



PREVENTION AND REHABILITATION: CASE STUDY

Immediate effects of kinesio taping on pain and postural stability in patients with chronic low back pain

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ABSTRACT

Objective: Postural control of patients with chronic low back pain (CLBP) is usually impaired. Effects of treatment applications on postural stability have not been well investigated. The aim of this study was to investigate the immediate effects of kinesio taping on pain and postural stability in patients with CLBP. **Methods:** One hundred and one patients with CLBP (age: 53.00 (10.69) years, body mass index (BMI): 31.52 (5.57) kg/m²) were included in this study. Kinesio taping was applied on paravertebral muscles and sacrum with muscle and ligament techniques. Postural stability was assessed with Biodex Balance System® (USA) both at static and dynamic mode in bilateral standing position. The base was set “static” for static mode, and set between “12–1” for dynamic mode. Pain intensity was evaluated with the pain section (0–5 points) of Oswestry Disability Index, including ten items (pain, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, travelling), pre- and post-application.

Results: The static overall (pre: 1.49 (1.15), post: 1.25 (1.11)) and antero-posterior (pre: 0.96 (0.86), post: 0.74 (0.59)), dynamic overall (pre: 3.12 (2.26), post: 2.73 (2.44)) and medio-lateral postural sway scores (pre: 1.62 (1.12), post: 1.24 (0.75)), and pain (pre: 2.00 (0.00–5.00), post: 1.00 (0.00–4.00)) decreased after the application ($p < .05$). However, no differences were observed in static medio-lateral (pre: 0.84 (0.78), post: 0.82 (1.01)) and dynamic antero-posterior postural sway scores (pre: 2.33 (1.99), post: 2.12 (2.33)), ($p > .05$).

Conclusions: Kinesio taping may immediately improve postural stability and decrease pain of patients with CLBP.

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1. Introduction

Chronic low back pain (CLBP) is a widespread problem causing enormous health and socioeconomic problems (Anderson, 1999; Andersson, 1997; Dagenais et al., 2008). Around 70%–80% of adults in general population have been believed to experience at least one episode of low back pain at some time of their lives (Taylor et al., 2014; Walker et al., 2004). Low back pain has been associated with female gender, trunk, muscle weakness, lack of flexibility, sitting and standing for a long time, physical inactivity, obesity, and smoking (Halbertsma et al., 2001; Ryan et al., 2009; Sitthipornvorakul et al., 2011). CLBP produces mobility restriction, long-term disability, and quality of life impairment and is one of the main causes of work absenteeism (Andersson, 1997; Taylor et al., 2014).

Studies have shown changes in mobility and stability of spine, insufficiency of muscle strength, coordination, sensory-motor function, the ability to control body balance, proprioception, and orientation in relation to low back pain (Barrey et al., 2016; Jacobs et al., 2016; Ruhe et al., 2011; Truszczyńska et al., 2016; Tsigkanos et al., 2016). It was reported that these changes and insufficiencies of the musculoskeletal system affect the balance performance ability and limit the use of a proper exercise strategy in perturbation (Xia et al., 2008). Especially, patients with low back pain have a decreased balance ability compared to normal individuals (Jacobs et al., 2016; Truszczyńska et al., 2016; Tsigkanos et al., 2016). When the human body is exposed to an unexpected load, muscles have to respond quickly to maintain the body's balance and posture against the load. It was observed that patients with low back pain had problems with balance and maintaining posture caused by a delayed response time (Xia et al., 2008).

Several physical therapy applications including educational programs (Engers et al., 2008), electro-physical agents (French

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et al., 2006), manual therapies (Assendelft et al., 2004), and exercises (Hayden et al., 2005) have been used for symptom management. However, prompt effective therapy options for pain control and improvement in discomfort and function are needed to further design long-term treatment programs. Lately, taping applications, especially kinesio taping, have been reported to reduce pain and disability shortly after the application in CLBP (Nelson, 2016; Paoloni et al., 2011). Moreover, the positive effects of the tape on lumbar muscle function, anticipatory postural control, and movement-related cortical potential have been declared (Bae et al., 2013). Although the exact mechanisms of the effects are not yet clear, some investigators claimed that kinesio taping had multiple functions: supporting injured muscles and joints; improvement of fascia function and position; increasing segmental stability; activation of the blood and lymph flow by lifting the skin; deactivation of the pain by reducing nociceptive stimuli and improvement of proprioception with mechanoreceptor stimulation (Kachanathu et al., 2014; Mostafavifar et al., 2012; Williams et al., 2012). Kinesio taping may contribute to improve anticipatory postural adjustments. However, there is an ongoing debate and lack of clinical trials about the efficacy of the taping on postural stability and postural reactions (Jassi et al., 2017; Voglar & Sarabon, 2014).

