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Acute Effect of Kinesio Taping Applied to Gastrocnemius Muscle on Jumping Performance in Athletes and Sedentary Individuals

Sporcu ve Sedanter Bireylerde Gastrocnemius Kasına Uygulanan Kinezyo Bantlamanın Sıçrama Performansına Akut Etkisi

Kağan ÜSTÜN[1], Hilal IRMAK SAPMAZ[2], Sadık Buğrahan ŞİMŞEK[2]

[1] Tokat Gaziosmanpaşa University, Health Sciences Institute, Tokat, Türkiye
[2] Tokat Gaziosmanpaşa University, Faculty of Medicine, Tokat, Türkiye

Abstract

Aim: This study aimed to investigate the acute effect of kinesio taping applied to athletes and sedentary individuals on vertical and horizontal jumping performances.

Material and Method: The study included 20 licensed male basketball players and 20 male sedentary individuals between the ages of 18-25. Vertical jump height and horizontal jump distance were evaluated. Free jumping and squat jumping tests were applied to measure the vertical jump height. Single leg hop test was chosen for the measurement of horizontal jump distance. Single leg hop test was performed with the dominant foot. Tests after kinesio taping were performed 10 minutes after facilitation technique was applied to gastrocnemius muscle.

Results: A comparison of the pre- and post-taping data in the athlete group revealed a significant increase in both squat jump and single leg hop tests ($p<0.05$). In the sedentary group, there was a significant increase only in the single leg hop test compared to before taping ($p<0.05$). All pretest and posttest values of the athlete group were higher than the sedentary group ($p>0.05$). In terms of the performance increases after kinesio taping, the increases in the athlete group were higher for all tests compared to the sedentary group ($p>0.05$).

Conclusion: Our study revealed that kinesio taping can improve jumping performance in both athletes and sedentary individuals. We think that kinesio taping could improve the performance especially in sports where jumping movements are frequently used such as basketball.

Keywords: Athlete, gastrocnemius muscle, kinesio taping, sedentary, jumping

Öz

Amaç: Bu çalışma, sporcu ve sedanter bireylere uygulanan kinezyo bantlamanın dikey ve yatay sıçrama performanslarına akut etkisini araştırmayı amaçlamıştır.

Gereç ve Yöntem: Çalışmaya 18-25 yaş aralığında lisanslı 20 erkek basketbolcu ile 20 erkek sedanter birey dahil edilmiş ve dikey sıçrama yüksekliği ve yatay sıçrama mesafesi değerlendirilmiştir. Dikey sıçrama yüksekliğini ölçmek için tek ayak üzerinde yapılan serbest sıçrama ve squat sıçrama testleri uygulanmıştır. Yatay sıçrama mesafesinin ölçümü için single leg hop testi seçilmiştir. Tek ayağın kullanıldığı testler dominant ayak ile gerçekleştirilmiştir. Kinezyo bantlama sonrası testler gastroknemius kasına fasilitasyon tekniği uygulandıktan 10 dk sonra yapılmıştır.

Bulgular: Sporcu grupta bantlama öncesi ile sonrası veriler karşılaştırıldığında hem squat sıçrama hem de single leg hop testlerinde anlamlı artış gözlendi ($p<0.05$). Sedanter grupta bantlama öncesine göre sadece single leg hop testinde anlamlı artış vardı ($p<0.05$). Sporcu grubunun tüm ön test ve son test değerleri sedanter gruba göre daha yüksekti ($p>0,05$). Kinezyo bantlama sonrası performans artışları açısından sporcu grubundaki artışlar tüm testlerde sedanter gruba göre daha yüksekti ($p>0,05$).

Sonuç: Çalışmamız, kinezyo bandın hem sporcularda hem de sedanterlerde sıçrama performansını artırabileceğini ortaya koymuştur. Özellikle basketbol gibi sıçrama hareketinin fazlaca kullanıldığı sporlarda kinezyo bantlamanın performansa etki edeceğini düşünüyoruz.

