Egyptian Journal of Physical Therapy
[EJPT]

Original Article

Immediate Effect of Kinesio Taping on Dynamic Balance and Pain in Chronic Mechanical Low Back Pain

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Abstract:

Objectives: To investigate the immediate and 48 hours effects after kinesiotape application on dynamic balance in different grades of pain intensity in patients with chronic mechanical low back pain. **Methods**: Forty-five male and female patients, with age between 18-40 years old, and body mass index from 18 to 30 [kg/m2], diagnosed with chronic mechanical low back pain. Methods: The Patients were subdivided in three groups, group A [n=15] had a mild degree, group B [n=15] had a moderate degree, group C [n=15] had a severe degree of mechanical low back pain, all received a star-shape kinesiotape application and assessed for dynamic balance by Biodex balance system and pain intensity by Arabic Numerical Pain Rating Scale as a primary outcome and global rating of change as secondary outcome, three times [pre-application, immediately after and 48hour after application]. **Results**: MANOVA testing revealed that the mean value of pain in group A significantly reduced. by 53%, group B by 45% and group C by 58% after 48 hours of Kinesiotape application compared with that before application [p = 0.001]. There was no significant difference in the mean values of overall stability index, anteroposterior stability index and mediolateral stability index pre-application, immediately after and 48hour after Kinesiotape application in the same group or between the three groups [p =0.733, 0.745 and 0.503]. **Conclusion**: Application of kinesiotape may improve pain intensity immediately and after 48 hours of kinesiotape application, meanwhile there was no significant improvement on dynamic balance.

Keywords: chronic mechanical Low Back Pain; Dynamic Balance; Kinesio Tape.
Academic Editor. Sarah Umar.
Received: March 2024, Revised: April 2025, Accepted: May 2025, Published: June 2025
Citation: To be added by editorial staff during production.
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1. Introduction

For many years, low back pain [LBP] has been a significant public health problem, causing significant work impairment and increasing healthcare expenditures **[1].** It is estimated that 70-80% of adults in the general public will suffer at some point in their life from low back pain **[2].** Chronic low back pain [CLBP] is now recognized as a complex illness involving cognitive, psychological, social, physical, and lifestyle components **[3].**

A variety of recognized or undiagnosed disorders or diseases can cause LBP, which is a symptom rather than an actual disease **[4].** Since a particular cause is rarely found, the majority of LBP is classified as non-specific or mechanical **[4].** The spine, intervertebral discs, or surrounding soft tissues are the intrinsic sources of mechanical LBP **[5].** Intrinsically, mechanical LBP is caused by the spine, intervertebral discs, or the soft tissues nearby

non-mechanical conditions include age-related major trauma, recent invasive spine surgery, a history of cancer, recent urinary retention or overflow incontinence, or progressive motor or sensory loss **[5].**

Balance is necessary for carrying out regular tasks efficiently **[6].** Back pain, which can have many different causes, is always linked to poor balance and a higher risk of falling **[7, 8].** According to a study suggested that decreased synchronization of the low back muscles and higher active muscular tension may be the cause of postural control deficit **[9].** Other studies clarified that CLBP patients have impaired dynamic balance in terms of postural control and dynamic limits of stability **[10, 11].** Furthermore, it was indicated by previous research that pain intensity was one of the drivers impacting dynamic balance in CMLBP **[12].**

There are several non-operative treatments for CMLBP, incorporating prescription drugs, instruction, physical activity, manual treatment, and modalities including hot packs, ultrasound, and electrical stimulation, etc **[13].** Only a few research has looked into the effectiveness of specialized treatment methods frequently employed by physiotherapists in the management of CLBP, one of these uses is kinesiotaping [KT] **[14].**

Therapeutic [KT] method is used for treatment of various musculo-skeletal states **[15].** Recently, it has been shown that taping applications, particularly KT, alleviate pain and impairment quickly after the application in CLBP **[16, 17].**

When compared to other application methods **[1, 18],** it has been claimed that the star-shape strategy in CLBP appears to be associated with decreases in disease-related impairment and pain intensity **[19].** Thus, this study was conducted to assess the immediate and 48 hours' effects after KT application on dynamic balance in different grades of pain intensity in patients with CMLBP.

