Biomechanical Analysis of Hip Angles During a Back Squat With and Without Kinesio® Tape

JANELL BURKART, TAMMY JOE, KATIE LYMAN, BRYAN CHRISTENSEN, KYLE HACKNEY, KARA STONE, JOSHUA BRODERSEN
North Dakota State University; Fargo, ND, Department of Health, Nutrition, and Exercise Sciences

ABSTRACT

Astronauts who participate in long-duration space flights have suffered from decreases in skeletal muscle and bone density. In order to attenuate negative physiological effects while in space, astronauts perform back squats; however, increased resistance is required due to zero gravity thereby potentially changing the mechanics. PURPOSE: The purpose of this study was to investigate the application of Kinesio® Tape to mitigate negative biomechanical alterations during a back squat. METHODS: Thirty-two active participants (Mage = 16, mSD = 16) (age = 34.4 ± 7.9) who regularly incorporate the back squat into their exercise routine were recruited. Markers were placed at the acromion process of the scapula, greater trochanter of the femur, center of the lateral knee, and lateral malleolus. A Casso Exilim EX-H20 camera captured sagittal plane movements. 30% of 1-repetition maximum squats was calculated by having participants perform a maximal voluntary isometric contraction back squat while on an ANTI Accupower force plate. Participants were randomized into two groups: Kinesio® Tape during the first or second set of eight repetitions. Kinesio® Tape was applied with two vertical strips along the paraspinal muscles. A third strip was applied horizontally along the SI joints. Four different hip angles in each repetition (16 total) were measured using Dartfish Motion Analysis Software. RESULTS: A repeated measures ANOVA revealed no statistically significant differences between the tape and no tape conditions (F(1,32.14) = 499, P = 0.486). The assumption of sphericity was not satisfied; therefore, the Greenhouse-Geisser corrected degrees of freedom were used for all tests. To examine fatigue effects, data were analyzed using only the 8th rep for each set with a repeated measures ANOVA and no statistically significant differences were found. CONCLUSION: The application of Kinesio® Tape did not affect the angles of the hip at any of the four points in any of the 16 repetitions. Previous research which incorporated Kinesio® Tape on the quadriceps muscles indicated a decrease in muscle activity of the paraspinals, as measured by electromyography. Thus, more biomechanical and surface EMG research is required to make recommendations for astronauts and athletes who participate use the back squat.

INTRODUCTION

• A back squat should be performed with a neutral back position.1
• Bending excessively at the hip during the squat creates a larger torque about the lower back due to the increasing moment of the weight.1
• Due to the mechanical disadvantage of the muscles, they have to contract with greater force, which can lead to injury in the muscles and the spinal column.1
• Excessive hip flexion during squatting is a common technique error, especially when using high resistance loads and for astronauts during space flights.2,3
• Astronauts who use the Advanced Resistive Exercise Device (ARED) are subjected to increased weight while back squatting in order to counteract the 0 gravity environment.4,5
• Kinesio® Tape can be applied to facilitate motor movements, possibly resulting in less hip flexion during squatting.6
• Therefore, we were interested in examining if Kinesio® Tape would change hip angles during squatting, potentially lowering the likelihood of developing an injury to the back extensors and spinal column.

METHODS

• Thirty-two active participants (Mage = 16, mSD = 16) (age = 34.4 ± 7.9) randomized into 2 groups: Kinesio® Tape during the first or second set
• 30% of 1-repetition maximum squats was calculated by force plate
• Kinesio® Tape was applied along the paraspinals muscles and the sacroiliac joint (Figure 1):
• Paraspinal facilitation: Kinesio® Tape was applied with no tension superior of bilateral SI joints. Participants went into forward flexion putting the lumbar spine in flexion. Kinesio® Tape was applied with 35% tension to the transverse processes of T8.
• Mechanical correction: 75% tension was applied to Kinesio® Tape in the middle 1/3 of the tape. The end of the tape were applied with no tension on the lateral aspects of the SI joints. The tape served as a supportive mechanism thus potentially influencing posture.4
• Biomechanical markers were placed at acromion process of the scapula, greater trochanter of the femur, center of the lateral knee, and lateral malleolus
• Hip angles for each repetition were measured by Dartfish Motion Analysis at the following positions (Figures 2-5):
  1) knee angle closest to 135° in eccentric phase (Figure 2)
  2) knee at smallest angle (Figure 3)
  3) knee angle closest to 135° in concentric phase (Figure 4)
  4) knee at largest angle (Figure 5)

RESULTS

• No statistical significant differences between tape and no tape conditions (F(1,32.14) = 499, P = 0.486).
• There were no significant difference between the two conditions for fatigue (Figure 1).

CONCLUSIONS

• The application of Kinesio® Tape did not effect the angles of the hip at any of the four points in any of the 16 repetitions.
• Kinesio® Tape did not result in facilitation of the back, thus not reducing hip flexion while performing a squat.

FUTURE RESEARCH

• Monitor biomechanical changes in alternative job-specific skills for astronauts
• Compare multiple Kinesio® Tape applications and their effects on pathomechanics

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REFERENCES