Ann Appl Sport Sci, InPress(InPress): e1227.
http://www.aassjournal.com; e-ISSN: 2322–4479; p-ISSN: 2476–4981. 10.52547/aassjournal.1227

ORIGINAL ARTICLE

Acute Effect of Kinesio Taping on Balance, Agility, and Jumping Performance in Tennis Players

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Submitted June 23, 2023; Accepted in final form 30 August, 2023.

ABSTRACT

Background. Kinesio is an elastic therapeutic agent used to cure sports injuries. The review of the literature revealed numerous studies on the usage of Kinesio tape while treating injuries, but it may also be used regularly in sports branches to improve sports performance parameters. **Objectives.** This study aimed to analyze the acute effect of Kinesio taping on balance, agility, and jump performance among 8-12 age-group tennis players. **Methods.** The study voluntarily included 22 tennis players (age 10,32±0,95 years, sports ages 3,43±0,82 years, stature 143,21±5,66 cm, body weight 39,73±5,92 kg, body-mass index 19,33±2,39 kg/m2). Physiotherapist affixed Kinesio tape to the participants' dominant ankle peroneal muscles using the muscle technique to assess the effects of taping. Measurements took place as a pre-test before the taping and a post-test after the taping. The measured parameters were the Star Excursion Balance Test (SEBT), T-Agility Test (TAT), and Vertical Jump Test (VJT). The study used the Statistical Package for Social Sciences (SPSS) Version for IBM, 23.0 programs for the data analysis. **Results.** As a result, the test results with Kinesio tape (with KT) were statistically and significantly better ($p<0.05$) when comparing the balance, agility, and jump tests with and without KT cleaved to the peroneal muscles. **Conclusion.** The study concluded that the Kinesio tape application onto the peroneal muscles by the appropriate muscle technique in 8-12 age-group tennis players had a statistically significant effect on balance, agility, and vertical jump performances.

KEYWORDS: ***Agility, Balance, Kinesio Taping, Jumping, Tennis***

INTRODUCTION

Kinesio is a tape invented by Dr. Kase in the 1070s and is an elastic therapeutic agent used to cure sports injuries and various other ailments (1, 2). Its texture is roughly the same thickness as human skin and can be stretched longitudinally to 20-40% of its original length (3). The unique texture and elasticity of the tape enable it to affix to the top layer of the skin and stimulate the elastic fibers in the skin; As a result, it improves the subsurface skin circulation, makes skin tissue function physically more comfortable, lessens feeling discomfort, and serves to relieve abnormal muscle strain so that muscle and fascia may eventually return to their physically normal state (4). The review of the literature revealed numerous studies on the usage of Kinesio tape while treating injuries. It may also be used regularly in sports branches to improve performance. Hsu et al. (2009) reported that Kinesio tape application statistically and significantly influenced the lower trapezius muscle strength (5), and Nakajima and Baldrige (2013) found that using Kinesio tape significantly improved dynamic postural control for certain aspects in women (6). Additionally, Müller and Branders (2015) stated that Kinesio tape application considerably escalated ball speed in football and handball (7) and Doğan (2015)

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discovered that Kinesio taping improved lower extremity jump performance and dynamic postural control in professional football players (8). Finally, Çelenay and Ünlüler (2019) noted that trunk Kinesio taping extended trunk muscle endurance instantly (9), while Lee and Choi (2018) emphasized that Kinesio tape application significantly improved men's and women's hand grip strength after having Kinesio tape applied to their dominant hand flexor muscles (10).

