Türk Fizyoterapi ve Rehabilitasyon Dergisi

2015 26(2)73-77

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ACUTE EFFECT OF KINESIOTAPE MUSCLE TECHNIQUE ON HAMSTRING FLEXIBILITY AND PAIN DURING STRETCHING

RESEARCH ARTICLE

ABSTRACT

Purpose: Static stretching exercises were generally used to improve hamstring flexibility. However it is known that stretching exercises generally create pain that makes stretching uncomfortable. The purpose of this paper is to investigate the effect of kinesiotaping on hamstring muscle flexibility and pain during stretching.

Methods: Fifteen voluntary participants (age=23.53±1.55 years) who have bilateral hamstring tightness were included in the study. Each subject's lower extremities were randomized with random number generator software and one included in the study group, the other included in control the group. Kinesiotape® was applied to the study group with muscle technique. After kinesiotape application to the study group, both groups did five repetitions of hamstring stretching exercises. Before and after intervention hamstring tightness and pain during hamstring stretching exercise were evaluated.

Results: Analysis of the pre and post intervention assessments showed a significant improvement in the study group in active knee extension test and pain during hamstring stretching exercise ($p<.01$). Study group gained 10.6 (mean) degrees of flexibility (Cohen's $d=0.90$). Control group's results were not significant ($p>.01$).

Discussion: Application of kinesiotape® muscle technique both increases muscle flexibility and decreases pain during stretching in acute condition. It could be used in subjects with hamstring tightness by physiotherapists to gain immediate effect.

Key Words: Skeletal muscle; flexibility; stretching

KİNESİOTAPE KAS TEKNİĞİNİN HAMSTRİNG ESNEKLİĞİ VE GERME SIRASINDAKİ AĞRI ÜZERİNE AKUT ETKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Statik germe egzersizleri hamstring kaslarının fleksibilitesini artırmak için genellikle kullanılmaktadır. Fakat statik germe egzersizlerinin ağrı yaratarak yapılan egzersizi konforsuz hale getirdiği bilinmektedir. Bu çalışmanın amacı, kinesiotape® uygulamasının hamstring kaslarının fleksibilitesi ve germe sırasındaki ağrı hissi üzerine etkisini araştırmaktır.

Yöntem: Bilateral hamstring gerginliği olan onbeş gönüllü (yaş=23.53±1.55 yıl) çalışmaya dahil edildi. Her gönüllün alt ekstremiteleri rasgele sayı üreten bir program ile randomize edildi ve bir alt ekstremite çalışma, diğeri kontrol grubuna dahil edildi. Kinesiotape® uygulaması sadece çalışma grubuna kas tekniği kullanılarak yapıldı. Çalışma grubuna kinesiotape® uygulaması yapıldıktan sonra her iki gruptaki olgular beş tekrarlı hamstring germe egzersizi yaptılar. Uygulamalardan önce ve sonra hamstring gerginliği ve germe egzersizi sırasındaki ağrı değerlendirildi.

Sonuçlar: Uygulamalar öncesi ve sonrası değerlendirmelerin analizi sonucunda, çalışma grubunda aktif diz ekstansiyonu testi ve germe egzersizi sırasındaki ağrı skorunda gelişme görüldü ($p<.01$). Çalışma grubu 10.6 derece (ortalama) esneklik kazandı (Cohen's $d=0.90$). Kontrol grubunun sonuçları anlamlı değildi ($p>.01$).

Tartışma: Kinesiotape® kas tekniği uygulaması hem kas fleksibilitesini artımaktadır, hem de germe sırasındaki ağrıyı azaltmaktadır. Hamstring gerginliği olan olgularda akut etki elde etmek için fizyoterapistler tarafından kullanılabilir.

Anahtar kelimeler: İskelet kası; esneklik; germe

Geliş Tarihi: 06.08.2014 (Received)
Kabul Tarihi: 24.07.2015 (Accepted)

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INTRODUCTION

Muscular flexibility is an essential component of muscle performance (1,2). Decreased flexibility is generally observed in biarticular, fast twitch muscles and leads to muscle strains and overuse injuries (3). Maintaining normal muscle length prevents muscle stiffness, enhances physical performance and decreases the risk of injury (4,5). Hamstring muscles were reported to be the most commonly injured biarticular muscle group (3,6). Decreased hamstring flexibility increases the risk of hamstring strains, increases low back pain and patellofemoral pain syndrome (6). In sports, hamstrings inflexibility was associated with muscle strains and strains , muscle damage following eccentric exercise and reduction in athletic performance(7-10).

