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Kinesio Tape® Associated with Lumbopelvic Stability Exercises in Chronic Nonradicular Lumbar Pain

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MBD and RBD designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors ELMM, FRM, RKB, TSS, CPD and CCC managed the analyses of the study. Authors ELMM, CPD and CCC managed the literature searches. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Aim: To evaluate the effect of Kinesio tape (KT) associated with a CORE exercise program in subjects with low back pain.
Study Design: Randomized, double-blind, placebo-controlled clinical trial.
Place and Duration of Study: Clinical Physiotherapy School of the Physiotherapy Course of the Lutheran University of Brazil, from March 2015 to January 2017.
Methodology: Sixty patients with chronic low back pain were randomised and divided into three groups: KT + CORE, KT, and Placebo KT. The subjects were evaluated before and after intervention regarding pain level, quality of life, functional disability, and lumbopelvic stability.

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Results: The group in which KT was associated to the CORE program (KTCG) obtained significant results in pain reduction at the initial evaluation (8.85 ± 3.50), with pain being significantly reduced at the final evaluation (4.35 ± 3.82); the functionality of these individuals also improved significantly (from 12.71 + 5.93 to 8.21 ± 3.66). At the follow-up evaluation, a significant reduction occurred for both the initial and final evaluation (7.79 ± 4.25) ($P<.05$). KT (KTG), when applied alone, demonstrated a significant effect on pain reduction and function improvement when compared to the placebo ($P<.05$).

Conclusion: This study demonstrated significant results on pain, quality of life, and decreased disability in subjects with nonspecific low back pain who used KT. Notwithstanding, when associated with CORE stability exercises, the results were significantly more satisfactory. KT can be used as a complementary method in chronic nonspecific back pain.

Keywords: Low back pain; athletic tape; physical therapy specialty; muscle stretching exercises.

1. INTRODUCTION

Low back pain (LBP) or lumbalgy is characterized as a pain or discomfort in the lumbar region located between the lower rib cage and gluteal folds, with or without radiation to the lower limbs. This condition presents a multifactorial etiology and is considered chronic when pain persists for more than three months [1,2]. It is believed to be disabling, since it happens very often, almost permanently, and can cause discomforts and limitations at work, domestic, and leisure activities [3,4]. Therefore, it is one of the most common reasons for total or partial disability retirement [3,4]. Affected people present not only pain and functional restrictions, but also increased risk for depression, weight gain, and worsening of quality of life [5]. The frequency of specific LBP is 15%, while 85% of people suffer from nonspecific low back pain [6]. It is the most common cause of pain in older people. The peak incidence of this dysfunction occurs between the fourth and sixth decade of life, that is, in people who are still of working age [3,5-7]. Lumbar pain usually presents a favourable clinical course, and about 95% of the patients improve after 60 days of onset of symptoms [7]. However, those who do not improve in this period are likely to develop a chronic pain that can last for more than three months and, in some cases, a lifetime [8]. The cost of LBP is high, both concerning the demand for health services, examinations, medications, physiotherapy, hospitalisations, and surgeries and to expenses resulting from service withdrawal and early retirement [9]. Social Security data show high disability retirement rates related to back pain in Brazil [9,10].

Kinesio taping® (KT) is an innovative rehabilitation technique that has been increasingly used in musculoskeletal conditions and sports injuries [11,12]. KT was created around the year 1970, in Japan, by Kenzo Kaze [13]. It is a thinner tape compared to conventional tapes, with an elastic ability to stretch up to 140% of its standard size when applied to the skin. It is made of 100% cotton and is porous, not restricting the range of movement [13-15]. According to the Kinesio Taping Method Manual, this traction promotes an elevation of the epidermis and reduces pressure on the mechanoreceptors located below the dermis, thereby reducing nociceptive stimuli [16,17]. According to Kase, KT can minimize oedema by directing exudates to lymphatic ducts, thereby improving lymphatic flow [18]. Also, it can reduce pain intensity, inhibit or facilitate motor activity, provide proprioceptive feedback, promote postural alignment, change recruitment activity patterns of the treated muscles, and generate joint stability [18,19]. Currently, KT acts in complementary rehabilitation in patients with LBP, aiming at reducing pain and increasing the functionality and the ability to perform daily life activities (DLAs) [19,20].

In the approach to these spinal pains, one of the objectives to be achieved is the stability of the lumbopelvic-hip complex, also called CORE [21]. The CORE is a functional concept commonly used to refer jointly to the muscular and osteoarticular structures of the central part of the body, especially the thoracolumbar spine, pelvis, and hips [21]. The CORE corresponds to the musculature that is in the center of our body, which is necessary to maintain the functional stability of the lumbopelvic region. These muscles form a muscular box comprised by abdominal muscles in the front; paraspinal and gluteal muscles in the back; the diaphragm as the roof; and the pelvic floor and hip girdle musculature as the bottom [22,23].