Apart from many other sports branches, tennis is an attention-grabbing discipline to advance children's developmental levels. Children should be introduced to this sport branch at a young age since it is a discipline potentially achieved with regular and escalating training (11). The athleticism and physical prowess of the players are the primary performance indicators in a tennis match (12). A professional tennis game could run anywhere from 45 minutes to 5 hours. During this time, the athlete constantly moves sideways, forward, backward, and diagonally in various directions to keep the ball in play by changing positions rapidly. Such an effort indicates how significant agileness is for tennis players. Hence, it is explicitly critical for a tennis player to retain good agility, move quickly to start and stop the game, strike the ball, retrieve for the next stroke, and take a swift position. Good agility is also associated with movement efficiency, which enables energy savings throughout the game (12). Balance ability is another factor affecting tennis performance. This term refers to keeping the balance throughout the body and holding the position during and after body movement in the game (13). Keeping balance enhances training performance even more and is crucial to upholding and sustaining the body composition required for high-level performance in sports (14). It appears that tennis is one of the sports branches where static and/or dynamic balance limits performance (15). Retaining a substantially dynamic balance enables tennis players to play the game in a controlled manner, hit the ball powerfully and accurately even when running, and uphold body control while executing such difficult shots (12). In addition to all these skill requirements, Gullikson (2003) indicated that the jumping ability is crucial for the players to deliver more satisfactory game performance (16). Tennis is a complicated sport requiring extremely motor elements and technical skills. For successful tennis players to display all their motor skills, they should have a fit ankle, be free from injuries, and be at an optimal level of mobility, enabling them effortless to adapt to excessive training and heavy charges (17). There are a variety of applications in which athletes practically manage ankle mobility or stability to improve their balance, agility, and jumping performance during matches. Kinesio taping is one of the applications (18).

Athletes diversely use this taping technique to enhance their performance, and studies into the subject continue progressively. Therefore, this study aimed to analyze the acute effect of Kinesio taping on balance, agility, and jump performance parameters on tennis players in the 8–12 age group.

MATERIALS AND METHODS

Features of Research Group. The research group consisted of random 22 tennis players with an average age of 10.32±0.95 years and a sportiveness period of 3.43±0.82 years. Participants also had 143,21±5,66cm, 39,73±5,92kg, and 19,33±2,39kg/m² average stature, body weight, and body-mass index, respectively. Measurements took place in Ankara Yıldırım Beyazıt University tennis court. The study received its ethics committee approval from the Gazi University Ethics Committee dated 30.12.2022 and numbered E.547129. After receiving thorough information about the study content and the measurements, tennis coaches gave their verbal consent, and tennis players and their parents provided a written 'Informed Consent Form. 'The measurement process took place in the form of pre-test and post-test and participation in the tests was voluntary.

Measurements and Tests Used for Research Data Collection. The tests were conducted on the training program's rest day, as it was also the day off from both training and competition and weariness was minimal. The measurement procedures took four weeks. Initially, the athletes were given detailed information about the tests, which were then applied to each athlete individually in practice to minimize the learning process during the first week. The study followed the same procedure to take measurements throughout the other three weeks. According to this procedure, the initial measurements without KT were taken in three repeats, with a one-minute rest between each repetition. After a 10-minute relaxation, measurements were obtained in three

repeats, again with the KT applied by a physiotherapist, with a one-minute rest between each repetition. Subsequently, the balancing, jumping, and agility tests were conducted in the second, third, and fourth weeks, respectively, to complete the measurement process.

Kinesio Taping Application. The size of the applied Kinesio tape was determined by the measurements of the muscle elongation distance, and its width ranged between 2.5 and 5 cm. Accordingly, they were affixed using the muscle technique to the peroneus longus and peroneus brevis muscles of the tennis players' dominant foot to reinforce the tibiofibular ligament. Physiotherapists, who received training for Kinesio taping performed the process. Tennis players were asked to be in a lengthy seated stance with their feet outstretched during the procedure. Kinesio tape was cut 2.5 cm wide. Initially, while the foot was in plantar flexion and inversion posture, it was affixed to the skin from the origin to the insertion of the muscle by applying 25-50% tension to the center section of the Kinesio tape without any tensity to the anchor parts of the peroneus brevis muscle, using the muscle technique (Figure 1). Afterward, again, using the muscle technique and at the same postures, the peroneus longus muscle was taped by the Kinesio to the skin from the muscle's origin to its insertion by applying 25-50% tension to the central section of the Kinesio tape without putting any pressure to the anchor parts. To support the talofibular ligament, a 5 cm wide Kinesio tape was used with 25% tension and cleaved to the lateral malleolus to support the ligaments surrounding the anterior and posterior talofibular ligament.

