

## Immediate Effect of Kinesio Taping on Dynamic Balance in Different Grades of Pain Intensity in Chronic Mechanical Low Back Pain

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### Abstract

**Background:** Low back pain (LBP) has been a significant public health problem. Recently, it has been shown that Kinesio taping (KT) applications, alleviate pain and impairment quickly after the application in CMLBP.

**Aim of Study:** To investigate the immediate and 48 hour effects after kinesio tape application on dynamic balance in different grades of pain intensity in patients with chronic mechanical low back pain (CMLBP).

**Subjects and Methods:** Forty-five male and female patients, with age between 18-40 years old, and body mass index from 18 to 30 ( $\text{kg}/\text{m}^2$ ), diagnosed with CMLBP. The Patients were subdivided into three groups according to Arabic Numerical Paine Rating Scale (ANPRS), group A (n=15) had a mild degree CMLBP, group B (n=15) had a moderate degree CMLBP, group C (n=15) had a severe degree CMLBP, all received a star-shape kinesio tape 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 (GROC) as secondary outcome, three times (pre-application, immediately after and 48hour after KT 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 KT application compared with that before application ( $p<0.001$ ). There was no significant difference in the mean values of overall stability index (OSI), anteroposterior stability index (APSI) and mediolateral stability index (MLSI) pre-application, immediately after and 48 hour after KT application in the same group or between the three groups ( $p>0.05$ ).

**Conclusion:** Application of kinesio taping might improve pain intensity immediately and after 48 hours of kinesio tape application, meanwhile there was no significant improvement on dynamic balance in patients with CMLBP.

**Key Words:** Chronic mechanical low back pain — Dynamic Balance — Kinesio tape.

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### 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 a 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 kinesio taping (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]. According to past studies, tape stimulates afferent nerve fibres in the soft tissue of the applied location, increasing blood flow and activating the pain-suppression mechanism [18,19].

When compared to other application methods [1,20], it has been claimed that the star-shape strategy in CLBP appears to be associated with decreases in disease-related impairment and pain intensity [21]. 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.

## Material and Methods

### The 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) from 18 to 30 ( $\text{kg}/\text{m}^2$ ), diagnosed with chronic mechanical low back pain CMLBP, depending on their willingness to engage and directly referred from orthopedist as a result, a convenience sample was chosen by samples size calculation and they sub divided into three groups according to Arabic Numerical Pain Rating Scale (ANPRS). It is an 11-point scale, with 0 signifying no pain and 10 indicating the most severe pain (22) graded as follows: 1-4 = Mild, 5-6 = Moderate, 7-10 = Severe (23):

- 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 kinesiotape application, the following specification for sample size were considered ( $\alpha=5\%$ , 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) (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 [24].

### 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 [25]. It is an 11-point scale, with 0 signifying no pain and 10 indicating the most severe pain [22]. 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 [23].

### Balance assessment:

#### Biodex Balance System (BBS):

Dynamic balance was assessed by the BBS (Model 945-300-E617, Version 3.08, Shirley, NY, USA) Fig. (1). 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 [26].

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 pa-

tient's capacity to manage the platform's tilt angle was evaluated Fig. (1).

All patients were tested on level 3 for two times repetitions for each trial (3 trials) [27], 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 [25].

#### *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  $\pm 1$  and  $\pm 3$  suggest slight changes in the patients' perceived recovery,  $\pm 4-5$  represent moderate changes, and  $\pm 6-7$  represent major changes [28].

Treatment procedures:

#### *Kinesio Taping (KT):*

The adhesive, breathable tape has a 5cm width and 0.5mm thickness. It can be worn for up to 5 days [1].



Fig. (2): Application of Star Shape KT.

#### *Statistical analysis:*

- 1- The numerical age and BMI variables were described using means, standard deviations, medians, minimums, and maximums.
- 2- The assumption of normality, the homogeneity of the variance, and the existence of extreme scores were checked in the data.
- 3- The data normality evaluation was tested using the Kolmogorov-Smirnov.

In a sitting position, the three groups (mild, moderate and severe CMLB Patients) each received a typical KT application and moderate lumbar 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 [20] Fig. (2).



Fig. (1): Patient Adjustment on BBS.

