

# **THE EFFECTS OF KINESIOLOGY TAPE ON ACTIVE KNEE FLEXION**

A Thesis by

Alexis Montgomery

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The following faculty members have examined the final copy of this thesis for form and content, and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Education with a major in Exercise Science.

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Michael E. Rogers, Committee Chair

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Heidi A. VanRavenhorst-Bell, Committee Member

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Nicole L. Rogers, Committee Member

## **DEDICATION**

I dedicate this thesis to my mom who inspired me to chase my dreams and to my dad who always reminded me to pray every day through the good and the bad. My two good friends, Shaq and Candace who listened to me vent and always gave me words of encouragement. Thank you all so much!

“I will persevere through every  
trial and tribulation,  
continue to break barriers,  
and never become complacent.”

-Alexis Montgomery

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## ABSTRACT

**INTRODUCTION:** Kinesiology tape (KT) is used in therapeutic clinics, chiropractic clinics, and sports settings as a tool to prevent or treat injuries. Some of the reported benefits of KT include decreasing pain, decreasing edema, increasing muscle strength, and improving circulation throughout the body. The current study evaluated the effects of KT on active knee ROM. **METHOD:** Forty students (29 females, 11 males) between the ages of 19-26 participated in the study. Two strips of KT were applied to the medial and lateral side of the patella on the right knee under these conditions; no tape, 0% elongation, 25% elongation, and 50% elongation. ROM was measured using the Microfet-3. **RESULTS:** A one-way analysis of variance (ANOVA) with repeated measures found no significant differences in the effects of KT on active knee flexion. (Greenhouse-Geisser  $F(2.38, 92.8) = 2.673, p = 0.065$ ). **CONCLUSION:** KT applied at 0%, 25%, and 50% elongation showed to have no significant effect on active knee ROM. These results suggest that KT does not restrict ROM when applied with tension over a joint. Future research needs to be done to determine the possible benefits of KT over longer periods of time.

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# CHAPTER 1

## Introduction

### 1.1 Introduction

Kinesiology tape (KT) was developed by a Japanese Chiropractor Dr. Kenso Kase in the 1970's (Yin-Hsin et al., 2009) However, KT did not become popular until the 2008 Olympics when KT was donated to over fifty countries to promote the effects of the tape (Yin-Hsin et al., 2009). There are many possible benefits of KT as it can be used on any joint or muscle. Some of the reported benefits of KT include decreasing pain, increasing proprioception, increasing muscle strength, and improving circulation throughout the body (Ferreira et al., 2017).

Over the past 10 years, KT has come to be used in sports, therapeutic clinics, and chiropractic clinics. The application of KT is being used both as a preventive and healing method for injuries (Williams, 2012). Many studies have tested the application of KT and how it can affect physical performance. Although KT has become a tool for treating and preventing injuries, many other studies have shown no effect of KT on a variety of outcomes. Research is continuously being done on KT to determine the possible effects it may have on the muscles and joints.

### 1.2 Statement of Problem

The use of KT in sports and therapy settings is common. Studies of KT show either improvements in measured outcomes or no effects, but generally do not report negative outcomes. As KT is commonly applied across a joint, it is possible that the application of KT could restrict range of motion (ROM). Studies have not evaluated this aspect of KT.

### **1.3 Purpose of Study**

The purpose of the study was to look at the effects of KT on active knee ROM. Specifically, the study was designed to determine if KT has an effect on active knee ROM at 0%, 25%, and 50% of KT elongation.

### **1.4 Hypothesis**

KT will limit active knee range of motion when being applied vertically to the lateral and medial sides of the patella at 0%, 25%, and 50% of elongation.

### **1.5 Independent variables**

No tape, 0%, 25%, 50% elongation.

### **1.6 Dependent variables**

Active Knee ROM in degrees.

### **1.7 Assumptions**

It is assumed that all participants were familiar with the use of KT and have seen it being used, has healthy ROM, and no abnormalities of the knee joint.