Figure 1. Kinesio taping application.

Stature. The data was recorded in centimeters (cm) with a Seca (Germany) brand stadiometer with a precision of 0.01 m.

Body Weight and Body Mass Index. Xiaomi-branded (China) scales with a 0.1 kg precision were used to measure body weight. While calculating the body mass indexes, the formula for body weight (kg)/body height (m^2) was used (19).

Star Excursion Balance Test. The dynamic balance of the athletes was measured using the SEBT, which is a straightforward, affordable, and reliable test (20, 21). A total of eight tapelines of 150 cm each was attached to a flat surface, intersecting their midpoints and making an angle of 45° between them to form the star-shaped test setting. About the stance leg, reaching directions was denoted by the letters, including anterior (A), anteromedial (AM), medial (M), posteromedial (PM), posterior (P), posterolateral (PL), lateral (L) and anterolateral (AL) (Figure 2) (22). Tennis players were allowed to try the test before the measurement. During the test, they had to stand in the center of the star-shaped area on their dominant foot and with their hands on their waists. They were requested to reach across the line with the tip of the contralateral foot and lightly touch the ground with their foot tip. The distance stretched out was recorded in centimeters. Participants were instructed to extend their muscles three times in each direction, and the average of these three measures was recorded in centimeters. After each stretch, there was a one-minute rest. Participants consistently rotated clockwise, picking a starting position randomly to eliminate the learning effect.

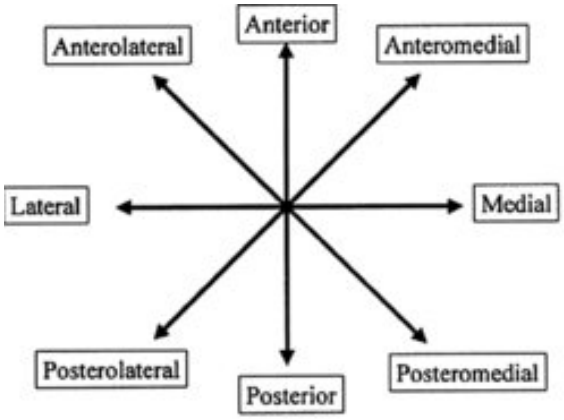

Figure 2. Star excursion balance test.

T-Agility Test. TAT is a four-way agility and body control test that measures the ability to change directions quickly while concurrently keeping balance without losing any speed (23). It is an accurate and reliable test to measure the agility parameter of athletes (24). After the start command, the tennis players begin the test at the offset position. They were instructed to touch cones respectively like figure 3 (25). Before the test, the participants received a brief on the test procedure, subsequently asking them to complete it as quickly and correctly as they could and recording their duration in seconds. The test was repeated three times, with a one-minute rest between each repetition, to determine and record the average records.

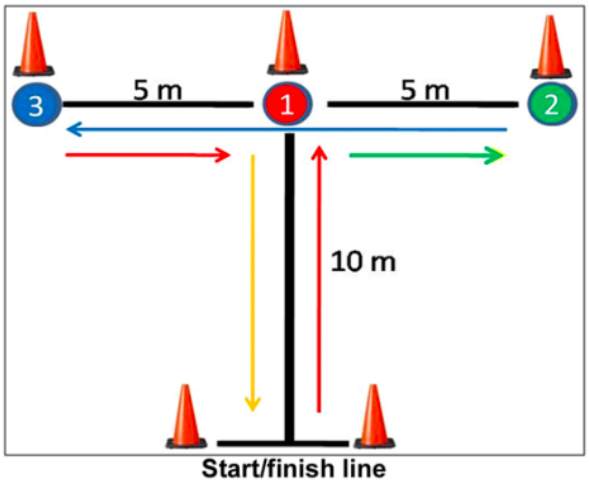

Figure 3. T-agility test protocol.