2. Materials and Methods:

Study design:

This study was carried out at the physical therapy faculty's outpatient clinic; Cairo University. The design was Pre and post comparative study. The study was carried out between October 2022 and May 2023 after obtaining the approval of the ethical committee from the Institutional Review Board [IRB] of the Faculty of Physical Therapy, Cairo University [approval number: PT.REC/012/004284].

Participants:

Forty-five male and female patients, with age between 18_40 years old, and body mass index [BMI] from18 to 30 [kg/m2], diagnosed with chronic mechanical low back pain CMLBP, depending on their willingness to engage. They sub divided into three groups according to Arabic Numerical Pain Rating Scale [ANPRS], the severity of LBP is graded as follows: 1-4 = Mild, 5-6 = Moderate, 7-10 = Severe **[20].**

Group A: [n=15] had a mild degree of CMLBP.

Group B: [n=15] had a moderate degree of CMLBP.

Group C: [n=15] had a severe degree of CMLBP.

Sample Size Calculation:

According to previous studies that measured balance immediately after kinesio tape application, the following specification for sample size were considered [α=5%, statistical power of 80% and effect size of 0.33 for F-test] to generate a sample of 42 [14 for each group]. To ensure suitable power and assuming sample losses, 45 patients will be considered [15 per group] **[21, 22, 23, 24, 25]** [GPower 3.0.10, University of Kiel, Kiel, Germany].

Patients were excluded if they had LBP due to lumbar spine abnormalities, disc prolapse, spondylolisthesis, fractures, tumours, osteoporosis, infections, neurologic deficits, and rheumatologic disorders [eg. Scoliosis], pregnant women, people with conditions that preclude the use of tape [such skin allergies], people who had neurological or psychiatric diseases, and anyone who received any treatment during the study, such as physical therapy, exercise, or medicine, were all excluded from the study **[25].**

Patients were selected based on the following criteria: age between thirty to sixty years old, having one of the degenerative conditions including disc degeneration, lumbar spondylosis and canal stenosis with or without spondylolisthesis and undergoing LSF of 1 to 3 levels of fixation, even with vertebral cage or not, performed from an anterior, posterior or lateral approach.

Assessment Procedures:

Eligible participants were aware of the study's goals at beginning, and the examiner addressed any questions or concerns by thoroughly going through every item on the informed consent form. The informed consent form was then given to the patients to sign. After deciding which patients to include and exclude based on inclusion and exclusion standards, all demographic information, such as age, weight, height, and BMI, was gathered.

We evaluated pain intensity using the Arabic Numerical Pain Rating Scale [ANPRS] and dynamic balance using the biodex balance system [BBS] in the primary outcomes. We examined the global rating of change [GROC] in the secondary outcomes. Primary and secondary outcomes were assessed pre-intervention and immediately after the application of the tape and after 48h of the KT application.

Pain level assessment:

The ANPRS, it is a reliable and valid tool for assessing pain intensity **[26].** It is an 11-point scale, with 0 signifying no pain and 10 indicating the most severe pain **[27].** Patients were asked to provide the number that best characterized their discomfort level. The severity of LBP is graded as follows: 1-4 = Mild, 5-6 = Moderate, 7-10 = Severe [20].

