
ORIGINAL RESEARCH

A COMPARISON OF TWO TAPING TECHNIQUES (KINESIO AND MCCONNELL) AND THEIR EFFECT ON ANTERIOR KNEE PAIN DURING FUNCTIONAL ACTIVITIES

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ABSTRACT

Background: Anterior knee pain is a clinical syndrome characterized by pain experienced perceived over the anterior aspect of the knee that can be aggravated by functional activities such as stair climbing and squatting. Two taping techniques commonly used for anterior knee pain in the clinic include the McConnell Taping Technique (MT) and the Kinesio Taping® Method (KT®).

Objective: The purpose of this study was to compare the effectiveness of KT® and the MT versus no tape in subjects with anterior knee pain during a squat lift and stair climbing.

Design: Pretest- posttest design.

Participants: A total of 20 subjects (15 female, 5 male) with unilateral anterior knee pain were recruited. The mean age of the subjects was 24 (+/-3) years, with a mean weight of 160 (+/-28) pounds.

Methods: Each participant was tested during two functional activities; a squat lift with a weighted box (10% of his/her body weight, plus the weight [8.5 pounds] of the box) and stair climbing under three conditions: 1) no tape, 2) MT and 3) KT®. Pain levels were assessed (verbally) using the 0-10 Numeric Pain Intensity Scale.

Results: The median (interquartile range [IQR]) pain during squat lift was 2 (2.75) for no tape, 1 (1) for KT®, and 0.5 (2) for McConnell, with no significant differences between the groups. During the stair activity the median (IQR) pain was 1.5 (2.75) for no tape, 1 (1.75) for KT®, and 1 (1.75) for MT with a significant difference ($p=0.024$) between the groups. Further analysis determined that the only a significant difference was ($p=0.034$) between the no tape and the KT® conditions.

Conclusion: The results of this study found that both the KT® and the MT may be effective in reducing pain during stair climbing activities.

Keywords: Anterior Knee Pain, Kinesio Taping® Method, McConnell Taping Technique

Level of Evidence: Level 2, Prospective Cohort study

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BACKGROUND

Knee pain is a common musculoskeletal complaint affecting approximately 25% of adults who comprise a significant percentage of patients seeking medical attention for musculoskeletal complaints.¹ Nguyen et al² report the prevalence rates of knee pain in general have increased significantly during the past 20 years. Increasing rates of knee pain are particularly alarming as such pain limits function, mobility, and significantly impairs quality of life.³ Anterior knee pain is a condition frequently treated in the orthopedic rehabilitation setting. It is a clinical syndrome characterized by pain experienced in the anterior region of the knee. The pain is usually mechanical, exacerbated by activity, and relieved by rest. While anterior knee pain has many etiologies, many cases of anterior knee pain result from patellofemoral pain syndrome (PFPS) as well as knee arthritis. Patients typically present with pain over the anterior aspect of the knee that can be aggravated by functional activities such as stair climbing and squatting.^{4,5} Due to the relatively high occurrence of knee pain, treatment approaches are widely variant, implemented across various settings, and can include single or mixed modality rehabilitation, including physical, behavioral, pharmacological, and surgical management. The vast majority of anterior knee pain cases are treated conservatively, placing physical therapy as a likely first line of treatment.

Taping is frequently used in the field of rehabilitation as a means of treatment for knee injuries.^{4,5} Two taping techniques commonly used for anterior knee pain in the clinic include McConnell Taping Technique (MT) and Kinesio Taping® Method (KT®).^{4,6} The MT is structurally supportive and uses a tape that is rigid, highly adhesive, and can be worn for up to 18 hours.⁵ MT has been reported to reduce anterior knee pain, regulate the mediolateral pulling force of the patella, improve joint alignment and facilitate the vastus medialis obliquus (VMO). Although MT has been reported to reduce pain and improve function in people with patellofemoral pain syndrome during activities of daily living, strong evidence to identify the underlying mechanisms is still not available.^{4,7,8,9,10} Recent studies have reported significant effects on knee proprioception using the MT.^{11,12} Proprioception is the ability of mechanoreceptors in the body to detect information regarding

joint position and movement and the perception of these movements by the central nervous system.^{11,12} Studies have reported that taping over the skin stimulates cutaneous mechanoreceptors, therefore allowing more sensory signals to be carried to the central nervous system for integration.^{11,12}

The KT® is a relatively new application of a more compliant adhesive taping used by physical therapists.⁶ The method incorporates a special tape product plus different techniques for various conditions. The elastic tape is unique in that it can stretch to 130-140% of its static length; theoretically allowing full range of motion while the muscle is placed on gentle functional stretch during the application. KT® is thought to increase proprioception by providing constant afferent stimulation through the skin.¹³ In addition to increasing proprioception, the tape used in the KT® is hypothesized to encourage normal muscular function, increase lymphatic and vascular flow, diminish pain, and aid in correction of possible articular malalignments.^{12,13} The tape can be worn for 3-5 days.¹³ Although taping techniques are used in clinical practice, there is limited scientific evidence evaluating the effectiveness of the KT® and conflicting evidence regarding the efficacy of the MT.^{4,14}

Therefore, the purpose of this study was to compare the effectiveness of KT® and the MT versus no tape in subjects with anterior knee pain during a squat lift and stair climbing.

