
ORIGINAL ARTICLE

Comparison between Mc Connell Patellar Taping and Conventional Physiotherapy Treatment in the Management of Patellofemoral Pain Syndrome – A Randomised Controlled Trial

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Abstract:

Background: Patellofemoral pain syndrome (PFPS), also called Peripatellar Tendinitis in Merchant's classification (1988), is the clinical entity of pain on - activity, on patellofemoral joint examination and on stair climbing, squatting, pseudo locking, prolonged sitting etc [1]. Varieties of conservative treatments are suggested, including quadriceps strengthening, patellar taping, stretching, electrotherapy and biofeedback with no single intervention being most effective. Hence, comparison between the two techniques – patellar taping and the conventional method was undertaken to determine their effectiveness with respect to pain and function. *Methods:* 20 subjects diagnosed with unilateral PFPS knee were randomly selected and allocated into two group - Group A (Mc Connell taping and vastus medialis oblique's (VMO exercises) and Group B (Short Wave Diathermy and VMO exercises). Treatment was continued for two weeks with pre and post Pain and Function recorded. Student's 't' test was used for statistical analysis. *Results:* Both groups showed statistically significant pain relief and functional improvements. On comparison, Group A showed

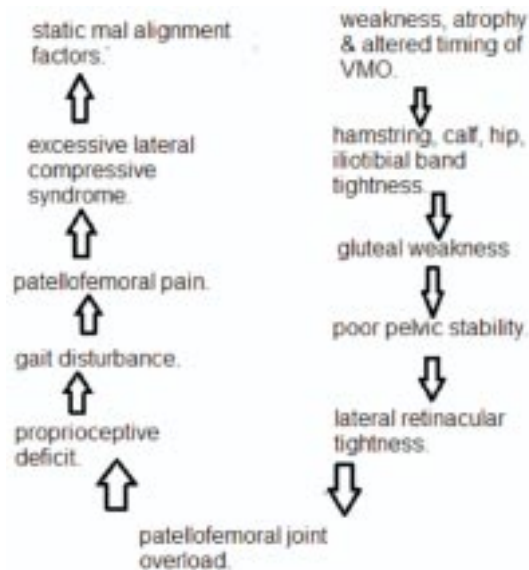
highly significant pain relief and higher % change for functional increment. *Conclusion:* Taping and Short Wave Diathermy (SWD) both showed significant pain relief and functional improvement. Taping showed highly significant pain relief for eccentric activities with a high % change in function. Thus, patellar taping appears more effective in treating PFPS.

Key Words: Patellofemoral pain syndrome (PFPS), McConnell taping, short wave diathermy, Vastus Medialis Oblique Exercises.

Introduction:

The Knee Complex is composed of Tibiofemoral and Patellofemoral joints within a single joint capsule. The patellofemoral joint is the articulation between the posterior patella and femur. It is one of the most incongruent joints of the body. Although the patella enhances the tibiofemoral mechanism, the problems of patellofemoral joint are distinct [1].

Patellofemoral disorders (anterior knee pain) are commonly treated conditions. Patellofemoral pain syndrome (PFPS), also called Peripatellar tendinitis in Merchant's (1988) classification, is the most frequent cause of an anterior knee pain [2].

Factors Precipitating PFPS [16]:

Symptoms of PFPS are Knee pain – anterior or posterior, Diffuse to sharp ache on activity, Pain on stairs, Pain on sitting, squatting, Crepitus, Giving way, Pseudolocking

Management of PFPS could be by a variety of conservative treatment or Mc Connell Patellae taping or a conventional physiotherapy treatment. Most patients respond well to conservative interventions [3]. A variety of conservative treatments have been suggested, including quadriceps strengthening, patellar taping, stretching, electrotherapy and bio feedback [4-7]. No individual technique was found to be as effective [3]. Kettunen *et al* (2007) compared subjects of chronic PFPS who underwent arthroscopy followed by home exercise program to similar subjects who participated only in a home exercise program. They found that all subjects reported similar functional improvements [8].