### **1.8 Limitations**

Some limitations of KT is that there are several different brands. Some of these brands include Rock Tape, TheraBand Kinesiology Tape, and Kinesio. Each brand is different, therefore each brand can provide different effects and allow for different percentage of elongation. KT can be pulled anywhere from 0% to 140% elongation, but not every brand of KT achieves 100% of elongation (Lins et al., 2016). Without actually measuring the tape length before and after

stretching, it is often difficult to determine the percent elongation. TheraBand KT was used in the study. This brand of tape has visual hexagon elongation indicators on its surface to verify the percent elongation at 25% and 50%.

The measurement of ROM can be inconsistent particularly when using goniometry (Gajdosk & Bohannon, 1987). Repeated measures taken over short time intervals tend to be more reliable than measures separated by long intervals (Gajdosk & Bohannon, 1987). In the current study, ROM was measured 15 times on each participant within a 20 minute time-frame using a Microfet-3 and reliability of the measurement was established.

### **1.7 Delimitations**

The study is delimited to college-age men and women, the right knee, and the application of TheraBand KT.

## **CHAPTER 2**

### **Review of Literature**

#### **2.1 Kinesiology Tape**

KT has been around for almost 50 years and has been evaluated in many studies to determine effectiveness on joints, muscle, skin, and nerves. Some studies have shown KT to be effective on various outcomes and some have not. At this time, KT is not fully accepted as an effective treatment or prevention method due to the equivocal results that exist in the literature (Farquharson & Greig, 2015).

#### **2.2 Elongation**

Unlike other athletic tape, the elongation of KT provides a lasting effect for 3-5 days which provides a constant pulling force to the skin and allows for enhanced stimulation of the muscle (de Jesus et al., 2017). Research was conducted to determine the effects of different tensions on KT and the effects of different KT applications (de Jesus et al., 2017). The purpose of the study was to analyze quadriceps strength and lower limb function in healthy individuals over a 7 day span using KT. KT was applied at 0%, 50%, 75%, and 100% of elongation. Results showed that KT did not promote quadriceps strength, and KT at different tensions did not show a significant difference in the performance of a single leg hop (de Jesus et al., 2017).

#### **2.3 Muscle Strength**

Numerous researchers have theorized that KT facilitates an immediate increase in muscle strength by generating a concentric pull on the fascia (Reneker et al., 2017). A study was conducted to determine the effects on scapular kinematics and muscle performance on collegiate

baseball players. This study focused on elastic taping on scapular kinematics, muscle strength, and electromyographic activity in baseball players with shoulder impingement syndrome (Yin-Hsin et al., 2007). Kinesio Tex was the brand of tape used and elastic taping was used as placebo taping. Results showed improvement in the lower trapezius muscle activity during 30 to 60 degrees of abduction. Also, there was a decrease in upward rotation between 30 to 60 degrees of arm flexion. There were no significant differences in muscle strength. The results suggested that KT could be useful in a therapeutic setting and as prophylactic assistance in rehab to increase muscle activation.

KT was applied to stroke patients to test muscle strength, gait, and functional parameters (Ekiz et al., 2015). The purpose of this study was to determine the long-term effects of KT. KT was applied to the four quadriceps muscles, on both the paretic and nonparetic side. Along with the application of KT, conventional exercises were performed for four weeks and showed that there was a significant increase in muscle strength on both the paretic and nonparetic side. The study did not show any improvement in functional parameters.

KT has been shown to provide possible benefits in the improvement of neuromuscular activity (Juchler et al., 2016). Neuromuscular activity is the activation of both the nerve and the muscle. Recent literature looked at the effects of KT on neuromuscular activity of the peroneus longus. The study was designed to determine if KT improves pre-activation and reflex induced activity of the peroneus longus (Juchler et al., 2016). The results of the study showed that participants experience less ankle stability with KT when performing downhill running. This is considered a negative effect of KT. There was also no significant effect on neuromuscular activity of the peroneus longus in participants.

