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EFFECT OF KINESIOTAPE ON STANDING LONG JUMP IN UNIVERSITY STUDENTS

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Abstract: *Objective: Verify the Kinesiotape (KT) effect on standing long jump (SLJ) performance in college-age students. Method: 100 college-aged students were randomly assigned to either the control group (CG) or the experimental group (EG). Both groups performed the standing long jump test in two consecutive days (pre-test and post-test), with a 24-hour rest period. The EG underwent the pre-test without KT, and the post-test with KT, which was bilaterally applied in the quadriceps femoris muscle with a tension of 75%. The CG performed the pre-test and the post-test without KT. Results: Significant differences were observed between the pre-test and post-test performance of EG, whereas there were no significant differences between the pre-test and post-test results in the CG. Conclusion: bilateral application of KT in the quadriceps femoris muscle with a tension of 75% could be useful to improve standing long jump performance in college-age students.*

Key words: *Kinesiotape. Performance. Standing long jump.*

1. Introduction

The primary tool of Kinesiotape (KT) method is an elastic multicoloured tape with an acrylic adhesive component. It is applied on the skin. The method itself is related to kinesiology science, recognizing the importance of muscle movement during daily life. KT is composed of narrowly interlaced high-strength elastic cotton fibres that are highly resistant to mechanical load and water. The tape contains no drug and no other active substance - all the benefits described are based on its elastic qualities [14]. KT is not used in the case of open wounds, irritated skin, on sacral body parts and in the case of allergy to the acrylic adhesive component. The effect is continuous for 24 hours until the tape is removed manually from the body. The maximum duration of application is 4-5 days as KT gradually loses the elasticity. Moore R. et al. [17] summarized the mechanical effects of KT into these points:

1. Support for muscle function.
2. Improvement of blood and lymph circulation through muscle and subcutaneous movement and accelerating metabolism in the area.

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3. Reduction of pain by raising the subcutaneous tissue layer and reducing the chemoreceptor irritation.
4. Reduction of a pain by increased sensory stimulation and change in pain perception - gate control theory.
5. Increasing proprioception by influencing skin mechanoreceptors.

The ability of KT to modulate muscle tone by affecting the superficial skin layer is described in many articles and publications. The continuous tension applied to the skin under the adhesive KT should activate the mechanoreceptors, which can then stimulate modulation mechanisms within the central nervous system and subsequently enhance the muscular excitability [10].

2. Objectives

In our experiment, we have decided to test the effect of KT on standing long jump as it is less explored area of testing although well measurable. Standing long jump is standard discipline for performance testing in all sport categories. The main goal is to verify the KT effect on standing long jump (SLJ) performance in college-age students.

3. Method and Materials

100 Students of Prince Sultan University aged 19-21 agreed to participate in our experiment. As a test unit, we decided to measure the standing long jump performance. The unit consists of 2 measurement periods, pre-test and post-test. For the accurate measurement we used the Atreq standing long jump mat with centimetres pictured. Our Inclusive criteria for participating students were the following. All BMI Category B (25 – 30) to keep the group homogenous. All of the probands had a good 7 and more hours sleep before the experiment and did the test at the same time in the morning. All students had easy breakfast. Everyone signed the content and were free to step out from research at any time. Motivation factor for students was the fact that mentioned tests are standardized on university and the final grade is affected by results of both tests. All students performed 10 minutes warm-up before pre-test and post-test. All students filled up a medical questionnaire to clarify their good medical condition. Pause between the pre-test and post-test was 1 day.

100 Students were divided into 2 research groups equally (50 each). In the group no. 2 (Control group) we were measuring the performance without KT in the pre-test and post-test as well, following the group no. 1 (Experimental group) with measurement of performance without KT in pre-test and with KT in post-test. Students who suffered from any kind of physical problem were excluded. Students that were not comfortable using KT for any reason were excluded from research. Students that did not prefer to use KT, but wanted to participate and met criteria were added to the Control group. All Experimental group probands were asked to shave the frontal side of thighs and knees. 24 hours prior the tests, KT was applied on bilateral quadriceps femoris muscle in supine position. The skin was disinfected before. The area was covered by 3 stripes of classic 5cm wide KT in 3 lines of medial, lateral and middle aspect. Particularly vastus medialis, vastus lateralis and rectus femoris. We used KT technique for muscular facilitation. Each stripe was applied from particular muscle origin to its insertion bellow knee on

tuberositas tibiae. The tension of each stripe corresponded to 75% as recommended by KASE [15]. The tension 75% was reached by extending the tape from its neutral position to 100% and releasing the maximal tension by 25% (one quarter) afterward. The KT was applied by a professional experienced specialist in KT method and physiotherapy.

