Abstract

Background: Patellofemoral pain syndrome represented by anterior knee pain is the most common condition experienced by individuals suffering from knee pathology. Pain behind the knee or around the kneecap is the main characteristic, can occur due to the stress on joint structures, commonly affecting athletes and females. It mostly occurs during ascending and descending stairs and remains in a sitting position for a prolonged duration. Objective: To determine the effects of McConnell taping on function and dynamic postural control in athletes with patellofemoral pain syndrome. Methods: This quasi-experimental study consisted of 38 participants with ages ranging from 18 to 40 years presenting with anterior knee pain. Data was collected from the Spine Physiotherapy clinic, Sahiwal. About 28 patients were treated with McConnell taping along with conventional physical therapy. Star excursion balance test and lower extremity functional test scale were used to assess functional and dynamic postural control before treatment and after 24 hours of treatment. Results: The outcomes revealed that there was a statistically significant difference within the group. The p-value was found significant (p<0.001) for both variables. Conclusion: This study concluded that McConnell taping was effective for treating patients with patellofemoral pain syndrome for functional and dynamic postural control.

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of PFPS of chondromalacia patellae. Pain mostly occurs during ascending or descending stairs, and also in sitting for long duration.

In anterior knee pain syndrome, alterations occur in the morphology of the lower limb such as tibial rotation, rotation of the deteriorated hip, increased pronation of foot range of motion (ROM), the stress in the anteverted femur in individuals suffering from anterior knee pain. As stress is placed in the region of a patellofemoral joint due to tightness in the iliotibial band and vastus medialis weakness. Due to variations in vastus medialis oblique and lateralis, it can lead to deviation of patella laterally when the knee is extended. As there are multiple factors and causes which are interlinked with each other and can lead to PFPS. The clinical manifestations of PFPS are pain anterior to the knee during functional activities, limited ROM, change in Q-angle, changes in static and dynamic stability.

The prevalence of PFPS annually is estimated to be 40% in patients suffering from PFPS. It mostly affects athletes at the age between 12 to 17 years. According to literature anterior knee pain affects 15-40% population, especially athletes. Risk factors of PFPS include altered biomechanics of lower extremity, weakness in quadriceps, increased strength of hip abductors, increased foot strain due to squatting or climbing stairs. The conservative treatment for PFPS includes medication like NSAIDs, corticosteroid injection and physiotherapy interventions that can comprise icing, rest, bracing/taping, therapeutic exercises, and modalities. An alternative treatment option is a surgery if it is not cured by a conservative treatment plan.

In 1986 Jenny McConnell was the one who proposed the concept, method, and application of McConnell taping (MT). It is similarly acknowledged as a rigid taping technique that is commonly practiced in physiotherapy setups. Bestowing to McConnell’s point of view, four diverse malalignment components need to be managed, that is anterior & medial tilt, medial glide and rotation. Option for applying McConnell taping technique depend on the patient’s pathology and their complaints, and the patient might present with more than one malalignment component to be treated.

MT is helpful and effective for relieving pain immediately after functional activities like stair climbing, squatting, etc. If taping seems to be not effective then alter the technique of taping application or reassess the patients. For example, if a patient’s quadriceps inhibit its function due to pain if it is treated properly and pain intensity reduces then quadriceps again start to work its function properly like doing pain-free stair climbing or squatting. Taping with exercise seems to be effective for strengthening of quadriceps. Basic function of the MT technique is to limit the anomalous tracking of the patella, so maltracking between the joint surfaces can be decreased. MT theory also proposed that if the patella is stabilized medially it can activate the vastus medialis oblique muscle and if stabilized in lateral direction then it can activate quadriceps muscles.

Some studies revealed that MT shows positive results for patellar repositioning in the groove of the femoral trochlea. This taping reduces the joint reaction forces and loads on the patellofemoral joint (PFT) which leads to a reduction of pain intensity. As the evidence is limited regarding the outcome of the taping technique on patella for modifying biomechanics effects of anterior knee joint pain. It is purposed that taping causes medial glide of the patella during passive flexion of the knee. Evidence suggests that taping to the patella lead to an increase in the angle of the knee during flexion and extensor moments when it is compared with patients suffering from PFPS without taping. But still, there is
limited evidence and having conflicts that taping show positive results for correcting the biomechanics of a structure. This study is designed to evaluate the effects of McConnell taping techniques for assessing the dynamic balance, postural control and functional activity in athletes suffering from PFPS.