Therefore, the aim of the study was to investigate the immediate effects of kinesio taping on pain and postural stability characteristics such as overall, antero-posterior and medio-lateral postural sway scores at static and dynamic conditions in patients with CLBP. The following hypotheses were investigated: 1. Kinesio taping would be effective on pain intensity reduction in patients with CLBP immediately after the application. 2. Kinesio taping would improve the static and dynamic postural stability characteristics in patients with CLBP.

2. Material and methods

2.1. Study design

A case series study design was used. The study was conducted in accordance with the rules of the Declaration of Helsinki. The study was approved by the Ethics Committee of University (Approval number: 2015-11/33).

2.2. Participants

Voluntary patients with CLBP, diagnosed by their physicians and referred to the Physiotherapy and Rehabilitation clinic were included. The inclusion criteria were: patients in an age range of 20–65 years with non-specific CLBP without any relevant ongoing pathologies, such as disc prolapse, spondylolisthesis, fractures, tumor, osteoporosis, infection, or neurologic deficit. Exclusion criteria included having a history of surgery related to lumbar spine, having scoliosis, a neurological disease, a rheumatologic disease, and a psychiatric disease, being pregnant, and being subjected to any intervention including exercise, physical therapy or medication during the study, and having any contraindications against the use of taping (such as skin allergy). Written informed consent was obtained from each patient.

2.3. Evaluations

Demographic and physical characteristics, such as age, gender, weight, height, smoking, alcohol consumption, and exercise habits of the patients were recorded via a form. Patients' body mass index (BMI) values were calculated as weight in kilograms divided by height in meters squared. The evaluations related to postural

stability and low back pain intensity were carried out at the baseline and 45 min after the tape application. All evaluations were conducted by the same physical therapist (STC).

The disability and pain intensity of the patients were evaluated with the Turkish version of the Oswestry Disability Index (ODI) (Yakut et al., 2004) and the pain section of the ODI, respectively. The index has ten items (pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life and travelling). Every item is scored on a scale of 0–5 points (the best score is '0' and the worst score is '5') based on functional performance. The best score of the index is '0' and the worst score is '50'. Higher scores indicate more severe disabilities and pain. Moreover, patients' disability states were calculated as the points of the marked items added with the possible maximum point divided with 100 squared. It was shown that the results between 0% and 20% indicated *minimal disability*, 20%–40% indicated *moderate disability*, 40%–60% indicated *severe disability*, 60%–80% indicated *crippled*, and 80%–100% indicated *bed bound*. Moreover, pain intensity was evaluated with the pain section (0–5 points) of the ODI.

Postural stability characteristics were evaluated with a Biodex Balance System SD (Biodex Medical Systems, Inc., Shirley, NY) in the static and dynamic mode in bilateral standing position. The patients were given an overview of the testing procedure, and they were positioned on the platform of the system on barefoot. During the assessment, the patients stood upright with both feet on the platform. The base was set "static" for static mode, and set between "12-1" for dynamic mode. In this system, the base was stable in static modes and it was unstable as the number decrease in the dynamic mode, thus the mode "1" was the most unstable mode. The patient was asked to stay stable while the platform was tilting. After two or three trials for familiarization, the test was applied on the eyes open position. All patients completed the static and dynamic mode in the same order. Both static and dynamic measurements took 32 s for each patient, respectively. Overall, antero-posterior (frontal plane) and medio-lateral (sagittal plane) postural sway scores for static and dynamic modes were obtained as postural stability characteristics, where a high value of postural sway indicated low stability (Schmitz & Arnold, 1998).

2.4. Taping application

Patients were taped according to the Kenzo Kase's Kinesio Taping Method (Kase et al., 2003) by an experienced physical therapist (DOK). Kinesio taping was applied on both sides of the paravertebral muscles with muscle technique and on sacrum with ligament techniques in standing position. Four I-shaped Kinesio tapes (KinesioTex® Gold) with a width of 5 cm and thickness of 0.5 mm were used. Two bands were applied when the lumbar flexion reached its maximum point and the lumbar rotation to the opposite side was performed. These bands were applied vertically from the lower posterior iliac crest region to the upper twelfth rib region, on each paravertebral muscles with 10%–15% of tension (paper-off tension). The remaining 2 bands were attached diagonally on the sacrum, with 50%–75% of tension (see Fig. 1).