Vertical Jump Test. VJT is a test whose validity and reliability were conducted in 1998 to measure the vertical jump performance of athletes (26). As developed by Dr. Dudley Allen Sargent, the test protocol is as follows (Figure 4). The test was repeated three times, giving a one-minute rest between each repetition, averaging the distance in centimeters.

Data Analysis. The study used the Statistical Package for Social Sciences (SPSS) Version for IBM, 23.0 programs for the data analysis. Accordingly, the Shapiro-Wilk Test analyzed whether the variables had a normal distribution. The sample paired test was used to compare normally distributed groups, whereas the Wilcoxon Signed Rank test was employed to compare groups displaying non-normal distribution. While setting the confidence interval at 95%, the 5% ($p<0.05$) threshold values were considered statistically significant.

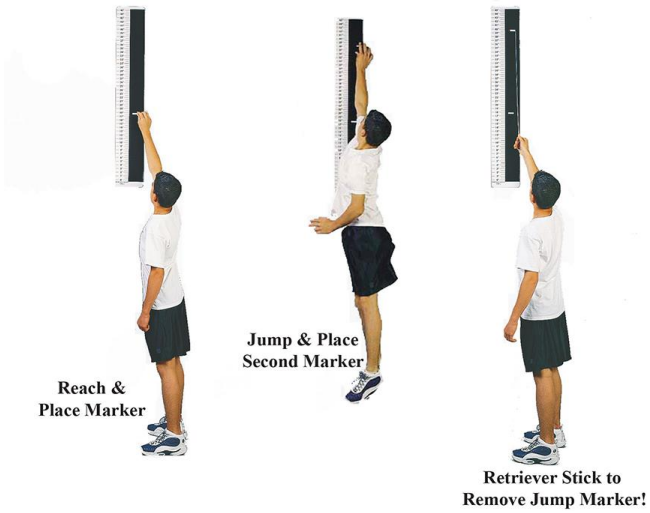

Figure 4. Vertical Jumping.

RESULTS

Table 1 displays the statistical analysis result for the A, AM, M, PM, P, PL, L, and AL regions of the SEBT, TAT, and VJT parameters representing the data as mean and standard deviation (SD) values. The statistical comparison of the data recorded with Kinesio tape (with KT) and without Kinesio tape (without KT) revealed that the KT application to the peroneal muscles resulted in a statistically significant difference in all directions of the SEBT ($p<0.05$). The data also indicated that the peroneal muscles' response to the KT had a statistically significant impact on T-test agility ($p=0.000$). Correspondingly, the effect of the KT application on the peroneal muscles was statistically significant on the VJT parameter ($p=0.000$).

Table 1. Comparison Results of SEBT, T-Test Agility, and VJT Data with KT and without KT

Parameters	Without KT Mean (cm) ± SD	With KT Mean (cm) ± SD	p
Anterior (A) (cm)	85.60 ± 0.82	87.90 ± 0.63	0.009*
Anteromedial (AM) (cm)	85.30 ± 1.00	86.60 ± 0.91	0.000*
Medial (M) (cm)	84.59 ± 1.40	85.85 ± 1.30	0.000*
Posteromedial (PM) (cm)	82.48 ± 1.55	83.21 ± 1.55	0.009*
Posterior (P) (cm)	74.50 ± 0.27	76.30 ± 0.85	0.009*
Posterolateral (PL) (cm)	71.90 ± 1.69	73.30 ± 1.66	0.009*
Lateral (L) (cm)	70.00 ± 0.33	70.60 ± 0.82	0.000*
Anterolateral (AL) (cm)	78.90 ± 0.51	82.00 ± 0.61	0.000*
T-Test Agility (sec)	16.46 ± 1.95	15.78±1.86	0.000*
Vertical Jump Test (cm)	202.08±10.69	203.61±10.82	0.000*