**Methods**

In this quasi-experimental study, data was collected from the Spine Physiotherapy clinic, Sahiwal in nine months. Almost 30 patients with anterior knee pain were enrolled in the study and treated with conventional therapy protocol and McConnell taping. The sample was calculated by using 5% level of significance, 90% power of the test, where $\sigma^2=\text{variance } 1.21$, $Z_{1-\alpha}=\text{confidence level } 95%=1.96$, $Z_{1-\beta}=\text{power of test } 90\%$, $\mu_o-\mu_a=\text{mean difference of McConnell taping: } n=(\sigma Z_{1-\alpha}+Z_{1-\beta}/\mu_o-\mu_a)^2$.

Both male and female athletes with acute anterior knee pain/PFPS from at least three months having positive Clark’s test, age ranged between 18 to 40 years were included in the study. Patients were excluded if they have a history of any ankle and hip pathology or arthritis, fracture or surgery in the lower limb region, use of corticosteroids, pregnant females, or if they have irritation from taping.

All information regarding their participation in the study was provided to all participants properly and consent was taken from them in written form. McConnell taping and conventional therapy protocol was provided to the patient of anterior knee pain. The conventional protocol included exercises for quadriceps, use of TENS and therapeutic ultrasound. Readings were documented before the treatment session and after 24 hours after treatment. Star excursion balance test (SEBT) and lower extremity functional scale (LEFS) were used as outcome measure tools for assessing postural control dynamically and functional activities. In SEBT, measurements were taken in anterior, post-lateral and post-medial directions. MT was applied for 24 hours, therapeutic ultrasound (1MHZ, 0.8W/cm²) for 4 minutes, TENS (100Hz, 50 µs pulse, 50% variation frequency) for 20 minutes, while quadriceps exercise with 10 times repetition.

SPSS version 23 was used to analyze the data. The $p<0.05$ was considered as significant value. Qualitative data measured over time was represented using frequency and percentage. Wilcoxon sign test was used to measure effects within the group.

**Results**

In the current study, 24(86%) subjects were males and 4(14%) were females. The means and standard deviation in McConnell taping group pre and post-treatment for SEBT. The result revealed that SEBT (ant) mean and standard deviation pre-treatment was $56.82\pm6.23$ and post-treatment it was $73.50\pm2.69$ with a mean difference of $16.68\pm3.54$. SEBT (post-medial) mean and standard deviation pre-treatment was $57.86\pm4.14$ and post-treatment it was $73.79\pm4.68$ with a mean difference of $15.93\pm0.54$. SEBT (post-lateral) mean and standard deviation pre-treatment was $57.89\pm4.80$ and post-treatment it was $73.61\pm3.91$ with a mean difference of $15.72\pm0.89$ with $p<0.001$ which showed significant difference. SEBT (post-medial) mean and standard deviation pre-treatment was $57.86\pm4.14$ and post-treatment it was $73.79\pm4.68$ with a mean difference of $15.93\pm0.54$. SEBT (post-lateral) mean and standard deviation pre-treatment was $57.89\pm4.80$ and post-treatment it was $73.61\pm3.91$ with a mean difference of $15.72\pm0.89$ with $p<0.001$ which showed significant difference.

