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A Study on the Effects of Patellar Taping on Pain, Quality of Life, and Radiographic Findings in Patients with Patellofemoral Pain Syndrome

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ABSTRACT

BACKGROUND AND OBJECTIVE: Patellofemoral pain syndrome (PFPS) is the most common cause of anterior knee pain in adults. Patellar taping is used to correct patellar position and rehabilitate patients with PFPS. However, the effectiveness and clinical efficiency of this technique in the treatment of these patients are not fully determined. Therefore, this study aimed to evaluate the effects of knee taping on patellar alignment, quality of life, and pain in patients with PFPS.

METHODS: This cross-sectional study was conducted on 25 PFPS patients within the age range of 20-50 years. McConnell taping technique was applied for patients during four weeks. Before and immediately after the treatment, quality of life (via KOOS questionnaire), patellar alignment (via skyline radiography of the knee), and pain intensity were measured.

FINDINGS: After four weeks, McConnell taping technique caused a decline in pain intensity from 50.13±21.60 to 26.67±10.14 mm in patients with PFPS ($p=0.001$). However, this technique had no positive effects on quality of life (score on KOOS questionnaire) or patellar angle/position ($p<0.05$).

CONCLUSION: Based on the findings, independent use of McConnell taping technique is not sufficient for improving the quality of life in patients with PFPS or correcting the abnormal alignment of patella; however, it can help reduce the induced pain.

KEY WORDS: *Patellofemoral Pain Syndrome, Patellar Taping, Pain, Quality of Life, Patellar Position*.

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Introduction

Patellofemoral pain syndrome (PFPS) is one of the most common knee problems, caused by repeated stress to the muscle and tendon structures surrounding the knee. This disorder, as the most common source of anterior knee pain, is prevalent in one-fourth of the total population. PFPS occurs mostly among physically active individuals and adolescents, especially women (<50 years of age) (1-3).

PFPS is characterized by extensive pain in the anterior knee, which is normally experienced while climbing the stairs, squatting, sitting (for a long period), kneeling, and running (2). Several factors including lower limb misalignment, overpronation of the foot, femoral anteversion, weakness of vastus medialis obliquus muscle, and tightness or shortness of the iliotibial band and vastus lateralis muscle have been proposed for the development and formation of PFPS (4-7); hence, the etiology of PFPS is multi-factorial. In recent years, use of taping techniques has gained increasing popularity as non-aggressive methods for the treatment of PFPS.

McConnell taping technique is commonly known as a therapeutic technique for patients with PFPS. Four major patellar misalignments have been identified including extreme lateral glide, extreme lateral tilt, posterior pelvic tilt, and extreme rotation of the patella (8). McConnell taping technique is intended to correct these abnormal alignments. According to McConnell, four different components need to be corrected, i.e., the glide component, tilt component, anteroposterior tilt, and rotational component. In McConnell technique, taping influences patellar tracking and centers the patella within the trochlear groove (9). In general, various and sometimes contradictory effects have been attributed to patellar taping in patients with PFPS, such as improved function of vastus lateralis obliquus (2, 10), pain reduction (3, 11-14), correction of misalignment (13, 15, 16), and changes in joint proprioception (12, 17). Some studies have revealed the ineffectiveness of patellar taping in pain alleviation among patients with PFPS (18), while others have outlined positive outcomes (12, 17). Also, correction of misalignment seems to be only effective for a short period of time, with no overall effects on changes in patellar alignment (14-16). Overall, conflicting findings have been reported on the effectiveness of patellar taping in correcting and improving the function of vastus medialis obliquus via electromyographic evaluations (10,19,20).

Two crucial points should be noted regarding the performed studies on McConnell taping technique for PFPS treatment. First, various and sometimes contradictory results have been reported in previous studies, and second, in many of these studies, McConnell taping technique has been accompanied by other therapies or physical therapy modalities; therefore, the findings cannot be fully attributed to this technique alone. The efficacy, clinical adequacy, and mechanism of action in McConnell taping technique have not been identified in patients with carpal tunnel syndrome. Therefore, in this research, we aimed to evaluate the effects of patellar taping on quality of life and pain intensity in PFPS patients.

