The Effect of Elastic Therapeutic Taping on Back Extensor Muscle Endurance in Patients With Low Back Pain: A Randomized, Controlled, Crossover Trial

Elastic therapeutic tape (ETT) is an increasingly popular intervention for clinicians treating patients with low back pain (LBP) and other musculoskeletal disorders. Unlike athletic or other types of therapeutic tape, ETT is designed to allow for longitudinal stretch, which is purported by the manufacturer to decrease pain and improve muscle performance when applied in a stretched position. The mechanisms by which this occurs are purportedly alterations of lymphatic fluid movement, proprioception, and muscle contraction. Currently, however, little to no data exist to support these claims.

Dysfunction of the lumbar paraspinal musculature has long been thought to be both a causal factor and a resulting impairment of LBP. Decrements in lumbar paraspinal muscle function are associated with LBP even during remission from recurrent episodes. Preliminary evidence regarding the effects of the application of ETT to the lumbar paraspinal muscles suggests that it may benefit patients with LBP by marginally improving trunk muscle endurance. Castro-Sánchez et al found that application of ETT over the lumbar paraspinals improved pain and disability scores above those of a sham taping procedure in 60 patients with chronic LBP. A similar study performed in 99 asymptomatic individuals found that ETT applied over the lumbar paraspinal muscles resulted in a significant increase in the endurance of the lumbar extensor muscles compared to a control group. However, no study to date has investigated the effect of ETT on back extensor muscle endurance (BME) in symptomatic patients.

**STUDY DESIGN:** Randomized, controlled, crossover trial.

**OBJECTIVES:** To examine the effects of elastic therapeutic taping (ETT) applied to the lumbar paraspinal region on back muscle endurance (BME) compared to no tape or a rigid therapeutic taping (RTT) procedure in individuals with nonspecific low back pain.

**BACKGROUND:** Elastic therapeutic taping is an increasingly popular intervention for clinicians who treat patients with low back pain. However, no studies have investigated the effect of ETT on back extensor muscle performance in a symptomatic population.

**METHODS:** We measured BME in 16 patients (mean ± SD age, 44.8 ± 10.4 years; 44% female) with nonspecific low back pain. Back muscle endurance was measured using the Biering-Sørensen test under 3 different conditions: ETT, no tape, and RTT. For the ETT condition, the tape was applied over the paraspinal muscles according to the Kinesio Tex taping protocol. The RTT condition consisted of the same tape configuration but using nonelastic athletic tape. All participants received each testing condition in random order, with 1 to 3 days between each condition. Differences in BME between the 3 testing conditions were explored with repeated-measures analyses of variance.

**RESULTS:** There were no differences in BME between ETT and RTT, or between the RTT and no-tape conditions. The difference in BME between the ETT and no-tape conditions was statistically significant (mean difference, 20.7 seconds; 95% confidence interval: 6.8, 34.5; \( p = .006 \)) but within the threshold of measurement error.

**CONCLUSION:** Back muscle endurance was higher with ETT applied over the paraspinal musculature when compared to a no-tape condition. However, the magnitude of difference did not exceed measurement error. There was no difference in BME when using elastic or rigid therapeutic tape.

**LEVEL OF EVIDENCE:** Therapy, level 2b.-

**KEY WORDS:** Biering-Sørensen test, lumbar spine, paraspinals
Therefore, the purpose of this study was to examine BME in individuals with nonspecific LBP, comparing the effects of ETT applied over the lumbar paraspinal region to those of no tape or a rigid therapeutic tape (RTT) procedure. We hypothesized that the application of ETT would result in greater BME when compared to the RTT and no-tape conditions.

**METHODS**

**Participants**

Participants were recruited from a multidisciplinary outpatient rehabilitation facility and consisted of individuals between 18 and 60 years of age, seeking treatment for LBP of at least 30 days in duration and with a minimal modified Oswestry Disability Index score of 20/100. Potential participants were excluded if they reported (1) pain radiating past the knee, (2) clinical red flags indicating the possible presence of serious pathology, (3) prior lumbar spine surgery, (4) being pregnant, or (5) being unable to tolerate the Biering-Sørensen test. Ethical approval was provided by the School of Psychology and Exercise Science, Murdoch University, Murdoch, Australia (2011/183), and all participants provided written consent prior to study enrollment.

**Examiners**

A physical therapist and a chiropractor, both of whom were certified Kinesio Taping practitioners with 3 and 17 years of clinical experience, respectively, administered the 3 test conditions in random and counterbalanced order. To standardize the study procedures, prior to any testing, the examiners reviewed and agreed on both the ETT and RTT application procedures, the procedures and positioning of the participants for testing, and the criteria used to terminate the test.