LEFT mean and standard deviation pre-treatment was $16.00\pm2.86$ and post-treatment it was $28.96\pm4.20$ with a mean difference of $12.96\pm1.34$ with $p<0.001$ which shows both taping techniques were effective for improving functional control (Table-I).
Table-I: Mean, standard deviation & p-values of SEBT and LEFS

| Outcome measures          | SEBT (anterior) | SEBT (post-medial) | SEBT (post-lateral) | LEFT       | Mean±SD (pre-treatment) | Mean±SD (post-treatment) | Mean difference | P-value |
|---------------------------|-----------------|--------------------|---------------------|------------|------------------------|--------------------------|----------------------|---------|
| Mean±SD                   | 56.82±6.23      | 57.86±4.14         | 57.89±4.80          | 16.00±2.86 | 73.50±2.69             | 73.79±4.68               | 73.61±3.91         | 16.68±3.54 | <0.001  |
| Mean difference           | 16.68±3.54      | 15.93±0.54         | 15.72±0.89          | 12.96±1.34 | <0.001                 | <0.001                   | <0.001               |         |

Discussion

Results of the current study revealed that the McConnell taping was effective in improving dynamic postural control and functional activity using SEBT and LEFS, both show a significant difference.

Chang WD et al. conducted a review and performed a meta-analysis about the comparison of Kinesio versus McConnell taping in patients of PFPS with 11 controlled studies included. It concludes that Kinesio taping method and McConnell taping techniques both are effective for reducing pain, increasing muscle flexibility, and helping correct the alignment of the patella when managing patients with PFPS.\(^7\) The current study is experimental and it involved only McConnell taping, variables used were SEBT and LEFS.

Another study conducted by Mange MN et al. worked on a patient with PF knee osteoarthritis (OA). It was a randomized controlled trial performed to check the effects of Kinesio and McConnell taping in subjects of knee OA at the patellofemoral joint during flexion and extension ROM, pain was assessed through a numeric pain rating scale in squatting and stairs descending in OA patients at the patellofemoral joint. In group 1, patients were treated with Kinesio taping and patients in group 2 were treated with McConnell taping. Goniometer and pain scale was used as an assessing tool for ROM and pain. Mann Whitney U test was used to analyze the data. The results revealed that Kinesio taping showed a significant difference for reducing pain (p<0.04) and gaining ROM (p<0.03) so Kinesio taping showed more significant results statistically and clinically as compared to McConnell taping.\(^24\) The present study incorporated one group assessing variables re and post-treatment, significant results were found with using McConnell taping.

Conclusion

McConnell taping is effective for athletes suffering from anterior knee pain is patellofemoral pain syndrome for enhancing functional activity and improving postural control dynamically.

Declarations

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding
author will submit all dataset files.