Mc Connell Patellar Taping is used to facilitate optimal patellar alignment and tracking within the femoral trochlea (Powers

et al 1998, Mc Connell, 2002) [6, 9].

Effects of Mc Connell Taping [10, 11], are alleviation of pain, correction of altered patellofemoral kinematics, offloading of compressive forces, provision of mechanical stability, usefulness as an adjunct to exercise and muscular balancing, improvement in the VMO to Vastus Lateralis ratio and improvement in proprioception.

Conventional physiotherapy treatment consists of short wave diathermy which works on the principle of electromagnetic radiations. The transmission of heat occurs by vibration of ions, dipole rotation and molecular distortion [12]. *Therapeutic effects* [12] are pain relief and sedation, encouragement of tissue healing, reduction of muscle spasm, and increase in range of motion by analgesic effect, reduced viscosity and increased collagen extensibility. Thus, the purpose of this study was to compare and analyze the effect of McConnell patellar taping and conventional physiotherapy technique in the management of PFPS with respect to pain and function

A study was undertaken to analyze the effect of Mc Connell patellar taping with respect to pain and function, to analyze the effect of conventional physiotherapy treatment (Short wave diathermy) with respect to pain and function, and to compare the effects of Mc Connell taping and conventional physiotherapy treatment.

Material and Methods:

Study design was a prospective randomized controlled trial. Study duration was of two weeks. This trial was conducted at a Public Sector Hospital (Lokmanya Tilak Municipal Medi-

cal College and General Hospital) in Mumbai, India. An institutional ethics committee approval was obtained before the commencement of the study. 20 subjects participated in the study based on the predetermined criteria. An informed consent was obtained from the subjects prior to participation in the study. Every subject was examined as per Mc Connell's Assessment Chart.

ether. Non-allergic under wrap (Micro Pore tape) was applied followed by the Dynaplast to maintain the corrected position of the patella every alternate day. The subjects were then taught exercises for strengthening Vastus Medialis Obliques (VMO).

VMO Exercises (Non-Weight bearing): Subjects were positioned in long-sitting on the plinth with the affected limb crossed over the

Table 1 : Inclusion and exclusive criteria.

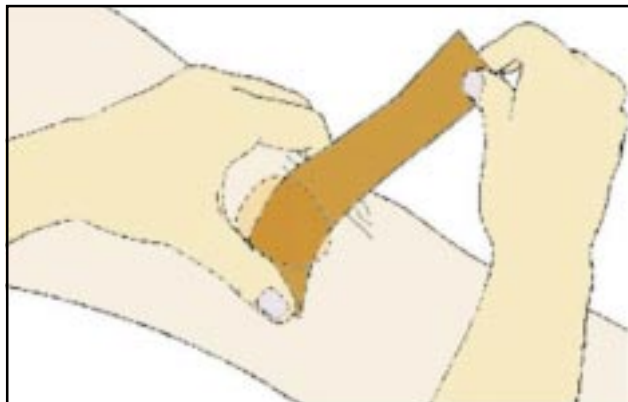
Inclusion criteria	Exclusion criteria
Age group 35 – 65 years	Tri compartmental affection
Pain around patella for at least a month	Severe tibio-femoral arthritis
Unilateral affection	Medial joint line tenderness
Malt racking of patella	Rheumatologic conditions
Positive patellar grind test	Diabetic, hypertensive subjects
Discomfort with palpation on the borders of patella	Any history of lower limb trauma and surgery
Mild to moderate degenerative changes on X-Ray in the patellofemoral joint based on the Altman classification system for osteoarthritis [13]	
Giving way of the knee during one/any activity	

Materials used were plinth, scissors, ether, micro pore tape, dynaplast, standard chair (height 17"), and staircase (stair height 6"). Twenty subjects fulfilling inclusion criteria were randomly selected and allocated to two groups with 10 subjects in each.

