

Can kinesiology tapes affect knee performance in healthy subjects?

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Abstract— Athletes use kinesiology tape to help work through injuries and increase performance. Kinesiology tape manufacturers claim that these tapes may improve strength, blood flow, and range of motion (ROM). The purpose of this pilot study is to analyze the validity of these claims through evaluation of biomechanical parameters (strength, ROM, muscle activity, and muscle oxygenation) that may potentially affect the performance in healthy subjects.

Three tapes were tested on healthy subjects. One of the tapes (Tape 3) demonstrated improvements in knee ROM, and strength, but no changes were observed in muscle activity or oxygenation levels. No improvement was found for other two tapes. Based on the results, further research involving a fatigue protocol would be beneficial to possibly reveal more evident differences between tapes.

Keywords— kinesiology tapes, knee, performance

I. INTRODUCTION

The goal of every athlete is to improve his or her performance through intense training. When pursuing intensive training paths many athletes explore new avenues, such as kinesiology tapes. The common goal of these tapes is to prevent injury, decrease recovery time, allow people to perform through an injury, and to improve performance. Kinesiology tapes have been shown to help those who are injured or are suffering from a musculoskeletal disorder(s) (Cho, 2014).

Previous studies have shown no changes in muscle strength for both the knee (Fu, 2008) and hand (Chang, 2010) in healthy subjects. However, a study conducted by Wong et. al. (2012) found changes in other parameters such as time to peak strength. These studies showed inconsistent results as to whether kinesiology tapes can improve performance in healthy subjects. However, there may be other parameters that show physiological changes when kinesiology tape is applied.

The goal of this pilot study is to test the validity of those claims through biomechanical evaluation of the parameters that could potentially affect performance in healthy subjects. The following parameters were selected for testing: range of motion (ROM), muscle activity (EMG), muscle oxygenation

(rSO₂), and joint strength. The joint of interest is the knee because it is the largest joint used in everyday activities.

II. METHODS

Four healthy male subjects (ages 20 – 25, height 71.5 ± 1.7 inches, weight 165.5 ± 18.7 pounds) with no previous history of knee injuries volunteered to participate in the pilot study. All subjects were mildly to very active (exercising 3 to 5 days per week). Three brands of the kinesiology tapes (T1, T2 and T3) were chosen for this study and application to the subjects was performed based on the manufacturer’s recommendation.

Knee joint ROM and strength were collected on a Biodex System 4 Pro (Shirley, NY) on both the right and left leg. For isometric strength testing, the Biodex dynamometer measured static knee torque output. Muscle activity was collected at 2,000 Hz and band pass filtered at 20-500Hz using Delsys Trigno wireless parallel bar surface EMG sensors (DelSys Inc, MA). Sensors were placed on the following knee flexor and extensors: vastus lateralis (VL), vastus medialis (VM), and bicep femoris (BF). Muscle oxygenation was collected using a near infrared reflectance spectroscopy (NIRS) Equanox 7600 (Nonin Medical Inc., MN). Muscle oxygenation sensors were placed on the VL and VM of the left leg.

A standing baseline was collected for muscle activity and muscle oxygenation. After that, each subject was fastened into the Biodex around the pelvis and thigh, aligning the lateral knee with the axis of rotation of the dynamometer.

ROM was collected from 90° knee flexion to full extension. Three trials for each tape were recorded. Each subject performed an isometric strength testing protocol before tape application (no tape), immediately after (day 0), and 24 hours after application (day 1) (see Figure 1). The peak torque was recorded for each day. This was repeated for

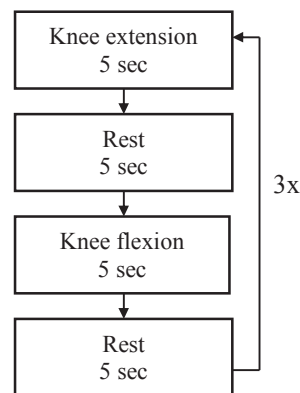


Figure 1: Isometric strength testing

the three different tapes in random order. Each subject rested a minimum of 24 hours between tape removal and new tape application.

III. ANALYSIS

The percent change in knee ROM and isometric strength was calculated comparing no tape to days 0 and 1. Muscle activity was root mean squared (RMS) with a center window of 0.125 seconds and an overlap of 0.0625 seconds. The peak RMS was normalized to the RMS standing baseline of its corresponding day.

$$nRM = \left[\frac{RMSTrial_i}{RMSStanding BL_i} \right] Day_i \quad (1)$$

Muscle oxygenation was normalized to standing baseline of the collection day. Percent change was calculated comparing no tape to days 0 and 1.

$$nRSO_2 = \left[\frac{rSO_2Trial_i}{rSO_2Standing BL_i} \right] Day_i \quad (2)$$

IV. RESULTS

Range of motion (ROM)

There was no changes in knee ROM observed 24 hours after T1 and T2 application in either leg. The average knee ROM for T3 had an increase of 6.2% in the right leg and 2.0% in the left leg (Figure 2).

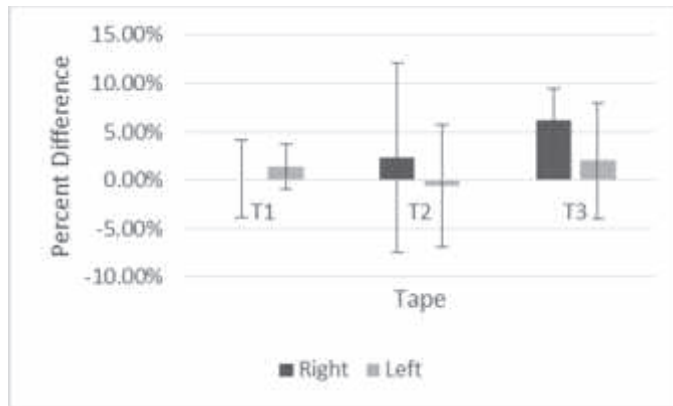


Figure 2: Average percent difference from no tape to day 1 for knee ROM.