Anahtar Kelimeler: Gastroknemius kası, kinesio bantlama, sedanter, sıçrama, sporcu

Corresponding *(İletişim)*: Hilal IRMAK SAPMAZ, Tokat Gaziosmanpaşa University, Faculty of Medicine, Tokat, Türkiye
E-mail *(E-posta)*: hisapmaz@yahoo.com
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INTRODUCTION

The triceps surae muscle, the strongest flexor of the foot, consists of the gastrocnemius and soleus muscles. Although it terminates in the calcaneus, it continues its strength on the sole of the foot to the toes through a flat tendon called the aponeurosus plantaris.[1] Plantar flexion muscles are the main source of mechanical power production required in movements such as walking, running, and jumping.[2] Most of the sports branches have a jumping movement. In the vertical jump, the goal is to reach the highest, while in the horizontal jump, the goal is to reach the farthest. Ankle muscle strength is significant enough to affect performance in sports that frequently needs jumping.[3,4] Kinesio taping (KT) is an application that supports the structural feature and flexibility of human skin without limiting joint movement. KT, which can be applied in different ways and directions, is used both for therapeutic and rehabilitation purposes and to support the locomotor system in many professional sports.[5,6]

MATERIAL AND METHOD

Ethics committee approval (19-KAEK-017) was obtained for our research, and this study was conducted with licensed basketball players and sedentary male individuals between the ages of 18-25.

Jump lengths pre- and post- taping were measured in two groups, athlete and sedentary, and 40 people, 20 in each group, were included in the study with 80% power, 5% margin of error and 0.4 effect size. G*Power 3.1.9.4 software was used for the sample size. Individuals with pain, limitation of movement, orthopedic discomfort, incompatibility during the test, allergy to kinesio tape, and neuromuscular disease were excluded from the study. Age, height, body weight and body mass index (BMI) values of individuals were recorded. In the literature, it was reported that the minimum time required for KT to interact with the skin is 10 minutes. Therefore, the measurements in the present study were made 10 minutes after taping.[5,7] For the muscle application of the tape, facilitation technique was selected for performance increase. According to this technique, the band, which was given 50% tension during the application, was started and finished without tension at both ends. In order to facilitate muscle contraction, Y strip tape, which is applied to surround the muscle and is one of the most common application methods, was chosen (**Figure 1**).[5,7,8] In the tests performed before and after the tape application, the acute effect was observed by measuring the jump height and jump distance.

Figure 1. Applying kinesio tape to the gastrocnemius muscle

The free (vertical) jump test and squat jump test, in which hand marking was performed to measure the jump height, were used. The single leg hop test was used to measure the horizontal jump distance. The dominant lower extremity was preferred for one-legged tests. All tests and applications were carried out by the same physiotherapist. Participants were given two minutes between different tests to rest. Three repetitions were performed 30 seconds apart in each test. While the best result was recorded in the free jump test, the average of the three measurements was recorded in the squat and single leg hop tests.[9-11]

In the free jump test, the distance difference between the highest point that can be reached on the wall without leaving the feet off the ground and the highest point reached in vertical jump was measured (**Figure 2**).[9]