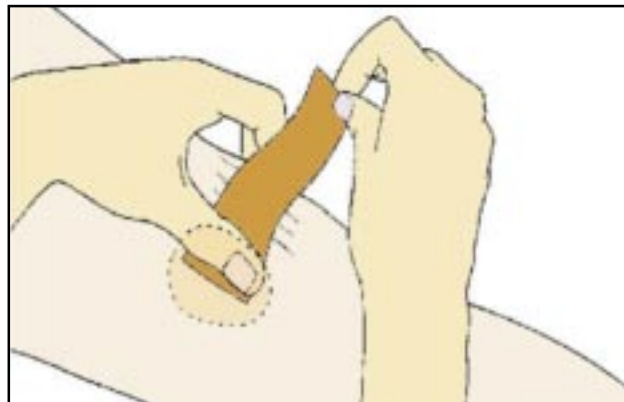
Group A (Mc Connell taping and vastus medialis obliques exercises) [9] - Subjects received Mc Connell patellar taping in order to correct one/any combination of patellar orientation i.e. Glide, Tilt or Rotation. Before taping the skin was prepared well and cleaned with

unaffected. This ensured that the affected limb remained in slight degree of flexion. Subjects were instructed to perform an isometric contraction of the hip adductors and knee extensors simultaneously and sustain this for 5 seconds. This was continued for 5 sets/day with 5 repetitions/set for a week.

VMO Exercises (Weight bearing): were encouraged for the second week. Subject was made to stand in front a mirror with affected limb crossed over the other. An isometric contraction of the same muscles were performed



Medial glide technique



Medial tilt technique

and sustained for 5 seconds. They performed 5sets/day with 10 repetitions/set for this week. Group B (Short Wave Diathermy and VMO exercises): These subjects were treated with Short Wave Diathermy (frequency – 27.12 MHz, wavelength – 11.06m) continuous mode

from a chair, standing to squatting, and squatting to standing.

Statistical analysis was done using SPSS software for unpaired Student’s t test

Table 2: Functional and Pain score	
Functional score :	Pain score:
0 - Can carry out activity independently without any difficulty	0 - Nil
1- Can carry out activity independently with difficulty	1 - Mild
2- Can carry out activity but with support	2 - Moderate
3- Cannot carryout activity even with support	3 - Severe

for 10 minutes. Following this VMO exercises both non-weight bearing and weight bearing were performed for 2 weeks.

Pain and function were measured on Jette Functional Status Index which measured three dimensions of functional capacity (dependence, difficulty and pain). Based on Indian population, the activities selected were level walking, stair ascent, stair descent, sitting on a chair, rising

Results:

The effect of therapy for group A is given in Table 3(a), 3(b) and shows highly significant values for both pain relief functional improvements within group A. A significant change appeared in the following order of descent for pain relief and functional improvement (Table 4)

Table 3(a) : Mc Connell Patellar Taping: Effect on pain

S.No.	Functional Activities	Pre	Post	Pre-Post	t-value	p-value
1	level walking	1.9±1.005	0.1±0.3	1.8±1.077	5.279	< 0.001
2	stair ascent	2.4±0.663	0.3±0.458	2.1±0.7	9.502	< 0.001
3	stair descent	2.4±0.663	0.4±0.489	2±0.633	10	< 0.001
4	sit on a chair	2.1±0.831	0.1±0.3	2±0.775	8.163	< 0.001
5	rise from a chair	1.7±0.781	0.3±0.458	1.4±0.917	4.844	< 0.001
6	stand to squat	2.8±0.6	0.4±0.489	2.4±0.663	11.483	< 0.001
7	squat to stand	2.4±0.663	0.6±0.489	1.7±0.781	6.883	< 0.001