- 4- MANOVA test was used to compare the three evaluation moments (pre, immediately, 48 hours after) between groups.
- 5- The Post hoc test to compare three evaluation moments (pre, immediately, 48 hours after) within each group.
- 6- Statistical analysis was conducted using SPSS for Windows, version 20 (SPSS, Inc., Chicago, IL). Alpha level set at 0.05.

## Results

### General characteristics of the subjects:

The mean values  $\pm$  SD of age weight height BMI were shown in Table (1). 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 ( $p>0.05$ ) (Table 1).

### 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 ( $p<0.001$ ) (Table 2).

#### II- Effect of KT 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. Table (2).

#### III- Effect of KT 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. Table (2).

#### IV- Effect of KT 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. Table (2).

#### V- Effect of KT application for different LBP severity on GROG:

There was significant increase in mean value of GROG by 200%, 185% and 187% in group A, B and C respectively after 48 hours of KT application compared with that before application ( $p<0.001$ ). Table (2).

The questionnaire of Global rating of change (GROC) has a relative zero and the score is ranged from  $-7$  (a very great deal worse) to  $0$  (about the same) to  $+7$  (a very great deal better). Thus if the patient was improved from  $-7$  to  $0$  this means that the improvement was 100% and any improvement beyond  $0$  in the positive direction increase the % of change, for example from  $-7$  to  $+1$  this means 130% improvement. etc.

Table (1): General characteristics of subjects of three groups.

|                          | Group A          | Group B          | Group C        | f- value        | p-value |
|--------------------------|------------------|------------------|----------------|-----------------|---------|
| Age (years)              | 25.1 $\pm$ 6.1   | 243 $\pm$ 5.9    | 22 $\pm$ 4.3   | 1.31            | 0.279   |
| Weight (kg)              | 66.8 $\pm$ 11.5  | 66.5 $\pm$ 9.1   | 61.8 $\pm$ 9.8 | 1.13            | 0.330   |
| Height (cm)              | 170.7 $\pm$ 11.6 | 166.9 $\pm$ 10.2 | 165 $\pm$ 7.2  | 1.22            | 0.303   |
| BMI (kg/m <sup>2</sup> ) | 23 $\pm$ 3.8     | 23.9 $\pm$ 3     | 22.7 $\pm$ 3.1 | 0.584           | 0.562   |
| Sex:                     |                  |                  |                |                 |         |
| Females                  | 9 (60%)          | 5 (33%)          | 4 (27%)        | $\chi^2 = 3.88$ | 0.143   |
| Males                    | 6 (40%)          | 10 (67%)         | 11 (73%)       |                 |         |
| Social state:            |                  |                  |                |                 |         |
| Married                  | 4 (27%)          | 3 (20%)          | 1 (7%)         | $\chi^2 = 2.12$ | 0.345   |
| Single                   | 11 (73%)         | 12 (80%)         | 14 (93%)       |                 |         |
| Occupation:              |                  |                  |                |                 |         |
| No                       | 0 (0%)           | 2 (13%)          | 0 (0%)         | $\chi^2 = 9.23$ | 0.055   |
| Student                  | 10 (67%)         | 12 (80%)         | 14 (93%)       |                 |         |
| Worker                   | 5 (33%)          | 1 (7%)           | 1 (7%)         |                 |         |

Data was expressed as mean  $\pm$  standard deviation or number (%).

$\chi^2$ : Chi square. **BMI: Body mass index.**

Group A: Mild Low Back Pain (LBP). kg : Kilogram.

Group B: Moderate LBP.

m<sup>2</sup>: Meter square.

Group C: Severe LBP.

F : Mixed MANOVA f-value.

p : Probability value.

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

| Measured variables                | Group A  | Group B  | Group C  | f- value | p-value | n <sup>2</sup> |
|-----------------------------------|----------|----------|----------|----------|---------|----------------|
| <i>Pain:</i>                      |          |          |          |          |         |                |
| 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*   |          |         |                |
| <i>Overall stability index:</i>   |          |          |          |          |         |                |
| 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    |          |         |                |
| <i>Anteroposterior stability:</i> |          |          |          |          |         |                |
| 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    |          |         |                |
| <i>Mediolateral stability:</i>    |          |          |          |          |         |                |
| 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    |          |         |                |
| <i>Global rating of change:</i>   |          |          |          |          |         |                |
| <i>Before application:</i>        | -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. Group A: Mild Low Back Pain (LBP). F: Mixed MANOVA f value. p-value: Probability value. Group B: Moderate LBP. p: Probability value. n<sup>2</sup>: Partial eta square. Group C: Severe LBP. \*: Significant.

