Türk Fizyoterapi ve Rehabilitasyon Dergisi

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THE EFFECT OF KINESIOTAPING ON ISOKINETIC KNEE STRENGTH DURING LONG TERM VOLLEYBALL TRAINING PROGRAM

RESEARCH ARTICLE

ABSTRACT

Purpose: The aim of this study was to investigate whether taping the quadriceps muscle using the KinesioTex facilitation technique affected isokinetic strength during an 8-week training program.

Methods: 20 female volunteer volleyball players aged 15–19 were divided into two groups; taping and control group. Isokinetic muscular strength was measured three times: before taping (1st measurement), 45 minutes after the first taping (2nd measurement) and after an 8-week taping process (3rd measurement).

Results: No significant differences were found between taping and control groups in isokinetic strength of Quadriceps ($p>0.05$). No significant variations were seen in peak torque and total work values before taping and after the 8-week taping process ($p>0.05$).

Discussion: In conclusion, it can be seen that long-term taping for healthy individuals does not cause any increase in muscle strength. The reason why no significant results are observed in other parameters may be that Kinesio® taping does not give sufficient tactile stimulus to cause increase in strength of healthy individuals; or that the facilitation technique suggested for Quadriceps muscle is insufficient, on its own, to stimulate the muscle.

Keywords: Kinesiotaping, quadriceps femoris, muscle strength, volleyball

VOLEYBOL ANTRENMANI SÜRESİNCE KİNESİO TAPE UYGULAMASININ DİZ İZOKİNETİK KAS PERFORMANSINA ETKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Araştırmada amaç, 8 haftalık antrenman programı süresince Quadriceps kasına KinesioTex fasilitasyon tekniği kullanılarak uygulanan bantlamanın izokinetik kas kuvvetine olan etkisini araştırmaktır.

Yöntem: Yaş aralığı 15-19 olan 20 kadın gönüllü voleybol oyuncusu bantlama (N=10) ve kontrol grubu (N=10) olarak rastgele iki gruba ayrıldı. İzokinetik kas kuvvetleri üç kez ölçüldü: bantlamadan önce (1. ölçüm), bantlamadan 45 dakika sonra (2. ölçüm) ve 8 haftalık bantlama işleminden sonra (3. ölçüm).

Bulgular: Bantlama ve kontrol grubu arasında izokinetik kas performansında fark ($p> 0.05$) bulunmamıştır. Bantlama öncesi ve 8 haftalık bantlama işlemi sonrasında da zirve tork ve total work değerleri arasında anlamlı farklılıklar görülmemiştir ($p> 0.05$).

Tartışma: Sağlıklı bireylere uzun süreli uygulanan bantlamanın izokinetik kas kuvvetinde herhangi bir artışa neden olmadığı görülmektedir. Anlamlı farklar görülmemesinin nedeni Kinesio® bantlamanın sağlıklı bireylerde kas kuvveti artışına neden olacak oranda yeterli taktil uyaran vermemesi ya da Kuadriseps kasına fasilitasyon tekniği ile yapılan bantlamanın kası stimüle etmekte yetersiz olması şeklinde düşünülebilir.

Anahtar Kelimeler: Kinesiotaping, quadriceps femoris, kas kuvveti, voleybol

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INTRODUCTION

Kinesio Tex Tape is an elastic adhesive tape that was developed by Kenzo Kase, in 1973. The tape can stretch to 120–140% of its own length. It is used by or without being stretched, in accordance with the intended purpose. It is 5 cm width but can be shaped to different sizes via scissors, again in accordance with the purpose and the characteristics of the area to which it is applied (1,2). The general effects of Kinesio taping is that, by adhering to the upper level of the skin and gathering the elastic fibers of the tissue there, it increases the hypodermic blood and lymph circulation and therefore enables the tissues to physical operations easier. MacGregor and colleagues described the possible effect mechanism of the tape as causing an increase in cutaneous afferent stimulation and motor unit initiation via neuro-facilitation and mechanical stabilization methods (3). Previous studies of this product reported that it increases the motion range of joints, has positive effects on pain and function, controls the blood circulation and increases muscle contractibility along with its supportive effect to the treatment (3-5).

