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Research Article

CLINICAL PREDICTION RULE FOR CLASSIFYING PATIENTS WITH PATELLOFEMORAL PAIN SYNDROME WITH RESPONSE TO PATELLAR TAPING

Jaywant Nagulkar and Ifat Naqvi

Dr.Ulhas Patil College of Physiotherapy, NH6, Jalgaon Bhusawal Road, Jalgaon Khurd, Jalgaon

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ABSTRACT

Introduction: It is reported that there is 96% success rate in using taping as a conservative treatment regimen for PFPS. Australian physical therapist Jenny McConnell has developed patellar taping. We know that many clinical trials have shown that patellar taping can be very important and effective part in reducing pain and improving function in patients with PFPS.

Aims and Objectives: To determine the intra-rater reliability of related clinical examination items for identifying patients who respond to patellar taping.

To determine the predictive validity of same related clinical examination items for identifying patients who would respond to patellar taping.

To develop a CPR derived from selected clinical examination items that would incorporated fewer clinical variables and provide the most certain outcome.

Method: 50 subject both males and females between age group of 18-40 years will be enrolled in the study. The subjects will be randomised into 2 groups, one controlled which are on conservative treatment and second which are on our intervention, i.e. taping. They will be clinically examined for PFPS and those clients who showed signs and symptoms for the above mentioned condition will be included. The diagnosis of PFPS will be determined by clinical symptoms of anterior/retro-patellar knee pain during weight bearing activities.

Results: Tibial angulations, Ankle dorsiflexion with knee flexed, Patellar tilt and Tibial angulations are major four characteristics in the study and two were identified by logistic regression analysis to form the CPR for intervention success and those were Tibial varum > 50 and Positive Patellar tilt test.

INTRODUCTION

The patella is a unique structure that plays a central role in the normal biomechanics of knee. Unfortunately, the patella remains the enigma of most physical therapy, sports medicine, professionals, sports therapy and orthopaedic clinics. Patellofemoral pain syndrome (PFPS) is a significant clinical problem and most prevalent knee disorder.[28,46,72] Despite its prevalence or frequent occurrence, patellofemoral pain syndrome remains a difficult condition for all of us to treat, it is not only difficult to treat but also to assess its gravity of pathology.[45,57,63]

Dye and colleagues suggested that the onset of PFPS may be due to a complex pathophysiological process that includes peripatellar synovitis, increased intraosseous pressure and remodeling. The most widely accepted theory for the etiology of PFPS suggests that it results from abnormal patellar tracking.[45,57,63,64]The accepted hypothesis of pathology related to patellar tracking is with Patellofemoral joint stress and therefore particular cartilage wear.[67] Although articular Cartilage is aneural and has been dismissed as a possible source of symptoms it has been proposed that subadjacent endplate is exposed to various pressure variations that would normally be absorbed by healthy cartilage. This mechanical stress is believed to stimulate pain receptors in the subcondral bone.

In PFPS identification of the underlying pathophysiology is difficult, though the classic picture of PFPS is easily identifiable. The patient is usually active and complains of retro patellar pain or peripatellar pain (mainly medial side) precipitated by prolonged sitting ("movie-goer's sign") pain is proportional to the activity .Predominant symptoms of PFPS is retro patellar pain that increases during weight bearing activities such as running, squatting and stair climbing.[13].

Corresponding author:* **Jaywant Nagulkar
Dr.Ulhas Patil College of Physiotherapy, NH6, Jalgaon Bhusawal Road, Jalgaon Khurd, Jalgaon

This pain should not be confused with pain that occurs directly on the patellar tendon (patellar tendonitis).

A Clinical Prediction Rule is type of medical research study in which researchers try to identify the best combination of medical signs, symptoms, and other findings in predicting the probability of a specific disease or outcome. Clinical prediction rules (CPRs) are tools designed to improve decision making in clinical practice by assisting practitioners in making a particular diagnosis, establishing a prognosis, or matching patients to optimal interventions based on a parsimonious subset of predictor variables from the history and physical examination. A clinical prediction rule (CPR) is a combination of clinical findings that have statistically demonstrated meaningful predictability in,

1. Determining a selected condition or prognosis of a patient who has been provided with a specific treatment.
2. Clinical prediction rules have been developed to improve decision making for many conditions in medical practice.[27]

Generally, onset of PFPS is insidious and progression is slow. Patient complains of discomfort on palpation of medial and lateral borders of patella. Giving away and instability is also common.[18]

