The effects of kinesio tape and stretching on hamstring muscles flexibility

The effect of kinesio tape on hamstring muscle

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Abstract

Aim: Kinesio Tape (KT) is a dynamic treatment approach which is used for pain relief, painless movement, soft tissue healing, and edema by increasing the circulation. The aim of this study is to investigate the effects of stretching exercises with KT on hamstring flexibility in young females. Material and Method: Thirty healthy young females participated in this study. The right leg hamstring muscles were stretched using PNF contract-relax technique and taped using KT (Group I; n=30), the left leg hamstring muscles were stretched by PNF contract-relax technique but they were not taped using KT (Group II; n=30). All the subjects were examined before and after the interventions (four weeks) with the active knee extension and modified sit and reach test. Results: Range of motion (ROM) and flexibility increased in both groups. When we compared the two interventions, there were significant differences in terms of the active knee extension test scores. But there was no difference in results in a comparison of the modified sit and reach test scores ($p>0.05$). The improvements in Group I subjects were significantly greater compared to those of Group II ($p=0.0001$). Discussion: The results indicate that KT increased the effect of stretching exercises of hamstring muscles and improved ROM of the knee joint in healthy female subjects.

Keywords

Kinesio Tape; Hamstring Muscle; Flexibility

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Introduction

Developed 30 years ago in Japan, the Kinesio Tape (KT) application is a treatment option that can be used for common musculoskeletal problems, such as low back, neck, and back pain, as well as for orthopedic and neurologic problems, and during post-operative periods [1]. The KT method uses special flexible tapes that can stay on the skin for a long period of time unlike its counterparts, and these tapes are applied with some special techniques for various goals. KT applications aim at enabling pain-free and easier movement, assisting soft tissue recovery, and increasing the blood and lymphatic flow. Theoretically KT lifts up the skin and expands the gap between the skin and muscle, therefore releasing the pressure in the application area that occurred due to injury or disease. The basic goal of the KT technique is to support pain-free movement, and in this way, to speed up recovery [2,3].

Forming a wide muscle group in the posterior femur, hamstrings are the primary flexors of the knee. Due to posture and exercise habits of today, hamstring muscle flexibility is easily lost. The length of hamstrings affects the pelvic tilt, and the lumbar curvature. According to Kapandji hamstrings slide anteriorly while standing, and actively work in order to keep the pelvis in a neutral position. Kapandji states that the level of effect of the hamstrings on the pelvis depends on the angle of the knees and hips, as well as the natural length of the muscle [4]. The shortness of a hamstring can be congenital or it could occur later in life. Adventitious hamstring shortness often develops after degeneration in the bottom lumbar area [5,6]. Tight hamstrings following an activity limit the mobility of the hips and may cause lower extremity injuries [7]. It loads stress, especially on the lumbosacral region of the spine, the back annular part of the disk, posterior ligaments, and the erector spinal muscles; this causes recurring micro traumas, and thus injuries. Furthermore, the indirect effect on the posture causes extreme stress on ligaments and over time the three joint complexes of the spine degenerate. Consequently, chronic low back and back pain occur [6,8]. Various stretching exercises (such as passive, active, and ballistic stretching) are applied for overcoming hamstring shortness [9-11]. The most commonly used method among these applications is the Proprioceptive Neuromuscular Facilitation (PNF). PNF is one of the most effective methods for developing static passive flexibility. A study reports the positive effects of hold-and-relax PNF technique on flexibility, especially in women [12].

The aim of our study is to examine the effects of PNF stretching along with the KT application on the hamstring muscles in healthy, adult women, and to compare it with the effects of PNF application only.

Material and Method

The study was conducted at the Akdeniz University, Alanya School of Management, and the Department of Rehabilitation Sciences and Physiotherapy at Gent University. It was approved by the Ethics Committee of the School of Medicine at Pamukkale University (PAU.0.20.05.09/46). This study is supported by the Scientific Research Projects Coordination Unit at Pamukkale University (2011SBE003).

Participants

The study includes 30 healthy women between the ages of 21 to 30 who agreed to participate in this study, who had not had any surgical operations related to the lower extremity, had at least a 160º or above knee extension angle, a value-5 quadriceps femoris muscle and hamstring muscle strength according to the manual muscle test, and who had a Body Mass Index (BMI) of 28 kg/cm² or lower. Women who are active athletes or regularly exercise, as well as those who are allergic to the KT application were excluded from the study. Before the start of the study the volunteer participants were notified of the applications and measurements to be conducted and they signed informed consent forms under the supervision of an observer. All participants were assessed by the measurement methods described below, both before the exercise and taping applications and then every week for four weeks.

Recordings

Shortness: The hamstring shortness of the participants was assessed with the active knee extension test, and by using a Baseline electrogoniometer. For this assessment the participants were asked to lie down on a bed in a supine position. The assessed leg was stretched out in a support box and the participant's pelvis was fixed on the bed with the help of a belt. The support box was used to fix the femur at a 900 angle. The participant was asked to actively extend his/her knee while the hip was at a 900 angle, and the physiotherapist recorded the goniometric measurement of the participant's end point.