Muscular strength is the muscular power applied against kinetic or static objects and is measured in appropriate positions and motions with tests performed at maximum effort (6). The frequent repetition of activities such as bouncing, falling down, running and dive-rolling in volleyball exposes the knee joint to serious tensions. The anatomic regularity of the knee joint and muscular strength are highly important in order to deal with these tensions. The Quadriceps Femoris muscle is one of the most important strength and stabilization sources of the joint (7). Muscle strength is a key component of performance of athletes and many studies like Fu and friends' investigate if it can be influenced by taping (8). Some studies suggest that the claim to increase stimulation in the acute effect of Kinesio taping is not that much to reflect upon muscular strength and they relate this to data showing that at least 4 to 6 weeks exercise training is necessary to produce any increase in muscular strength (9). Theoretically, the Kinesio taping application, which was reported to support the bioelectrical activities of muscle (2), can give support to the power of the muscle to which it is applied by stimulating the neurological system (10) or/and increasing the blood circulation in the taped area (11,12) much more during a training program, where muscle activity is high.

Therefore, the purpose of this study was to determine the effects offered before help the muscle strength increase or not after an 8 week long application during the practice sessions in quadriceps muscle of volleyball players.

METHODS

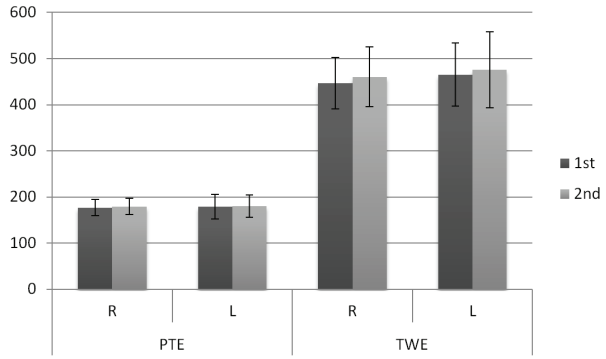
The study included 25 female volunteers, aged 15–19 years (mean tape group 17.5 ± 1.35 years, control group 17.9 ± 0.73 years). They are all members of Gazi University Sports Club; a second league volleyball team in Turkey. All participants had played volleyball for at least 2 years and were free from any lower extremity injuries during the preceding 6 months. Exclusion criteria were: an allergy to the tape, or the occurrence of any problem preventing the subjects following the regular training programs (including lower extremity injury after the training program began).

The study was approved by the Scientific Research Ethics Committee at Gazi University in Ankara, Turkey. Volunteer participants were informed about the study and all completed an informed consent form (competed by a parent where the athlete was younger than 18 years).

The participants were divided into two groups: taped (Experimental group T; n=13), and non-taped (Control group C; n=12), were observed for 8 we-

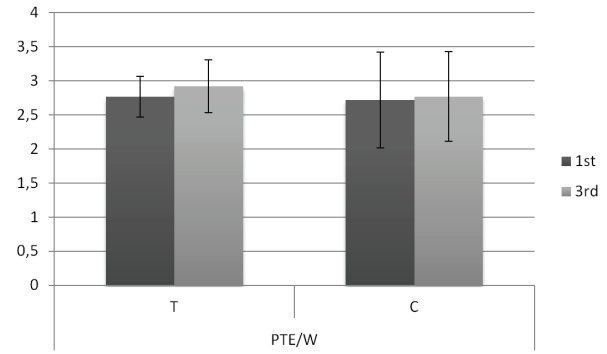
Table 1: Baseline physical measurements of athletes.

Variable	BBody Height (m)	VBody Weight (kg)	YAge (yrs)	BBMI (kg/m2)
Group T (N=10)	1.80 ± 7.97	64.1 ± 5.93	17.5 ± 1.35	19.92± 1.54
Group C (N=10)	1.77 ± 6.02	61.7 ± 4.94	17.9 ± 0.73	19.61± 1.23



Graph 1: The average of the first and second measurements of both knees.

The values of rigth and left knees of all subjects in first and second measurements. Rigth (R) and left (L) knees.



