Effect of Kinesio Taping on Pain and Functional Disability in Chronic Nonspecific Low Back Pain

A Randomized Clinical Trial

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Study Design. A randomized controlled trial with 2-week Kinesio taping intervention.

Objective. The aim of the study was to investigate the effectiveness of Kinesio taping application on pain, functional disability, and trunk flexion range of motion (ROM) in patients with chronic nonspecific low back pain (chronic NSLBP).

Summary of Background Data. Kinesio taping is a therapeutic tool used for treatment of chronic NSLBP. However, there is little scientific evidence that describes its clinical efficacy.

Methods. Forty-four patients with chronic NSLBP were randomized into experimental group (n = 21) and placebo group (n = 23). The experimental group was treated with Erector Spinae Taping, whereas the placebo group was treated with placebo taping. The primary endpoint was pain intensity on visual analog scale. Secondary endpoints were functional disability on Arabic version of Oswestry disability index (ODI) and trunk flexion ROM on Modified Schober’s test. All measurements were recorded at baseline (W0), after 2-week intervention (W2), and at 4-week (W4) follow-up.

Results. Both group were comparable at baseline (P > 0.05). The experimental group had a greater decrease in pain than the placebo group after W2 of intervention (mean between-group difference 2.05 cm, 95% confidence interval [CI] = 1.67–2.82 points). This was maintained to W4 follow-up (2.25 cm, 95% CI = 1.67–2.82 points). At W2, the experimental group had significantly greater improvement in disability, by 3.90 points (95% CI = 1.68–8.54 points). This effect was significant at W4 follow-up (5.6, 95% CI = 2.65–8.54 points). Similarly trunk flexion ROM was significantly better at W2 (−0.71 cm, 95% CI = −0.85 to −0.56) and W4 follow-up (−0.73 cm, 95% CI = −0.88 to −0.58).

Conclusion. Kinesio taping reduces pain and disability and improves trunk flexion ROM after 2 weeks of application. However, these effects were very small to be considered clinically relevant and meaningful when compared with placebo taping.

Key words: elastic tape, functional disability, Kinesio taping, nonspecific low back pain, trunk flexion range of motion.

Level of Evidence: 2

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Low back pain (LBP) is among the most known challenges facing physical therapists. This is because it represents more than 50% of the referrals regarding outpatient clinic for physical therapy.1–3 On the contrary, nonspecific LBP (NSLBP) refers to LBP of unknown pathology. It establishes about 85% to 95% of the entire cases. It is often created spontaneously, and could be disabling and painful.4–7

There is no clear estimation in Saudi Arabia for the percentage of patients that suffer from the LBP and are referred to physical therapy clinics. However, LBP impacts on a significant number of Saudi Arabians and the approximated prevalence is from 18.8% to 26.3%.8–10 In addition, work-related LBP is probably a huge problem among the teachers (63.8%),11 nurses (65.7%),12 physical therapists (33%),13 and dentist (73.5%).14

The current literature provides several treatment strategies for NSLBP. These include pharmacological therapy,15 limited bed rest,16 and education and activity alterations.17 However, these are sometimes inadequate and additional therapeutic modalities are required, such as electrotherapy,18 manual therapy,19 exercise therapy,20 and behavioral cognitive therapy.21 Nonetheless, there is mild to moderate evidence regarding the effectiveness of these physical therapy interventions, leading to controversy and uncertainty within medical and health allied professions.22–24
In the 1970s, Kenzo Kase developed KT. It is latex free and adhesive and is stretchable to approximately 120% to 140% of its initial length. Hundred percent of cotton fibers allow for the faster drying and evaporation without having restricts the range of motion (ROM). The potential mechanisms of KT are unclear. However, the KT applications induce the following functions: (1) improvement of muscle function; (2) activation of circulation (blood and lymph); (3) pain system deactivation; (4) support the joint function; and (5) the segmental influence.

Few of the published clinical trials offered preliminary evidence on the KT’s beneficial effectiveness in the treatment of chronic NSLBP. However, other studies showed that KT lacks evidence and produced a minimal effect in the investigated outcome measurements varieties. These are involved but unlimited to the pain, the functional disability, the flexibility of the lumbar spine, and the muscular strength. The purpose of this study, therefore, was to detect the effectiveness of KT application technique on the reduction of pain, functional disability, and trunk flexion range improvement of motion (ROM), in participants with chronic NSLBP.

MATERIALS AND METHODS

Design and Setting

This study was a single-blinded, randomized controlled trial. Participants were recruited from three hospitals in the central area of Riyadh. Physical assessment and KT application were conducted in the physical therapy department, Al-Nakheel Medical Center, Riyadh, Saudi Arabia, from May 2014 to February 2015.