## **2.4 Physical Performance**

The use of KT tape has also been examined for use in improving physical performance. Studies done to determine whether KT can improve physical performance usually recruit healthy adults or elite athletes. A research study conducted in 2015 evaluated the effects of KT on jump performance in healthy elite female track and field athletes (Schiffer et al., 2015). The athletes were required to perform a broad jump without KT and then with the application of KT. Results showed that there were no significant differences in the enhancement of jump performance with the application of KT.

Further, research has looked at the effects of KT on functional performance (Ekiz et al., 2015). Participants were required to perform a few functional tests with KT and athletic tape. Some of the tests included the hopping test, vertical jump test, dynamic balance test, and the standing heel test. Participants had chronic inversion ankle sprains. KT as well as athletic tape was used to support the tibiofibular ligament and the peroneal muscle. The results showed that athletic tape caused a significant decrease in performance in the vertical jump and KT caused a significant decrease in the standing heel rise test. Results showed that KT and athletic tape did not have a positive effect on performance (Ekiz et al., 2015).

## **2.5 Pain**

KT was designed to mimic the qualities of the skin which aids in the removal of edema that can lead to a reduction in pain (Piva et al., 2006). Research has been conducted using KT as a variable to determine the effects it may have on pain, in which one of the possible benefits of KT is the reduction of pain. A study compared the short term efficacy of the application of KT and sham tape. KT and sham tape were applied to participants who had rotator cuff tendonitis for

6 days. Although the findings showed no significant difference in pain with the application of KT and sham tape; the results did show an immediate increase in shoulder ROM with KT (Piva et al., 2006).

KT, however, has been shown to be effective in treating pain in patients with degenerative knee arthritis. A recent study evaluated the effects of KT on patients with degenerative arthritis (Lee et al., 2016). Pain, physical function, and active ROM were measured. Pain was measured using a Visual Analogue Scale (VAS). Daily functional activities were measured using the Korean Western Ontario and McMaster Universities Osteoarthritis Index (K-WOMAC) and ROM was measured using a universal goniometer. The study consisted of two groups, a conservative treatment group (CTG) and a KT group (KTG). Therapy was performed three times a week for four weeks. KT was re-applied at every therapy session. Results of intragroup comparisons showed that pain and daily functional activities scores were significantly decreased in the CTG and KTG. ROM showed a significant increase in intragroup comparisons in both groups. Intergroup comparisons showed significantly lower scores for pain and daily functional activities and a significant increase in ROM in the CTG. Conservative treatment using modalities was shown to be more effective than KT.

## **2.6 Quadriceps Flexibility**

Flexibility refers to the amount of motion that can be achieved in the joints and the length in the muscles that crosses the joint to produce movement (Erhman et al., 2013). Flexibility of the quadriceps primarily dictates knee ROM. Proprioceptive neuromuscular facilitation (PNF) stretching is the best type of stretching to increase muscle ROM. PNF stretching was originally developed for rehabilitation purposes and involves stretching and contraction of the muscle

group (Pearce et al., 2009). Although static stretching is also good to perform, if performed before physical activities for a long duration it can produce decrements in strength as well as poor performance in physical activities or exercises (Pearce, et al 2009).

Modalities such as a foam roller can assist in increasing quadriceps ROM as well. Roller massages are used as a recovery and rehabilitative tool to initiate relaxation of the muscles (Bradbury-Squires et al., 2015). Roller massages can also improve muscular performance. Research showed that after 2-10 minutes of foam rolling, knee ROM was increased 10.3%-12.7% and ROM at the quadriceps increased 11% 48 hours after foam rolling (Bradbury-Squires et al., 2015). The force of the foam roller also contributes to the increase of ROM. It has also been shown that 20-60 seconds of foam rolling increases knee ROM 10%-16% (Bradbury-Squires et al., 2015). It has been recommended that a foam roller be used during a warm-up or as a complement to stretching to increase flexibility (Bradbury-Squires et al., 2015).

## **2.7 Assessing ROM**

A goniometer, Micro-Fet 3, and a few other tests can be used to assess knee ROM. Although these tools are useful and can be easy to access, the reliability of using these tools varies. These tools are often used in a clinical, rehabilitative, or sports setting. Each tool provides clinician or researchers the ability to measure and assess abnormal or normal ROM in the joints.