The standing long jump testing is part of the curriculum program for each proband in the beginning and end of both semesters. The students are training correct technique and are familiar with performance. Despite of this fact, each student was educated again before the experiment. The jump was performed with initial knees angle of 90 degrees for both Experimental and Control group. All procedures of the investigation were conducted in accordance with the Helsinki Declaration of 1975. The consent form and the study were approved by the Institutional Review Board Committee of Prince Sultan University.

4. Results

Experimental Group – We evaluated the standing long jump (SLJ) performance without and with KT usage in probands. The crucial value was length in centimetres. Are the pre-test values significantly different from post-test values?

H0: KT does not affect the results in the monitored students. The jump length difference achieved without and with KT is statistically insignificant.

H1: KT has an impact on the results in the monitored students. The jump length difference without and with KT usage is statistically significantly different. Jump performances with KT usage are significantly longer.

A paired t-test at a level of significance of 0.05 was used to verify the assumptions. The test results are presented in the following table.

Experimental group (N=50) Table 1

	Pre-test SLJ [cm]	**Post-test SLJ (with KT) [cm]**
Average	180.04	184.52
St. dev.	16.181	19.906
St. error	2.288	2.815

T-test Experimental group Table 2

Number of samples	N = 50
Paired differences	Mean = -4.480 St. dev. = 12.786 St. error = 1.808
Paired *t*-test	t = -2.478 df = 49 Significance: p = 0.017
Paired samples correlations	r = 0.768 Significance: p < 0.001
Effect size	r = 0.334 Cohen's d (Sample 1 variance) = 0.277 Cohen's d (pooled variance) = 0.247

Based on a significance level of 0.05, there is a statistically significant difference between pre-test and post-test in Experimental group. The alternative hypothesis **H1** was confirmed.

Control group – The Control group was subjected to perform SLJ without using KT in the pre-test and post-test. Are the pre-test values significantly different from post-test values?

H0: Statistically significant better results

were not achieved in the second measurement.

H1: Statistically significantly better results were achieved in the second measurement.

We used a paired t-test of two mean values to verify the assumption. The test results are shown in the following table.

Control group (N=50) Table 3

	Pre-test SLJ	**Post-test SLJ**
Average	179.04	181.04
St. dev.	20.662	19.923
St. error	2.922	2.818

T-test Control group Table 4

Number of samples	N = 50
Paired differences	Mean = -2.000 St. dev. = 7.801 Standard error = 1.103
Paired *t*-test	t = -1.813 df = 49 Significance: p = 0.076
Paired samples correlations	r = 0.927 Significance p < 0.001
Effect size	r = 0.251 Cohen's d (Sample 1 variance) = 0.097 Cohen's d (pooled variance) = 0.099

Based on a p-value threshold of 0.05, there is not a statistically significant difference between pre-test and post-test in the Control group. Null hypothesis H0 was confirmed.

5. Final Results

Significant differences were observed between the pre-test and post-test performance of Experimental Group, whereas there were no significant differences between the pre-test and post-test results in the Control Group. We attributed this to the effect of KT, and we assume its application improved the SLJ performance in students tested.

6. Discussion

Many studies dedicated to KT effect research are using an ipsilateral movement model. The frequent test is jump used by following authors [13], [26], [19], [9]. We must admit that from the physiological point of view, the ipsilateral model is less natural for the human body. A more natural and physiological variant of testing is contralateral movement. The contralateral model is the method that can assess both the central and peripheral mechanisms associated with proprioception [7]. Dominating form is vertical jump. In our experiment, we have decided to test the effect of KT on standing long jump as it is less explored area of testing although well measurable. Standing long jump is standard discipline for performance testing in all sport categories.

