 22 mm, in bipolar configuration. Before the placement of the electrodes, the tricotomy and the skin cleaning were performed. The electrodes were aligned longitudinally to the muscle fibers and fixed on the skin covering the most prominent belly. A slight pressure was applied on the electrodes to increase the contact between the electrode gel and the skin⁽¹⁷⁾. A reference electrode was positioned on the skin covering the clavicle. The EMG signal was acquired at a sampling frequency of 2000 Hz, amplified 1000 times and stored on a computer by means of an A/D converter with 14 bits of resolution. A bandpass digital filter with a cutoff frequency of 20-500 Hz of the fourth-order Butterworth type was used to remove possible noises.

The root mean square (RMS) values regarding the muscle activation level was obtained from cuts of one second of duration (cut-off corresponding to 2000 points) of each maximum voluntary contraction (MVC), eliminating the beginning and the end of the contraction. The absolute RMS value was obtained from the average of the RMS values of the three MVC. In addition, the RMS value obtained 48 hours after the first evaluation was normalized by the mean RMS value corresponding to the first evaluation. The delimitation of the electrodes location was performed using a demographic pencil. The Matlab® program, version 7.5 (Mathworks Inc., Novi, MI, EUA), was used to process the electromyographic signal through a custom mathematical routine. For the evaluation of the muscular electrical activation, the volunteers were in the prone position. The lower lumbar region, the hip and the

knees were stabilized by belts fastened to a stretcher, while the region of the shoulder blades was stabilized by a velcro strip. Each patient performed three MVCs of trunk extension against gravity, lasting approximately five seconds each and with 2-minute intervals between MVCs to avoid possible effects of muscle fatigue.

The protocol was always applied in the afternoon shift to avoid possible differences in muscle electrical activation, since some symptoms of LBP are more prevalent in the morning and others at the end of the day. After the initial evaluation, a functional taping of the rigid type (Endura-Tape; Victor Endura-Tape, Clareville, Australia) was applied on the EG, from the level of the last ribs, towards the opposite posterolateral iliac spine. The taping was applied bilaterally, forming a letter "X", in order to decrease the existing muscular tension⁽¹⁸⁾. After 48 hours of the first evaluation, all tests were performed again in both groups⁽¹⁹⁾. The results were presented using descriptive measures, which involved the calculation of the mean and standard deviation. In the comparison between the groups for the qualitative variables referring to the initial evaluation was used the Fisher's Exact test (Monte Carlo Simulation). For the comparison between the two groups in relation to the quantitative variables, the Mann Whitney test was used and the Wilcoxon test for intra-group comparisons. All the analyzes were performed in SPSS version 13.0 with a level of significance (α) of 5%.

RESULTS

The groups were similar in relation to age ($p=0.529$) and body mass index ($EG=25.2 \pm 5.9$; $CG=25.7 \pm 6.7$; $p=1.00$). Despite the slightly different pain percentages, the groups were similar for this variable ($p=0.149$). In the EMG, no significant differences were observed in comparison of the absolute and normalized RMS values for the right and left sides ($p=1.000$), as well as for the first and second evaluations, in relation to both groups (Table 1). Regarding the Rolland Morris questionnaire, in the intragroup comparison, was verified significant difference in the EG ($p=0.037$) showing that the second evaluation scores (6.5 ± 6.7 points) were significantly lower than those of the first (9.8 ± 6.8 points), i.e., was detected improvement of functionality after the application of the taping. In the CG comparison, the differences observed between the first and second evaluation were not significant ($p=1.000$) (Table 2). Considering the VAS data, it was verified that, in EG, there was a significant reduction between the first and second evaluation ($p=0.005$), showing that the second evaluation scores (3.1 ± 1.9 degree) were significantly lower than those of the first (5.7 ± 1.9 degree). The comparison between the groups showed that, in the second evaluation, was detected a statistical difference ($p=0.015$), and the EG scores (3.1 ± 1.9 degree) were significantly lower than those of CG (5.8 ± 2.4 degree) (Table 2).



Table 1. Central tendency measures (mean \pm standard deviation) for the absolute RMS value and percentage for the normalized RMS value of each side, according to the group, in each of the evaluations.

MVC	Groups		p
	Experimental	Control	
First L absolute RMS (mV)	0.092 \pm 0.054	0.067 \pm 0.034	0.315¶
Second L absolute RMS (mV)	0.085 \pm 0.054	0.067 \pm 0.031	0.579¶
Second L normalized RMS (%)	96.8 \pm 19.3	105.6 \pm 30.7	0.452Φ
First R absolute RMS (mV)	0.078 \pm 0.045	0.057 \pm 0.033	0.631¶
Second R absolute RMS (mV)	0.092 \pm 0.065	0.063 \pm 0.032	0.436¶
Second R normalized RMS (%)	117.6 \pm 35.6	100.5 \pm 26.8	0.241Φ

Note: MVC: maximal voluntary contraction; ¶: Mann Whitney test; Φ: t-Student test for independent groups with equality of variances; R: right; L: left.