2.5. Sample size and statistical analyses

Twenty participants were randomly recruited for the pilot study. G*Power package software program (G*Power, Version 3.0.10, Franz Faul, Universität Kiel, German) was used to determine the required sample size for this study. According to the pain parameter of the study, it was calculated that a sample consisting of 101 individuals was needed to obtain 95% power with $d = 0.33$ effect size, $\alpha = 0.05$ type I error, and $\beta = 0.05$ type II error (Faul et al., 2007).



Fig. 1. Application of kinesio taping.

IBM SPSS Statistics 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) program was used to analyze the outcomes. The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Smirnov test) to determine whether or not they were normally distributed. Descriptive analyses were presented using mean and standard deviation (SD) for the normally distributed variables, and tables of frequencies, median, and minimum and maximum values for the non-normally distributed and ordinal variables. Paired Student's *t* and Wilcoxon tests were used to compare the measurements of the postural stability and pain intensity before and after the taping. An overall *p*-value of less than 0.05 was considered to be statistically significant.

3. Results

Of the 105 patients, 4 patients did not meet the inclusion criteria. Three patients due to surgery related to lumbar spine and one patient due to scoliosis were excluded from the study. One hundred and one patients (age: 53.00 (10.69) years, BMI: 31.52 (5.57) kg/m²) completed the study. There were no adverse events reported with the application.

Demographic and physical characteristics were displayed in Table 1. It was found that, according to the ODI scores, 19.8% had minimal disability, 40.6% had moderate disability, 29.7% had severe disability, and 9.9% were crippled patients.

Before and after the application, it was found that static overall and frontal postural sway scores, dynamic overall and sagittal postural sway scores, and pain intensity decreased (*p* < .05). However, no differences were observed in static sagittal and dynamic frontal postural stability scores (*p* > .05), (see Table 2).

4. Discussion

In the present study, immediate effects of kinesio taping on postural stability and pain in patients with CLBP were investigated and the following findings were observed: (i) Pain intensity of the patients decreased, (ii) static overall and frontal plane stability improved, and (iii) dynamic overall and sagittal plane stability improved immediately after the taping application.

Table 1

Demographic and physical characteristics of the participants.

Demographic and physical characteristics	Patients with CLBP (n = 101)
Age (years, X (SD))	53.00 (10.69)
BMI (kg/m ² , X (SD))	31.52 (5.57)
ODI score (Median (Min-Max))	18.00 (1.00–38.00)
Gender (n, %)	
Female	74, 73.3
Male	27, 56.7
Smoking (n, %)	
No	89, 88.1
Yes	12, 11.9
Alcohol consumption	
No	100, 99.0
Yes	1, 1.0
Exercise habit	
No	77, 76.2
Yes	24, 23.8

X: Mean; SD: Standard Deviation, Min: Minimum, Max: Maximum, ODI: Oswestry Disability Index; BMI: Body Mass Index, CLBP: Chronic Low Back Pain.

Lately, patients and professionals have been seeking effective, immediate, and side-effect-free interventions for the treatment of CLBP. Recently, kinesio taping has gained popularity for pain control. A systematic review has shown that kinesio taping may be effective when used as an adjunctive therapy, perhaps by improving the range of motion, muscular endurance, and motor control (Nelson, 2016). In the literature, there are various studies examining the effects of kinesio taping in patients with low back pain (Inanoglu & Baltacı 2014; Kaplan et al., 2016; Keles et al., 2017; Nelson, 2016; Paoloni et al., 2011). Kaplan et al. (2016) investigated the short-term (5 days) effects of lumbar kinesio taping on pain intensity and disability in women with pregnancy-related low back pain and compared to paracetamol usage. They declared that kinesio taping was superior to using paracetamol in decreasing pain and disability. Keles et al. (2017) investigated the short- (after the taping) and long-term (20 weeks later) effects of kinesio taping applied for 3 weeks on pain, lumbar flexion movement, disability, quality of life, and using paracetamol in patients with low back pain due to lumbar disc herniation. They explained that kinesio taping improved all parameters in short- and long-term and also reduced the analgesic need of these patients. Inanoglu and Baltacı (2014) assessed the 3-week effect of different taping techniques (rigid, placebo, kinesio taping) on pain and the quality of life in lumbar problems without neurological deficits. They explained that only taping therapy had positive effects on pain and quality of life. Moreover, kinesio taping was found to be more effective when compared to rigid taping and placebo. Similar to these studies, we also investigated the immediate effects of kinesio taping on pain intensity in patients with CLBP and found that pain intensity decreased. In the literature, many underlying mechanisms have been discussed for the pain control. In our study, pain intensity may be immediately decreased due to gathering fascia to align tissue in the desired position, activation of the blood and lymph circulation by lifting the skin and stimulating cutaneous mechanoreceptors (Kachanathu et al., 2014; Mostafavifar et al., 2012; Williams et al., 2012). This study supports the literature about pain control and possible mechanisms.