Balance Assessment

Biodex Balance System [BBS]:

Dynamic balance was assessed by the BBS [Model 945-300-E617, Version 3.08, Shirley, NY, USA] figure1. The BBS is an objective and reliable tool for evaluating balance, with eight stability levels, 8 indicating a maximum stable level as it provides the highest amount of steadiness by making the platform at least readily inclined. Stability level 1, on the other hand, represents the patient's minimal stable level, and it gets harder for the patient to sustain that stability **[28].**

Before the evaluation process began, all patients received an explanation of the various test processes. Each patient in the three groups was instructed to assume a two-legged posture while standing barefoot in the center of the locked platform and the patient's capacity to manage the platform's tilt angle was evaluated **Figure 1.**

Figure1: Patient Adjustment on BBS

All patients were tested on level 3 for two times repetitions for each trial [3 trials] **[29],** the mean of each trial was calculated and recorded. Three measures of dynamic balance were obtained: [1] the overall stability index [OSI]: a

patient's capacity to maintain balance in all directions. [2] Anteroposterior stability index [APSI]: a patient's capacity to maintain equilibrium from front to rear. [3] Mediolateral stability index [MLSI]: a patient ability to maintain balance while moving from side to side. A high result for any of the three variables indicates that the patient was having trouble **[28].**

2.3.3. Assessment of Global Rating of Change [GROC].

'How would you describe yourself these days, compared to when this episode first began?' asked the patient. −7 [significantly worse] to 0 [about the same] to +7 [much better]. Scores on the GROC between ±1 and ±3 suggest slight changes in the patients' perceived recovery, ±4–5 represent moderate changes, and ±6–7 represent major changes **[30].**

2.4. Treatment procedures:

Kinesio Taping [KT].

The adhesive, breathable tape has a 5 cm width and 0.5 mm thickness. It can be worn for up to 5 days **[1].** In a sitting position, the three groups [mild, moderate, and severe CMLB Patients] each received a typical KT application with moderate lumber flexion. The strips were placed by the examiner [One vertical, one horizontal, and two I-strips at a 45-degree angle to the vertical strip], over the lumbar region's center area of most pain, attached with 15–25% tension and overlapped in a star shape. By pressing and adhering, the middle of the strips was adhered before the ends, and all of the strips were crossed at the center of the tape **[18] Figure 2a, 2b.**

Figure 2a: Application of Star shape KT

Figure 2b: Application of Star shape KT

Statistical analysis

The numerical age and BMI variables were described using means, standard deviations, medians, minimums, and maximums. The assumption of normality, the homogeneity of the variance, and the existence of extreme scores were checked in the data and the data normality evaluation was tested using the Kolmogorov-Smirnov. MANOVA test was used to compare the three evaluation moments [pre, immediately, 48 hours after] between groups. The Post hoc test to compare three evaluation moments [pre, immediately, 48 hours after] within each group. Statistical analysis was conducted using SPSS for Windows, version 20 [SPSS, Inc., Chicago, IL]. Alpha level set at 0.05.

3. Results:

General characteristics of the subjects:

The mean values ± SD of age, weight, height, and BMI were shown in table1. The mean values of age, weight, height, and BMI did not significantly differ between the three groups ($p>0.05$). Between the three groups, there was no discernible variation in the distribution of sexes ($p = 0.143$); the same was true for socioeconomic status and occupation ($p>0.05$) As shown in **table1**

Table 1. General characteristics of subjects of three groups.

	Group A	Group B	Group C	f- value	p-value
Age (years)	25.1 ± 6.1	24.3 ± 5.9	22 ± 4.3	1.31	0.279
Weight (kg)	66.8 ± 11.5	66.5 ± 9.1	61.8 ± 9.8	1.13	0.330
Height (cm)	170.7 ± 11.6	166.9 ± 10.2	165 ± 7.2	1.22	0.303
BMI (kg/m2)	23 ± 3.8	23.9 ± 3	22.7 ± 3.1	0.584	0.562
Sex					
Females	9 (60%)	5 (33%)	4 (27%)	$\chi2 = 3.88$	0.143
Males	6 (40%)	10 (67%)	11 (73%)		
Social state					
Married	4 (27%)	3 (20%)	1 (7%)	$\chi2 = 2.12$	0.345
Single	11 (73%)	12 (80%)	14 (93%)		
Occupation					
No	0 (0%)	2 (13%)	0 (0%)		
Student	10 (67%)	12 (80%)	14 (93%)	$\chi2 = 9.23$	0.055
Worker	5 (33%)	1(7%)	1 (7%)		

Data was expressed as mean ± standard deviation or number (%), $\chi2$: chi square.