Because of the multifactor nature of PFPS, numerous intervention strategies have been proposed for the disorder. Historically, conservative treatment of PFPS is focused on restoring normal patellar tracking by improving dynamic stability.[53] Of particular interest to clinicians has been the vastus medial is oblique(VMO),which has been implicated as being the primary medial stabilizer of patella [38]. Lieb and Perry identified the distal fibers of VMO to be angled at approx 55 degree from the longitudinal axis of femur, making this portion of muscle suited to prevent lateral subluxation of patella. [13] The first step in VMO strengthening program is to learn to isolate the muscle as much as possible for maximum contraction. The patient needs to be free of patellofemoral pain before these exercises become effective, otherwise muscle action may be inhibited. Therefore taping may be required to isolate the muscle to relieve pain and allow contractions to occur.

Taping technique has gained acceptance as an effective component of treatment for anterior knee pain is patellar taping.[60, 91, 53.] Australian physical therapist Jenny McConnell developed patellar taping and reported 96% success rate using taping as a component of treatment regimen for PFPS. The approach is based largely on the premise that patellar malalingment and a poorly tracking patella can lead to patellofemoral pain[91]. Patellar taping is to create a mechanical shift of patella, thereby centering the patella within the trochlea groove and improving patellar tracking.[65]

Several clinical trials demonstrated that patellar taping can be effective part of an intervention plan for reducing pain and improving function within patients with PFPS.[60,53,90,61.]

Need of Study

It is reported that there is 96% success rate in using taping as a conservative treatment regimen for PFPS .Australian physical therapist Jenny McConnell has developed patellar taping. We know that many clinical trials have shown that patellar taping can be very important and effective part in reducing pain and improving function in patients with PFPS.

There have been very few published studies which suggest that, identification of examination variables which are predictive of patients with PFPS, which will respond successfully to patellar taping. So in this study, identification of selected clinical examination items would help the therapist with a useful clinical decisions making tool and may help increase the efficacy of treatment.

After the development of CPR

1. It would identify patients who would respond successfully to taping.
2. Reduce the treatment time.
3. Result in optimum outcomes.

Aims and Objectives

1. To determine the inter-rater reliability of related clinical examination items for identifying patients who respond to patellar taping.
2. To determine the predictive validity of same related clinical examination items for identifying patients who would respond to patellar taping.
3. To develop a CPR derived from selected clinical examination items that would incorporated fewer clinical variables and provide the most certain outcome.

MATERIALS AND METHODS

The study was designed to develop CPR (Clinical prediction rule) to quantify the patients with patella-femoral pain syndrome with the response of patellar taping in the clinical settings.

Research Design: Predictive validity/ Diagnostic test study was carried out to provide the CPR for classifying patients with patellofemoral pain syndrome with response to patellar taping.

Sampling: Purposive sampling was used and the participants were recruited from the urban area and rural area. 50 subject both males and females between age group of 18-40 yrs were enrolled in the study. They were clinically examined for PFPS and those clients who showed signs and symptoms for the above mentioned condition were included. The diagnosis of PFPS was determined by clinical symptoms of anterior/retropatellar knee pain during weight bearing activities.

All the subjects took part in the study on a voluntary basis after signing consent form and received general guidelines about the study.

Setting: Subjects from Urban and rural areas (Jalgaon District) were screened and selected for study.

Duration of study*:* One and half year.

Inclusion criteria

The criteria for admission onto PFPS included one or more of the symptoms shown below:

1. Constant/intermittent dull pain around patella or antero-medial to patella.
2. Retro patellar pain
3. Pain during descending stairs
4. Pain during ascending stairs.
5. Pain during partial squat.

Exclusion criteria

1. Recent history of trauma to knees
2. Ligamentous laxity of painful knee
3. Knee surgery
4. Systematic disease.
5. Neurologic disease
6. Connective tissue disease
7. Stress fracture
8. Shin splint

Materials Used

1. Plastic Goniometer (2 degree accuracy)
2. Non-stretchable measure tape
3. Hypoallergic "hypafix"
4. Dynaplast (johonson and johonson)
5. Numerical Pain Rating Scale
6. Global rating of Change Questionnaire
7. Patients record cards.