In addition to pain control, proprioceptive and exteroceptive stimuli and functional self-confidence may further affect the modulation of body segments, postural reflexes, and postural stability characteristics (Bae et al., 2013; Paoloni et al., 2011). Taping may improve dynamic stability by increasing sensory input and stability and decreasing the delay in postural reflexes (Riemann &

Table 2

Comparison of postural stability and pain intensity scores of patients with CLBP before and after kinesio taping.

The scores of the patients with CLBP (n = 101)					
	Pre	95% Confidence Interval	Post	95% Confidence Interval	p
Pain intensity (Median (Min-Max))					
Pain section of the ODI	2.00 (0.00–5.00)	1.65–2.14	1.00 (0.00–4.00)	0.88–1.29	<.001*
Postural stability scores (X (SD))					
Static overall stability	1.49 (1.15)	1.25–1.71	1.25 (1.11)	1.03–1.47	.046*
Static antero-posterior stability	0.96 (0.86)	0.78–1.12	0.74 (0.59)	0.62–0.86	.016*
Static medio-lateral stability	0.84 (0.78)	0.68–0.99	0.82 (1.01)	0.62–1.02	.785
Dynamic overall stability	3.12 (2.26)	2.65–3.54	2.73 (2.44)	2.24–3.22	.005*
Dynamic antero-posterior stability	2.33 (1.99)	1.92–2.70	2.12 (2.33)	1.65–2.59	.105
Dynamic medio-lateral stability	1.62 (1.12)	1.39–1.83	1.24 (0.75)	1.09–1.39	<.001*

*p < .05.

Lephart, 2002). A variety of studies investigated the effects of different tape applications on postural stability in CLBP (Bae et al., 2013; Jassi et al., 2017; Paoloni et al., 2011). Jassi et al. (2017) researched the immediate (after application of the tape and 7 days post-intervention) and 1-month effects of functional taping on lumbar spine for pain intensity and postural control in patients with CLBP and compared it to sham taping. The results of this study demonstrated that functional taping was effective on pain intensity and postural control compared to sham taping. Similar to this study, we questioned the immediate effects of kinesio taping applied to the lumbopelvic region in static standing and also in dynamic positions. Tsiganos et al. (2016) declared that both dynamic and static balance abilities may provide supplementary information for the identification of the presence of CLBP. However, dynamic balance was focused as more instrumental. To our knowledge, the current study is the first study investigating the dynamic stability of CLBP and responses of the body to the tape. We found improvements on static overall and antero-posterior, and dynamic medio-lateral stability with the decrease in postural stability. Antero-posterior sway refers to sagittal plane adaptations and medio-lateral sway refers frontal plane adaptations. It seems that the tape applied to the lumbopelvic region may improve medio-lateral sway and may enable fine tuning of the sensorimotor system in static position. However, dynamic postural stability improved especially in the sagittal plane. According to Pinheiro-Franco and Roussouly (2016), sagittal balance disturbances have been generally mentioned in degenerative disk diseases. Our patients with CLBP probably had some degree of a degenerative condition that we did not investigate. Further research may consider degenerative situations. However, we can conclude that taping may improve the posturographic characteristics of patients with a degenerative disk disease.

The current study had some limitations. First of all, the study was designed to observe immediate effects. Cumulative treatment effects might also be investigated. However, in the long term, the treatment further progressed with other applications and exercises. This may have caused a contribution of the effects of different applications in addition to the effects of taping. Secondly, there was no control group in our study. However, our sample size was large enough to show the improvements. Thirdly, degenerative conditions were underestimated. It may be considered for further studies. Fourthly, assessments conducted before and after the application and the second assessment was always after the taping per the study design. This might have caused a motor learning effect for postural stability assessment and a positive psychological approach for the pain. Furthermore, we had to explain the main aim of the tape to the patients as the pain control and back support. It might generate a positive psychological effect to the patients. However, any gain for balance control was not told to the

participants. These conditions should be taken account.

5. Conclusion

The study was observed that kinesio taping may immediately improve pain intensity and static and dynamic postural stability of the patients with CLBP.

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Conflicts of interest

None.

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