**Competing interests:** None.

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**References**

1. Sanchis-Alfonso V, Ramírez-Fuentes C, Roselló-Sastre E, Dye SF, Teitge RA. Pathophysiology of anterior knee pain. Patellofemoral pain, instability, and arthritis: Springer; 2020: 93-116.
2. Crossley KM, Callaghan MJ, van Linschoten R. Patellofemoral pain. Br J Sports Med 2016; 50(4): 247-50.
3. Flores DV, Mejía Gómez C, Pathria MN. Layered approach to the anterior knee: normal anatomy and disorders associated with anterior knee pain. Radiographics 2018; 38(7): 2069-101.
4. van der Heijden RA, Lankhorst NE, van Linschoten R, Bierma-Zeinstra SM, van Middelkoop M. Exercise for treating patellofemoral pain syndrome. Cochrane Database of Systematic Reviews 2015; (1).
5. Aysin IK, Askin A, Mete BD, Guvendi E, Aysin M, Kocyigit H. Investigation of the relationship between anterior knee pain and chondromalacia patellae and patellofemoral malalignment. The Eurasian journal of medicine 2018; 50(1): 28.
6. Hamilton T, Pandit H, Maurer D, et al. Anterior knee pain and evidence of osteoarthritis of the patellofemoral joint should not be considered contraindications to mobile-bearing unicompartmental knee arthroplasty: a 15-year follow-up. The bone & joint journal 2017; 99(5): 632-9.
7. Chang W-D, Chen F-C, Lee C-L, Lin H-Y, Lai P-T. Effects of Kinesio taping versus McConnell taping for patellofemoral pain syndrome: a systematic review and meta-analysis. Evidence-Based Complementary and Alternative Medicine 2015; 2015.
8. de Oliveira Silva D, Briani RV, Pazzinatto MF, et al. Q-angle static or dynamic measurements, which is the best choice for patellofemoral pain? Clinical Biomechanics 2015; 30(10): 1083-7.
9. Slotkin S, Thome A, Ricketts C, Georgiadis A, Cruz Jr AI, Seeley M. Anterior knee pain in children and adolescents: overview and management. The journal of knee surgery 2018; 31(05): 392-8.
10. Culvenor AG, Øiestad BE, Holm I, Gunderson RB, Crossley KM, Risberg MA. Anterior knee pain following anterior cruciate ligament reconstruction does not increase the risk of patellofemoral osteoarthritis at 15-and 20-year follow-ups. Osteoarthritis and cartilage 2017; 25(1): 30-3.
11. Whitlock K, Mosier B, Matzkin E. Anterior knee pain: Diagnosis and treatment. Principles of Orthopedic Practice for Primary Care Providers: Springer; 2018: 313-27.
12. Neal BS, Lack SD, Lankhorst NE, Raye A, Morrissey D, van Middelkoop M. Risk factors for patellofemoral pain: a systematic review and meta-analysis. Br J Sports Med 2019; 53(5): 270-81.
13. Rodríguez-Merchan EC. Evidence based conservative management of patellofemoral syndrome. Archives of Bone and Joint Surgery 2014; 2(1): 4.
14. Kakar RS, Greenberger HB, McKeon PO. Efficacy of kinesio taping and McConnell taping techniques in the management of anterior knee pain. Journal of sport rehabilitation 2020; 29(1): 79-86.
15. Clifford AM, Dillon S, Hartigan K, O’Leary H, Constantinou M. The effects of McConnell patellofemoral joint and
tibial internal rotation limitation taping techniques in people with Patellofemoral pain syndrome. Gait & Posture 2020; 82: 266-72.

16. Leibbrandt DC, Louw QA. The use of McConnell taping to correct abnormal biomechanics and muscle activation patterns in subjects with anterior knee pain: a systematic review. Journal of Physical Therapy Science 2015; 27(7): 2395-404.

17. Begum R, Tassadaq N, Ahmad S, Qazi WA, Javed S, Murad S. Effects of McConnell taping combined with strengthening exercises of vastus medialis oblique in females with patellofemoral pain syndrome. Assoc 2020; 70(4): 3QW.

18. Pelletier A, Sanzo P, Kivi D, Zerpa C. The effect of patellar taping on lower extremity running kinematics in individuals with patellofemoral pain syndrome. Physiotherapy theory and practice 2019; 35(8): 764-72.

19. Campolo M, Babu J, Dmochowska K, Scarah S, Varughese J. A comparison of two taping techniques (kinesio and mcconnell) and their effect on anterior knee pain during functional activities. International journal of sports physical therapy 2013; 8(2): 105.

20. Ghourbanpour A, Talebi GA, Hosseinzadeh S, Janmohammadi N, Taghipour M. Effects of patellar taping on knee pain, functional disability, and patellar alignments in patients with patellofemoral pain syndrome: a randomized clinical trial. Journal of Bodywork and Movement Therapies 2018; 22(2): 493-7.

21. Derasari A, Brindle TJ, Alter KE, Sheehan FT. McConnell taping shifts the patella inferiorly in patients with patellofemoral pain: a dynamic magnetic resonance imaging study. Physical Therapy 2010; 90(3): 411-9.

22. Kumar SN, Babu VK, Ayyappan V, Shah SR. Immediate effect of kinesio versus Mcconnell taping on patellofemoral pain syndrome during functional activities-A comparative study. International Journal of Physiotherapy 2015; 2(6): 1077-84.

23. Ragia MK, Ahmed R, Ashraf NM, EL-Sayed SE-DB. Kinesiotaping versus Mcconnell Taping in Management of Knee Osteoarthritis. The Medical Journal of Cairo University 2018; 86(March): 909-17.

24. Mange MN, Zore L, Kumar A. Immediate effect of kinesio taping v/s McConnell taping in patellofemoral OA knee patients. Int J Physiother Res 2019; 7(2): 3040-5.