Flexibility: To assess lower extremity flexibility, a modified sit-stretch out test was applied. The participant sat in a long sitting position with the sole of their tested foot leaning on the test apparatus. While the knee joint on the side to be measured was in full extension, the other knee was put in a slightly flexed position (between 90º-45º). The participant was asked to slowly lie down in this position towards the box, and the level at which she could stay for two seconds was recorded (Fig.1). In order to implement the test, the level where the sole of the foot leaned measurement box was set as zero on the measurement scale. 40 cm forward and 20 cm backward from the zero point were marked on the apparatus.

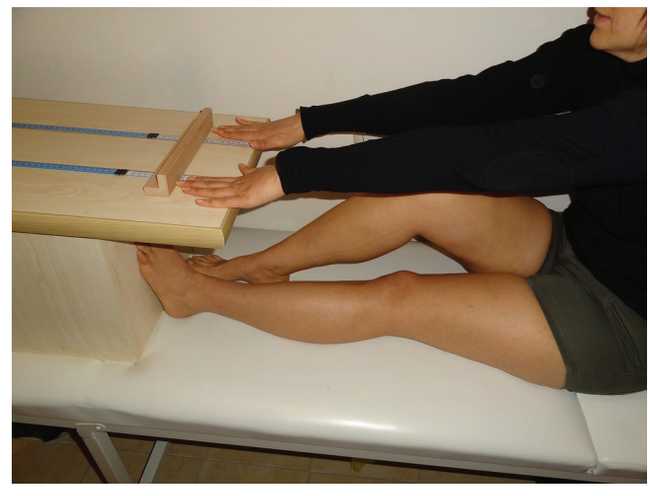

Fig. 1 Modified sit and reach test

Experimental Procedures

The left legs of all 30 participants were assigned to Groups I. The right legs of all participants were assigned to Groups II. Contract-relax stretching exercise, a PNF technique, was applied to the left lower extremity hamstrings every day for four weeks, with 10 30-second repetitions of 1 set (Group II). Each participant was shown the exercises by the physiotherapist, and they were asked to try them; it was confirmed that the exercises were implemented correctly, and stretching exercises were monitored throughout the study.

The "contract-relax" stretching exercises of the PNF technique were also applied to the participants' right extremity hamstrings every day for 4 weeks as above, additionally the KT gold elastic therapeutic band was applied on the semitendinosus, semimembranosus, and biceps femoris of the hamstring muscles of the right lower extremities (Group I). The tape was applied without any stretching; therefore its elasticity feature was excluded (Fig. 2).

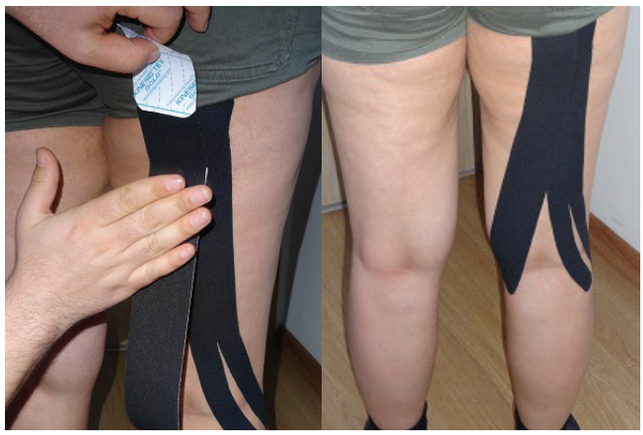

Fig. 2 Kinesiotaping application

Statistical analysis

The SPSS 13.0 version of the Windows operating system was used for all statistical analyses. The t test was used in the independent sample for differences among groups. In order to determine which applied methods were superior, the difference between the values (the delta value) that were obtained before and after the application was taken and analyzed. In order to determine the effectiveness of the methods used in the study, the Wilcoxon Signed Rank test was applied, while the Mann-Whitney U test was implemented to analyze the before and after differences to determine the primacy of the applications against each other. The level of significance in all statistics has been accepted as $p \leq 0.05$.

Results

The demographics data of participants are shown in Table 1. At the baseline, no difference was found between the participants' left and right side extremities in muscle shortness or flexibility ($p>0.05$). Following the Kinesio Tape and PNF applications, both applications resulted in an increase in the active knee extension and flexibility (Table 2). The difference is statistically significant ($p=0.0001$). During group comparison, the measurement amount obtained in the active knee extension test was greater for Group 1; the difference between the two groups was statistically significant ($p=0.028$). There was no significant difference between groups as measured by the modified sit-stretch test ($p>0.05$) (Table 2).