For the application of KT, we chose the area of m. quadriceps femoris bilaterally. Quadriceps femoris muscle is directly connected to knees extension during jump. Anatomically, the quadriceps consists of three heads (vastus medialis, intermedius and lateralis) originating from the femur and inserting via the quadriceps tendon, patellar bone, and patellar tendon at the tibial tuberosity. The fourth head – rectus femoris, in contrast, originates from the inferior anterior iliac spine, and therefore not only extends the knee, but also flexes the hip [23]. It is concluded that the lower limb muscle strength is the main determinant of jump performance with

technique playing a smaller role [25]. Contribution of knee extensors is crucial in standing long jump performance and the highest level of activation of the thigh muscles is at the beginning of hip extension [3]. Afterward, the knee joint extensor muscles mainly m. rectus femoris transfer the energy from hip into the knee. By KT application on above mentioned muscle group we intended to improve the factors related to knee extension so as the length of the standing long jump performed in probands overall. During recent years, a number of studies and meta-analyses that support but also oppose the KT supportive effect theory, have been revealed. Saavedra-Hernandez [22] consider the effect of KT on muscle fibre activation controversial. Several authors claim that the current evidence does not support the use of KT in practice, and many studies are based on overestimated results. They also point out the gaps describing the technique of application [11], [18], [21]. Our experiment estimates KT being efficient for the SLJ enhancement. Based on our study outcome we recommend to use KT if SLJ support and improvement are intended. The KT effect might decreases stabilization and muscle activation demands. Freedman [3] reported a short-term moderate improvement in muscle performance and a pain reduction in the Single Leg Hop test in patients with patellofemoral pain syndrome. There was a patellar taping performed. Our technique was applied over the knee and patella as well. We assume that patellar fixation and stabilization plays the role in our outcome. Centner and Salinas [5] measured the effect of KT on the concentric muscle strength of the rectus femoris and the tibialis anterior muscle in healthy individuals. They did not ascertain a significant difference in the research before and after the use of KT. A similar result was observed by Oliveira et al. [20]. According the study outcome, KT did not modulate the neuromuscular performance of the quadriceps femoris. Authors reported inadequate tactile stimulus generated by KT, which was not sufficient enough to induce muscle contraction. Our experiment outcome has different results. We presume that different kind of KT application is the reason. Vithoulk et al. [27] explored m. quadriceps femoris activation with KT application in healthy women. The results revealed a significant statistical increase in eccentric isokinetic activation during the peak torque test.

We presume that the various area of KT applications might play an important role in the different results of the studies. Some authors only apply it to individual quadriceps muscles. In the case of Centner and Salinas [5] it is only the rectus femoris muscle. Oliveira et al. [20] measured the KT effect on the vastus lateralis muscle itself. Vithoulk et al. [27] measured the facilitation of the whole quadriceps femoris and KT was applied on the rectus femoris, vastus medialis and vastus lateralis. Ahn et al. [2] explored the effect of KT on quadriceps femoris muscle fatigue with positive results. The area covered was 3 quadriceps muscles. The same area of quadriceps muscle was covered in our experiment. We used 3 stripes of classic 5cm wide KT in 3 lines of medial, lateral and middle aspect. Particularly vastus medialis, vastus lateralis and rectus femoris.

Furthermore, it should be noted that also the tension of KT application is not the same for individual researches. The tension recommended by the author of

the methodology ideal for facilitating muscle fibres is 75%. It is achieved by pulling the KT by 100% after taking it off from the cover paper and reducing by one quarter of length reached [15], [16]. Song et al. [24] applied a 20% tension of KT. Haerle and Zwiebel [12] used 25-50% tension for muscle activity facilitation. Ahn et al. [2] used 40%. Both, Davis [6] and Oliveira [20] investigated the effect of KT on performance with the tension of 40% to 60%. Cai et al. [4] and Aghapour et al. [1], used the above-mentioned value of 75% tension. Our research team used the tension of 75% as well. We believe that notable inconsistency of individual application methods has significant impact on research results. It must be mentioned that except for potential increased muscular facilitation, the segment stabilization might play a role in a final result as well.

7. Conclusion

The inconsistency in KT application in several studies is notable. The main area is the size of KT application and tension. In accordance to positive KT effect on the SLJ we assume that except of muscle activation element, the knee and patellar partial stabilization played a role in the final result as well. We have to realize that 75% KT tension may provide increased stability for both knees and knee caps during initial jump phase. Therefore, based on our data outcome we can recommend KT usage when there is focus on SLJ support. Our recommended tension corresponds with originally presented 75%.

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