Strength

Isometric knee strength testing displayed an average increase of 4.2% on the right leg and 6.9% on the left leg for T3. While the average changes in knee strength for T1 and T2 were close to zero, the observed variability ranged from -9.6% to 8.6% on the right leg, and -2.9% to 6.6% on the left leg.

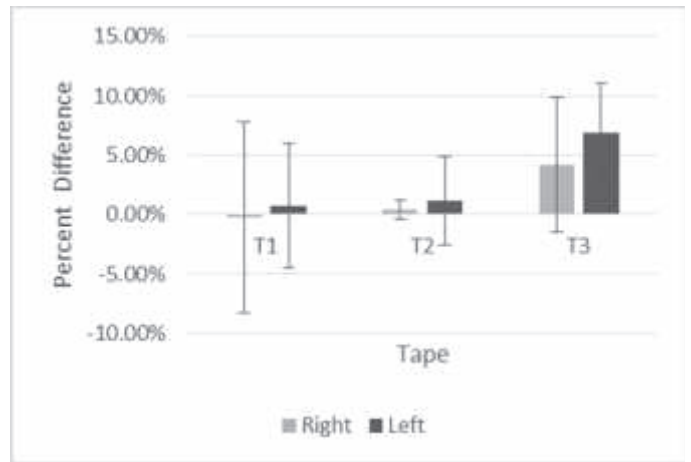


Figure 3: Percent change from no tape to day 1 for knee strength.

Muscle activity (EMG)

The variability of muscle activity was high for all muscles and all tape combinations. The BF displayed smaller average changes in T2 and T3 while T1 had an average decrease of -28.0%. The VM had an average increase of 25% in T1 as opposed to a 27% decrease in T3.

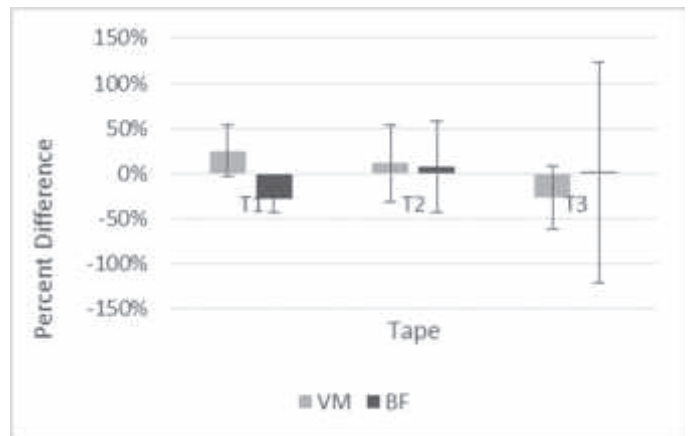


Figure 4: Percent difference from no tape to day 1 for muscle activity.

Muscle Oxygenation (rSO₂)

Muscle oxygenation had the greatest change in T3 with 32.4% and 14.6% in the VL and VM respectively. T2 had changes close to zero for both muscles while T1 had opposite results - with 12.1% for the VL and -12.6% for the VM.

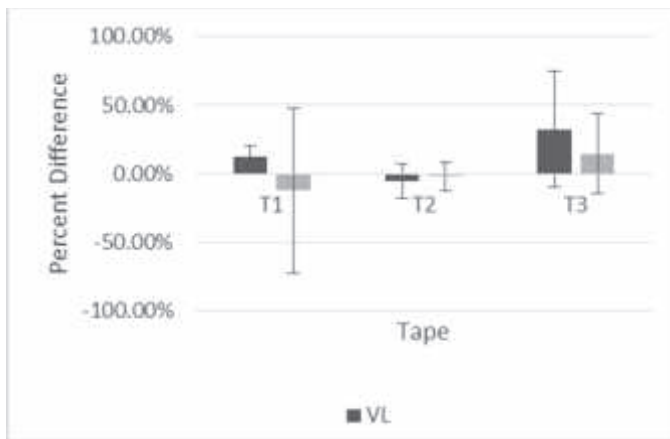


Figure 5: Average percent difference from no tape to day 1 for muscle oxygenation.

V. DISCUSSION

An increase knee ROM and strength was observed due to application of T3 for 3 out of 4 subjects. A possible explanation for this increase could be due to the difference in material make-up between the tapes. T3 seemed to be the stiffest of the tapes, possibly due to having multiple layers. The greater stiffness may have caused an increase in knee ROM because the tension was resisting the knee bent at 90°, thus, contributing to knee extension.

The greater tension of T3 applying a force to extend the knee could have resulted in a placebo effect causing an increase in strength. The tension pulling in the direction of knee extension could have given the subjects the idea that they were aided by T3.

Muscle activity had a high variability for all muscles which suggests that kinesiology tape does not contribute to

muscle excitation, at least in asymptomatic subjects. This result may be explained from the tapes being applied to the skin and not innervating the muscle. Muscle oxygenation seemed to share a close relationship with muscle activity, thus, a similar result was found.

Future research should look at subjects that have been recovering from an injury, joint pain or chronic problem.. A fatiguing protocol for asymptomatic subjects may reveal more evident changes in healthy subjects like an isotonic or isokinetic test. This could be done by identifying the time when parameter values start to vary from a resting baseline with no tape to tape (T1, T2, T3) conditions. Strength would be an accurate measure of fatigue, by measuring the time to reduced torque generation between tape and no tape conditions.

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