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The Effect of Gluteus Medius Kinesio Taping on Pain in Athletes with Patellofemoral Pain Syndrome during Functional Tasks

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Abstract

Background: *The weakness of hip muscles, abductors, and external rotators has been confirmed in individuals with patellofemoral pain syndrome in comparison with healthy people. This study investigates the effects of gluteus medius Kinesio taping in athletes with patellofemoral pain syndrome during functional tasks.*

Methods: *A total of 30 females with PFPS were randomly assigned into Kinesio taping group (n = 15) and the placebo group (n = 15). Pain intensity was measured using the numerical pain rating scale in 4 functional tasks; walking, squatting, ascending, and descending stairs, at baseline plus immediately as well as 24 following Kinesio taping. The data were then statistically analyzed.*

Results: *Mixed-model ANOVAs, with repeated measures on time, indicated statistically significant differences between groups in pain over time for walking (P = 0.000), squatting (P = 0.007), and descending stairs tasks (P = 0.000). However, there were no significant differences between groups in the ascending stair task (P = 0.651).*

Conclusions: *The results showed that compared to placebo in reducing pain in athletes with PFPS, gluteus Medius Kinesio taping was effective in functional tasks of walking, squatting, as well ss moving up and down stairs.*

Keywords: Gluteus medius, Kinesio taping, Patellofemoral pain syndrome, Functional task.

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Introduction

Patellofemoral pain syndrome (PFPS) is one of the most common knee disorders in athletes. This complication is twice more likely to occur in females than in men.[1,2] The most salient symptoms are pain when squatting, moving up and down stairs, running, jumping, and cycling.[3]

Given the disagreement about the etiology of PFPS, different treatments[4,5] such as Quadriceps,[4] and hip abductor and external rotator strengthening,[6] hamstring and iliotibial band stretching, bracing,[2] patella taping[7] have been suggested in people with PFPS. Taping is used both for the treatment and prevention of sports injuries. The major function of taping is to provide support while moving. Kinesio taping (KT) was introduced by Kenzo Kase in 1990 and became increasingly common among athletes.[8] The techniques used by KT differ from traditional tape.[9] KT is designed to imitate the elasticity of the skin, which provides appropriate local stimuli for articular structuring, rather than muscle strengthening.[10,11] KT can be stretched from 30 to 140% of its original length and is water resistant for 3-5 days.[10,11] The use of KT affects the skin more than the muscles and articular structure. It is believed that to reduce pain and facilitate circulation, KT influences the interstitial tissue of the usual tension of the skin by providing appropriate local stimuli through the skin.[9] It has been suggested that KT functions through giving persistent stimulation through the skin to enhance proprioception.[11] KT is also used to improve muscle function, increase lymphatic and vascular flow, reduce pain, and help improve joint misalignments.[12]

Various studies have been conducted on the efficacy of KT on injuries and musculoskeletal disorders. Reduction of neck pain and increase in cervical range of motion immediately and 24 hours after use in people with whiplash,[13] mitigation of pain in shoulder movements in patients with shoulder pain,[14] improvements in disability index and considerable decline of pain after one week KT use, have been reported in patients with chronic low back pain.[15]

Previously patellar taping has been used for pain reduction, increasing the strength of quadriceps, enhancing neuromuscular recruitment, and modifying the onset of VMO activation in the patients with PFPS.[10,16,17] Also, taping creates a mechanical change in the patella, which reduces knee pain and results in the early treatment in people with PFPS. While PFPS can cause symptoms that range from uncomfortable to very painful, it seems that the condition can usually be treated by KT and exercise therapy.[18,19,20]

In the literature, various studies have examined the effects of KT in patients PFPS.[16,21-23] Since the imbalance in the EMG activity of the VMO and VL muscles leads to abnormal patellar tracking,[24] in these studies, mainly patellar taping has been considered. It is believed that increasing shear and compressive loads associated with abnormal patellar tracking may contribute to the appearance of patellofemoral pain.[25] The hypothesis that patella tracking is due to abnormal patellar kinematics on the constant femur is the basis for the design of therapeutic protocols in patients with PFPS. This is the result of the kinematic studies considered in non-weight-bearing conditions, regardless of the motion of the femur.[25] Powers et al. observed that the kinematics of the patellofemoral joint are different in bearing weight conditions.[26] According to this study, the main cause of the lateral tilt and its lateral displacement in patients with patella instability is the internal rotation of the femur.[26] For this reason, in recent studies, the proximal parts of the knee joint have been more widely considered.[27-29] This study is of great importance regarding the role and effect of gluteus medius (GMed) in pelvic and femoral biomechanics in PFPS. The reduction of muscle strength of the hip joint and the change in EMG activity of GMed in patients with PFPS have been reported in many studies.[30-33] Delayed onset and shorter duration of GMed activity in mowing up and down stairs in patients with PFPS have been confirmed in several studies.[34,35] Delay in the GMed activation may reduce the stability of the hip joint in the frontal plane and increase the spin of the hip and knee joints in weight-bearing activities.[36] All these result in excessive femoral adduction and internal rotation during functional tasks and an increase in dynamic knee valgus plus reduction in the contact area of the patellofemoral joint, the potential cause of patellofemoral pain.[37,38]

According to studies, the use of GMed Kinesio tape in the treatment of patients with PFPS is not well established. Accordingly, the present study investigates the effect of GMed Kinesio taping on pain in athletes with PFPS during functional tasks.

