

ORIGINAL RESEARCH

The Effects of Kinesiotape on Injury Risk in Young Tennis Players: A Randomized Trial

Nihan Ozunlu Pekyavas¹ , Senay Cerezci Duygu^{2*} , Gulcan Harput³ ,
Burak Ulusoy⁴ , Gul Baltaci⁵ 

¹Baskent University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye

²University of Health Sciences, Gulhane Faculty of Health Sciences, Orthotics and Prosthetics Department, Ankara, Türkiye

³Hacettepe University, Faculty of Physiotherapy and Rehabilitation, Ankara, Türkiye

⁴Cankırı Karatekin University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Cankırı, Türkiye

⁵Güven Private Hospital, Ankara, Türkiye

*Corresponding Author: Senay Cerezci Duygu, e-mail: senay.cerezciduygu@sbu.edu.tr

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Abstract

Objective: Injury prevention is very important factor affecting success in tennis and Kinesio Taping is a newly rising method for decreasing injury risk in athletes. This study was carried out to determine whether Kinesio Taping reduces the risk of injury to tennis players and, if it decreases, which Kinesio Tape material should be used.

Material-Method: Thirty-three young tennis players were included in our study. Assessment was done bare (no tape), after 45 min of Performance Plus Kinesio Taping application and after 45 min of Gold Text Finger Print Kinesio Taping application. Thermal analysis was done for risk of injury including both lower extremities. Quadriceps muscle was chosen from upper leg and gastro soleus muscle was chosen from lower leg region for thermal analysis.

Results: Statistically significant differences were found at lower leg and upper leg assessments for both dominant and non-dominant sides in skin temperatures between bare assessment (no tape), Performance Plus Kinesio Taping application and Gold Text Finger Print Kinesio Taping application ($p < 0.05$) in triple comparison. When comparing Performance Plus Kinesio Taping application and gold text Finger Print Kinesio Taping application, there were no statistically significant differences in skin temperature ($p > 0.05$).

Conclusion: The results show that Kinesio Taping may be an effective application for decreasing risk of injury but there is no difference between the types of Kinesio Taping material used, as long as it is applied with the same technique.

Keywords: Sports, Athletic Injuries, Thermography, Kinesiotape, Pragmatic Study

INTRODUCTION

Injury prevention is very important factor affecting success in tennis. According to The National Collegiate Athletic Association, tennis has the incidence of injury as much as contact sports¹. Also, tennis practice involves repetitive stresses that make players more vulnerable and lead to musculoskeletal injuries. Data about the frequency of injury in tennis sports were also reported in several studies. The incidence of acute musculoskeletal injuries at lawn tennis varies from 0.04 to 3.0 injuries/1.000 playing hours. According to the data obtained, the injury prevalence in tennis players is not low and many of the injuries are joint injuries²⁻⁴.

In the researchers conducted to prevent injuries, some methods have been mentioned to take

precautions against injuries. Functional Movement Screen, online monitoring systems, infrared thermography are some of the methods for the detection of injury risk in sports practice⁵⁻⁷. The use of infrared thermography in preventive rehabilitation is an effective, safe, and relatively cost-effective for detecting changes in the skin surface temperature⁸.

Kinesio Taping is a newly rising method for decreasing injury risk in athletes. Kinesio Tape with the elastic, acrylic adhesive structure differs from regular white athletic tape because of the wavelike design on the adhesive surface. The structure and elasticity of the tape provides a tensile force to the skin and is purported to lift the fascia and soft tissue, thus increasing interstitial space. When the skin is

lifted by this technique, the flow of blood and lymphatic fluid beneath the skin improves and several therapeutic benefits occurs⁹. The effects of Kinesio Taping treatments on injury risk prevention are due to the therapeutic benefits outlined above, as well as influencing range of motion, proprioception, and strength¹⁰. Yet no studies have been conducted on the effects of Kinesio Taping application on injury risk prevention by thermal injury risk analysis.