In a few studies using the Micro-Fet 3, it was shown to be a reliable assessment instrument when measuring ROM (Clarke, 2011; Kelin, 2008). A study was conducted to measure intratester reliability and intertester reliability using the Microfet-3. Intratester reliability refers to the reproducibility of measurements by the same examiner whereas interrater reliability refers to the reproducibility of measurements taken by different examiners. Results showed that

the Microfet 3 was more reliable when measuring lower extremity joints compared to upper extremity joints (Clarke, 2011). Intratester reliability was moderate to excellent, with associations ranging from 0.56-0.92. Intertester reliability was poor to moderate with associations ranging from 0.60-0.66. The reliability of goniometer measurements can be very depending on the tester's skills and ability. Research showed that when the same person measures knee extension and flexion the measurements were reliable. This study showed that passive ROM measured was a more reliable measurement when taken by the same individual.

Passive ROM allows for the clinician to force ROM, which can have a positive or negative impact on the joints. Active ROM allows for the participant to achieve true ROM without assistance. A few studies compared the reliability of measuring passive ROM compared to active ROM. Evidence suggests that passive ROM is more difficult to perform due to the stretching of soft tissue, and the force applied to the limb must be controlled consistently with every measurement (Gajdosik & Bohannon, 1987)

Ely's Test and Thomas test are two special tests used in a therapeutic setting that can evaluate ROM in the quadriceps. Ely's test is performed with the patient lying in a prone position with the knee being passively flexed. If the patient hip rises off the surface while the knee is passively flexed, then it is a positive indication of tightness in the rectus femoris. The Thomas test is performed with the patient supine flexing the uninvolved knee to the chest with the involved leg hanging off the table. If the involved leg achieves full extension during the process of flexing the uninvolved knee, then it is a positive indication of rectus femoris tightness. Ely's test and Thomas test have been shown to be reliable assessments when assessing flexibility of the rectus femoris (Peeler, 2008).

### **2.7.1 ROM**

A few research studies have looked at the effects on KT and ROM. The effect of KT on ROM remains unclear because of the limited number of studies done on ROM and conflicting results. A mechanism of KT on active ROM is an increase in blood circulation. Physiologically this change may facilitate an increase in ROM. (Williams et al., 2012).

A study conducted in 2007 looked at the effects of KT on trunk flexion, trunk lateral flexion, and trunk extension (Yoshida & Kahanov, 2007). The assessment of ROM was measured three times before and after the application of KT for reliability. Results showed a significant difference in trunk flexion but no significant differences in trunk extension or lateral flexion (Yoshida & Kahanov, 2007). The study implies that trunk flexion can be improved with the application of KT. A similar study was conducted to determine the effects of KT on ankle range of motion. The study showed a significant effect of KT on ankle ROM immediately after being applied but not after completion of a duathlon competition (Juchler et al., 2016). The study showed that the application of KT to the calf increases dorsiflexion immediately. This study suggests that KT is only effective for a short duration of time during physical activity.

The effects of KT on cervical ROM have been studied as well. ROM was assessed in six directions; flexion, extension, right lateral rotation, left lateral rotation, right rotation, and left rotation. Measurements were taken immediately post treatment and 24 hours later. Results showed beneficial effects on cervical extension and lateral flexion 24 hours post-treatment. The study showed beneficial and possible trivial effects, but no significant effect of KT on all six directions of cervical ROM. (Williams et al., 2012.)

A recent study looked at the efficacy of KT on muscle extensibility (Farquharson & Greig, 2015). The study observed the effects of KT over a 5 day period. KT was applied in a Y-shape to the biceps femoris. There were three groups in the study; KT only, static stretching, and PNF stretching. Active knee extension was measured 30 minutes, 3 days, and 5 days after the application of KT. There was a significant increase in ROM after the application of KT at 30 minutes (Farquharson & Greig, 2015). Static stretching and PNF stretching had the greatest improvement on active knee extension but the changes were not significantly different (Farquharson & Greig, 2015).