Overall effect of treatment as Result from repeated measures MANOVA:

I- Effect of KT application for different LBP severity on pain:

After 48 hours of KT application, there was a substantial reduction in mean value of pain by 53% in group A, 45% in group B, and 58% in group C when compared to that before application ($p = 0.001$) As shown in **table2.**

II- Effect of Kinesio Tape application for different LBP severity on Overall stability index (OSI):

The mean OSI values for the three groups did not differ significantly from one another. The percentage of decrease was 15.6%, 24% and 33% in group A, B and C respectively after 48 hours of KT application compared with that before application. As shown in **table 2.**

III- Effect of Kinesio Tape application for different LBP severity on Anteroposterior stability index (APSI):

The three groups' APSI means did not differ significantly from one another. The percentage of decrease was 16%, 24% and 35.7% in group A, B and C respectively after 48 hours of KT application compared with that before application. As shown in **table 2**.

IV- Effect of Kinesio Tape application for different LBP severity on Mediolateral stability index (MLSI):

There was no significant difference in mean value of APSI in the three groups. The percentage of decrease was 5%, 20.8% and 23.8% in group A, B and C respectively after 48 hours of KT application compared with that before application. As shown in **table2.**

V- Effect of Kinesio Tape application for different LBP severity on GROC:

There was significant increase in mean value of GROC by 200%, 185% and 187% in group A, B and C respectively after 48 hours of KT application compared with that before application (p = 0.001). As shown in **table 2.**

Table (2): Comparison between mean values of measured variables before, after and after 48 hours of Kinesio Tape application between and within groups

Measured variables	Group A	Group B	Group C	f-value	P value	η2
Pain						
Before application	3.1 ± 0.8	5.5 ± 0.5	7.7 ± 0.8	148.875	0.001*	0.876
After application	2.5 ± 0.8	4.4 ± 1.1	5.4 ± 2.2	13.875	0.001*	0.398
After 48h of application	1.46 ± 0.6	3 ± 1.4	3.2 ± 1.9	6.436	0.004*	0.235
% of change	53%	45%	58%			
(P-value)	0.002*	0.001*	0.001*			
Overall stability index						
Before application	3.2 ± 1.5	3.7 ± 1.8	3.6 ± 2	0.308	0.737	0.014
After application	2.8 ± 1.3	3.2 ± 1.6	2.9 ± 1	0.439	0.648	0.020
After 48h of application	2.7 ± 1.6	2.8 ± 1.2	2.4 ± 0.9	0.402	0.672	0.019
% of change	15.6%	24%	33%			
(P-value)	0.694	0.299	0.130			
Anteroposterior stability						
Before application	2.5 ± 1.3	2.9 ± 1.4	2.8 ± 1.5	0.313	0.733	0.015
After application	2.2 ± 1.1	2.5 ± 1	2.3 ± 0.9	0.297	0.745	0.014
After 48h of application	2.1 ± 1.3	2.2 ± 1	1.8 ± 0.5	0.698	0.503	0.032
% of change	16%	24%	35.7%			
(P-value)	0.605	0.207	0.070			
Mediolateral stability						
Before application	2.1 ± 0.8	2.4 ± 1	2.1 ± 0.8	0.384	0.684	0.018
After application	1.96 ± 0.7	2 ± 0.7	1.8 ± 0.5	0.225	0.800	0.011
After 48h of application	2 ± 0.8	1.9 ± 0.6	1.6 ± 0.4	1.169	0.321	0.053
% of change	5%	20.8%	23.8%			
(P-value)	0.758	0.213	0.208			
Global rating of change						
Before application	-2.4 ± 0.9	-3.4 ± 0.9	-4.6 ± 0.7	24.818	0.001*	0.542
After application	0.8 ± 1	1.7 ± 1.5	1.9 ± 1.1	2.625	0.084	0.111
After 48h of application	2.9 ± 1.6	2.9 ± 1.5	4 ± 1.4	2.441	0.099	0.104
% of change	200%	185%	187%			
(P-value)	0.001*	0.001*	0.001*			