*: Statistically significant at significance level 0.05

DISCUSSION

The study findings indicated that the Kinesio tape application resulted in a statistically and positively significant outcome for all parameters analyzed, including balance, agility, and jumping ($p<0.05$). Kinesio tape has begun to gain recognition on a global scale as a supporter of athletic performance with the use of athletes from diverse sports disciplines in the 2008 Beijing Olympics. Yet it has been extensively applied for this purpose for over 25 years (27). Hitherto, several Kinesio tape-related studies focused on numerous parameters that would potentially affect the performance of athletes. Balance is one of these parameters. However, the literature review revealed contradictory results, concluding that the effect of Kinesio taping might be either positive or ineffective on the balance parameter.

As reported in the following studies, for instance, the Kinesio tape was considered affectless on balance: Bayraktar (2017) stated that

the Kinesio tape application to the ankle of 24 taekwondo athletes, averaging 21 years of age, did not affect the postural sway (27). Nunes et al. (2013) indicated that Kinesio taping had no significant impact on dynamic balance performance, according to 20 athletes, with an average age of 22.33 years, from athletics, handball, volleyball, and football branches (28). Similarly, concluded that the effect of Kinesio taping was insignificant on dynamic balance in semi-professional athletes (29). Contrary to these findings, studies in the literature also report that the Kinesio tape application positively impacts the balance parameter. For instance, Çamcı et al. (2010) stated that Kinesio tape has a statistically significant and positive effect on postural control in female volleyball players (30). Semple et al. (2012) conducted a study on 31 rugby players averaging 19.57 years of age and concluded that Kinesio tape application significantly improved postural control (31). Similarly, documented that Kinesio taping application substantially improved postural control in 15 dancers with an average age of 23 (32). Most of these studies explicitly used the muscle technique for Kinesio taping application. The current study also used the muscle technique for Kinesio tape applications and concluded that it had statistically positive and significant effects on balance. In this context, it is safe to say that the studies published in the literature have comparable findings. It was also explicit that the research subject groups under consideration typically had average ages of 18 or above and no studies are focused on the effect of Kinesio taping on balance among athletes aged 8-12. Given that children between the ages of 8 and 12 were the focus of the current study, its findings about the positive effect of Kinesio taping on balance performance in this age range would potentially provide a significant contribution to the literature. In this age group, the use of Kinesio tape would additionally encourage dynamic balance in tennis-like games, where quick turns and changes in course are typical. The current study also found that the effect of Kinesio taping was statistically significant on the agility parameter.

The literature review disclosed very few studies associated with Kinesio taping and agility. For instance, a study reported that Kinesio taping was ineffective on the balance and agility parameters among 20 male basketball players aged 18-22 who experienced ankle sprains (33). Correspondingly, the other indicated that Kinesio tape application to the peroneal muscles of 17 female volleyball players averaging 17.82 years of age, was ineffective on agility performance (34). Contrary to these studies, indicated that adhering to Kinesio tape separately to the quadriceps and gastrocnemius muscles among 32 male volunteers aged between 18-38 provided significant improvement in agility performances for both muscle groups (35). Mostaghim et al. (2016) analyzed the effect of Kinesio taping application on the quadriceps muscle on physical fitness tests and stated that there was a significant improvement in agility performance in measurements made 24 hours after the taping procedure (36). Considering the research group on which the current study focused was between 8-12, it is conceivable to argue that the positive effect of Kinesio tape application on tennis players' agility parameters at this age range would be a valuable contribution to the existing literature. Indeed, Aktaş et al. (2021) published a study supporting this view and conclusion, reporting that the Kinesio tape applied to 15 male table tennis players between the ages of 10-12 improved the agility parameter (37).