To date research conducted on KT and ROM, hypothesize that KT would have a beneficial impact, show an increase in joint ROM, or provide significant improvements. No study evaluated the possibility of negative effects of KT. The current study looked at KT possibly causing a decrease in knee ROM.

## CHAPTER 3

### Methods

#### 3.1 Participants

Male and female participants aged 19-30 were recruited for the study. Individuals who had any musculoskeletal injuries to the leg or knee were excluded from the study.

#### 3.2 Procedures

The study was described to the participants verbally and a written consent form was provided. A media release form was also provided for participants to sign if any photo documentation was used. Symptoms that may occur after the KT is applied were explained to each participant, including possible skin irritation, skin discoloration, rashes, and discomfort around the knee joint. Participants were instructed to wear shorts or loose fitting pants that could roll above the knees. Males participating in the study were instructed to shave around both knees before arriving to be tested. The study was approved by the Institutional Review Board at Wichita State University.

Before testing, participants were instructed to remove their shoes and any heavy fitting clothing to record height and weight. Height was recorded in centimeters using a stadiometer and weight was recorded in kilograms using a digital weight scale. Each participant's age and gender was also recorded.

Each participant was instructed to lie prone on a flat massage table while active ROM was measured three times on each knee using the Micro-Fet 3 (Hogan Health Industries Inc, Salt Lake City, Utah) which was placed against the posterior aspect of the ankle, specifically the

achilles tendon. Next, KT (TheraBand Kinesiology Tape, Performance Health, Akron, OH), pre-cut to a length of 6 inches was applied to the right knee under 3 conditions: Two 6 inch strips of KT applied at 0% elongation, two 7.5 inch strips at 25% elongation, and two 9 inch strips at 50% of elongation. A ruler was used to verify the length of tape after each application. Tape was applied to the lateral and medial side of the patella with the participant in a seated position and the knee joints at a 90 degree angle. The anterior lateral and medial border of the patella was used as landmarks as the initial placement of the KT. The participant was then instructed to lie prone on the table and actively flex his/her knee as far as possible and hold the position for three seconds. Three measurements were taken for each application using the Micro-Fet 3. Measurements were recorded and the median value was used for analysis.

### **3.3 Data Analysis**

Descriptive data are expressed as mean and standard deviation (SD). To establish reliability of the ROM measurements, Cronbach's alpha and inter-item correlations were calculated for the three measures performed on the left knee. Mauchly's test was used to evaluate assumptions of homogeneity of variance and sphericity. The Greenhouse-Geisser correction was applied for any violations. Data were analyzed using a one-way analysis of variance (ANOVA) with repeated measures for the main effects of tape application (no tape, 0%, 25%, 50% elongation) that served as the within-subject factor. Follow-up post-hoc analyses were used to determine the nature of any observed differences. A probability value of less than 0.05 was considered statistically significant. Data were analyzed using the IBM SPSS Statistics (version 21) statistical program (SPSS Inc., Chicago, IL).

## CHAPTER 4

### Results

#### 4.1 Descriptive Statistics

Forty students participated in this study, 29 females and 11 males. The means and standard deviations of the group are located in Table 4.1.

**Table 4.1**  
**Descriptive Statistics (Mean and SD)**

	Mean	Std. Deviation
Age (yrs)	21.82	1.73
Weight (kg)	72.76	17.89
Height (cm)	1.67	.10
BMI (kg/m <sup>2</sup> )	25.86	4.74

#### 4.2 Reliability of ROM Measures

Values for three left knee ROM measures are produced in Table 4.2.

**Table 4.2**  
**Left knee ROM measurements (Mean and SD) (Degrees)**

	Mean	Std. Deviation
Measure 1	104.22	9.77
Measure 2	105.52	9.23

**Table 4.2 (continued)**

Measure 3	105.65	9.38
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The Cronbach Alpha (.94) and inter-item correlations .838-.866 indicated a high level of consistency and reliability of measurements on the left knee. The values are located in Table 4.3.