Table 3(b):Mc Connell Patellar Taping: Effect on function

S.No.	Functional Activities	Pre	Post	Pre-Post	t-value	p-value
1	level walking	0.8±0.4	0.1±0.3	0.7±0.458	4.828	< 0.001
2	stair ascent	1.3±0.781	0.1±0.3	1.3±0.781	5.263	< 0.001
3	stair descent	1.4±0.8	0.2±0.4	1.1±0.7	4.977	< 0.001
4	sit on a chair	0.9±0.538	0.1±0.3	0.8±0.6	4.255	< 0.01
5	rise from a chair	0.9±0.538	0.1±0.3	0.8±0.4	6.299	< 0.001
6	stand to squat	1.7±0.64	0.5±0.671	1.22±0.41E	9.258	< 0.001
7	squat to stand	1.5±0.922	0.6±0.663	0.9±0.539	5.263	< 0.001

Table 4: Resending order of relief in pain and functional improvement

Pain Relief	Functional Improvement
Standing to squat	Standing to squat
Stair descent	Rise from a chair
Stair ascent	Stair ascent & squat to stand
Sitting on a chair	Stair descent
Squat to stand	Level walking
Level walking	Sit on a chair
Rise from a chair	

Stair ascent and Sitting on a chair showed higher order of pain relief than functional improvement. Standing to squat showed highest significance for both.

The effect of therapy for group B is given in table 5a and 5b

Table 5(a) : Conventional Physiotherapy Treatment: Effect on pain

S.No.	Functional Activities	Pre	Post	Pre-Post	t-value	p-value
1	level walking	1.7+0.64	0.9+0.538	0.8+0.6	4.232	< 0.01
2	stair ascent	2.2+0.6	1.3+0.781	0.9+0.3	9.475	< 0.001
3	stair descent	2.3+0.6	1.5+1.024	0.8+0.6	4.232	< 0.01
4	sit on a chair	2.2+0.6	1.1+0.538	0.9+0.3	9.475	< 0.001
5	rise from a chair	1.9+0.538	1+0.447	0.8+0.4	6.299	< 0.001
6	stand to squat	2.4+0.663	1.5+0.922	0.8+0.4	6.299	< 0.001
7	squat to stand	2.1+0.7	1.5+0.806	0.6+0.489	3.871	< 0.01

Table 5(b) : Conventional Physiotherapy Treatment: Effect on function

S.No.	Functional Activities	Pre	Post	Pre-Post	t-value	p-value
1	level walking	0.8+0.748	0.2+0.4	0.5+0.5	3.165	< 0.01
2	stair ascent	1.3+0.9	0.5+0.671	0.8+0.4	6.299	< 0.001
3	stair descent	1.4+0.663	0.6+0.489	0.8+0.4	6.299	< 0.001
4	sit on a chair	1.2+0.4	0.4+0.458	0.9+0.3	9.474	< 0.001
5	rise from a chair	1+0.775	0.2+0.4	0.8+0.6	4.211	< 0.01
6	stand to squat	1.8+0.748	0.8+0.748	1+0.447	7.092	< 0.001
7	squat to stand	1.8+0.6	0.8+0.6	0.9+0.3	9.474	< 0.001

A significant improvement was observed in pain relief as well as functional capacity of group B patients. A significant change in order of descent in relation to pain relief and functional improvement is given in Table 6.

Table 6: Improvement in pain relief and functional capacity in group B patients in descending order

Pain Relief	Functional Improvement
Stair ascent & sit on a chair	Squat to stand & sit on a chair
Rise from a chair & stand to squat	Stand to squat
Stair descent & level walking	Stair ascent & stair descent
Squat to stand	Rise from a chair
	Level walking

Many functional activities showed same hierarchy in significance for pain and function

Table 7: Descending order of pain relief difference in tapping and SWD

1. Stand to squat
2. Stair ascent
3. Stair descent
4. Sit on a chair
5. Squat to stand
6. Level walking
7. Rise from a chair

Higher significant values were observed for stand to squat, stair descent and sit on a chair. Functional improvement: was statistically non-significant in the above mentioned activities. There was a significantly superior pain relief in activities like level walking, stair ascent, stair descent, sitting on chair, standing to squatting and squatting to standing position. No difference was observed in pain relief while rising from chair as well as in performance of all above mentioned activities.