The current study identified that the muscle technique used to cleave the Kinesio tape to the peroneal muscles had a statistically significant and positive effect on vertical jumps. Considering the relationship between Kinesio taping and jumping, the current literature mainly analyzed the short- or long-term effects of Kinesio taping applied to one or more muscles (38-40). Furthermore, these studies predominantly concentrated on vertical jumping while analyzing the jump performance (6, 41) and typically preferred m. Quadriceps (39), or m. Gastrocnemius (40) when deciding which muscle group to apply the Kinesio taping. This study, however, focused on peroneal muscles as an applied field and also on an age group that hasn't been examined before, it is thought that it might offer a new perspective to the existing literature for Kinesio taping. The subject-related literature review revealed the following: Mendez-Rebolledo et al. (2018) found no improvement in vertical jump and squat jump after 24 hours of Kinesio tape application in 12 male athletes with an average age of 23.4 years from diverse branches (42). Kümmel et al. (2011) documented that the Kinesio tape application was ineffective on the vertical jump, according to their study

conducted by 11 participants averaging 25 years of age (41). Tamura et al. (2020) also reported that Kinesio taping applied to the vastus medialis obliquus muscle of 13 college students averaging 19.7 years of age using y-type tape and facilitation technique lowered the vertical jump height and consequently reduced jump performance (43). Similarly, Huang et al. (2011), who studied 21 participants between 21-31 years of age indicated that the vertical ground reaction force increased after Kinesio tape application, whereas the vertical jump height decreased (40). These findings explicitly demonstrate that the studies focusing on athletes are limited, and the most general sense is that Kinesio taping has no short-term effect on jumping. Yet, the current literature also includes studies supporting that Kinesio taping has a short-term, significant impact on vertical jump (40, 44). One of the accessible, albeit limited, sources, Karimijashni et al. (2020), reported that Kinesio taping used on athletes improved vertical jump performance (41). In line with the findings of the current study, it is reasonable to speculate that the finding —that Kinesio tape used on the peroneal muscles may have favorable effects on jumping performance acutely— may be one of the few instances that lend support to this argument. The literature analysis uncovered numerous articles exploring Kinesio tape applications on diverse muscle groups using various taping methods and types, all of which had different impacts on balance, agility, and vertical jump performance. Many of these studies explicitly used participants spanning a wide range of ages and high-performance levels. Unlike the others, the current research focused on the applicability and the effects of Kinesio taping on younger age groups.

CONCLUSION

In conclusion, the current study determined that Kinesio tape might provide statistically significant, positive, and substantial results in those who have just begun sports at children's setup and are willing to improve their performance. This study also proved that Kinesio taping has a performance-enhancing impact on the balance, jump, and agility parameters acutely. Therefore, it is suggestible that training or competition performance for the younger age group should incorporate Kinesio tape application to the peroneal muscles with the muscle technique.

It is assessed that further studies regarding the effect of Kinesio taping on different parameters for younger age groups where performance development is crucial.

APPLICABLE REMARKS

- This study, unlike the others, focused on the applicability and the effects of Kinesio taping on younger age groups.
- It is suggestible that training or competition performance for the younger age group should incorporate Kinesio tape application to the peroneal muscles with the muscle technique.

AUTHORS' CONTRIBUTIONS

Study concept and design: Hüseyin Kargın, Sezen Çimen Polat. Acquisition of data: Hüseyin Kargın, Sezen Çimen Polat. Analysis and interpretation of data: Hüseyin Kargın, Sezen Çimen Polat. Drafting the manuscript: Hüseyin Kargın, Sezen Çimen Polat. Critical revision of the manuscript for important intellectual content: Hüseyin Kargın, Sezen Çimen Polat. Statistical analysis: Hüseyin Kargın, Sezen Çimen Polat. Administrative, technical, and material support: Hüseyin Kargın, Sezen Çimen Polat. Study supervision: Sezen Çimen Polat.

CONFLICT OF INTEREST

There is no conflict of interest between the authors.

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