Methods

This cross-sectional study was conducted on 25 patients with PFPS, aged 20-50 years. The inclusion criteria were as follows: 1) age range of 20-50 years; 2) pain in the anterior or posterior surfaces of patella for at least one month; 3) discomfort and pain upon palpating the outer lateral and medial borders of patella; 4) exacerbation of the symptoms during prolonged sitting, climbing the stairs, squatting, running, hopping, and jumping; 5) patellar misalignment (especially lateral glides); 6) positive findings on Clarke's test and apprehension test; and 7) pain during dynamic resistance extension of the leg. On the other hand, the exclusion criteria were as follows: 1) dislocation and direct trauma to the patella; 2) any rheumatologic diseases (e.g., osteoarthritis and rheumatoid arthritis) or diabetes; 3) any meniscus tears or injuries; 4) ligamentous instability; 5) pain extending from the lumbar spine, hip, pelvis, or sacroiliac joint; 6) knee inflammation and high effusion; 7) prior history of knee surgery; and 8) history of steroid injections or physical therapy. The

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data were gathered and analyzed, using a demographic questionnaire, Visual Analog Scale (VAS), Knee injury and Osteoarthritis Outcome Score (KOOS) questionnaire, and evaluation of patellar alignment via radiography before and after the treatment. We used the Farsi version of KOOS questionnaire, which consists of 42 questions (Cronbach's alpha>0.7). KOOS questionnaire includes five subscales, i.e., pain, activities of daily living (ADL), sport and recreational function, other symptoms, and knee-related quality of life (nine questions on pain, seven questions on other symptoms, 17 questions on ADL, five questions on sport and recreational function, and four questions on knee-related quality of life). The questions were graded on a five-point Likert scale, with higher scores indicating desirable symptoms (21). VAS was used to evaluate the subjects' pain severity. For this purpose, the respondents specified their pain along a continuous 10 cm line, graded from 0 (no pain) to 10 (severe pain). To analyze the patellar alignment, we incorporated skyline or sunrise X-ray examinations at 30° knee flexion. Three patellar angles including lateral patellofemoral angle (LPFA), lateral patellar dislocation (LPD), and patellofemoral congruence angle (PFCA) were analyzed (22). LPFA represents lateral patellar tilt, while PFCA indicates lateral patellar glide and lateral tilt. Moreover, LPD quantifies the position of the patella in the frontal plane, relative to the medial femoral condyle in millimeters. Patellar taping was used to correct patellar glide, tilt, and malrotations for a period of four weeks. McConnell technique was applied by a skilled physiotherapist (8, 9). Patellar tapes were replaced on even days every week. The desired variables were measured before and after the treatment. For statistical analysis, paired t-test was performed before and after the intervention and $p<0.05$ was considered statistically significant.

Results

In total, 25 patients with PFPS were recruited in this study. The mean age of the subjects was 35.25±10.29 years, and the mean pain intensity was 50.13±21.60 mm, based on VAS (table 1). The mean pain score changed from 50.13±21.60 to 26.67±10.14 mm (p=0.001) (table 2). In addition, after four weeks of applying McConnell taping technique, pain was the only subscale, which significantly improved in KOOS questionnaire (p=0.011) (table 2). Moreover, the mean difference in LPFA, LPD, and PFCA was not significant before and after the intervention (p=0.449, p=0.089, and p=0.111, respectively) (table 2).

Table 1. Demographic characteristics of the study samples

Number of samples	N=15 Mean±SD
Gender	20 females, 5 males
Mean age (years)	35.25±10.29
Mean body mass index (%)	24.70±6.76
Mean pain intensity (mm)	50.13±21.60
Mean duration of pain (month)	5.11±6.08

Table 2. Comparison of changes in pain intensity, quality of life, and patellar alignment before and after the application of McConnell taping technique

Variables		Before taping Mean±SD	After taping Mean±SD	P-value
Visual Analog Scale (VAS)		50.13±21.60	26.67±10.14	0.001*
Subscales of KOOS questionnaire	Other symptoms (e.g., swelling and knee stiffness)	20.14±12.64	23.31±11.67	0.326
	Pain	22.97±11.11	40.77±18.37	0.011*
	Activities of daily living	53.43±25.92	60.47±23.76	0.123
	Recreational and sport function	14.33±10.21	15.46±12.63	0.151
	Knee-related quality of life	11.16±8.79	12.75±9.39	0.209
Patellar alignment	Lateral patellofemoral angle (degree)	24.67±15.47	23.36±13.9	0.449
	Lateral patellar dislocation (mm)	2.25±3.54	1.75±2.48	0.089
	Patellofemoral congruence angle (degree)	9.50±7.12	7.87±6.36	0.111