SUBJECTS

A total of 20 subjects (15 female, 5 male) ages 13-30 years old with unilateral anterior knee pain were recruited for participation in this study (Table 1). All subjects gave informed consent prior to participation and the study was approved by the institutional review board at the University of the Sciences. The

Table 1. Subject demographic data.	
GENDER	n = 20
Males (n)	5
Females (n)	15
AGE	years
Mean (SD)	24(3)
WEIGHT	kg
Mean(SD)	160(28)

inclusion criteria consisted of: (1) anterior knee pain that increased with stair climbing, squatting, kneeling, or running and (2) 13 to 30 years of age. Exclusion criteria consisted of: (1) recent knee surgery (< 1 year), (2) chronic knee pain greater than 4 years, (3) pregnancy or the possibility of pregnancy, (4) corticosteroid injections of the knee joints within the past 3 months, (5) presence of tenderness of the medial and lateral knee joint lines, (6) presence of moderate-severe arthritis of the knee based self-report of radiographic evidence, and (7) presence of any other non-orthopedic diseases that may affect the knee.

METHODS

Each participant was tested during the performance of two functional activities, including a squat lift while lifting a weighted box (10% of his/her body weight, plus the weight [8.5 pounds] of the box) and ascending and descending three flights of stairs (16 steps per flight, 9 inches high) under three conditions: 1) no tape, 2) MT and 3) KT®. All subjects in this study presented with symptoms consistent with



Figure 2. *McConnell Taping Technique Application.*



Figure 1. *Kinesio Taping® Method Application.*

PFPS. The tape application techniques used in the study were consistent with the accepted KT® (Figure 1) and the MT (Figure 2) methods used for PFPS.^{6,12} Consistency was maintained with all taping applications and functional tasks by having the same tester apply the tape and instruct the subjects on executing the functional task. Subjects performed the two functional tasks under the above-mentioned conditions in a randomized order and were asked to provide a pain level, using the 0-10 Numeric Pain Intensity Scale (NPIS), before the activity and during the activity. Subjects were instructed to rate their pain on a scale from 0-10 with zero defined as no pain at all and ten defined as “the worst possible pain you can imagine”. The values on the pain scale correspond to the pain level descriptions as follows: 1-3 mild, 4-6 moderate, 7-10 severe. Subjects were given a rest period of approximately 15–30 minutes to allow for pain levels to return to baseline prior to performance of the next activity. All subjects’ pain levels did return to baseline prior to proceeding.

STATISTICAL ANALYSIS

Demographic descriptive data is reported as mean and standard deviation (SD) and the verbal pain level on the 0-10 Numeric Pain Intensity Scale (NPIS) is reported as median and interquartile range (IQR). Changes in pain between pre- and post-activity in all three conditions were measured using the NPIS pain scale. For all hypothesis test the alpha level was set at $\alpha = .05$. Data collected for the 3 groups (no tape, MT and KT[®]) performing both functional activities (squat lift and stairs) did not meet the normality assumption (normality test, p -value $< .05$) of an ANOVA test and was therefore analyzed using two non-parametric tests, the Wilcoxon Signed Rank Sum test and the Kruskal-Wallis test. Due to the use of non-parametric tests, instead of mean, median values were used for comparison.

RESULTS

The minimally clinical important difference for the NPIS is 1 point or a 15% change.¹⁵ None of the subjects reported pain prior to performing the functional activities. The median IQR for pain during squat lift was 2 (2.75) for no tape, 1 (1) for KT[®] and 0.5 (2) for MT. During the stair activity the median IQR for pain was 1.5 (2.75) for no tape, 1 (1.75) for KT[®], and 1 (1.75) for MT. As seen in Figure 3, there was no statistically significant difference ($p > .05$) in median pain scores between the three conditions during the squatting activity ($p = 0.275$). However, there was a statistically significant difference ($p = 0.0238$) in median pain scores between the three conditions

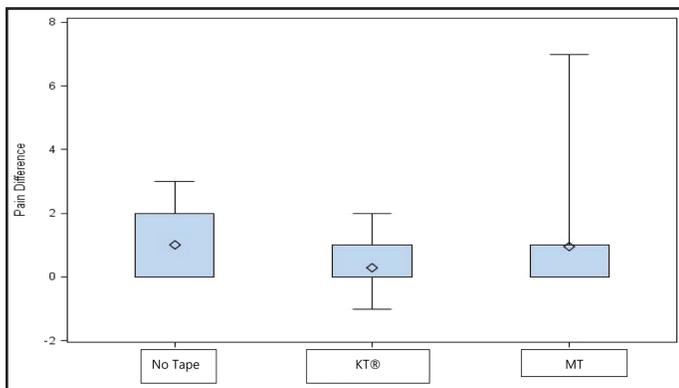


Figure 3. Distribution of Pain Difference During Squats. Median (in quartile range and spread)
KT[®] = Kinesio Taping[®] Method
MT = McConnell Taping Technique