**Procedures**

A randomized, controlled, crossover design was used, with the participants acting as their own control by undergoing all
3 testing conditions (ETT, RTT, and no tape). A random-number generator was used to create a randomization list. After providing informed consent, participants' self-reported LBP-related disability was measured with the modified Oswestry Disability Index questionnaire. Current pain intensity was measured using a numeric pain-rating scale, with possible scores ranging from 0 ("no pain") to 10 ("worst imaginable pain"). Immediately after the baseline assessment, participants underwent the first of the randomly assigned testing conditions. The other 2 conditions were tested in subsequent visits, with 1 to 3 days between each testing session. Examiners were not blinded to testing condition.

Testing Conditions
For the ETT condition, the tape was applied per the Kinesio Tex Tape manufacturer guidelines (Kinesio Taping Association International, Albuquerque, NM) for facilitation of muscle contraction (FIGURE 1A). The ETT is composed of elastic cotton fibers with medical-grade acrylic adhesive. The tape is applied with tension, which is purported to be the key component to any potential therapeutic benefit of ETT.

Back Muscle Endurance
Back muscle endurance was measured using the Biering-Sørensen test, which has established good test-retest reliability (intraclass correlation coefficient = 0.88; standard error of measurement, 11.6 seconds in patients with LBP), validity, and responsiveness. Participants were positioned on a treatment table in prone, with the lower half of their body secured with 3 straps (FIGURE 2). For testing, the participant’s ability to maintain a horizontal position was timed using a stopwatch, and standardized verbal encouragement was provided at 30-second intervals. When contact between the

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th>Comparison</th>
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<tr>
<td></td>
<td>No Tape</td>
<td>RTT</td>
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<tr>
<td>Back muscle endurance, s</td>
<td>85.1 ± 26.4</td>
<td>90.8 ± 36.9</td>
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<tr>
<td>Reason for test termination, n</td>
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<tr>
<td>Fatigue in legs</td>
<td>5</td>
<td>6</td>
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<td>Fatigue in lumbar spine</td>
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<td>1</td>
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Abbreviations: ETT, elastic therapeutic tape; RTT, rigid therapeutic tape.
*Values are mean ± SD unless otherwise indicated.
†Values are mean difference (95% confidence interval).
‡Significantly different at P<.05.

FIGURE 3. Flow diagram of participant recruitment and retention.
lumbar spine and the tennis ball secured at the end of the plumb line was lost for more than 1 second, participants were cued to re-establish the test position. If contact with the tennis ball was not re-established, the test was terminated and the maximal hold time recorded.

Data Analysis
An a priori power analysis was performed using G*Power 3.1.3 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) software, with a minimal detectable change estimate of 32 seconds and an anticipated within-subject standard deviation of difference of 34 seconds. Data management and statistical analyses were performed using SPSS Version 21.0 (SPSS Inc, Chicago, IL). We conducted uncorrected, planned pairwise comparisons with repeated-measures analysis of variance to examine for differences between the testing conditions. The independent variable was taping application with 3 levels (ETT, RTT, and no tape) and the dependent variable was BME measured in seconds.

RESULTS
Sixteen participants (7 [43.8%] women; mean ± SD age, 44.8 ± 10.4 years; Oswestry Disability Index score, 29.4% ± 7.2%; numeric pain rating for LBP, 5.0 ± 1.7; median [interquartile range] duration of symptoms, 180 [870] days) were enrolled in the study and included in the analysis. Participant flow through the trial is presented in Figure 3. Results of BME testing per tape condition are presented in the TABLE. All 16 participants were able to complete all 3 testing conditions. Three participants reported stopping the test due to increased LBp in 1 of the tapping conditions. All 3 reported that the increase in pain subsided once out of the testing position. The majority of participants stopped the test primarily because of leg fatigue or low back fatigue. Some participants stopped for different reasons at each tape condition (TABLE).

There was no statistically significant difference in BME between the ETT and RTT conditions (mean difference, 14.9 seconds; 95% confidence interval [CI]: −3.1, 33.0; P = .099) or between the RTT and no-tape conditions (mean difference, 5.8 seconds; 95% CI: −10.2, 21.7; P = .455). The difference in BME between the ETT and no-tape conditions was statistically significant (mean difference, 20.7 seconds; 95% CI: 6.8, 34.5; P = .006) but within measurement error (TABLE).