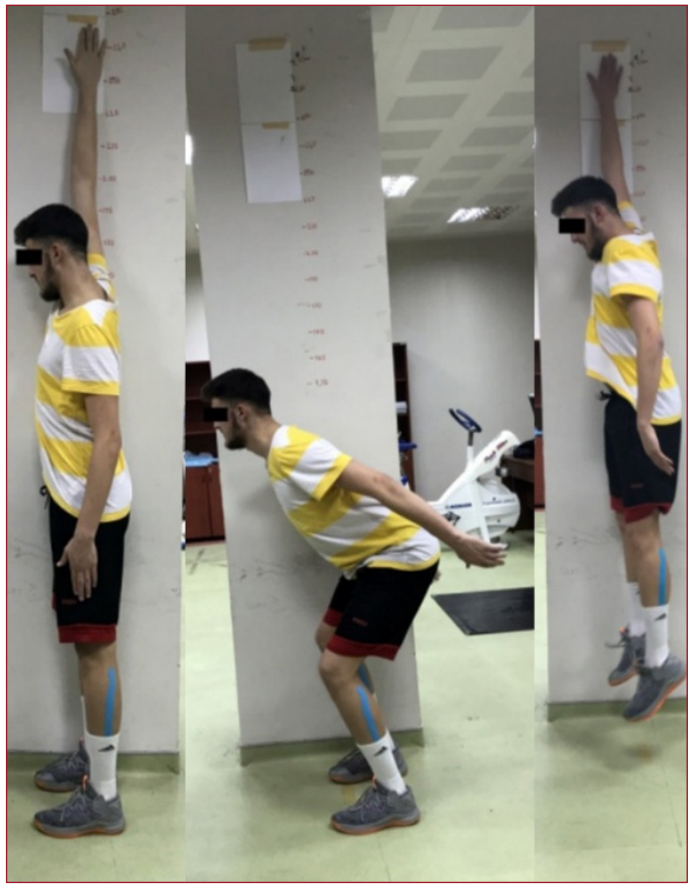

Figure 2. Vertical (free) jump test stages

Newtest Powertimer 300 device and its integrated mat were used in the squat jump test. Participants tried to reach the highest point they could jump without springing in the 90º squat position (**Figure 3**).[10]

In the single leg hop test, they jumped forward as far as possible using their dominant foot and arms, landing on the same leg and achieving balance (**Figure 4**).[11]

Figure 3. Vertical (squat) jump test stages

Figure 4. Horizontal jumping (single leg hop) test stages

Statistical Analyses

Parametric tests were preferred when investigating the differences in terms of the characteristics of the individuals. Performance differences between the two groups and before and after taping were examined. In addition, the individuals in the groups were categorized according to age, height, BMI, and dominant side characteristics. The normality tests of the variables were examined with the Jarque Bera test. Paired Samples t test was used to compare the differences of the dependent groups. Independent paired-sample t-test was used to compare the differences of independent groups, and Levene test was used for the homogeneity of variances. Pearson correlation analysis was used to examine the relationships between variables. P<0.05 was considered statistically significant in all analyses. Statistical analyses were performed using the IBM-SPSS 22 software. Only normality tests were performed using the Past software since SPSS does not have the Jarque Bera (JB) test.

RESULTS

The mean age, height, body weight and BMI values of athletes and sedentary individuals are given in **Table 1**. Fourteen individuals in the athlete group and sixteen individuals in the sedentary group used their right leg dominantly.

Table 1. Mean values of age, height, body weight and BMI of individuals

Variables	Athletes (n=20)	Sedentaries (n=20)	t	p
Age (year)	20.25 (±1.59)	20.45 (±1.54)	0.405	0.688
Height (cm)	185.80 (±6.66)	176.05 (±5.74)	4.960	<0.001
Weight (kg)	82.17 (±9.45)	72.94 (±8.79)	3.199	0.003
BMI (kg/m2)	23.84 (±2.37)	23.53 (±2.52)	0.406	0.687

Paired samples t test was used. p<0.05

An increase was observed in all individuals after taping for free, squat and single jump performance (**Table 2**).

Table 2. Difference Test Between Individuals' Jump Scores

Test	Kinesio-taping	n	Mean (cm)	Sd (cm)	t	p
Free	Before	40	50.58	5.39	2.187	0.035
	After	40	51.65	5.48		
Squat	Before	40	38.54	4.31	4.229	<0.001
	After	40	39.59	4.20		
Single	Before	40	167.71	15.11	6.027	<0.001
	After	40	172.28	17.11		

Paired samples t test was used. p<0.05

The results of the difference test between the pre- and post-KT jump scores of athletes and sedentary individuals are given in **Table 3**.

Table 3. Difference Test Between Jump Scores According to Groups

Groups	Test	Kinesio-taping	Mean (cm)	Sd (cm)	t	p
Athletes (n=20)						
	Free	Before	50.70	5.22	1.763	0.094
		After	52.15	5.29		
	Squat	Before	39.17	4.65	4.924	<0.001
		After	40.46	4.38		
	Single	Before	169.57	14.23	5.429	<0.001
		After	175.45	17.10		
Sedentary (n=20)						
	Free	Before	50.45	5.68	1.277	0.217
		After	51.15	5.75		
	Squat	Before	37.91	3.97	1.906	0.072
		After	38.71	3.92		
	Single	Before	165.85	16.09	3.249	0.004
		After	169.12	16.94		

Paired samples t test was used. p<0.05

Individuals were evaluated in two groups according to their height, 180 cm and below and 181 cm and above, and the effect of KT on jumping performance is given in **Table 4**.