Data is represented as mean ±SD, p-value: probability value, η2: partial eta square *: significant

4. Discussion:

The current study aimed to investigate the immediate effects of KT on dynamic balance in different grades of pain intensity in patients with CMLBP. The results regarding primary outcomes showed that there was significant decrease in pain immediately after and after 48 hours of KT application in the three groups A, B and C According to this study, cutaneous mechanoreceptor stimulation, activation of blood and lymph circulation by raising the skin, and gathering fascia to align tissue in the correct posture may all cause an instantaneous decrease in pain intensity **[25].**

These results are consistent with recent studies who showed a good result of using KT with LBP patients for pain suppression **[18,31,32].**

Abbasi et al. **(18)** hypothesized that star-shaped KT reduces pain and disability scores after 3 days of therapy with a substantial effect size by evaluating the effects of KT on lumbar proprioception, pain, and functional disability in 30 patients with nonspecific CLBP**.** Alikhajeh Et al**. [31]** indicated that women with chronic nonspecific LBP can have improvements in pain intensity and impairment through the use of aquatic exercise AE and KT therapy techniques.

It was proved that KT can be successful when used in conjunction with other therapies. In a systematic review by Sun and Lou et al, who examined and evaluated the results of recent randomized controlled trials showing that KT is helpful for CLBP when used as an additional form of physical therapy (PT) for at least two weeks, they discovered that when KT was combined with PT, patients with CLBP experienced better therapeutic effects in terms of pain relief and disability improvement than when PT was used independently **[32]**.

In contrast a study found no significant decrease in pain after KT treatment. Araujo et al **[33]** investigate the effectiveness of KT in patients with CLBP, and found that KT versus sham had no influence on the degree of pain, the overall perception of recovery, or impairment. Regression to the mean, non-specific treatment effects or the natural course of the ailment can all be blamed for the groups' improvements over time.

Concerning dynamic balance measurements, the results showed that there was no significant difference in the mean values of OSI, APSI, and MLSI before, immediately after and after 48 hours of KT application in group A, B and C, also there was no significant difference in the mean values between the three groups. This is may be due to weakness of the trunk muscles in terms of strength and endurance. This finding is in line with the study that looked at the immediate effects of trunk (KT) treatment on young, healthy people' postural stability and found no improvement **[34].**

The result contradicts with different studies who found a valuable outcome regarding postural stability **[35,36]**. Jassi et al **[35]** investigated 120 patients with CLBP were evaluated for pain intensity and postural control following the application of the tape, seven days after the intervention, and one month later. Functional taping was compared to sham taping. The findings showed that functional taping, as opposed to sham taping, had a positive effect on pain intensity and postural control. Bernardelli et al **[36]** additionally demonstrated how KT applied to the lumber region might enhance postural balance.

Regarding the global rating of change which was the secondary outcome in our study, the results showed that there was significant increase in the mean values of GROC in group A, B and C between the three measures. This result is due to since KT can modify skin stretching and activate cutaneous receptors; we think it may have an impact on how people perceive their own healing. This result agreed with the results of previous studies, **[37, 38, 39]**. Global perceived effect and care satisfaction were the secondary outcomes. They discovered that both groups of participants were extremely satisfied with their care and that treatments using KT alone or in conjunction with physical therapy boosted the participant's felt improvement **[37,38,39]**. It is recommended to investigate KT effect on a larger sample, and further studies also to see KT longer influence in physical therapy.

5. Conclusion:

The study concluded that application of kinesiotape may improve pain intensity immediately and after 48 hours of kinesiotape application, meanwhile there was no significant improvement on dynamic balance in patients with CMLBP.

Declaration of Interests:

Authors declare no potential conflicts of interest.

Funding:

Not Funded

Acknowledgments:

We want to express our gratitude to everyone who took part in this study.

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