A CORE training program is characterised by isometric exercises, low intensity, and synchrony of the deep trunk muscles aiming to stabilise the lumbar spine, thus protecting its structure from excessive wear [21,24]. Therefore, exercises that increase muscle flexibility and strength are very important for people with low back pain [24]. CORE training exercises can be performed through static and dynamic exercises that increase activation and recruitment of muscle fibres, working abdominal and trunk muscles and those connecting upper limbs, pelvis, and lower limbs [22,25]. Several studies have demonstrated the effects of a lumbopelvic stability program on pain, lumbar dysfunction, and improvement of the quality of life of people with low back pain [21,23-26].

The aim of the study was to evaluate the effect of KT combined to a CORE exercise program in patients with non-radicular LBP.

2. MATERIALS AND METHODS

2.1 Design

Randomized, double-blind clinical trial of 72 people with chronic non-radicular low back pain attended at the Physiotherapy School of the Lutheran University of Brazil (ULBRA), in the city of Torres/RS, Brazil, from March 2015 to January 2017. Twelve participants were excluded from the study, five of whom had herniated disc, two with spondylolisthesis, and five with three consecutive absences during the intervention period. Therefore, the final sample comprised 60 participants. The study was registered in the Brazilian Clinical Trials Registry (REBEC) under the number RBR-69T5JQ.

2.2 Eligibility Criteria

2.2.1 Inclusion criteria

- Subjects of both genders, aged 18-60 years, who presented nonradicular low back pain greater than or equal to five in the Visual Analogue Pain Scale (VAS) for a period greater than three months;
- Not performing any other type of physiotherapeutic approach to nonradicular low back pain at the time of the study;
- Having signed the Free and Informed Consent Form (TCLE);
- Having medical referral for physiotherapeutic treatment.

2.2.2 Exclusion criteria

- Severe vertebral pathologies (fracture, tumors, and inflammatory conditions, such as ankylosing spondylitis);
- Previous surgery in the lumbar region;
- Nerve root involvement (disc herniation and spondylolisthesis with neurological involvement of the spine, stenosis, and others);
- General contraindication for the use of KT (allergy or intolerance to the use of bandage);
- Severe cardiorespiratory disease;
- Pregnancy;
- Nonattendance in three consecutive treatments.

2.3 Randomization

We initially selected 72 subjects with low back pain. Of these, seven were excluded prior to the study throughout the treatment. Hence, 65 subjects were eligible for the study. At the end of the partial evaluation, there were five losses (Fig. 1). They were allocated through sealed envelopes containing folded papers with the number of the group to which each study subject belonged. After the initial evaluation, the study participant chose one of these envelopes.

The 65 subjects participating in the study were initially randomly divided into three groups:

- Group I, KT + Core group (KTCG), n = 21, in which subjects underwent an intervention protocol with KT application associated with a protocol of lumbopelvic stability exercises (CORE) three times a week, during four weeks of treatment;
- Group II, KT group (KTG), n = 21, which received only the application of KT with tension, three times a week, during four weeks of treatment;
- Group III, Placebo KT group (PKTG), n = 23, which received only placebo KT application without any tension, three times a week, during four weeks of treatment.

2.4 Data Collection Procedures

Initially, subjects who met the eligibility criteria were invited to participate in the study and sign the Free and Informed Consent

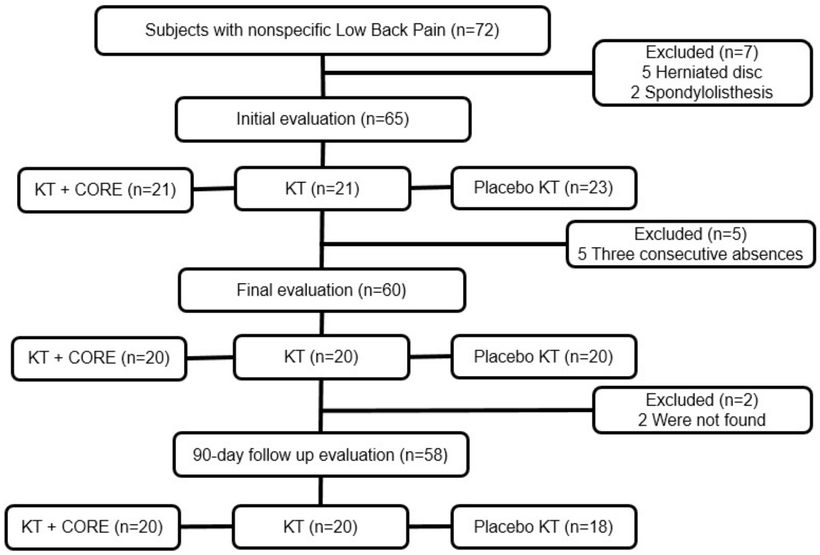

Fig. 1. Study flow chart

Term (FICT). After agreeing, they were referred for the initial evaluation. The latter, in turn, was done by a single blind evaluator, that is, not knowledgeable of which group each patient belonged to. This evaluation included the following items:

The level of low back pain was assessed through the Visual Analogue Pain Scale (VAS), in which the patient scores pain on a scale of zero to 10, with zero indicating "absence of pain" and the number 10 considered as the "worst pain imaginable".