**Table 4.3**

**Inter-Correlation Matrix Comparisons of Dependent Variables**

Measure 1	1.00	.838	.840
Measure 2	.838	1.00	.866
Measure 3	.840	.866	1.00

The results of the one-way within subjects ANOVA did not show significant differences between the no tape and three tape conditions. (Greenhouse-Geisser  $F(2.38, 92.8) = 2.673$ ,  $p = 0.065$ , power = .639) The values are located in Table 4.4. This implies that KT at 0%, 25%, and 50% of elongation has no significant effect on active knee ROM.

**Table 4.4**

**Active Range of Motion of Right Knee (Mean and SD) (Degrees)**

	Mean	Std. Deviation
No tape	111.00	9.67
0% Elongation	108.55	10.27
25% Elongation	109.17	10.38
50% Elongation	108.70	10.52

## **CHAPTER 5**

### **DISCUSSION**

#### **Hypothesis Revisited**

The hypothesis stated that KT will cause a decrease in active knee ROM, however the findings indicate no significant difference in ROM with the application of KT at 0%, 25%, and 50% of elongation.

#### **5.2 Discussion**

The purpose of this study was to determine if KT had an effect on active knee ROM. The results refute the hypothesis that KT will decrease ROM in the right knee. There was no significant difference in ROM at 0%, 25%, and 50% of elongation as shown by measures that were determined to be highly reliable. Although the measurements showed reliability, the data analyzed as an ANOVA with repeated measures showed no significant effect within participants tested on multiple measures of ROM under four treatment conditions.

According to a few studies conducted on ROM, KT has been shown to be effective in increasing ROM in certain joints of the body. A study conducted on ankle ROM showed a significant increase in ROM immediately following the application of KT. The findings agree with the study conducted by Yoshida and Kahanov (2007), in which they did not find a significant difference in KT in trunk extension and lateral rotation. Also, the results of the current study with KT applied at 0%, 25%, and 50% of elongation were similar to another study that evaluated the effects of KT at 0%, 50%, 75%, and 100% where there was no significant effect on quadriceps strength and lower limb functions (de Jesus et al., 2017).

In the current study, ROM was assessed only for knee flexion. Yashida and Kahanov assessed ROM on trunk flexion and extension with the application of KT and the results showed a significant difference in trunk flexion but not trunk extension (Yoshida & Kahanov, 2007). The results indicate that KT is not effective for increasing trunk extension, in which the current study suggests that KT does not decrease or increase knee flexion.

The reliability of ROM measurements can be influenced by changes in ROM which results from repeated measures (Gajdosik & Bohannon, 1987). The results of the current study showed high intratester reliability using the Microfet-3. These results are similar to the results of Clarke (2011). The study showed that intratester reliability is moderate to excellent. The results from the current study, as well as those of the Clarke (2011) study, indicate that the Microfet-3 is a reliable tool to measure knee ROM.

Assessing active ROM is more reliable than passive ROM (Gajdosik & Bohannon, 1987). Active ROM is not manipulated in comparison to passive ROM, which allows for the patient to achieve full ROM without assistance. Manipulating ROM can cause possible injuries to the joints or muscles. Active ROM allows for the clinician to take reliable measurements and patient consistency. The current study showed reliability of active ROM measurements.

### **5.3 Limitations**

The application of KT could have been applied longer than 1-2 minutes to determine if there was a significant effect on active knee ROM. Farquharson and Greig looked at the effects of KT over a 5 day time span and KT was shown to be effective, causing an increase in ROM of the hamstrings after the application of KT for 30 minutes. A possible warm-up or sequence of exercises could have been performed to enhance ROM. Static stretching as well as

proprioceptive neuromuscular facilitation stretching are two types of stretching used often before and after physical activities (Pearce et al., 2009). The performance of either stretch could have provided possible effects on ROM as well. The application of a massaging tool to the quadriceps could have been implemented in the current study as a variable. Research has shown that the application of foam rolling can increase knee ROM 10%-16% after rolling for 20-60 seconds (Bradbury-Squires et al., 2015). Many studies included stretching, or a series of exercises, when measuring ROM. Ekiz (2015) looked at the effects of KT on functional performance and participants were required to perform a series of functional tests with KT and athletic tape to compare any differences. The results of the study showed that there was no significant difference on functional performance with the application of KT or athletic tape.