As time changes, Kinesio Taping applications and materials used change due to technological developments. Today, 4 types of different Kinesio Tape materials are presented: Kinesio Tex Classic, Kinesio Tex Performance Plus, Kinesio Tex Gold Fingerprint and Kinesio Tex Gold Light Touch Plus. The differences between these tapes are presented as nano technological differences¹¹. Classic and Performance Plus tapes are said to be effective in muscle correction techniques. For the usage in field, no studies have been found to present the difference between these two tapes and which one to use would affect performance better.

Therefore, current study had two aims; to determine the effectiveness of Kinesio Taping application on decreasing injury risk for young tennis players and to determine which Kinesio Taping material is more effective.

MATERIALS AND METHODS

Design

Randomized, double-blind trial. Clinical trial number of this study is NCT04059575. The study protocol was approved and required permissions were taken from related tennis club officials, and a written consent was obtained from all the participants' parents about the study. Evaluations were made in the centers of the tennis clubs to which the participants were affiliated.

Thirty-three young tennis players aged between 9 and 12 were included in the study (age 11.16 ± 1.56 years; BMI 18.49 ± 2.57 kg/m²). Assessments were done bare (no tape), after 45 min of performance plus Kinesio taping application (PP application) and after 45 min of gold text fingerprint Kinesio taping application (GT application). Players were randomly taped with either PP or GT taping applications using an online random allocation software program (GraphPad Software QuickCalcs, GraphPad Software Inc., La Jolla, CA, USA). Thirty minutes of rest was given between 2 taping applications after the removal of the first tape. One

participant was not able to complete the second taping procedure. The flowchart of the study is shown at Figure 1. PP and GT taping applications were done by using Kinesio taping muscle facilitation techniques to Quadriceps and Gastrosoleus muscles. I tape with a tension of 10-35% was used for muscle facilitation (Figure 2-3)¹². All patients were assessed by an experienced physiotherapist, and the tapings were done by another experienced physiotherapist. Participants and physical therapist who performed the evaluation was blind to the study to provide a double-blind structure of the study.

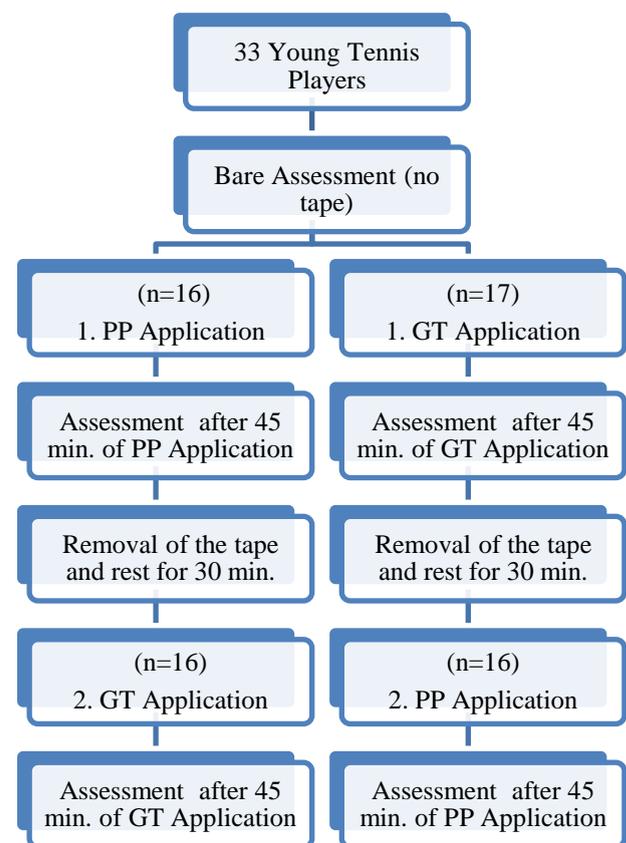


Figure 1. Flow-chart of the study

Subjects

Thirty-three young tennis players aged between 9 and 12 years were recruited in the study. The exclusion criteria included those (a) with soft tissue or bone problems affecting lower extremity, (b) who had acute inflammation affecting lower extremity region, (c) had scoliosis, (d) who had undergone any orthopedic surgery, (e) who had defined any pain or painful area at lower extremities and (f) who were obese (BMI > 30 kg/m²).