The Oswestry Disability Index (ODI) and the Roland-Morris Disability Questionnaire (RMDQ) were used to evaluate the functionality of the lumbar spine. The Roland-Morris Disability Questionnaire comprises 24 self-response questions that patients complete in less than five minutes. The questions are dichotomous (yes or no). The result is the sum of the yes responses; it can range from zero to 24. Zero corresponds to a person with no complaints, and the maximum value refers to a patient with a high dysfunction.

The body mass index was verified by measuring height and weight. Weight was measured using a previously calibrated anthropometric scale, with the subject wearing light clothing, and barefoot. Height was measured on the same scale by a stadiometer, and the subject was barefoot, with arms extended along the body, and in respiratory apnea. Three measurements of height and weight were made, and their median was recorded.

Lumbopelvic stability tests were selected from the study by Perrott et al. [22], namely, the Single Leg Squat, the Dip test, and the Runner pose test.

2.5 Intervention Protocols

2.5.1 KT + CORE Group

KT application was developed from the protocol proposed by Added (2013) [19], and the protocol of core stability exercises was developed with exercises based on static postures, starting with a maintenance of this posture for five seconds. As the program evolved, the degree of difficulty in controlling the posture was increased, as well as the time of postural control, for 10 seconds. In all exercises, the researcher performed the command of continuous contraction of the stabilizers ("abdominal press") (Table 1).

It is noteworthy that during the exercises, participants were instructed to maintain the posture for 5 to 10 seconds in each position, repeating for 10 times with 30-second intervals between each exercise. Volume and intensity varied, considering the individual characteristics of each subject.

At the end of the intervention protocol and three months after it ended, all subjects were reevaluated by VAS and the Roland-Morris and Oswestry Disability Index questionnaires (Fig. 1).

The KT placement protocol occurred three times a week for four weeks, as described in Table 2.

2.6 Sample Calculation

The statistical program EPI-INFO® was used to calculate the sample size. After reviewing the literature, we observed a prevalence of

Table 1. Intervention protocol with CORE exercises

Exercise	Exercise description
1	**Prone bridge** ***IP:*** Ventral decubitus while resting on the elbows, and prone hands resting on the ground. ***Development:*** to elevate the trunk, thighs, and knees, leaving only the feet and upper limbs (UL) resting on the ground, maintaining isometry. ***FP:*** same as the initial position. ***Variation*:** same as above, but with the knees resting on the ground.
2	**Side bridge** ***IP*:** Right lateral decubitus, with shoulders abducted at 90º, and elbows flexed at 90º; prone hand resting on the ground. ***Development:*** to elevate the body, maintaining isometry, with support only from the right UL, and the right LL extremity resting on the ground. ***FP*:** same as the initial position. ***Variation*:** same as above, however, with the knees flexed at 90º, resting on the ground.
3	**Supine bridge** ***IP:*** lying in dorsal decubitus, with the hip and knees flexed, and with a small ball between the knees and the feet; UL resting on the ground. ***Development*:** to elevate the hip (hip extension), until remaining only with the shoulder blades, feet, UL, and head resting on the ground, tightening the ball and maintaining isometry. ***FP*:** same as the initial position.
4	***Four spots*** ***IP:*** cat-like position with the knees, hands, and toes resting on the mat (hip flexed at 90°, and hands resting in alignment with the shoulders). ***Development:*** after verbal command, the subject flexes the shoulder and extends the contralateral hip until both are parallel to the trunk. This position is then maintained. ***FP:*** same as the initial position.
5	**Swiss ball bridge** ***IP:*** dorsal decubitus with the feet resting on a Swiss ball. ***Development*:** the subject elevated the hip, maintaining isometry. ***FP:*** same as the initial position.
6	**Supine elevation of the lower limbs** ***IP:*** dorsal decubitus, with the arms along the body. ***Development:*** to perform unilateral hip flexion with knee extension, maintaining isometry. Subsequently, the subject performs the same movement with the other leg. ***FP:*** same as the initial position.
7	**Mini-squatting** ***IP:*** With the Swiss ball on the back, while resting on the wall. ***Development:*** perform a squatting, until sitting with the knees and hip at 40º. Maintain this position. ***FP:*** same as the initial position.
8	***IP:*** dorsal decubitus, with the arms along the body. ***Development:*** to stretch the entire posterior chain against the floor, maintaining this position. ***FP:*** same as the initial position.

IP = Initial Position; FP = Final Position

Table 2. KT application protocol

KTG	Subject positioned in an anterior trunk flexion, resting on the examination table. The researcher placed the KT on the paravertebral muscles (bilaterally), parallel to the spinal processes of the lumbar spine, starting from the posterior iliac spine up to the T12 level. The degree of KT tension was approximately 30%. Subsequently, anchorage was performed by two transverse bandages, one in the thoracolumbar region, and the other in the sacroiliac region.
KTG	The KT was positioned on the spinal processes of the lumbar spine, starting from the posterior iliac spine up to the T12 level, but without any tension.

approximately 70% LBP in the adult population, and 6% in the general population. Using for sample calculation a prevalence of 70%, a power (1-beta, % probability of detection) of 80%, a bilateral significance (1-alpha) of 95%, a 10 percentage between unexposed subjects, and 70 percentage between exposed subjects, we reached the estimated number of 13 subjects for each study group. Estimating the losses and refusals to be around 50%, the final number is 20 subjects for each study group.