The study protocol and consent form were approved by the Research Ethic Committee, College of Applied Medical Science, King Saud University (CAMS 23–34/35), Riyadh, Saudi Arabia. This study was apart from the large trial project to evaluate the effect of different KT application techniques on the outcomes of the patient with chronic NSLBP. The trial registration code of this study was ACTRN12615000494538.

Participants

Inclusion criteria of participant enrolled in the study; males and females aged 25 to 55 years with history of chronic NSLBP ≥3 months. Exclusion criteria were as follows: (1) diagnosis of systemic metabolic and/or neurological disorder; (2) neuropathic pain; (3) spinal surgery and/or fracture; (4) pregnancy; (5) previous physical therapy treatment during the last 6 weeks; and (6) contraindicated to KT (e.g., skin allergy and/or intolerance to tape, dermatitis, or pre-existing skin lesion and infection).

Sample Size and Randomization

The sample size was calculated to detect a difference of 2 cm in pain intensity between groups on the visual analog scale (VAS), with the statistical power of 80%, and significant level was ≤0.05. Therefore, the sample size was estimated to be 40 participants in both groups. This sample would be increased to 46 for a potential dropout rate of 15%.

Participants were randomly assigned into an experimental group (n = 21), and placebo group (n = 23). The allocation was performed using a computer-generated randomized table. Participant allocation was concealed using a random numerical sequence in sealed opaque envelopes.

Outcome Measures

The primary outcome was pain intensity (1–10 cm) on VAS. The secondary outcomes were functional disability using Arabic version of Oswestry Disability Index (Ar-ODI) and trunk flexion ROM using modified Schober’s test (MST).

The primary investigator who was aware of the treatment groups collected all outcome measurements.

Pain Intensity (1–10 cm) Visual Analog Scale

The VAS is a continuum horizontal line of the 10-cm labeled “No pain” at the left and “Worst pain” at the right. The Participants were provided with a translated Arabic version of VAS.

Functional Disability

Level of daily living activities was measured using Ar-ODI. The questionnaire contains 10 items related to limitations in daily life activities (like personal care, lifting, walking, sitting, standing, sleeping, social life, traveling, and work). Each item includes six potential responses that are rating on a 0 to 5 points scale, with maximum scores of “5” or “total disability” and a minimum score of “0” or “no disability.” The total score is calculated as follows: (patient’s score/50) × 100 to obtain the score expressed in percentage.

Trunk Flexion Range of Motion

The primary investigator who was expertise (10 years) in orthopedics used the MST on a daily base in clinical practices. However, before initiation of the study standardizing measurement procedures (location of the anatomical landmark, verbal command, and the number of trials) were established between the authors. Following this ability to use the MST was examined. A pilot study on five healthy (three males and two females) subjects took place for all the lumbar flexion ROM for all participants using the MST. The test provided an excellent inter-rater reliability (r = 0.96) and intra-rater reliability (r = 0.94) reliability, and is sensitive to change following intensive physiotherapy for LBP.

The therapist evaluated the pain-free active trunk flexion ROM for all subjects using MST. The measurement was
done with participant standing erect, knees extended, arms relaxed at the sides, and body weight centered. The plastic tape and pen were used to make three markings on the skin overlapping the lumbosacral spine. The first mark was made at the lumbosacral junction, as indicated by the midpoint between the two posterior superior iliac spines (S2 level). Second point mark (superior mark) was made 10 cm above the lumbosacral junction. Finally, third point mark (inferior mark) was made 5 cm below the lumbosacral junction. The participant was instructed to bend forward as far as possible until the onset of the pain and the new distance between the second and third marks was measured. The initial length (15 cm) was subtracted from the final length of trunk flexion to obtain the extent of trunk flexion.

Intervention
In the first session, the therapist taught the participants how to perform relaxation position for back at home (e.g., lie down on back without pillows under head and hip and knee bent 90°). They were instructed to assume this position for 10 minutes, three times daily, and recorded their adherence in the dairy booklet.

Prior to KT application, the skin of the lower back was cleaned with alcohol swabs to ensure that it is free of lotions and oils. Excessive hair must shave for the best results and less pain when removing the tape. The therapist rounded every corner to prevent edges from peeling. The certified KT therapist (attendant levels KT1 and KT2) applied the KT twice a week for 2 weeks (total of four sessions) to the level of the T12 vertebra. All participants were instructed to leave the tapes attached in situ until the next intervention.