Graph 2: The average of the first and third measurements of rigth knee.

The PTE/W values of rigth knees of tape group (T) and control group (C) in first and third measurements.

eks. To make each group include nearly same numbers of jumpers and diggers in order to balance the groups about muscle activity of lower extremity during the practices, randomization was made by Pocock- Simon Method. The isokinetic muscular strength of all participants was tested prior to the training program; all participants subsequently followed the same 8-week training program, with the experimental group being taped by the same investigator in every session. Follow-up tests were conducted at the end of the 8-week training period.

The subjects trained for 2 hours per day, at least for 5 days a week. During the training period, 3 players from the taped group and 2 players from the control group were excluded due to injuries and the study was finalized with 20 athletes (Figure 1).

Isokinetic knee extension muscular strength was measured by an ISOMED 2000 device. As a preliminary test, after a 3-minute free warm-up, which includes active stretching of lower extremity muscles and body weight exercises of quadriceps and hamstring muscles varying due to the athletes' warm-up practices. The taped group were seated on the isokinetic machine at 90° stabilized both their waist and knee joints, and then at a 60°/s velocity test was conducted. After this measurement, the Quadriceps muscle of the subject was taped with a Y-shaped cut (Figure 2) and applied with a 10–15% paper-off tension, in accordance with the facilitation technique (12). Afterwards, the subject remained in the facility for 45 minutes until the second measurements were performed (8,13).

The taping was performed in the suggested position by the same investigator, a minimum of 1 time every 4 days as the effects of the tape are thought to have decreased by the fourth day after taping and some related studies were still being carried out, tape usage is not permitted for more than 4 days even though the tape was still strong (1,14).

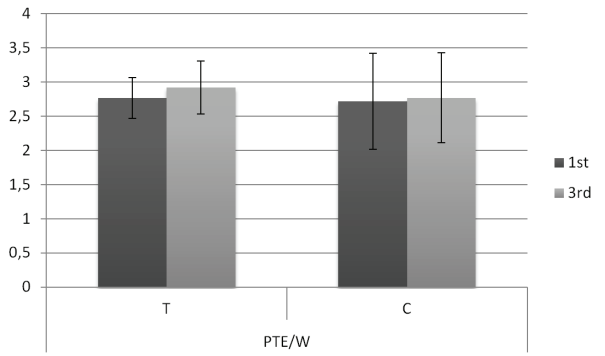
Statistical Analyses

The data were analyzed using the Statistical Package for the Social Sciences (SPSS version 15.00) software. Descriptive statistics were calculated for all variables and are reported as mean ± standard deviation (SD). The data was checked for normality using the Kolmogorov-Smirnov test; normally distributed data was evaluated by the Student-t test and non-normal distributions were evaluated by the Wilcoxon test. MANOVA repeated measurements test was used for the 8-wk period measurements of two groups' comparison. Statistical significance was set at $p<0.05$ for all tests.

RESULTS

There were no significant differences in physical characteristics between the groups ($p>0.05$) (Table 1). The mean BMI of Group T (tape group) was 19.92± 1.54 kg/m2 and Group C (control group) was 19.61± 1.23 kg/m2. The mean ages were; Group T 17.5 ± 1.35 years and Group C 17.9 ± 0.73.

All Peak Torque Extension (PTE), Total Work Extension (TWE) and Peak Torque Extension/Weight (PTE/W) parameters were studied and there were no statistical differences between the measurements of any parameters.



Graph 3: The average of the first and third measurements of left knee.

The PTE and TWE values of tape group (T) and control group (C). *PTE: Peak Torque Extension. *TWE: Total Work Extension. *PTE/W: Peak Torque Extension/weight. *R: Rigth. *L: Left. *T: Tape group. *C: Control group.

Considering the acute taping effects, there were no significant increase in any data both on the right or left legs before taping (1st measurement) and the measurement performed 45 minutes after taping (2nd measurement) (p≥0.05) (Graphic 1). There were no significant differences in the right (Graphics 2 and 3) and left legs of the players between the measurement performed before taping (1st measurement) and the follow-up measurement after the 8-week taped training (3rd measurement) program in any parameters (p>0.05).