2.7 Statistical Analysis

The SPSS (Statistical Package for the Social Sciences), version 17.0, was used as database and statistical package. The data were double-typed to avoid errors and expressed as mean and standard deviation. Afterwards, these were analyzed statistically by the following parametric tests: analysis of variance (ANOVA) for repeated measures of analysis, within each group, from the initial to the follow-up evaluation; and unpaired Student's t-test for analysis of the variables between groups at every period. For nonparametric variables, the Kruskal-Wallis and Mann-Whitney tests were used, respectively. The level of significance established for the statistical test was $P<.05$.

2.8 Ethical Considerations

This project was developed according to the Regulatory Guidelines and Norms for Research Involving Human Subjects, and was approved by the Ethics and Research Committee of the Lutheran University of Brazil, under Opinion number 771.596. All participants were asked to sign the Free and Informed Consent Form.

3. RESULTS AND DISCUSSION

The final sample consisted of 60 study patients, of which 45 were female (75.0%). The subjects were aged 42.03 ± 13.88 years; 91.7% were white; 25% were homemakers; time of pain was 4.38 ± 5.14 years; weight of 71.87 ± 13.60 kg; height of 166.58 ± 8.86 cm; and BMI of 25.35 ± 5.03 kg/cm².

The studied groups were homogenous regarding gender, age, skin color, occupation, time of pain, weight, height, and BMI, with no significant difference between them (Table 3).

Analyzing pain, measured through the visual analogue pain scale (VAS), there was a significant decrease in pain from the initial to the final evaluation in CKTG, KTG, and PKTG. However, at the follow-up evaluation, CKTG presented a significantly lower pain level than the groups KTG and PKTG (P=.001) (Fig. 2).

CKTG subjects significantly reduced their pain when compared to the groups KTG and PKTG at the follow-up evaluation. In the CKTG group, the subjects presented an initial pain level of 6.95 ± 1.10, decreasing to 2.85 ± 2.300 at the final evaluation (P=.001). At the follow-up evaluation, pain was 2.05 ± 1.85 (P=.001 relative to the initial evaluation) (Fig. 2).

In the KTG group, pain decreased from 6.60 ± 1.23, at the initial evaluation, to 2.95 ± 2.01, after the final evaluation (P=.001). At the follow-up evaluation, the pain level increased to 3.95 ± 2.63 (P=.001 relative to the initial evaluation) (Fig. 2).

PKTG also demonstrated a significant reduction of pain level at the final evaluation. At the initial evaluation, the value was 6.22 ± 2.45, decreasing to 3.83 ± 2.26 at the final evaluation (P=.001). At the follow-up evaluation, the pain level increased to 4.94 ± 1.89 (P=.07) (Fig. 2).

The level of disability, assessed through the Roland-Morris Disability Questionnaire (RMDQ), demonstrated a significant decrease in scores from the initial to the final and follow-up evaluations only for CKTG and KTG. PKTG did

Table 3. Characterization of the study sample

Variable	Intervention group			
	KT + core (n=20)	**KT (n=20)**	**Placebo KT (n=20)**	***P* value**
Gender[a], n. M/F	6/14	7/13	2/18	.155
Age[b], years (n ± sd)	43.50 ± 13.13	39.65 ± 14.19	42.95 ± 14.67	.645
Skin color, n (%)[a]				.804
White	18 (90.0)	19 (95.0)	18 (90.0)	
Black	2 (10.0)	1 (5.0)	2 (10.0)	
Ocuppation[a], n (%)				.278
Homemaker	8 (40.0)	3 (15.0)	4 (20.0)	
Professor (a)	3 (15.0)	1 (5.0)	0 (0.0)	
Self-employed (a)	2 (10.0)	0 (0.0)	2 (10.0)	
Student	2 (10.0)	4 (20.0)	2 (10.0)	
Others	5 (25.0)	12 (60.0)	12 (60.0)	
Time of pain[b], years (n ± sd)	3.02 ± 2.24	4.06 ± 4.01	6.08 ± 7.47	.162
Weight[b], kg (mean ± sd)	71.17 ± 13.93	73.11 ± 12.26	71.34 ± 15.09	.886
Height[b], cm (mean ± sd)	165.20 ± 8.84	170.85 ± 8.81	163.70 ± 7.60	.474
BMI[b], kg/cm^2 (mean ± sd)	25.31 ± 5.50	24.42 ± 4.03	26.34 ± 5.48	.490