Discussion:

The patella functions to increase the lever of quadriceps, thus increasing its mechanical advantage for efficient knee function. This results in an increased Patellofemoral Joint Reaction Force (PFJRF) which is equal and opposite to the resultant forces of quadriceps and patellar tendon tension. With increased knee flexion, PFJRF also increases. Dvir *et al* (1991) also showed that eccentric contraction results in higher pain ratings [14].

Quadriceps torque [2] is calculated during activities as

- Level walking = 0.5 X body weight
- Stair climbing = 3 X body weight

- Squat position = 7 – 8 X body weight

Many intrinsic and extrinsic factors, thus, predispose the joint to patellofemoral disorders [15].

On the virtue of high incidence & associated morbidity for PFPS, this study was conducted to compare Mc Connell patellar taping & conventional Treatment modality SWD, keeping VMO activation exercises as common with regards to pain relief and functional improvement achieved by both.

When compared within Group A, (Table 1) pain relief and functional improvement showed high statistical significance for all activities. However, activities involving higher eccentric peak torque production as stand to squat, stair descent and sit on a chair showed higher increment in pain relief than activities involving concentric peak torque production. Eccentric activity of quadriceps is associated with higher knee flexion angles thus increasing the PFJRF's [2, 15, 16].

Description of Patellar Taping: The aim of patellar taping is to create a mechanical medial realignment of the patella, thus centralizing it within the trochlea to groove and improving patellar tracking (McConnell 1986) [10]. This realignment of the patella within the trochlea has been proposed to affect the function and activation of the vastii. Theoretically, patellar taping may either enhance the magnitude of activation and/or timing of the vastus medialis obliquus (VMO) relative to the vastus lateralis (VL) muscles or decrease the activation and/or timing of the VL relative to the VMO.

McConnell classified patellar malalignment (McConnell 1986, 1991) [10, 17] into–

- Excessive lateral glide

- Excessive lateral tilt
- Excessive posterior tilt of inferior pole
- Excessive rotation

The choice of taping techniques is based on assessment of patellar alignment and attainment of pain reduction. Research has demonstrated an immediate decrease in pain during provocative tasks. (Kenna 1991; Conway et al. 1992; Bockrath et al. 1993; Worrell et al. 1994; Cerny 1995; Herrington & Payton 1997; Powers et al. 1997 a; Handfield & Kramer 2000) [18-23]. Treatment for PFPS should aim to increase the ability of patellofemoral joint to withstand forces associated with quadriceps function. Hence, patellar taping along with VMO exercises were chosen to improve patellar tracking through soft tissue adaptations & muscle re-education [24]. This decreases the eccentric torque reducing the PFJRF, thus, producing higher pain relief in eccentric activities than others. Lower functional improvements may suggest requirement of longer follow up.

In Group B, (Table 2) pain relief & functional improvement showed same hierarchy. This was probably due to deep heating of all compartments of the knee (patellofemoral, medial & lateral tibiofemoral). Hence, though asymptomatic, medial compartment degenerative changes must have benefitted leading to improvement.

When Group A was compared to Group B, (Table 3) pain relief was highly significant for Group A and more for activities involving high eccentric torque production. This showed that taping was more effective. Functional improvement though statistically non-significant, % change was higher for Group A.

Conclusion:

1. Both Mc Connell taping and Short Wave Diathermy showed significant pain relief & functional improvement individually.
2. Mc Connell taping showed highly significant pain relief than SWD for eccentric activities which are affected more in PFPS.
3. The percentage change observed for taping was higher than SWD although on comparison the functional improvement was found non-significant.

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