DISCUSSION
To our knowledge, this is the first study to examine the effect of therapeutic taping on BME in a symptomatic population. Results indicated that BME was greater with ETT applied over the paraspinal musculature when compared to a no-tape condition, but not when compared to RTT. However, the magnitude of difference between the ETT and no-tape conditions was within measurement error.

Two previous studies evaluated change in trunk muscle endurance with application of ETT over the lumbar region and reported results similar to those of the current study. In a parallel-group randomized trial, Castro-Sánchez et al examined the effect of a 1-week application of ETT versus a sham taping procedure on trunk muscle endurance, pain intensity, LBP-related disability, kinesiophobia, and trunk flexion range of motion in 60 participants with nonspecific LBP. After 1 week, participants randomized to receive ETT experienced less pain and LBP-related disability than those given sham taping; however, there were no between-group differences in kinesiophobia and range of motion. At 1 and 4 weeks after tape application, participants in the ETT group had greater trunk muscle endurance (mean difference, 23 seconds; 95% CI: 14, 32 and 18 seconds; 95% CI: 9, 26, respectively). This was measured using the McQuade test, in which participants isometrically hold the trunk off the floor. The clinimetric properties and clinical utility of the method used to assess trunk endurance are unknown, thus the significance of this result is unclear. However, the differences in pain intensity and LBP-related disability were, like the results of this study, less than the minimum threshold of clinical significance.

In a similar double-blinded, randomized controlled trial, Álvarez-Álvarez et al investigated the immediate effect of ETT on BME in 99 asymptomatic individuals. Participants received ETT applied longitudinally over the lumbar paraspinal muscles, a sham procedure consisting of short pieces of ETT applied horizontally to the skin over the lumbar spine, or no tape. The ETT procedure was identical to that used in the current study, except that the tape was applied with a 10% to 15% stretch during full flexion, compared to the approximately 50% stretch used in the current study. The sham taping procedure was applied without stretch. Back muscle endurance was measured with the Biering-Sørensen test, using the same protocol as the current study. Their analysis yielded results identical to those of the current study: significantly longer BME during the ETT condition than during the no-tape condition, but no statistical differences between the ETT and sham conditions, or between the sham and no-tape conditions. The mean BME times in this asymptomatic sample were nearly double those of the current study, but followed the same ordinal trend and percentage increase from the no-tape condition (ETT mean, 203.2 seconds [121% of no tape]; sham mean, 188.9 seconds [113% of no tape]; no tape mean, 167.7 seconds) as that of the current study (ETT mean, 105.8 seconds [124% of no tape]; RTT mean, 90.8 seconds [107% of no tape]; no tape mean, 85.1 seconds). The time differences between the 2 studies may be an indication of BME impairment in our participants with LBP.
Among the limitations of the current study was that it only examined the immediate effects of the 3 taping conditions on BME. Therefore, the effects of prolonged or repeated applications of these 3 taping conditions are unknown. The BME outcomes were measured by examiners who were aware of the testing conditions, potentially resulting in bias. We attempted to minimize this bias by standardizing the encouragement used during each condition and limiting measurements to position-hold time, as opposed to more subjective ratings of functional assessment. Surprisingly, most patients cited leg fatigue as the reason for test termination, and very few participants reported increased LBP. All participants felt that they could complete the 3 test conditions without increasing their baseline back pain, which was, on average, 5/10. It is also possible that, although participants were blinded to the order of tape condition, they might have felt a difference in tape texture or stretch that biased their BME performance, especially if any of the participants had previous treatment with ETT or RTT. Last, the amount of stretch in the tape might have varied between individuals. We estimated a 50% stretch in tape applied during full flexion; however, tape guidelines by the manufacturer recommend anywhere from 50% to 100% tape stretch for muscle "facilitation," so it may be more consistent to stretch the tape to its maximum length.

Future research should compare different taping techniques and evaluate the effect of taping in different subgroups of patients with LBP, as it may be that the variability in response could be at least partially explained by clinical examination findings (eg, signs of lumbar instability or paraspinal muscle weakness). Examining prolonged use of both RTT and ETT and their effect on patient-reported pain reduction and functional outcomes might also provide worthwhile information.

**CONCLUSION**

**RESULTS OF THE CURRENT STUDY** indicated that BME was not different when ETT or RTT was applied over the paraspinal musculature. The application of ETT resulted in greater BME when compared to a no-tape condition, but the magnitude of difference was small and did not exceed measurement error. Although further investigation is warranted, our results do not support the claim that ETT improves muscle endurance.

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**REFERENCES**