[a] Chi-square test; [b] One-way ANOVA

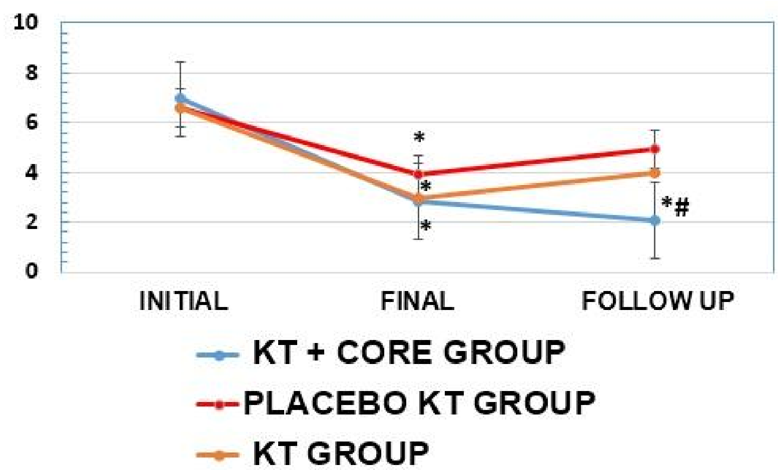

Fig. 2. Assessment of pain level by VAS during the study period

** P<.05 relative to the initial evaluation of the same group. ANOVA for repeated measures;*
 # P<.05 relative to the same evaluation of the groups KT and Placebo KT. One-way ANOVA

not demonstrate a reduction in the RMDQ scores for the different evaluations. No differences were found between the study groups in any of the evaluations. The CKTG group had an initial score of 8.85 ± 3.50 points, decreasing to 4.35 ± 3.82 points at the final evaluation (P=.001). At the follow-up evaluation, the score obtained remained at 4.35 ± 4.40 points (P=.001 relative to the initial evaluation). KTG also showed a significant decrease in the score. At the initial evaluation, the score obtained was 8.50 ± 4.38 points, decreasing to 4.30 ± 3.69 points at the final evaluation (P=.001). At the follow-up evaluation, the score was 4.95 ± 3.36 points (P=.001 relative to the initial evaluation). On the other hand, PKTG did not present significant differences between the study evaluations. At the initial evaluation, the Roland-Morris Questionnaire score was 9.85 ± 5.49 points, decreasing to 7.10 ± 5.38 points at the final evaluation, and to 6.61 ± 5.36 at the follow-up evaluation (Fig. 3).

The results of the Oswestry Disability Index (ODI) showed a significant reduction of the score at the final evaluation for CKTG and KTG. Only

CKTG maintained a significantly lower follow-up score. At the initial evaluation, the CKTG group obtained 13.64 ± 1.63 points, decreasing to 8.21 ± 0.98 points at the final evaluation (P=.002). At the follow-up evaluation, the score decreased to 7.79 ± 1.13 points (P=.01 relative to the initial evaluation). KTG presented an initial score of 9.89 ± 3.68 points, decreasing to 7.78 ± 3.89 points at the final evaluation (P=.007), and to 7.89 ± 4.17 points at the follow-up (P=.08). PKTG, in turn, showed an initial score of 13.17 ± 9.84 points, final score of 10.00 ± 8.18 points (P=.137), and follow-up score of 10.80 ± 9.04 points (P=.11) (Fig. 4).

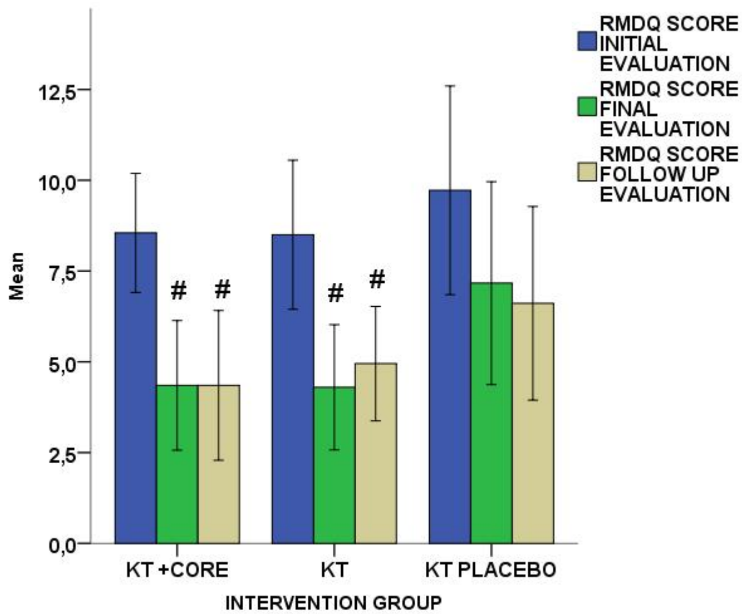

Fig. 3. Results obtained from the Roland-Morris Disability Questionnaire (RMDQ) during the study period;