Figure 2. PP and GT taping applications for quadriceps muscle



Figure 3. PP and GT taping applications for gastrosoleus muscle

Methodology

Thermal analysis was done for the analysis of risk injury including both lower extremities. Quadriceps muscle was chosen for upper leg and gastro soleus muscle was chosen for lower leg region for thermal analysis. The thermographic assessment was performed by using FLIR E5 (FLIR Systems AB, Sweden) thermal camera to evaluate which muscles had the highest thermal activity while maintaining

stable upright posture. The part of muscle with more activation (greater heat) was measured by the thermographic camera and the heat was recorded in centigrade. Each participant was thermographically evaluated in the same room (ambient temperature, 21°C)¹³ and participants were left for 10-20 minutes to 'acclimatize' to the thermographic imaging environment^{14,15}. FLIR E5 Thermal Camera, with a resolution of 120 x 90 pixels was used for thermal imaging and the Color Palette iron was chosen for displaying the images. It is indicated that IR imaging might be a reliable and valid measure of treatment outcomes with clinical utility and sensitivity¹⁶.

Statistical analysis

The power analysis indicated that 33 participants for total were needed with 80% power and a 5% type 1 error. The power analysis of our study showed a power of 80% with tissue temperature as the primary outcome. The data were analyzed using statistical software (SPSS version 18, Inc., Chicago, IL, USA). All the statistical analyses were set a priori at an alpha level of $p < 0.05$. The tests for homogeneity (Levene's test) and normality (Shapiro-Wilk) were used to determine the appropriate statistical methods. According to the test results, nonparametric Friedman test was used for comparisons between baseline, first taping and last taping. Wilcoxon test was used for possible differences which might occur between taping applications in order to identify the application that provided the difference. Parametric test assumptions were not possible due to small sample size and inhomogeneous parameters.

RESULTS

The flowchart of the study is shown at Figure 1. The trial was ended when the number of participants calculated in the power analysis was reached ($n=33$). One participant in PP application group was not able to complete the second taping procedure. Statistically significant differences were found at lower leg and upper leg assessments for both dominant and non-dominant sides in skin temperatures between bare assessment (no tape), PP application and GT application ($p < 0.05$) in triple comparison (Table 1).

Considering pairwise comparisons, both performance PP application and GT application are found significantly different than bare assessment in terms of skin temperature ($p < 0.05$). But when comparing PP application and GT application, there

were no statistically significant differences in skin temperature ($p>0.05$) (Table 2).

Table 1. Differences between skin temperatures for different taping applications

	Bare Assessment n=33 (X±SD)	PP Application n=33 (X±SD)	GT Application n=32 (X±SD)	P
Upper Leg-Dominant Side (°C)	28.05±2.2	29.25±2.56	29.15±2.31	≤.01*
Upper Leg-Nondominant Side (°C)	27.63±2.42	29.05±2.49	28.76±2.54	≤.01*
Lower Leg-Dominant Side (°C)	30.00±1.75	30.66±1.93	30.81±1.96	0.024*
Lower Leg-Nondominant Side (°C)	30.13±1.62	30.82±1.61	30.84±1.82	≤.01*

Friedman test, * $p<0,05$, PP: Performance Plus Tape, GT: Gold Text FP Tape

Table 2. Pairwise skin temperature comparisons for different taping applications.