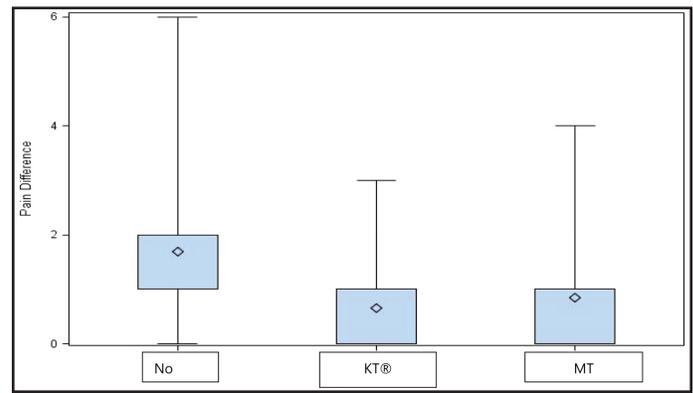


Figure 4. Distribution of Pain Difference During Stair Climbing.

Median (in quartile range and spread)
KT[®] = Kinesio Taping[®] Method
MT = McConnell Taping Technique

during the stair activity, as shown in Figure 4. Further analysis comparing the three conditions during stair climbing, two at a time (using Wilcoxon Rank Sum test, Table 2), demonstrated a statistically significant difference in median pain values between the no tape and KT[®] conditions ($p = 0.0339$), and no statistically significant differences between the no tape and MT conditions ($p = 0.1053$) or the KT[®] and MT conditions ($p = 0.8687$).

DISCUSSION

Taping has become a popular intervention for treatment and prevention of anterior knee pain. MT, first introduced in 1984 by Jenny McConnell, has been extensively studied in the literature with inconsistent results; for every study that shows altered patellar kinematics, enhanced EMG and muscle function, improved dynamic alignment, and decreased patellofemoral joint reaction forces, there is another study that shows just the opposite, frequently due to varying methods. Also, although the MT taping has been reported to reduce pain and improve function in people with patellofemoral pain syndrome during activities of daily living, there is not strong evidence to identify the underlying mechanisms.⁷ Despite this, the MT appears to be the rehabilitation taping technique of choice in the clinic. The KT[®] was developed in the 1970's by Dr. Kenzo Kase and was introduced into the United States in the 1990's.¹⁶ KT[®] gained international exposure during the 2008 Beijing Olympics when athletes such as volleyball

Table 2. Results of Wilcoxon Test, During Stair climbing task.

Wilcoxon Test Comparison	p-Value
No Tape vs Kinesio Taping® Method	0.0339
No tape vs McConnell Taping® Technique	0.1053
Kinesio Taping® Method vs McConnell Taping® Technique	0.8687

players wore the multi-colored versions of this type of tape. KT® has become extremely popular recently; however, there remains a paucity of evidence on the use of KT® for knee pain^{4,5} as well as other conditions.¹⁶ Finally, there is a lack of research comparing these two taping methods.

The purpose of this study was to compare the effectiveness of pain control during functional activities by the KT® versus the MT on subjects' with anterior knee pain. The results revealed no significant difference in pain between the three conditions during the squatting activity. The use of an inadequate load may account for these findings. Both KT® and the MT were effective in reducing pain during stair climbing when compared to the no tape condition. It has been proposed that taping over the skin could stimulate cutaneous mechanoreceptors and increase afferent feedback to the central nervous system resulting in decreased pain.^{17,18} Further studies are needed to investigate this possibility. While the authors of the current study cannot clearly describe the mechanism, both the MT and KT® appear to be viable alternatives method for addressing anterior knee pain that occurs during stair climbing.

LIMITATIONS

Limitations of the current study included subjects of a limited age range (average age 22), a small sample size, very few males, and the use of only 10% of body weight during squatting activity. Using 10% of body weight in the box during the squat lifting may not have been a significant enough load to elicit substantial pain response during the maneuver. Also, most of the subjects in the study had never experienced KT® or MT; therefore a placebo effect must be considered as a possible mechanism by which pain was diminished.

CONCLUSION

The results of this study demonstrate that both he KT® and the MT were effective in reducing pain

during stair climbing activities as compared to the no tape condition. Results obtained from this study suggest that these two taping techniques may be a beneficial component in the treatment of anterior knee pain during stair climbing. Further studies using a larger, more varied sample size and investigating pain responses during additional functional activities should be performed in order to support the current findings.

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