Kinesio Taping Application
For all participants, two I-shaped tapes of cure tape type (width 5 cm and 0.5 mm thickness) were applied on the erector spinae paravertebral muscles (bilaterally) parallel to the spinous processes of the lumbar spine.

For Participants in the Experimental Group; KT was applied according to the Kenzo Kaser KT manual as shown in Figure 1. The participants assumed sitting position on a chair without back support to allow forward bending while the therapist standing behind the participants. The KT was applied as the following; the initial anchor point of tape (4–5 cm) was carefully removed from its paper backing and applied to the posterior superior iliac crest without stretch. After that, the participant was asked to perform maximum trunk flexion and the tape was removed from the backing paper; the tape was applied in the shape of an “I” over the skin in the paravertebral region up to the T12 vertebra at 10% to 15% stretch. The final anchor point of tape (4–5 cm) was fixed directly above the transverse process of the T12 vertebra without a stretch. The same procedure was then applied to the other side. The tape was rubbed by hand several times to warm the adhesive film to achieve adhesion. Ask subjects to stand and observe the wrinkles in the tape that indicate right application.

For the Participants in the Placebo Group: Tape application was done in the standing position. Two I-strip of the same tape were applied without stretch as shown in Figure 2. The first anchor of the tape was applied to the posterior superior iliac crest without stretch (0% tension). Then the patient was asked to remain in the standing position and tape was applied over each erector spinae muscle to the level of the T12 vertebra, and then completely removed the backing paper of the tape to remove the tension from the tape.

Data Analysis
Data were analyzed with Statistical Package of Social Science (SPSS) version 22.0 (Chicago, IL). Kolmogorov–Smirnov test was used to determine the normality of data distribution. Normally distributed data were described as mean and standard deviation; otherwise the data were presented as frequency, median, and range and analyzed nonparametrically. Participant’s characteristics and demographic data were compared between groups with unpaired t test and Mann-Whitney U tests.
Separate 2-by-3 mixed-model analysis of variance was used to examine treatment effects (dependent variables), with a group (experimental or control) as between-participant variable and time (baseline [W0], 2-week [W2] post-intervention and at 4-week [W4] follow-up) as the within-subject variable. In addition to examining statistical significance, calculation of mean differences and 95% confidence intervals (CIs) between each follow-up data and pretreatment data were performed (independent-samples t tests). All analyses were performed at alpha (P < 0.05) as statistically significant.

RESULTS

Participants Characteristics
The flow of the participants through the study procedures is illustrated in Figure 2. Fifty subjects were referred by the primary physician as potential candidates with chronic NSLBP. Six participants were excluded due to failure to meet the inclusion criteria. Forty-four participants were eligible and assigned randomly into two groups. During the follow-up period, four participants were withdrawn from the study. Three participants did not attend final assessment session; experimental group (n = 1), and placebo group (n = 2), and one patient was referred to the physical therapy clinic for additional intervention in the placebo group. Therefore, 40 participants completed the study procedures and were included in the final analysis: experimental group (n = 20) and placebo group (n = 20).

Both groups had similar baseline demographic characteristics (P > 0.05) as in Table 1. The study sample represented a population of long-standing chronic NSLBP for the duration ranged from 3 to 84 months. The majority of participants (72.5%) described their LBP duration to be between 3 and 36 months. There were no significant differences in pain (P = 0.9), functional disability (P = 0.18), and trunk flexion ROM (P = 0.69) between groups at baseline (W0).

Pain VAS changed significantly over time in the experimental group and the placebo or control group as in Table 2. Pain intensity improved (mean difference = 2.05 points, 95% CI = 1.38–2.71 points) in favor of the experimental...
group at 2 weeks (W2) postintervention. This benefit was maintained (mean difference = 2.25 points, 95% CI = 1.67–2.82 points) after 4-week (W4) follow-up.

At the end of the 2-week (W2) postintervention, there were significant improvements of functional disability (mean difference = 3.90 points, 95% CI = 1.68–8.54 points). In addition, there was a great improvement in functional disability at 4-week (W4) follow-up in the experimental group (10.70 points) than in the control group (5.10 points), with mean differences of 5.6 points (95% CI = 2.65–8.54 points).

The trunk flexion ROM was significantly improved in both groups over time when compared with baseline (W0). The initial improvement in trunk flexion ROM was greater in the experimental group at 2-week (W2) postintervention (mean difference = −0.71 cm, 95% CI = −0.85 to −0.56 cm). This effect was maintained at 4-week (W4) follow-up (main difference = −0.73 cm, 95% CI = −0.88 to −0.58).