### 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. This results are consistent with recent studies who showed a good result of using KT with LBP patients for pain suppression [20,29,30].

Abbasi et al., hypothesised 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 [20]. Thirty-six women with nonspecific

CLBP were randomly assigned to the AE (n=12), KT (n=12), and no treatment control (n=12) group- examined the effects of KT and aquatic exercise (AE) on the degree of pain and functional impairment, and they found that both treatments reduce back pain and improve disability, though AE was superior to KT [29].

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 [30].

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.

The result contradicts with different studies who found a valuable outcome regarding postural stability [31,32]. Jassi et al., 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 [31].

Using baropodometric evaluation at four different times pre-intervention, 10 minutes after the intervention, 48 hour after the intervention, and 10 days after the intervention on the treatment group Bernardelli et al., identified postural balance changes on 50 subjects with LBP after the application of KT, which was then compared to a no treatment control group, they concluded that KT in the lumbar region of participants with CLBP improved postural balance as evidenced by changes in plantar peak pressure, plantar surface, and mass distribution 48 hours after KT administration, with effects lasting up to 10 days [32].

The lack of improvement in our study on dynamic balance can be due to a small sample size and the fact that this was an observational study, if we had a larger sample size with more available time, we could have seen a more significant effect.

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 agreed with the results of previous studies, [33,34,35]. 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 [33,34,35]. However, this study had a limitation of no follow up report to detect the long term effect of KT application therefore, further studies is recommended to see KT longer influence in physical therapy. And also investigate its effect on a larger sample size.

#### **Conclusion:**

The study concluded that application of kinesio taping may improve pain intensity immediately and after 48 hours of kinesio tape application, mean-

while there was no significant improvement on dynamic balance in patients with CMLBP.

#### **Declaration of interests:**

The authors have stated that writing this paper and/or its publication do not present any conflicts of interest for them.

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## التأثير الفوري لشريط كينيسيو على التوازن الديناميكي في درجات مختلفة من شدة الألم في ألام أسفل الظهر الميكانيكية المزمنة

لقد كانت ألام أسفل الظهر مشكلة صحية عامة كبيرة، ولقد ثبت مؤخرًا أن تطبيقات شريط كينيسيو تخفف الألم وتحسن ضعف التوازن بسرعة بعد التطبيق. هدفنا هو التحقيق في التأثيرات الفورية و بعد ٤٨ ساعة بعد تطبيق شريط كينيسيو على التوازن الديناميكي في درجات مختلفة من شدة الألم للمرضى الذين يعانون من الام أسفل الظهر. خمسة وأربعون مريضاً من الذكور والإناث، تتراوح أعمارهم بين ١٨-٤٠ عاماً، ومؤشر كتلة الجسم يصل إلى ٣٠ (كجم / م<sup>٢</sup>)، تم تشخيصهم بـ ألام أسفل الظهر الميكانيكية المزمنة تم تقسيم المرضى إلى ثلاث مجموعات، المجموعة أ (ن = ١٥) لديهم درجة بسيطة من ألام أسفل الظهر الميكانيكية المزمنة، المجموعة ب (ن = ١٥) لديهم درجة معتدلة من ألام أسفل الظهر الميكانيكية المزمنة، المجموعة ج (ن = ١٥) لديهم درجة شديدة من ألام أسفل الظهر الميكانيكية المزمنة، كلهم حصلوا على تطبيق شريط كينيسيو على شكل نجمة وقياس توازن نظام توازن بالبايوديكس وقياس شدة الألم باستخدام المقياس الرقمي العربي لتقييم الألم كنتيجة أولية. وقياس وتصنيف عالمي للتغيير كنتيجة ثانوية (قبل وبعده مباشرة، وبعد ٤٨ ساعة من تطبيق شريط كينيسيو). وقد وجدت الدراسة أن تطبيق شريط كينيسيو على مرضى الام أسفل الظهر قد يقلل من شدة الألم فوراً وبعد ٤٨ ساعة من التطبيق، وأن هناك تحسن كبير في GROG بعد تطبيق شريط كينيسيو مقارنةً قبل التطبيق. ومع ذلك، لم يكن هناك تحسن كبير في التوازن الديناميكي في المرضى الذين يعانون من الام أسفل الظهر الميكانيكية المزمنة.