Kinesiotape®, invented by Kenzo Kase, is an adhesive taping application with theoretical physiological effects were stated to decrease pain, support muscular movements and joints (11). The application of kinesiotape® creates convolutions to increase the space between the skin and muscles and theoretically increase lymphatic drainage (11). Recent studies identified positive outcomes in the areas of strength , joint position sense , range of motion muscle performance, proprioception lymphedema (11-16). Kinesiotaping increased lower trunk and cervical range of motion (14,17) The effect of kinesiotape® on range of motion is explained by it's effect on blood circulationon the taped area and this effect may create physiological change on the myofacial tissue (18). An aother explanatory theory is that cutaneous mechanoreceptors are stimulated at the taped area thus increasing ROM (14).

An inflexible muscle creates pain during stretching. During hamstring stretching exercise pain was defined as painful feeling of tension in the dorsal part of the thigh (19). The pain relieving effect of kinesiotape® may be observed during stretching exercises. The aim of this study is to investigate the effect of kinesiotaping on hamstring flexibility and pain during hamstring stretching exercises. The hypothesis of this study is that (H0) kinesiotaping does not have any effects on hamstring flexibility and pain during stretching and (H1) kinesiotaping has effects on on hamstring flexibility and pain during stretching.

METHODS

To investigate the effect of kinesiotaping on hamstring flexibility and pain during stretching exercises 15 healthy voluntary sedentary female university students (age=23.53±1.55 years, weight=59.99±4.70 kg, height=170.13±3.97 cm, body mass index=20.60±1.43 kg/m^2) with bilateral hamstring tightness were included in the study. All participants signed an informed consent form prior to participation. Participants were required to have tight hamstrings according to active knee extension (AKE) test. Tight hamstrings were defined as the angle greater than 20^o in the AKE test (20). Subjects with knee or low back pain were excluded. Measurements were performed by the same physiotherapist throughout the study before and after intervention. Kinesiotape® application was conducted by a physiotherapist who was certified and experienced in kinesiotaping method. Each participant's lower extremities were randomized with a random number generator software and one extremity was included in the study group (n=15), the other extremity was included in the control group (n=15).

Assessments

Because of the goniometer's validity and highly accurateness to measure hamstring flexibility , evaluation was done with a universal goniometer by measuring knee extension angle. AKE test (ICC2,1= 0.81-0.87, standard error of measurement (SEM)=3.5°-3.8°) was performed to both lower extremities (21,22). Subjects lied in supine position, non-tested hip positioned in 0^o flexion, tested hip flexed 90^o and knee flexed 90^o, asked for extending the knee as much as possible. The complete knee extension was 0^o and lack of knee extension was measured with a goniometer.

Pain during hamstring stretching exercise was evaluated with visual analog scale (VAS). The VAS consisted of a horizontal line 100 mm in length. At the left end point "No pain" was placed, at the right end point "worst imaginable pain" was placed on the line. The subjects were asked to mark on the line that represents their level of pain intensity (23). One repetition of hamstring stretching exercise in the supine position by using a stretching cord was used to evaluate pain during stretching. All cases

Table 1. Comparison of study and control groups results.

	Study group		Control group	
	Pre intervention	Post intervention	Pre intervention	Post intervention
	Mean±SD**	Mean±SD	Mean±SD	Mean±SD
Active knee extension test (degree)	30.33±7.72#,*	19.73±10.46*	24.93±8.96#	21.73±9.18
VAS score (0-100 mm)	48.33±32.55 ƛ,¥	30.0±24.79¥	44.06±31.72ƛ	35.20±26.55

#,ƛ Initial values of study and control groups were not different when assessed with Mann-Whitney U test (p>0.01).
*,¥ Results showed significant difference in study group between pre and post intervention values in study group when assessed with Wilcoxon test (p<0.01).
**SD: Standard deviation.

stayed thirty seconds in stretched position and the worst pain during stretching on hamstring muscle region was evaluated.

Interventions

Kinesiotape® muscle technique performed to the study group. In side lying position, hamstring muscles were stretched passively and the length of the hamstring muscle and tendon region was measured with the tape. Kinesiotape® was cut as a Y-shape band for the tendon region and as a I-band for the muscle region. Then, tape applied with no tension starting from tuberositas ischium going throughout the hamstring muscle and tendon region. After taping the study group, both groups did five repetitions of hamstring stretching exercises. The active-assisted SLR stretch was done in supine position by using an exercise band (24). Subjects holded the exercise band and passed it from their foot and then flexed their hip while the knee was extended until they felt tightness and stayed in this position for 15 seconds. The stretching was done 5 times with a 15 seconds rest interval between repetitions and total stretching time was 75 seconds (25). After stretching, AKE test and pain assessment were repeated.