Instrumentations

Two types of instruments were used:

Numeric Pain Rating Scale (NPRS)

The numeric pain rating scale is a self-reported measure that establishes pain levels after the subject performed after each functional test. It is an 11 point scale that ranges from 0(no pain) to 10(worst imaginable pain). After performing each of the 3 functional tests, squatting, stair ascends and stair descends. Subjects were instructed to circle the number on NPRS that best represented their knee pain. A mean of NPRS score was established.[74]

Global Rating of Change Questionnaire

The GRC scale is a single item, self reported measure used to measure the subject's impression of the change in his or condition following an intervention.

A GRC questionnaire measures the overall changes in the quality of life of the subjects. The use of a GRC is a common, feasible, and useful method for assessing outcome, and has shown to be a valid measurement of change in patient's status. The subjects were instructed to check the statement that best represented their status in response to patellar taping intervention[41,44,] shown in Appendix C.

Procedure

All subjects were instructed to remove his or her shoes and lie prone on examination table.

⇩

Anatomical landmarks of each subjects lower leg and foot was taken for measurement purpose. Calcaneous and Achilles tendon on the same side of symptomatic knee was bisected with a marker. Navicular tuberosity was marked with a dot.

⇩

Battery of tests were performed as listed in appendix by the examiner.

⇩

Recordings were recorded. First examiner had 4 and half years of experience.

⇩

Series of tests and measurements were repeated (retest) by examiner prior to functional testing.

⇩

Three functional activities:

1. Stepping up on a 20cm step.
2. Stepping down from 20cm step
3. Squatting

⇩

Subjects immediately assessed his or her knee pain during above mentioned functional activity and circled the number that represented their pain on Numeric Pain Rating Scale (NPRS).

⇩

Examiner then applied patellar tape using medial glide component described by McConnell. Several authors reported that an excessive lateral tilt or displacements is the main aetiology of PFPS.

⇩

So examiner displaces the subjects patella medially using thumb and a single piece of tape was applied to maintain patella in position. [32,33,11,34]

⇩

During squat test the angle of knee flexion at which the subject first experienced pain was measured and assessed the pain at same angle after the patellar tape was applied.

⇩

Subjects again assessed his or her pain after the tape was applied and circled the pain on NPRS. It was recorded during first examination.

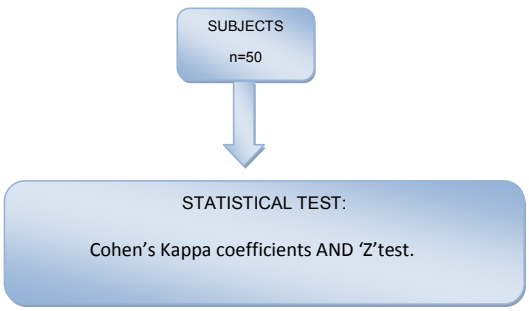
⇩

Subjects then repeated each functional test with the patellar tape on and again recorded the pain experienced during each activity on NPRS.

⇩

The subjects concluded the examination by assessing the overall change in his or her condition on Global Rating Scale (GRS).

Flowchart



RESULTS AND TABLES

All statistical analyses were performed using SPSS software, Version 11(SPSS Inc, Chicago, IL) Intra-rater reliability of physical examination measurements were calculated using Cohen's Kappa coefficients for dichotomous data and for the continuous data p value was obtained using 'Z'test.

For the predictive validity portion of study, each subject was first classified as either treatment success or non-success. The reference criteria used to define treatment success was either a 50% improvement on mean NPRS or moderate improvement on GRC.

Since it's said that taping should decrease the patients pain by at least 50 % during the performance of a provocative task.[65]. Furthermore it has been proposed that a 30% change on a NPRS represents a clinically meaningful reduction in pain in subjects with a variety of disorders.[22]. Juniper *et al* proposed that at least 4 on GRC indicate a moderate change in persons condition [44]. Therefore in this study a 50 % improvement on NPRS or a score of +4 or greater on the GRC was sufficiently high to identify individuals who response to the intervention.