***Significance level**

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Discussion

According to the results of the present study, pain intensity remarkably decreased after four weeks of applying McConnell taping technique. In this regard, Mostamand and colleagues indicated a 50% decline in pain intensity during weight-bearing activities and squatting, following the use of patellar taping (11). Moreover, Ebrahimi et al. showed that taping reduced pain intensity via reconstructing and maintaining the patella, which could increase the contact surface of patella with the femur (19).

According to a study by Aminaka and colleagues, patellar taping could lead to pain alleviation by reducing the neuronal inhibition of quadriceps (reducing large afferent fiber input) (13). In other studies, repeated stimulation of vastus medialis obliquus is caused by patellar taping, which can accelerate the onset of activity in vastus medialis obliquus and vastus lateralis and thus, lead to pain reduction (10, 12). Based on the findings of the present study, use of patellar taping for four weeks had no significant impact on quality of life, according to KOOS questionnaire. This questionnaire studied PFPS patients from different aspects such as pain, disease symptoms, ADL, recreational and sport function, and knee-related quality of life.

Whittingham and colleagues suggested that a combination of patellar taping and exercise could increase patients' scores on the functional index questionnaire (14), while Clark et al. reported no significant difference in subjects' scores on Western Ontario and McMaster Universities (WOMAC) questionnaire between the banding, exercise therapy, and patient training groups (18).

The results of the present study indicated that use of patellar taping for four weeks had no significant impact on patellar position or angle. So far, no research has been conducted with regard to patellar alignment among PFPS patients or healthy individuals by the use of X-ray examinations under weight-bearing conditions. Therefore, no normal or abnormal values for patellar alignment have been reported, so far (22). In a study by Worrell et al., across all knee angles, LPD was more medial in the braced group, compared to the taping and control groups, while no significant difference was observed in the lateral patellar angle between the groups (16). Additionally, according to the study by Aminaka and colleagues, improvement in patellar lateralization was not significantly different between the groups with and without patellar taping (13). Larsen and colleagues suggested that the ineffectiveness of tapes to withstand exercise-induced stress may be the reason behind the insignificant difference in patellar alignment; this can in fact limit the use of patellar taping techniques (15).

Also, in a study by Herrington and colleagues, through more accurate ultrasound evaluations on patellar alignment, a considerable difference was observed in the normal position of patella in both taping and exercise therapy groups (23). According to the present study, although McConnell taping technique was effective in pain alleviation of PFPS patients, it had no positive impacts on quality of life (based on KOOS questionnaire) or patellar misalignment.

In general, the reported results concerning the effect of patellar taping are not consistent in terms of pain, quality of life, or patellar position/angle. It seems that various factors have different contributions to PFPS. Some of these underlying factors are directly associated with local disorders such as the weakness of vastus medialis, anatomical deformities of the femoral cap, and shortness or stiffness of vastus lateralis. Another group of these effective factors includes non-localized disorders such as tibiofemoral rotation syndrome (adduction and excessive internal rotation of the femur during weight-bearing activities), overpronation of the foot, femoral anteversion, and weakness of abductor muscles and lateral rotators of the hip (4-7).

Therefore, depending on the type and share of each factor in PFPS, patellar taping technique might not be the only effective treatment for the patients. It is even possible that hip adduction and excessive internal rotation of the femur during weight-bearing activities be the main causes of PFPS (24-26); in such cases, patellar taping cannot control femoral disorders. The limitations of this study were the small sample size, the

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wide age range of subjects, and absence of a control group. It is suggested that future studies incorporate patient screening (in terms of local and proximal disorders), a control group, and a larger sample size in order to evaluate the impact of different taping techniques in patients with carpal tunnel syndrome. Although the application of McConnell taping technique seems effective in pain alleviation of PFPS patients, it probably lacks enough power to improve patients' quality of life or correct patellar misalignment. It seems that the final clinical decision concerning the use of taping techniques is dependent on the type of disorder, based on patient evaluation.

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