Table 4. Difference Test Between Jump Scores According to Height in Individuals

Height	Tests	Kinesio-taping	Mean (cm)	Sd (cm)	t	p
80 cm and less (n=19)						
	Free	Before	49.95	5.45	1.402	0.178
		After	51.21	6.00		
	Squat	Before	37.52	4.43	2.661	0.016
		After	38.69	4.27		
	Single	Before	164.02	13.94	3.401	0.003
		After	167.49	13.08		
181 cm and up (n=21)						
	Free	Before	51.14	5.40	1.875	0.075
		After	52.05	5.08		
	Squat	Before	39.45	4.09	3.545	0.002
		After	40.40	4.06		
	Single	Before	171.05	15.67	5.115	<0.001
		After	176.62	19.37		

Paired samples t test was used. p<0.05

In athletes, an increase in jumping performance was observed after KT application in squat and single leg hop test ($p<0.001$) in those with a BMI below 25, while in those with a BMI of 25 and above an increase in jumping performance after KT was evident only in free jumping ($p<0.05$). In sedentary subjects, an increase in jumping performance was observed in squat and single leg hop tests in those with a BMI below 25 ($p<0.05$).

After KT, an increase in jumping performance was observed in all tests ($p<0.001$) in individuals with the dominant right leg, and only in the single leg hop test ($p<0.05$) in those with dominant left leg.

The pre- and post-KT jump performances of all individuals according to their age groups are given in **Table 5**.

Table 5. Difference Test Between Jump Scores According to Age in Individuals

Age (year)	Tests	Kinesio taping	Mean (cm)	Sd (cm)	t	p
18-19 (n=14)						
	Free	Before	50.79	4.46	1.963	0.071
		After	51.93	4.21		
	Squat	Before	38.77	3.80	3.157	0.008
		After	39.78	3.29		
	Single	Before	172.93	15.30	3.398	0.005
		After	177.38	17.19		
20 (n=9)						
	Free	Before	52.33	5.64	0.819	0.437
		After	53.78	6.12		
	Squat	Before	40.59	5.00	0.616	0.555
		After	40.89	5.52		
	Single	Before	172.70	16.87	2.237	0.056
		After	177.15	18.99		
21 (n=9)						
	Free	Before	48.00	3.97	0.540	0.604
		After	48.56	4.56		
	Squat	Before	37.51	3.43	2.203	0.059
		After	38.99	3.76		
	Single	Before	163.44	11.08	3.446	0.009
		After	168.07	14.57		
22 and up (n=8)						
	Free	Before	51.13	7.59	2.553	0.038
		After	52.25	7.01		
	Squat	Before	36.98	5.02	2.482	0.042
		After	38.47	4.80		
	Single	Before	157.75	12.16	2.788	0.027
		After	162.62	14.65		

Paired samples t test was used. $p<0.05$

DISCUSSION

Parameters such as jumping distance, leg strength and anaerobic power used in the evaluation of physical performance were reported to be closely related to age, gender, muscle type, muscle mass, heredity, body composition and training status. It is emphasized that regular training improves the performance of the individual and that physical characteristics are an effective factor on performance. Vertical jumping is an excellent indicator of lower extremity muscle strength in many sports. When the leg strength, vertical jump heights, flexibility and anaerobic power of young individuals were tested, a significant difference was observed between athletes and sedentary individuals.[12] In the evaluation of jump performance, vertical jumping is mostly evaluated.[13-15] The number of studies in which both horizontal and vertical jump are considered together is less.[4,16,17] There are many studies investigating the effects of KT on muscle strength, vertical jump, explosive force, pain, inflammation, blood circulation and tissue healing.[14,18-21] In order to measure vertical jump and horizontal jump performances, KT was applied on different muscles, and generally the quadriceps femoris muscle was evaluated.[16,17,19] In recent years, studies on KT on the gastrocnemius muscle have been increasing and facilitation technique is generally used.[14,18,22] In the present study, we evaluated the effect of KT applied to the gastrocnemius muscle by facilitation technique on horizontal and vertical jumping performances.