The increase that occurred post application in Group I's active knee extension is more than the increase that occurred post application in Group II ($p=0.0001$). When the two methods were compared in terms of hamstrings shortness, the active knee extension degree measured after the PNF contract-relax stretching method applied with the KT application in Group I was observed to be greater than only the application of the PNF contract-relax stretching method in Group II; the difference is statistically significant ($p=0.001$) (Table 3).

Table 1. Demographic data of participants

Variables	min-max	Mean ± SD
Age (year)	21-30	22.56 ± 1.81
Height (cm)	155-186	166.40 ± 8.13
Weight (kg)	47-78	59.40 ± 8.68
BMI (kg/cm^2)	17.26-25.80	21.29 ± 2.07

min: minimum, max: maximum, SD: Standard Deviation; BMI: Body Mass Index

Table 2. Comparison of baseline and after treatment measurements of groups

Variables	Baseline Mean ± SD	After treatment Mean ± SD	p-Value
Group I			
Active Knee Extension Test (º)	152.50 ± 6.27	161.07 ± 5.65	0.0001
Modify Sit and Reach Test(cm)	-5.20 ± 3.79	-1.46 ± 2.86	0.0001
Group II			
Active Knee Extension Test (º)	152.07 ± 5.47	158.37 ± 5.46	0.0001
Modify Sit and Reach Test(cm)	-5.06 ± 3.78	-2.63 ± 3.62	0.0001

SD: Standard Deviation; *Wilcoxon test was used

Table 3. The Comparison of measurement differences among groups after treatment

Variables	Group I (n=30) Mean (Δ) ± SD	Group II (n=30) Mean (Δ) ± SD	p- Value*
Active Knee Extension Test (º)	9.56 ± 3.39	6.30 ± 3.43	0.0001
Modify Sit and Reach Test(cm)	3.73 ± 1.68	2.43 ± 1.13	0.001

SD: Standard Deviation; Δ: Delta; *Mann-Whitney U test was used

Discussion

The KT application has been used by physiotherapists in rehabilitation settings as an additional method to modulate some of the physiological processes. This study analyzed the effects of stretching performed with the KT application on hamstring muscle shortness in healthy young adult women with hamstring muscle shortness; it detected the effectiveness of the KT application and compared it to the PNF application only.

The literature mentions five major effects of the KT application. These are reduction of pain, supporting muscles during movements, getting edema under control, regulating the lymphatic liquid flow, and stretching the soft tissue. [1,13]. There are some studies that show that the KT application provides proprioceptive feedback regarding the hamstring flexibility [2,14]. The role of KT in pain relief is explained by the reduction of edema and inflammation; the activation of gate control mechanism, as well as the descending inhibitor mechanisms through emotional stimulations; and analgesic effect mechanisms through

regulation of superficial and deep fascia functions [15]. A study of 30 healthy individuals established that the KT increased the extent of lower body flexion active joint movement, but was not effective in lateral flexion [13]. The KT application increases blood flow under the region it is applied to, and the range of motion is improved because the KT stimulates the cutaneous mechanoreceptors of the muscle and myofascial tissues.

In a study of acute effects, KT was found not to increase hip flexion angle in healthy young people [16]. Another study that examined the short-term effects of KT found that it reduced hamstring tightness in 30 healthy individuals in the span of a week [17]. In our study the KT was applied to the muscle group for 4 weeks, and as a result, a reduction in the hamstrings tightness, as well as an increase in the degree of active knee extension was obtained. The muscle stretching that continued for 3-4 weeks does not change the viscoelastic structure of the muscle; it only affects its stretching tolerance and increases its normal range of motion. When regularly performed, this stretching exercise reduces the central neuromuscular inhibition and therefore causes improve flexibility [18].

In the literature there are several studies where different techniques were implemented in order to improve hamstring flexibility. It has been reported that a 6-week duration eccentric training and static stretching exercise program improved hamstring flexibility [19]. It has also been determined that Hatha yoga and static and dynamic stretching also improve hamstring flexibility [20-22]. It has been reported that the hold-relax PNF technique established an increase in the 11º knee extension angle [23]. It has also been determined that the "Slow Counter Hold Relax" PNF technique increased the flexibility of the hamstrings, while the hold-relax technique succeeded in increasing flexibility more than the ballistic stretching technique [24,25]. In our study we performed the KT application along with the PNF contract-relax, and we achieved an increase in hamstring flexibility and the knee joint's range of motion. This result leads us to believe that KT is more effective in improving hamstring flexibility because it facilitates the cutaneous mechanoreceptors and reduces the sense of pain according to the gate control theory.

Our study demonstrates the superiority of the PNF contract-relax stretching method applied along with the KT over the sole application of the PNF contract-relax stretching method. Our study also shows that the PNF stretching application along with KT, an alternative taping technique for physiotherapy applications, increase the active joint mobility of the knee joint in healthy, adult individuals, and have a positive effect on the flexibility of the hamstrings.

A weakness of this study may be that it chose young and healthy individuals as its cases. Additionally, we believe that future studies examining the long-term effects of the PNF contract-relax stretching method that is applied with the KT would be appropriate.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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