There was only one treatment group in the current study. Lee (2016) had two treatment groups to determine the effects of KT on ROM in patients with degenerative knee arthritis. The two treatment groups consisted of a conservative treatment group and KT treatment group. The study showed an increase in ROM in the conservative treatment group but not with KT.

#### **5.4 Conclusion**

The study demonstrated that KT does not affect knee ROM when applied at 0%, 25%, or 50% of elongation. Although KT has no effect on knee ROM, it may produce possible benefits in edema, muscle re-activation, and proprioception (Ferreira, et al., 2017). Knowing that KT will not limit knee ROM is of benefit to researchers and clinicians who apply the tape for clinical purpose, as well as the general population. Future studies should determine the possible benefits and effects of KT over longer periods of time. Furthermore, studies utilizing KT in conjunction with stretching activities and modalities (e.g., foam rollers) are also warranted

## BIBLIOGRAPHY

## BIBLIOGRAPHY

- Anandkumar, S., Sudarshan, S., & Nagpal, P. (2014). Efficacy of Kinesio Taping on isokinetic quadriceps torque in knee osteoarthritis: a double blinded randomized controlled study. *Physiotherapy Theory & Practice*, 30(6), 375-383. doi: 10.3109/09593985.2014.896963
- Bradbury-Squires, D. J., Nofall, J.C., Sullivan, K. M., Behm, D. G., Power, K. E., & Button, D. C. (2015). Roller-massager application to the quadriceps and knee-joint range of motion and neuromuscular efficiency during a lunge. *Journal of Athletic Training*, 50(2), 133-140. doi: 10.4085/1062-6050-49.5.03
- Clarke, M.N., Ni Mhuircheartaigh, D.A., Walsh G.M., Walsh, J.M., & Meldrum D. (2011). Intratester and inter-tester reliability of the Microfet 3 hand-held dynamometer. *School of Physiotherapy*, 31(1), 13-18.
- de Jesus J.F., J, Franco, Y.R., Nannini, S.B., Nakaoka, G.B., Dos Reis, A.C., & Bryk, F.F. (2017). The effects of varied tensions of kinesiology tape on quadriceps strength and lower limb function. *International Journal of Sports Physical Therapy*, 12(1), 85-93.
- Ekiz, T., Meryem Doğan, A., & Özgirgin, N. (2015). Effects of Kinesio Tape application to quadriceps muscles on isokinetic muscle strength, gait, and functional parameters in patients with stroke. *Journal Rehabilitation Research & Development* 52(3), 323-331.
- Erhman, J.K., Gordon, P.M., Visich, P.S., & Keteyian, S.J. (2013). *Clinical Exercise Physiology* (3rd ed.). Champaign, IL: Human Kinetics.
- Farquharson, C., & Greig, M. (2015). Temporal pattern of Kinesiology Tape efficacy on hamstring extensibility. *International Journal of Sports Physical Therapy* 52(3), 323-10.1682/JRRD.2014.10
- Ferreira, R., Resende, R., & Roriz, P. (2017). The effects of Kinesio Taping® in lower limb musculoskeletal disorders: A systematic review. *International Journal of Therapies & Rehabilitation Research*, 6(3), 1-13.
- Gajdosik, R.L., & Bohannon, R.W. (1987). Clinical measurement of range of motion review of goniometry emphasizing reliability and validity. *Physical Therapy*, 67(12), 1867-1872.
- Juchler, I., Blasimann, A., Baur, H., & Radlinger, L. (2016). The effect of Kinesio Tape on neuromuscular activity of peroneus longus. *Physiotherapy Theory & Practice*, 32(2), 124-129. doi: 10.3109/09593985.2015.11107
- Kaneko, T., Muraki, T., & Nago, T. (1997). Micro FET: Norms for Upper Extremity Muscle strength and test-retest reliability. *Physical Medicine*, 7, 128-133.