**DISCUSSION**

This controlled clinical trial showed a reduction in pain and functional disability and improvement in trunk flexion ROM after 2-week postintervention. These improvements persisted at a similar magnitude for 4-week follow-up in favor of the experimental KT group compared with the placebo group. However, there were no significant differences detected between groups.

The effect of KT on pain was relatively mild. As our best estimate of the effect KT on pain (e.g., an improvement of 2.05 and 2.25 on 10 cm VAS) was at the marginal level of minimal detectable change of 2 cm, the upper limit of the 95% CI did reach this threshold. However, this effect was sustained for 4 weeks after KT application.

Based on literature review, 10 cm points or 30% scores of improvement is considered to be clinically significant. Therefore, a reduction with 10 points on the ODI scales was used as minimal detectable changes. Our estimate of the effect of the tape on disability measured on the ODI did include 8.5 points at the upper confidence limit. However, the best estimate was that the ODI has only improved by 5.6 points by the taping. Therefore, our estimate of the effect of taping on the ODI and its confidence limits is relatively small in comparison to the range of possible scores on the ODI (0–100) and in comparison to the baseline scores of the study participants, which ranged from 22 to 35. So, our
the finger-tip-to-floor measurement, in the healthy subject. However, this could be explained by normal values of trunk flexion ROM, which is at baseline for all the participants (mean 6.07 ± 1.2 cm).

The results of this study were similar to the finding of Parreira et al. The authors never reported significant differences (P < 0.05) within group. Significant differences (P < 0.05) between group. 95% CI indicates 95% confidence interval; Con, placebo; Exp, experimental group; ODI, Oswestry disability index; ROM, range of motion; VAS, visual analog scale.

The results of our study are contradicted with finding from the previous studies. As all of these studies demonstrated a significant beneficial effect of KT when compared to various placebo application.

The KT discrepancy results in comparison to the placebo tapping may be attributed to the differences in tapping application, for example, I-strip tapping, Y-strip, star tapping, Kinesio Fascia Correction, and the Functional Fascial Taping. In addition, there is huge variability in assessment tools such as Pain VAS, ODI, NRPS, functional disability using the ODI or RMDQ. In addition, there is an assessment of trunk flexion ROM that uses modified Schober test, Flexi meter, and finger to tape measurements. Moreover, these studies are identified by small sample size, visibility, and short-term effect.

There are few potentials underline mechanisms that could at least partially explain our findings. One proposed mechanism is that the application of tape on the skin could stimulate large diameter afferent fibers and then modulates nociceptor input (gate control mechanism) to inhibit pain transmission. A further possible mechanism by which
KT induced these changes may be related to the neural feedback received by the participants, which may improve their ability to reduce the mechanical irritation of soft tissues when moving the lumbar spine.\(^{28,31}\) Another proposed mechanism may be attributed to an increased recruitment in the motor units of the lumbar erector spinae muscle to perform the activity due to increased proprioceptive stimuli. Proprioception could be enhanced through increased cutaneous feedback supplied by KT. Applying pressure and stretching effect of KT on the skin at extremes of motion, similar to joint mechanoreceptors, can stimulate cutaneous mechanoreceptors and signal information of joint movement or joint position.\(^{28,31,60}\)

It has been suggested that placebo treatments are important tools that can be used by the medical community to complement regular therapies; most physicians reportedly believe they use to be ethically permissible.\(^{61}\) However, the use of placebo treatments in clinical medicine remains controversial.\(^{62}\) In the current study, placebo effect derived from a participants’ expectation from the treatment could be another possible explanation for pain relief. The binding of participants and the outcome assessor in the current study might attribute to reduce the placebo bias and an exaggerated treatment effect. This finding is in agreement with the work of Chen et al.\(^{2012}\).\(^{55}\)

From this study, all the avenues that make the research vulnerable to biases are avoided through all the methodological approaches. The inability to blind participants and therapists, however, are considered to be the limitation of this study. Moreover, the scope of the current study covers only therapists, however, are considered to be the limitation of this study. The inability to blind participants and the outcome assessor in the current study might attribute to reduce the placebo bias and an exaggerated treatment effect. This finding is in agreement with the work of Chen et al.\(^{2012}\).\(^{55}\)

In this study, KT appears to reduce pain and disability and improves trunk flexion ROM after 2 weeks of application and sustained for 4 weeks. However, the effects of KT were very small to be considered clinically relevant and meaningful when compared with placebo taping for pain, disability, and ROM.

**CONCLUSION**

In this study, KT appears to reduce pain and disability and improves trunk flexion ROM after 2 weeks of application and sustained for 4 weeks. However, the effects of KT were very small to be considered clinically relevant and meaningful when compared with placebo taping for pain, disability, and ROM.

**References**

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