 # P<.05 relative to the initial evaluation of the same group. ANOVA for repeated measures

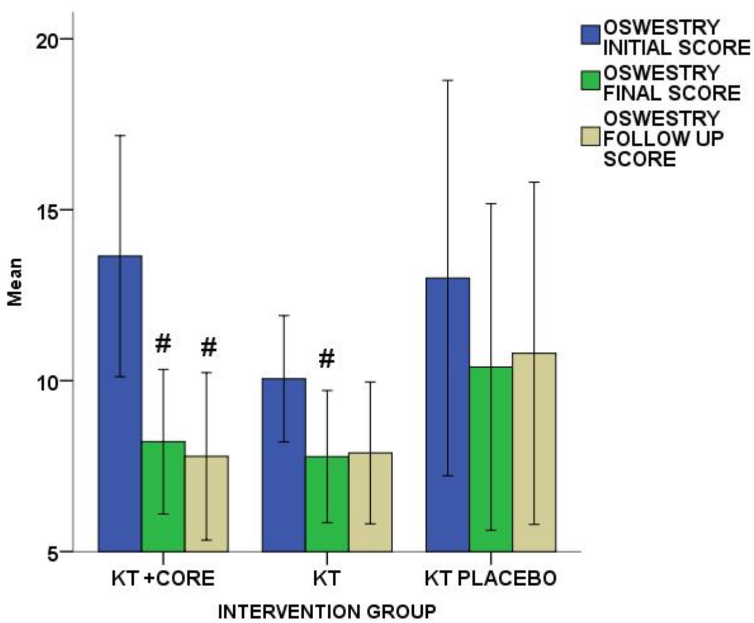

Fig. 4. Oswestry Disability Index (ODI) score

 # P<.05 relative to the initial evaluation of the same group. ANOVA for repeated measures

Table 4 represents the functional classification obtained from the Oswestry Disability Index during the study period. There was a significant improvement in the Oswestry classification from the initial to the final and follow-up evaluations in all study groups. No differences were found between the study groups in any of the evaluations.

The results obtained from the Dip test to evaluate lumbar spine stability demonstrated that 19 subjects of the CKTG group showed positive values at the initial evaluation. At the final evaluation, only nine were positive. At the follow-up, 13 were positive (P=.002). The groups KTG and PKTG did not show significant results within the groups, showing significantly worse results than CKTG (P=.05) (Fig. 5).

In the Single Leg Squat test to assess lumbar spine stability, CKTG demonstrated a significant improvement in stability from the initial to the final and follow-up evaluations. Nineteen subjects from CKTG showed positivity at the initial evaluation. At the final evaluation, only eight were positive. At the follow-up evaluation, 12 were positive (P=.001). The groups KTG and PKTG did not show significant results within the groups, showing significantly worse results than CKTG (P=.02) (Fig. 6).

The results obtained from the Runner Pose test also demonstrated a significantly better result for CKTG in relation to the other groups, and within CKTG from the initial to the follow-up evaluation. The lumbar spine stability test showed that 19 CKTG subjects were positive at the initial evaluation in the Runner Pose test. Notwithstanding, at the final evaluation, only seven were positive. At the follow-up, 13 were positive (P=.001). The groups KTG and PKTG did not show significant results within the groups, showing significantly worse results than CKTG (P=.05) (Fig. 7).

In the present study, we aimed to evaluate the efficacy of KT in subjects with chronic nonradicular lumbar pain. With this purpose, KT was used alone and in association with a program of lumbopelvic stability exercises (CORE).

A significant decrease was observed in the Oswestry Disability Index (ODI) scores from the initial to the final evaluation, both in the group which associated KT with exercises and in the group which used it alone. However, only CKTG maintained a significantly lower follow-up score. Bae et al. [27] selected 20 patients of both sexes with LBP for more than 12 weeks, dividing them into control group, in which Placebo KT was applied, and experimental group, in which KT was applied. At the end of the study, both groups had a significant reduction in pain and improvement in ODI scores [27]. The use of KT reduced pain and improved functional performance [27]. It is believed that such a technique makes it possible to increase blood and lymphatic circulation, stimulating the neurological system and thus positively

Table 4. Functional classification obtained from the Oswestry Disability Index during the study period

Variable	Intervention group			
	KT + core (n=20)	**KT (n=20)**	**Placebo KT (n=20)**	***P* value**
Initial evaluation, n (%)				.793
Severe disability	1 (5.0)	1 (5.0)	2 (10.0)	
Crippled	10 (50.0)	7 (35.0)	7 (35.0)	
Invalid	9 (45.0)	12 (60.0)	11 (55.0)	
Final evaluation				.680
Severe disability	0 (0.0)	0 (0.0)	1 (5.0)	
Crippled	4 (20.0)	3 (15.0)	4 (20.0)	
Invalid	16 (80.0)	17 (85.0)	15 (75.0)	
Follow-up evaluation				.660
Severe disability	0 (0.0)	0 (0.0)	1 (5.6)	
Crippled	4 (20.0)	5 (25.0)	4 (22.2)	
Invalid	16 (80.0)	15 (75.0)	13 (72.2)	
P value	.02	.05	.04	

Chi-square test

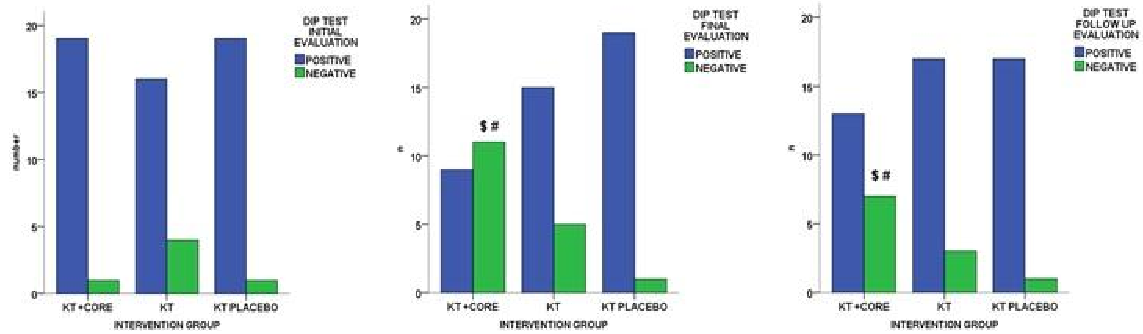

Fig. 5. Classification obtained from the Dip test in the study groups
$ P=.002 relative to the initial evaluation of the same group. Friedman's test;
 # P=.05 relative to the same evaluation of the groups KT and Placebo KT. Chi-square test