Materials and Methods

Thirty females with PFPS from sports clubs were included in the study. All participants were informed about the research, and each gave her written consent. They were randomly classified into two groups: placebo (15) and KT groups (15). The present study was a part of scientific research conducted in the winter of 2015 in Hamedan, Iran. The inclusion criteria were: being athlete, i.e. participating in athletic activities at least 3 days a week for 30 minutes per day for six months; pain in at least 2 cases; moving up and down stairs, squatting, long-term seating with bending knee, running, jumping, pain score of at least 3 out of 10. Subjects who had any of the cases of patellar dislocation, patellar fracture, knee surgery in the past two years, knee ligament injuries, neurological diseases, pregnancy, tendonitis patella, Osgood-Schlatter disease, and Sinding Larsen disease were excluded.[23,39,40] Before the treatment, there were no statistically significant differences between the groups in terms of age, height, weight, BMI, and duration of pain (Pvalue > 0.05) (table 1).

To facilitate the activation of the GMed, the KT with the NS-TEX (South Korea) was used lateral to the hip and on the GMed. To employ the KT, the subject lies sideways while the upper leg was on. For implementing the protocol, a KT 1 piece was used in the KT group. In that way, a third of the elemental type began without any traction from the posterior upper thrust. Then, the subject was asked to lie actively in a flexion position, while the femur was in the internal abduction and internal rotation, where a middle third of the tape, which was about 50% tensile, was drawn into the GMed muscle. While the subject's feet were in their original position, the remaining third of the tape was applied without any tensile action in the trochanter area of the femur. The first and second bars on the strip were used in the same way, except for the upper anterolateral throat. The subjects were asked to check the taping position for re-inspection. The KT protocol was based on previous studies in patients with pathologic pain syndrome[40] and was performed by a practitioner (figure 1).

In the placebo group, a tissue wound adhesive tape was used without tension. The similarity to KT, easy access, lack of elasticity, and its use in similar studies[10] were among the reasons for choosing a scar tissue adhesive tape in this study. The wound adhesive was used precisely in places similar to the KT group. The pain was measured using a numerical pain rating scale in four conditions: walking, squatting, up, and downstairs. In the assessment of walking pain, the subject was asked to walk a distance of 50 meters on a straight path, then the level of pain on the walk was evaluated. To measure pain in the squat, the legs were positioned as wide as the shoulder and fingers, where squat running at a 90-degree angle was evaluated through visual assessment. To coordinate the subjects, ten consecutive repetitions were considered in 15 seconds.[9] To assess the pain in the up and down stair movements, the subjects were asked to perform 12 steps up and down, and then, the pain was evaluated. In the four situations mentioned, the maximum pain was felt by the subject. The pain assessment protocol was selected based on previous studies.[9,10,40] On the numerical scale of the pain, the zero means no pain while 4 to 6 signal moderate pain, and 10 represents the maximum possible pain. This scale has been used in previous studies in patients with PFPS.[4,9,41] All steps of pain measurement were performed before, immediately and 24 hours after KT application. Each measurement was performed three times, and the mean of three measurements was used in the analysis.

Figure 1. GMed taping

SPSS software was employed for statistical analysis. Friedman's statistical test was utilized for comparison before and after the KT application at a significance level of 0.05 in the two groups.

Results

Table 1 reports the demographic characteristic of the subjects. Changes in the pain scores of the two groups in 4 situations; walking, squatting, climbing, moving downstairs, immediately and 24 hours after the KT application are provided in table 2.