DISCUSSION

This study examined whether Kinesio tape, which is an elastic tape commonly used by athletes from many disciplines, has any effect on muscular strength. In our study based on strength, it is hard to find 25 athletes who do the same technical and strength program. Further investigations based on strength may include other sport branches to overcome this problem.

These are the limitations of this research. Published literature found that Kinesio taping had no effect on strength (15). However, other studies reported that ultrasonography showed improvement in muscle cells, which can increase muscular performance (16). In several studies of the amount of muscular support, it was found that the tape had some effects that facilitate and eliminate function disorders and pain. It is surmised that these effe-

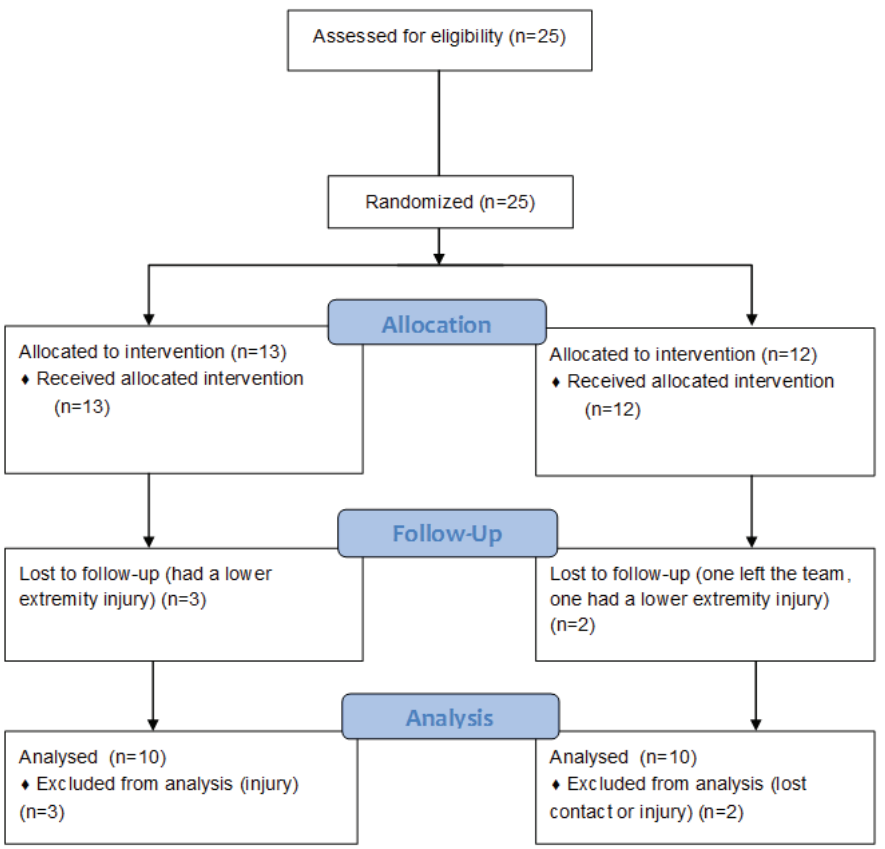


Figure 1: Consort Flow Chart.

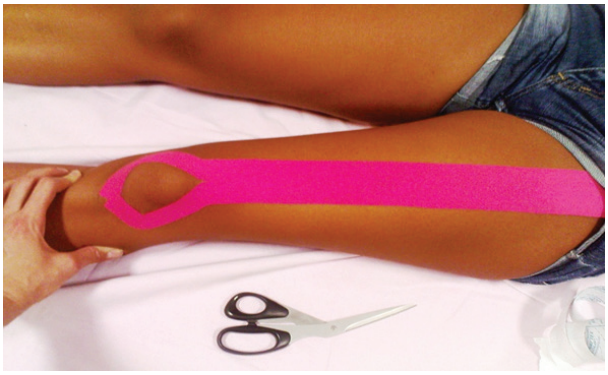


Figure 2: Y shape M. Quadriceps Femoris Kinesio Taping.

cts are due to the constant positive feedback and postural reformations (17,18). Some researchers commented that the variations in their data suggest that the effects of Kinesio taping may vary between individuals (19).