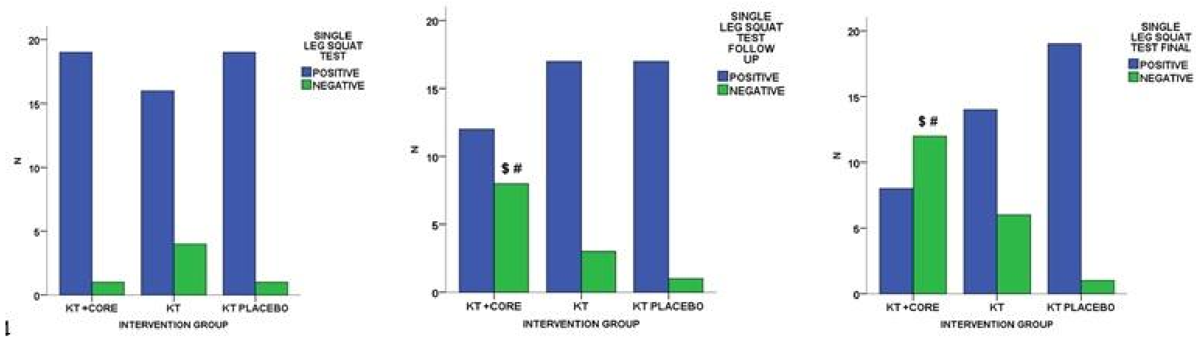

Fig. 6. Classification obtained from the Single Leg Squat test in the study groups
$ P=.001 relative to the initial evaluation of the same group. Friedman's test;
 # P=.02 relative to the same evaluation of the groups KT and Placebo KT. Chi-square test

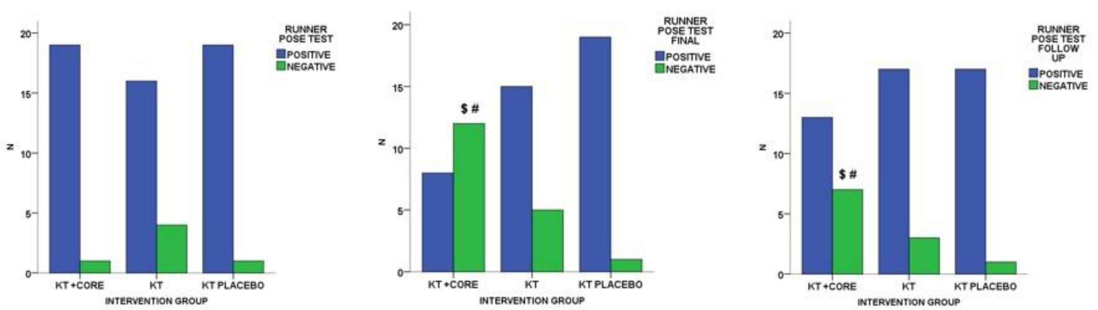

Fig. 7. Classification obtained from the Runner Pose test in the study groups
$ P=.001 relative to the initial evaluation of the same group. Friedman's test;
 # P=.05 relative to the same evaluation of the groups KT and Placebo KT. Chi-square test

influencing functional movements [27]. Köroglu et al. [28] included in their study 60 subjects of both sexes with LBP. Patients were divided into the groups KTG (n=20), PKTG (n=20), and CG (n=20). KT was associated with ultrasound therapy, transcutaneous electrical nerve stimulation (TENS), and therapeutic exercises. Intervention was applied for 10 sessions during a 2-week period [28]. Both KT and placebo KT were applied to the subjects at the end of each treatment session. No KT was applied to the third group, which constituted the control group (CG) [28]. All subjects were assessed before and after treatment regarding pain, functional status (ODI questionnaire), flexibility, and endurance [28]. Only the group which associated KT had a significant decrease in ODI scores [28]. This finding is in line with the finding of this study, which showed a significant decrease in ODI scores in the groups that used KT with tension.

In this study, pain was significantly reduced in all groups from the initial to the final evaluation. However, CKTG was the only group that maintained low levels of pain at follow-up for the same evaluation when compared to KTG and PKTG. KT contributed positively to the reduction of pain, but this effect was more expressive when associated with the lumbopelvic stability program, maintaining a significant result for analgesia in this group at the follow-up evaluation. Added et al. [18] evaluated men and women with chronic LBP, aged 18 to 60 years [18]. The subjects were divided into one group of conventional physiotherapy and another group with KT plus conventional physiotherapy [18]. The authors assessed pain and functionality, and found that KT provided pain relief and improved functionality when associated with conventional physiotherapy. Notwithstanding, when comparing the application of KT to the group that only performed conventional physiotherapy, there was no great difference in the improvement of functionality and pain relief.