Table 1. Demographic characteristics of subjects

Variable	Placebo group (Mean ± SD)	KT group (Mean ± SD)	Pvalue
Age	23.13 ± 2.61	24.2 ± 1.65	0.193
Height	164.0 ± 0.26	162.53 ± 0.39	0.240
Weight	61.83 ± 3.63	60.66 ± 3.03	0.348
BMI (Kg)	23.00 ± 14.5	22.98 ± 1.31	0.975
Pain(0-10)	6.50 ± 1.45	6.90 ± 1.51	0.601

Table 2. Pain scores before, immediately and 24 after KT in three different situations

Task	Before KT(Mean ± SD)	After KT(Mean ± SD)	24 Hours after KT(Mean ± SD)	Pvalue
Walking				
– KT group	4.44 ± 0.80	2.00 ± 0.84	1.80 ± 0.56	0.000*
– Placebo group	4.10 ± 0.87	3.83 ± 0.69	3.73 ± 0.70	
Squat				
– KT group	6.13 ± 1.50	5.46 ± 1.18	4.40 ± 1.18	0.007*
– Placebo group	6.83 ± 1.34	6.40 ± 0.91	6.00 ± 0.92	
Step-up				
– KT group	6.43 ± 1.21	4.20 ± 1.01	4.06 ± 1.03	0.651
– Placebo group	5.60 ± 0.93	5.10 ± 0.66	5.06 ± 0.88	
Step-down				
– KT group	5.98 ± 1.27	3.60 ± 0.82	3.46 ± 1.24	0.000*
– Placebo group	5.78 ± 1.00	5.60 ± 1.05	5.45 ± 0.99	

The results indicate that time has had a significant effect in the walking task (P = 0.000, F = 40.89) for both groups (figure 1). Paired comparisons analysis showed a significant difference between before and immediately and 24 hours after KT application (P = 0.000), while there was no significant difference between immediately (Pvalue > 0.05) and 24 hours after KT use (P = 0.345).

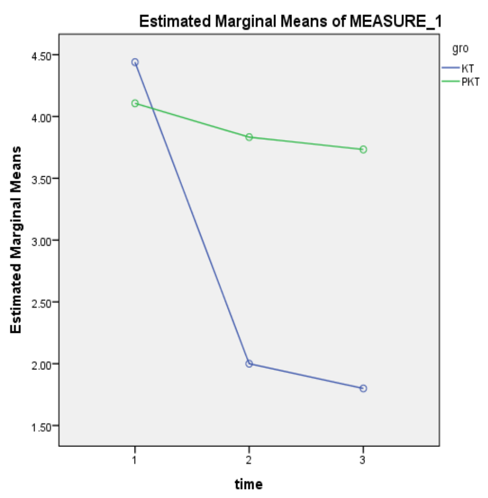

Figure 1. Comparison of pain scores in the walking task in two groups

Mauchly test revealed that the assumed sphericity had been distorted. Thus, the results were corrected using Greenhouse Geisser indicating that over time, a significant effect was observed on squat (P = 0.000, F = 22.66 (figure 2). Paired comparisons analysis revealed a significant difference between before and immediately (P = 0.003), between immediately and 24 hours later, and between before and 24 hours after application of KT (P = 0.000).

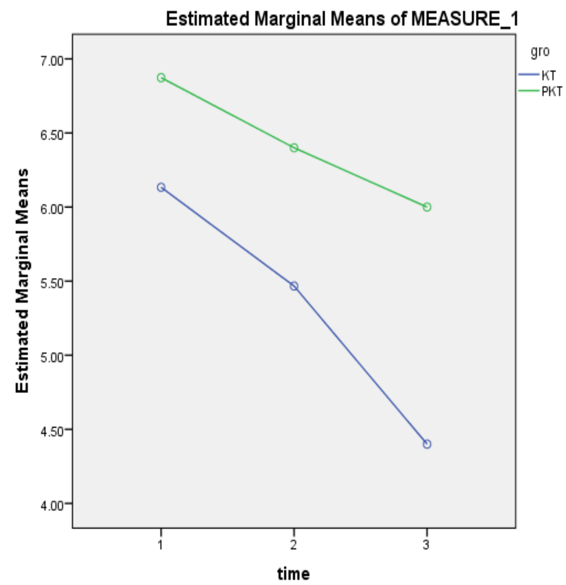

Figure 2. Comparison of the pain score in a squatting task in two groups

As the results indicate, the time has had a significant effect on pain in the two groups in the stepping up task, (Pvalue = 0.000, F = 34.37) as shown in Figure. 3. Multiple comparisons showed that there was a significant difference between before and immediately and 24 hours after KT (Pvalue=0.000). There was, however, no significant difference between immediate application and 24 after KT (Pvalue=0.06).