A scientific question is the amount of tactile stimulus on the skin provided by the effects of the different clinging patterns of the Kinesio taping. Some researchers working with injured individuals suggested that Kinesio taping increases the bioelectrical activity of the muscle to which it is applied and so enables the muscle to produce a greater muscular strength (4). This suggestion is not supported by the results of our study, based on several strength parameters measured in healthy volleyball players. In our study, it is seen that the tactile stimulus provided by long term taping does not cause a significant force increase for healthy athletes; this results does not support the theory of a facilitation effect on the muscle with its own tension in the direction of the muscular fibers beneath the skin to which the tape is applied (20). It is assumed that this result may occur because Kinesio taping does not provide sufficient tactile stimulus to cause a strength increase in healthy individuals (8); or that the facilitation technique suggested for quadriceps muscle is not sufficient, on its own, to increase the muscle strength. A similar study by Aktaş et al. reported significantly increased peak torque in Kinesio-taped quadriceps muscle (measured at a rate of 180˚/s) compared with braced or non-taped muscle; however, they did not observe any difference in the isokinetic measurement performed at a rate of 60˚/s. Aktaş et al. suggested that this was attributed to increased range of joint extension due to mechanoreceptor stimulation, and that Kinesio taping can provide sufficient tactile stimuli to increase muscle function in healthy individuals (21).

Tactile stimuli are important inputs that are known to affect motor control by increasing stimulation of the central nervous system, and are commonly used in treatment phases, accordingly (15,22). However, it remains unclear whether these inputs increase muscular power; in other words, whether they provide any practical improvements for healthy individuals. A study by Tieh-Cheng Fu et al. emphasized that differences in muscular stimulation caused by the tape may be too small to affect the physiological characteristics of healthy athletes, and therefore no significant difference is found in the results (8).

Similarly, a study of vastus medialis muscle by Slupik et al. reported that transdermal EMG measurement performed 24 hours after taping showed increased maximum torque values of the muscle compared to the values measured before taping (14).

In a study by Murray on quadriceps and hamstring muscle groups of two individuals who underwent ACL operation, it was found that the muscular activities of the individuals who were tracked with non-elastic tape and Kinesio taping showed a 150% increase immediately after Kinesio taping (4). According to Yin-Hsin Hsu et al., Kinesio taping causes increases in electrical activities in m. serratus anterior and m. trapezius muscles during scaption motion for individuals with impingement syndrome (9). Stedge et al. found no statistically significiant changes in healthy populations' Gastrocinemius muscles and our study agrees with this results (23). Our study agrees with Wong et al. about KT does not increase quadriceps muscle strength in healthy subjects (24). They suggested that KT may provide tactile input and stimulate the mechanoreceptors and such stimulation might alter the firing time of the motor neurons, but not be strong enough to enhance muscle strength.

It is suggested that the non-significant results were influenced by the small sample size, and that some of these observations would be statistically significant with a larger number of observations.

In our study, we found that long-term Kinesio taping did not have any effect apart from the one provided the healthy female young volleyball players by the applied training program or an acute effect of muscle strength increase. With these results, although it may be concluded that the quantity of the tactile stimuli provided by the long-term taping on healthy individuals may be insufficient to produce an increase in isokinetic strength, this conclusion can not be generalized without repeating the tests for different sports, gender and taping techniques. Also other factors such as Hamstring muscle elasticity, other lower extremity biomechanical disorders and the training programs should be researched in the future and testing techniques such as EMG can be applied to see whether the facilitation is provided by the taping.

CONCLUSION

In conclusion, our findings indicate that Kinesio taping does not facilitate or increase the isokinetic strength of quadriceps muscle in an acute way, also does not cause increase in strength in the long-term applied during the training period.

Limitations of this study were that subjects who assessed were young and the number of volleyball players were low. So, the generalizability of these results to the whole athlete population is uncertain. However, important findings emerging from this study might provide guidance for future studies that may use a greater number of subjects.

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