We found that KT applied alone, both with and without tension (placebo), showed a favorable effect on the reduction of pain and improvement of function. Unlike these findings, Parreira et al. [13] selected subjects of both sexes, aged 18 to 80 years, who presented LBP for more than three months [13]. These subjects were divided into a KT group with tension of 10 to 15% and a KT group without tension [13]. There were no significant results between the groups regarding pain reduction and disability [13]. In the present study, the KTG group received a 30% tension. However, the application site was the same, that is, bilaterally on the erector muscles of the spine, parallel to the spinal processes of the lumbar spine [13]. It can be assumed that the difference in the result was due to the low tension used. Hwang-Bo et al. [29] reported that pain is alleviated by KT due to the skin stretching stimulus that it provides, which may interfere with the transmission of painful and mechanical stimuli, thus providing afferent stimuli that facilitate pain inhibitory mechanisms [29]. These changes may be related to the neural feedback received by patients, which may improve their ability to reduce mechanical irritation of soft tissues by moving the lumbar spine [30,31]. Parreira et al. [32] suggested that KT activates nerve endings according to the application form, and causes the brain to respond to stimuli improving the injured area and decreasing pain. This occurs because the pressure exerted on sensory and neurological receptors is relieved through undulations that the bandage promotes, elevating the skin and thus allowing the blood circulation and lymphatic system to flow more freely [32].

Paoloni et al. [33] reported that muscle functions were normalized, and pain was relieved when KT was applied. The effects of KT were studied under several conditions, including musculoskeletal lesions of the lower extremity, plantar fasciitis, and chronic nonspecific low back pain [33]. Some studies have reported, however, conflicting results regarding the use of KT in subjects with chronic nonradicular low back pain [13,34]. Nonetheless, there are studies that have provided sufficient evidence to support the use of this concept as a form of complementary treatment [32,35]. Castro-Sánchez et al. [36] compared the efficacy of KT and placebo KT in 60 subjects with chronic low back pain. The authors reported significant short-term improvements in pain intensity in the KT group when compared to the placebo group, but there was no significant difference at four weeks [36]. The method of application was similar to that applied in this study, but with one application per week. In this study, three weekly applications were performed with two-day intervals between KT replacements. We believe that the application of KT at only one day per week can influence the results, that is, the number of applications may not be sufficient to promote significant results in the long term. Loss of tension during the week can lead to a loss of activation of mechanoreceptors, thus leading to loss of pain blockage.

In the present study, the Roland-Morris Disability Questionnaire (RMDQ) was used to assess the degree of functional disability of the chronic LBP patient. This self-evaluative questionnaire puts the subject in front of various situations of his/her daily life. Hence, the level of disability generated by low back pain is assessed. We can observe that CKTG and KTG presented an expressive improvement in the disability degree. Pereira et al. [37] conducted a study to evaluate the effectiveness of using KT on pain, flexibility, and functionality of seamstresses with LBP. Five young women between the ages of 18 and 32 participated in the study [37]. The volunteers were subjected to 10 sessions of KT application

[37]. Afterwards, they were instructed to maintain them for three days [37]. After three days, a new application of KT was carried out in the same place, maintained for another three days [37]. This operation was repeated during the four weeks of treatment, with assessment of pain (McGill-Brazil questionnaire) and functional capacity (RMDQ) before and after the intervention period [37]. It was verified a decrease in pain and improvement of functional capacity of the respondents after the intervention period [37]. At the initial evaluation, the participants obtained 14.6 points in the RMDQ questionnaire, decreasing to 6.2 points at the final evaluation (P=.004) [37]. This corroborates our study, in which the KTG group obtained 8.50 points at the initial evaluation, decreasing to 4.30 points at the final evaluation regarding RMDQ. The authors concluded that KT was effective in improving pain, trunk flexibility, and functional performance in seamstresses with LBP [37].

A significant effect of KT alone was observed, especially on low back pain. However, in this study, we analyzed only the effects of KT, associated or not with a program of lumbopelvic stability exercises in people with chronic low back pain. In a context of clinical applicability, we believe that the use of KT in patients with acute low back pain (where the performance of an exercise program is limited by pain) can bring real benefits, especially if associated with other analgesic techniques.

This study has some limitations. The need for a longer follow-up after the end of the intervention protocol and a specific analysis of other variables such as muscle volume increase and postural alignment were not considered in the study, and may provide interesting data with the proposed intervention protocols.

4. CONCLUSION

This study demonstrated significant improvements in pain, quality of life, and decreased disability in subjects who used KT. In addition, when associated with central stability exercises (CORE), the results were even more satisfactory, especially in the medium term. Thus, KT can be used as a complementary method in chronic nonspecific low back pain. Withal, central stability exercises seem to us to be fundamental in the reduction of symptoms and functional improvement of subjects with nonspecific LBP. However, new studies should be conducted to confirm these findings and the perceived benefits with the use of kinesio taping and lumbopelvic stability exercises.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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