	Bare Assessment - PP Application	Bare Assessment - GT Application	PP Application - GT Application
Upper Leg-Dominant Side (°C)	≤0.01*	≤0.01*	0.505
Upper Leg-Nondominant Side (°C)	≤0.01*	≤0.01*	0.383
Lower Leg-Dominant Side (°C)	0.013	≤0.01*	0.800
Lower Leg-Nondominant Side (°C)	≤0.01*	≤0.01*	0.902

Wilcoxon test, * $p<0,05$, PP: Performance Plus Tape, GT: Gold Text FP Tape

DISCUSSION

In current study we found that Kinesio Taping might be an effective application for decreasing risk of injury. Also, the types of Kinesio Tape used would be more effective than other type for decreasing risk of injury and found that both types of Kinesio Tape material (Performance Plus Tape and Gold text FP) have equal effects on decreasing risk of injury.

According to many studies in the literature, tennis

has the risk of injury to the lower extremity; the most common (51%) followed by the upper extremity (24%) and the trunk (24%)¹⁷⁻¹⁹. The principal findings of these studies were that there is a great variation in the reported incidence of tennis injuries and most injuries occur in the lower extremities, followed by the upper extremities and then the trunk. We found that Kinesio Taping application on bilateral lower extremities normalizes thermally assessed risk of injury in tennis players. Also there is a research indicating that Kinesio Taping application to Gastro soleus and Quadriceps muscles might provide injury prevention in triathletes²⁰. The reason for us to apply taping on Gastro soleus and Quadriceps muscles were because of common lower extremity injuries.

Studies about tennis state that there are no randomized controlled trials investigating injury prevention measures in tennis²¹. Measurement of injury risk is a very complicated assessment because of multifactorial influence of the player during training or playing. Due to these factors, there might be minor injuries to the muscle, which might not give symptoms to the player, but might increase the temperature of injury area as a symptom of injury inflammation process. These minor injuries might form a major injury of the muscle during an exercise or training. For the evaluation of this type of injuries thermal risk analysis is a commonly used assessment method since 1900's. Thermal risk analysis is indicated as a cheap and non-invasive method used for detecting minor traumas^{22,23}. According to our results, Kinesio Taping application has shown a decrease in injury risk depending on decrease in skin temperature. We believe that Kinesio Taping application has regularized the skin temperature on areas that create injury (max 4.9%).

Our limitation was that we investigated the immediate effects of KT, but the long-term effects could have been investigated. Further studies are needed to see long-term effects of KT either PP or GT during sports activities. Also, it would be better to compare with different types of tapes as well as the sham group. However, during the study period, no negative side effects of both GT and PP were observed and none of participants reported any discomfort during assessments. Furthermore, we believe that in future studies, different sample sports can be safely applied.

There are no studies yet comparing the types of Kinesio Tape material used in neither study about performance nor injury risk. But there are some studies about the comparison of original Kinesio tape material and other taping materials. These studies indicate that Kinesio taping enhances dynamic muscle support and functional performance as much as non-elastic tape for ankle region^{19,24}. One of the hypotheses of our study was to understand which kind of Kinesio Taping material should be used to decrease injury risk better. According to the results of two different types of Kinesio Taping application, we might say that there is no difference between the types of Kinesio Taping material used if it is applied with the same technique.

Practical applications

Considering the results of our study, we might be said that Kinesio Taping has regularized the skin temperature of both Gastro soleus and Quadriceps muscle region. According to the knowledge we have about thermal risk analysis, we might say that Kinesio Taping decreases risk of injury on most injured area. This finding might be very important

for the training programs and prevention from injury of tennis players.

CONCLUSION

Our results had contributed to the knowledge of temperature changes in skin which was associated with risk of injury.

Both types of Kinesio Tape material (Performance Plus Tape and Gold Text Finger Print) had equal effects on decreasing risk of injury.

There was no difference between the types of Kinesio Taping material used, as long as it was applied with the same technique.

For future research, it could be beneficial to see long-term effects of KT either PP or GT during sports activities and add sham taping to applications.

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