Table 2. Central tendency measures (mean \pm standard deviation) for the visual analogue scale and the Roland Morris questionnaire scores, according to the group, in each of the evaluations.

Variables	Groups		p ¶
	Experimental	Control	
First Visual Analogue Scale	5.7 \pm 1.9	4.4 \pm 2.4	0.280
Second Visual Analogue Scale	3.1 \pm 1.9	5.8 \pm 2.4	
p Φ	0.005	0.052	0.015
First Roland Morris	9.8 \pm 6.8	7.0 \pm 7.1	
Second Roland Morris	6.5 \pm 6.7	7.1 \pm 7.0	0.780
p Φ	0.037	1.000	

Note: Φ: Wilcoxon test; ¶: Mann Whitney test.

DISCUSSION

As shown in the EMG results, after the application of the taping there were no significant differences in the RMS value for the right and left sides, as well as for the first and second evaluations. Kang, Choi and Oh⁽⁷⁾ analyzed the influence of postural functional taping on the kinematics of the lumbo-pelvic-hip complex, the EMG of the erector spinae muscles, and the subjective perception of effort in the lumbar region in patients with chronic LBP. The authors found a significant reduction in the angle and range of motion of lumbar flexion, and a significant increase in the angle and range of motion of anterior pelvic tilt and hip flexion on the use of functional taping compared to the no-taping during the transference of the patient. In addition, the application of the non-elastic taping in the lumbar region resulted in a significant reduction in the electromyographic activity of the spine erectors and in the subjective perception of effort during the transference of the patient. The results demonstrated that postural functional banding can change not only the kinematics of the lumbo-pelvic-hip complex, but also the EMG activity of the erector spinae muscles and the subjective perception of effort in the lumbar region during a dynamic task such

as the transference of the patient. In the present study, the two-minute interval between MVC was used, a time that may not have been enough to allow muscle recovery between one contraction and another. A study evaluating muscle recovery time showed that a 10-minute interval is sufficient for recovery of muscle fiber conduction velocity and also for substantial recovery in kinematic performance⁽²⁰⁾. Regarding the evaluation of pain degree, a significant reduction in pain intensity was observed after the application of the taping in EG. No studies were found in the literature that used the same taping technique as the present investigation. However, studies analyzing pain with other functional taping techniques have reported evidence that this feature promotes improvement of pain.

A randomized clinical trial analyzed the effect of functional taping compared to a short- and a medium-term placebo on non-specific LBP. After the intervention there was a significant reduction of LBP in the group that used bandage when compared to the placebo group. There was no difference in pain between groups in the medium-term. The authors point out as a plausible explanation that the application of the adhesive tape on the skin could stimulate afferent fibers of great diameter and then modulate the nociceptive stimulus. In addition, stretching the skin in the specific direction of the pain with the taping could affect the perception of pain or alter the internal architecture of local tissue, as well as stimulate cutaneous mechanoreceptors⁽²¹⁾. The use of VAS to verify the level of pain before and after the use of bandage is present in the literature. A study used VAS to investigate the effect and predictors of taping efficacy by the McConnell method in the treatment of Patellofemoral Pain Syndrome. The findings indicated a significant decrease in VAS after the use of the bandage, corroborating with the present study⁽²²⁾. Ng and Wong⁽²³⁾ investigated the effects of taping on pain and muscle activation through EMG in patients with patellofemoral pain. The tests were performed comparing pain and muscle activation before and after muscle fatigue among three groups: with taping, with placebo and without taping. The results of the study indicated the reduction of pain after use of the taping, but did not show a significant difference in muscle activation of the vastus medial between the different test conditions. However, there was a significant difference in the amplitude of activity of the vastus medial obliquus, with a lower activity of this musculature in the taping group than in the group without taping. The authors point out as possible explanation the effect of mechanical restriction of the taping, which corrects the alignment and maintains joint stability. The difference in this measurement compared to the present study is the fact that the application of the bandage and the pre and post exercise measurement were performed in one day. The 48-hour period may have been too much to obtain a differentiation in the measurement of muscle activation. The results regarding the Rolland Morris questionnaire were



significant, since it was verified that the scores presented in the second evaluation of the EG were significantly lower than those of the first evaluation, demonstrating better functionality. To date, no studies have been found to evaluate the functionality after the use of functional taping through this instrument, but it is believed that this improvement is related to the decrease of pain.

CONCLUSION

The use of functional taping in the lumbar spine had positive effects on the functionality and the pain process, and can be considered an effective physiotherapeutic technique to reduce pain, in the evaluated sample and in the research conditions adopted. It is believed that such studies can promote scientific knowledge of techniques commonly used in physiotherapy.

AUTHOR'S CONTRIBUTIONS

APBK: study design, data collection, data analysis, critical review; TM: elaboration of the discussion and critical review; FD: data analysis and critical review; MAV: critical review. All authors read and approved the final version of the manuscript.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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