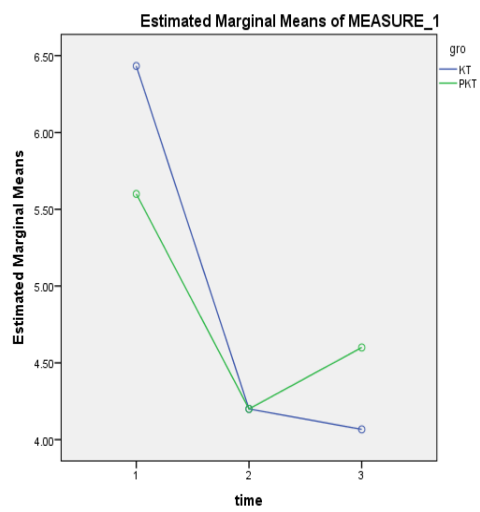

Figure 3. Comparison of pain scores in the stepping up task in two groups

Based on the results, a significant effect of time on pain was observed in the two groups (P = 0.000, P = 0.66) (figure. 4). Multiple comparisons indicated that there was a significant difference between before and immediately after KT, before and 24 hours after KT (P = 0.000), while there was no significant difference between immediately and 24 after KT using (P = 0.02).

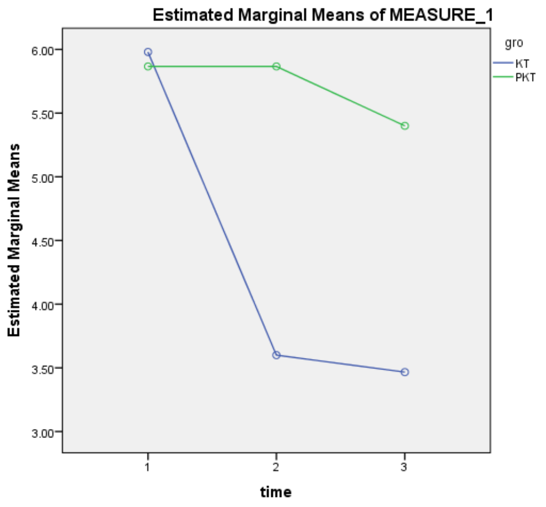

Figure 4. Comparison of pain scores in the stepping down task in the two groups

Discussion

In the present study, the effects of KT were investigated on pain in the athlete with PFPS and the following findings were observed: Pain intensity of the patients in walking, squat, and stepping up tasks diminished after the taping application.

Previous studies have confirmed pain reduction and functional activity improvement after the use of KT in patients with PFPS. The results of this study are inconsistent with previous similar studies.

In a study by Campolo et al., there was a significant difference between the KT group and the McConnell type group during a stepping up task in comparison to the control group. Although there was a significant difference between the three groups without taping, KT and McConnell taping, no significant difference was observed during the squat activity.[42] Miller et al. compared the KT group of GMed, the lumbopelvic region, manual group, and the control group. They found that the KT group had significantly better Y-score and squat scores.[40] Reduction of pain and improvement in the ratio of VMO / VL EMG activity for people with PFPS in ascending step was reported by Chen et al.[43]. The results of the study by Fu et al. revealed that the hip abduction improved with abductor KT. However, no increase in the power of GMed was confirmed following the KT in the Fu study.[44]

In contrast, in the study by Aytar et al., despite the positive effects of KT on muscle strength and balance, there was no significant difference between the KT group and the placebo group in the severity of pain in walking up and downstairs.[45] Jancaitis and colleagues reported improvement in the performance of walking downstairs after the KT application, though no statistically significant difference was observed in the results.[46] Akbas et al. compared the reinforcement and flexibility exercises with KT and reinforcement exercises and flexibility alone. They observed that KT did not affect the pain reduction and improvement in subjects' performance.[2]

Based on scientific evidence, KT can have an immediate effect that help to reduct the symptoms of musculoskeletal disorders.[9,44] Generally, KT blocks the transfer of pain information to the spinal cord by stimulating the mechanical receptors of the skin, thereby reducing pain.[20] The application of KT on the skin surface provides tactile sensory inputs come from cutaneous mechanoreceptors in the skin that interact with the changes in the central nervous system's irritability with motor control. Local stimuli provided by KT replace muscle protections from the joint structure.[11] It is also likely that pain relief is a result of improvement in the direction and mechanical displacement of the femur and patella.[9,43,45] As Powers describes, the weakness of the hip abductor muscles can be the cause of the hip prolapse. This situation would increase the Varus angle of the opposite knee; to compensate for the weakness of the abductor muscles, especially the GMed, the center of mass would change to the support foot, thereby increasing the angle of the knee valgus in the affected foot.[47] GMed mainly acts to stabilize the femur and pelvis in the frontal plate.[48] The GMed and gluteus Maximus muscles play an essential role in controlling the hip motions, especially in the subtraction torque on the frontal plate. Changes in the neuromuscular function of the GMed muscle may cause the internal rotation of the femur to rotate under the patella, resulting in abnormal deviation. To adapt to femur adduction, the tibia would be abducted which may cause excessive pronation.[37] The hip abductor KT may specifically facilitate the activity of GMed, thereby improving the postural stability and dynamic knee valgus.[40]

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Conflict of Interest

The authors declare that they have no conflict of interest.

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