- Kelin, B.M., Mckeon P.O., Gontkof L.M., & Hertel, J. (2008). Hand-held dynamometry: reliability of lower extremity muscle testing in healthy, physically active, young adults. *Journal of Sport Rehabilitation*, 17, 160-170.
- Laur, D.J., Anderson, T., Geddes, G., Crandall, A., & Pincivero, D.M. (2003). The effects of acute stretching on hamstring muscle fatigue and perceived exertion. *Journal of Sports Sciences*, 21(3), 163-170.
- Lee, K., Yi, C.W., & Lee, S. (2016). The effects of Kinesiology Taping therapy on degenerative knee arthritis patients' pain, function, and joint range of motion *Journal of Physical Therapy Science*, 28(1), 63-66.
- Lins, C.A., Borges, T., Macedo, L.B., Costa, K.S., & Brasileiro, J.S. (2016). Delayed effect of Kinesio Taping on neuromuscular performance, balance, and lower limb function in healthy individuals: a randomized controlled trial. *Brazilian Journal of Physical Therapy*, 20(3), 231-239. doi: 10.1590/bjpt-rbf.2014.0161
- Mason, M, Keays, S.L., & Newcombe, P.A. (2011). The effect of taping, quadriceps strengthening and stretching prescribed separately or combined on patellofemoral pain. *Physiotherapy Research International*, 16(2), 109-119.
- Peeler J.D., & Anderson J.E. (2008). Reliability limits of the modified thomas test for assessing rectus femoris muscle flexibility about the knee joint. *Journal of Athletic Training*, 43(5), 470-476.
- Pearce, A.J., Kidgell, D.J., Zois, J., & Carlson, J.S. (2009). Effects of secondary warm up following stretching. *Europe Journal Applied Physiology*, 105(2), 175-183. doi: 10.1007/s00421-0080887-
- Piva, S.R., Fitzgerald, K., Irrgang, J.J., Jones, S., Hando, B.R., Browder, D.A., & Childs, J.D. (2006). Reliability of Measures of impairments associated with patellofemoral pain syndrome. *BMC Musculoskeletal Disorder*, 7, 33. doi: 10.1186/1471- 2474-7-33
- Roach, K.E., & Miles, P. (1991). Normal hip and knee active range of motion: The relationship to age. *Physical Therapy*, 71(7), 29-38.
- Schiffer, T., Möllinger, A., Sperlich, B., & Memmert, D. (2015). Kinesio Taping and jump performance in elite female track and field athletes. *Journal of Sport Rehabilitation*, 24(1), 47-50. doi: 10.1123/jsr.2013-0111
- Williams, S., Whatman, C., Hume, P.A., & Sheerin, K. (2012). Kinesio Taping in treatment and prevention of sports injuries a meta-analysis of the evidence for its effectiveness. *Sports Medicine*, 42(2), 153-164.

- Van Dijk, G.M., Veenhof, C., Spreeuwenberg, P., Coene, N., Burger, B. J., & Van Schaardenburg, D. (2010). Prognosis of limitations in activities in osteoarthritis of the hip or knee: a 3- year cohort study. *Archives of Physical Medicine and Rehabilitation*, *91*(1), 58-66. doi: 10.1016/j.apmr.2009.08.147
- Yin-Hsin, H., Wen-Yin, C., Hsiu-Chen, L., Wendy, T.J., & Yi-Fen, S. (2009). The effects of taping on scapular kinematics and muscle performance in baseball players with shoulder impingement syndrome. *Journal of Electromyography and Kinesiology*, *19*, 1092-1099.
- Yoshida, A., & Kahanov, L. (2007). The effect of Kinesio Taping on lower trunk range of motions. *Research Sports Medicine*, *15*(2), 103-112. doi: 10.1080/15438620701405206