It was reported that the shortening of the muscle due to the effect of KT, which is applied with stretching from the origos to the insertion of the muscle, increases the muscle tone by activating the length-contraction mechanism and providing traction in the direction of contraction.[23,24] KT was hypothesized to facilitate momentary increases in muscle strength by providing a concentric pull on the fascia that can stimulate muscle contraction.[25,26] Another theory is that KT affects muscle strength by increasing muscle activity through facilitator action.[3,27] KT is used in athletes, rehabilitation and treatment due to its effect on muscle strength and jumping performance, supporting the muscular system, increasing muscle performance, and contributing to the tissue healing process. Ahn et al. (2015) reported that KT is effective in restoring the decreased muscle strength after muscle fatigue.[16] There are two different theories for the action mechanism of KT: it strengthens muscle and fascia functions by increasing blood circulation in the area where it is applied[23,29] and it influences the range of motion by stimulating cutaneous mechanoreceptors.[30,31] The application of tape on stretched skin facilitates motor function through cutaneous afferent stimulation, and the activation of stimulated α-motor neurons improves muscle performance after muscle fatigue induction.[32]

KT has significant implications for sports performances that require rapid production of high muscle strength.[29] In the literature, it was reported that there was no change in jumping performance 10 minutes after KT, but an increase in performance and muscle activity was observed after a few days.[15] In our study, on the other hand, an increase in jumping performance was observed in both sedentary and athlete individuals 10 minutes after taping.

A study conducted by Mostert-Wentzel et al. (2012) in young athletes concluded that KT improved vertical jumping. We reached similar conclusions in our study. Similar to our

findings, there are studies in the literature reporting a positive effect of KT on jumping performance.[4,18,28,34] Conversely, there are also studies showing that KT has no effect on jumping performance.[8,13]

Besides the studies that evaluated only horizontal jumping,[28,34] many of the studies examining vertical and horizontal jump performance like ours preferred the single leg hop test because it is a reliable and practical method.[4,16,17,22] Contrary to the reports indicating positive effects of KT on horizontal jumping,[4,16] there are also reports in the literature mentioning no such effects.[8,17,22] Ahn et al. (2015) observed a significant difference in healthy women whose quadriceps femoris muscle was supported with KT compared to those for whom KT was not applied, and suggested that it was an effective method to reduce muscle fatigue. We et al. (2019) found that the application of KT to the rectus femoris, biceps femoris, and gastrocnemius muscles in healthy individuals significantly improved horizontal jumping performance. Similarly, Alghamdi and Shawki (2018) observed positive effects of KT on horizontal jumping in athletes with ankle instability. Similar to these studies, we observed that KT increased horizontal jumping performance in both athletes and sedentary individuals. In the present study, vertical and horizontal jump performances were evaluated with three different tests, and a significant increase was observed after KT. We think that especially in athletes KT contributes to performance in the squat jump and single leg hop test, and supports muscle contraction with its fascia stimulating mechanism.

Studies considering the dominant legs is not common in the literature. In our study, we preferred the dominant foot in single-leg jumping, and we observed that athletes and sedentary individuals with a dominant leg on the right side achieved significant results in all three tests while those with a left dominant leg made a significant difference only in the single leg hop test. Macdowall et al. (2015) reported that KT provided a significant increase in static jump height on the dominant leg in athletes, suggesting that this effect may provide a significant advantage in sports such as basketball and volleyball.

In their study evaluating the jumping performance of young individuals, Bchini et al. (2023) found that muscle volume was higher in the 20-22 age group than in adolescents. They reported that jumping performance increased depending on muscle volume. Yıldırım and Ozdemir (2010) found similar results. Our results were similar to those in the literature. An explanation for this could be that the age-related increase in muscle volume and muscle strength in young people affects jumping performance. It was reported in the literature that both jump performance and anaerobic strength of tall people are better.[36,37] In terms of the association of performance with height, our results were similar to those reported in the literature.

CONCLUSION

Jumping is very important in many sports, especially in sports competitions that involve jumping. Jumping performance is very valuable in terms of influencing the success of the athletes and thus the outcome of the competitions. We think that our study dealing with the effectiveness of KT on both horizontal and vertical jump in athletes and sedentary individuals and compared performance of these two groups could contribute to the literature and sports activities.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Tokat Gaziosmanpasa University Local Ethics Committee (Date: 05/12/2019, Decision No: 19-KAEK-017).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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