Statistical Analysis

Statistical analysis was done with the Statistical Package for the Social Sciences 15.0 software. Two groups' initial values were tested with a Mann-Whitney U test. To determine the significance between pre and post intervention, Wilcoxon test was used for each group. The significance level was set a p value of <0.01. Achieved power of the study and effect sizes (Cohen's d) were calculated with the G Power 3.1.7 software.

RESULTS

Initial values of two groups were not different for all variables (p>0.01) (Table 1). Pre-post intervention results suggested significant improvement in AKE (p<0.001, achieved power=0.81), and pain during stretching in the study group (p<0.001) (Table 1). Improvement in study group was 10.6±8.34 (mean±SD) degrees in AKE test and 18.80±16.69 milimeters in VAS score. Effect size of pre and post comparisons of AKE test and VAS score were 0.90 and 0.69 respectively in study group. The control group gained 3.20±4.45 degrees of flexibility and showed decrease in pain score 8.40±15.50 milimeters, however these findings were not significant (p>0.01). Small effect sizes was observed between pre and post comparisons of the control group. Effect sizes were 0.24 for flexibility and 0.22 for VAS.

DISCUSSION

In this study, application of kinesiotape to tight hamstrings improved hamstring flexibility and decreased pain sensation during stretching exercise which makes stretching comfortable. Both the p values and effect sizes showed that stretching with kinesiotape application is superior to stretching only. In literature one study the effect of kinesiotape® on flexibility was investigated in subjects with normal hamstrings (passive straight leg raise test>80°) and no effect was found (26). In another study kinesiotape® application was compared with electrical stimulation in subjects with hamstring tightness and found that both tecniques improve hamstring flexibility however electrical stimulation has larger effect size (d=0.843) than kinesiotape® application (d=0.431) . In this study the study group both received kinesiotape® application and did stretching. This might be the reason of the larger

effect size of this study than Espejo-Antunez et al.'s study (27).

Our results showed that kinesiotaping does help to enhance muscle flexibility and decreases pain during stretching when applied to tight hamstring muscles. To gain hamstring flexibility static and dynamic stretching exercises were generally used. Static stretching exercises are most commonly used to prevent from injuries, and generally improve flexibility in 3-6 weeks (19,20,28,29). Ayala et al. showed that approximately 8 degrees of flexibility gain could be achieved in 4 weeks, 13 degrees of flexibility gain in 8 weeks and 15 degrees of flexibility gain in 12 weeks with static stretching 3 times in a week in subjects with tight hamstrings (29). Similar findings were denoted by other researchers (20,28). In our study approximately 10 degrees of flexibility gain were achieved in acute condition which could only be gained by static stretching exercises in 3 or 4 weeks. This might be the result of the effect of kinesiotape® on fascial tissues theorized by Kase et al (18). Additionally this study showed that static stretching did not have positive effect on flexibility in control group in acute condition. Decrease in pain in study group may be associated with gain in flexibility and increased visco-elastic properties of the muscle tendon unit by the application of kinesiotape and could provide more comfortable stretching. Effect of kinesiotape® on pain was observed in a study on patients with whiplash injury (17). According to Kase et al. kinesiotape® creates space by lifting fascia, aligns fascial tissues, provides positional stimulus through the skin, provides sensory stimulation to assist motion (18). These effects may have influence on improvement of flexibility and decreasing pain.

The hamstring muscle injury appears to have resulted in loss of hamstring flexibility (30). Hamstring flexibility is needed to prevent from sport injuries and stretching was the most important training factor associated with hamstring strain injuries and stretching program is a key to improve flexibility (6,24,31). Our short term results suggest both gain flexibility and decrease pain after kinesiotape® application. We recommend using of kinesiotaping to gain flexibility in acute conditions and to make stretching less painful. Additionally it could prevent from on eccentric muscle damage after exercise, hamstring pulls and strains in acute conditions because of a positive effect on flexibility. We suggest using kinesiotape® muscle technique by physiotherapists to decrease pain during stretching exercises, improve hamstring flexibility and prevent from hamstring strains in acute conditions.

One limitation was that we evaluated only volunteer subjects who wanted to join the study, a randomization process could not be performed to select participants but participants' lower extremities were randomizely included in study or control group. Another limitation was that we were not able to observe all subjects in long term. This study necessitates further studies investigating the effects of kinesiotaping on flexibility in long term. Besides healthy group, patients with hamstring injury can be included in further studies.

CONCLUSION

This study showed kinesiotaping improves flexibility and decreases pain when evaluated by active knee extension test and VAS. Application of kinesiotape® muscle technique might be used by clinicians to improve muscle flexibility and decrease pain during stretching in acute conditions.

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