After dichotomizing the subjects into 2 outcome groups, each elements of the clinical examination was analyzed to determine if it was a predictor of treatment success. Sensitivity, Specifity and likelihood ratios were calculated for each variable. Sensitivity of test reflects true positive rate and Specificity of a test is the true negative rate.[71]. To calculate the Sn and Sp for each clinical measurement item, 2 *2 contingency tables were used. When a zero cell value was encountered, 0.5 was added to all cell values in the tables to permit calculations and their 95% confidence interval. Continuous variables were dichotomized using a receiver operator characteristics (ROC) curve.[71] The cutoff of a positive test to be the point on the curve nearest the upper left hand corner that maximized the area under the curve, representing the value with the best diagnostic accuracy.[71]

Likelihood ratios were calculated. Positive likelihood ratios (+LR), Negative likelihood ratios (- LR) were also calculated.

$$LR^{+} = \frac{sensitivity}{1 - specificity}$$

$$LR^{-} = \frac{1 - sensitivity}{specificity}$$

Likelihood ratios are convenient summary measures of diagnostic test performance that indicate how much a given diagnostic test will raise or lower the pretest probability of the target disorder of interest.[41]

A high +LR would be indicative of a more favourable response to the treatment technique i.e patellar taping whereas a lower -LR would be indicative of less favourable response to patellar tape.

According to User's Guide to Medical Literature[32], a +LR greater that 10 or a-LR less than 0.1 generates larger and often conclusive changes from pretest to posttest probability. In this study +LR greater intervention than or equal to 2.0 and a-LR less than or equal to 0.5 to clinically meaningful.[74,75]

A binary logistic regression was used to develop a CPR for predicting treatment success with patellar taping [37]. A forward step wise selection procedure was used to enter the variables of those who were in the treatment success group only. A liberal P value of 0.15 was chosen to prevent potentially useful variable from being excluded from the model.[23]

Observation Tables

Table 1 Sex wise distribution of Success and Non-success group

GROUP	SEX		Total
	Female	Male	
Nonsuccess1	9	13	22
Success	12	16	28
Total	21	29	50

Success defined as an immediate 50% pain reduction or moderate improvement on Global Rating of Change Scale.

Table 2 Initial and final mean of Numeric Pain Rating Scale for Both the Groups

Pain Rating Scale	Success Group Mean± S.D	Non-Success Group Mean±S.D
Pre N P R S	22 ± 2.10	23 ± 1.94
Post N P R S	12 ± 2.06	18.59 ± 2.49

Success defined as an immediate 50% pain reduction or moderate improvement on Global Rating of Change Scale.

Table 3 Comparison of the results (Retest and Intra-rater)

Parameters	Exam1 MEAN ±S.D	Exam 2 MEAN ± S.D	Z Test	P Value	Result
Femoral anteversion	18.12 ± 6.0	18.4 ± 5.8	1.03	P >0.05	Not Significant
A.D.F K .Flex	16.12 ±12	16.3 ± 1.9	0.5	P >0.05	Not Significant
A. D.F K. Ext	18.6 ± 2.65	19.66 ±0.6	0.38	P >0.05	Not Significant
Tibial angulation	4.96 ± 1.95	5.28 ± 2.04	2.1	P < 0.05	Significant
Navicular Drop Test	8.18 ± 1.91	8.76 ± 5.9	0.60	P >0.05	Not Significant
Relaxed calcaneal stance	8.38 ± 4.05	8.98 ± 3.94	0.75	P >0.05	Not Significant
Q-Angle	14.02 ±1.68	14.8 ± 1.66	0.45	P >0.05	Not Significant

It has been observed that there is no statistical significant difference between Physiotherapist 1 and 2 except for the tibial varus. Henceforth, both examiners are equally reliable.

Table 4 Inter-rater Reliability Values

Parameteres	Kappa
Thomas Test	0.44
Hams 90-90 Test	0.64
Ober's Test	0.54
McConnell Test	0.81
Patellar Tilt Test	0.49
Patellar Glide	0.73
Patellar orientation	0.29

Table 5 Sensitivity (Sn) and Specificity (Sp) of the Clinical Examination items.

Parameters	Sensitivity	Specificity
Femoral anteversion	0.36	0.84
A. Dorsiflexion with knee flexed	0.643	0.75
A.Dorsiflexion with knee extended	0.321	0.818
Tibial Angulation	0.89	0.591
Patellar Tilt	0.98	0.51
Navicular Drop Test	0.321	0.682
Relaxed Calcaneal Stance	0.893	0.70

Table 6 Likelihood Ratios

Parameters	Likelihood Ratios (+ LR)	Likelihood Ratios (- LR)
Femoral anteversion	2.25	0.76
A.Dorsiflexion with knee flexed*	2.5	0.4
A.Dorsiflexion with knee extended	1.76	3.71
Tibial Angulation*	2.17	0.18
Patellar Tilt*	2.1	0.03
Navicular Drop Test	1.09	0.9
Relaxed Calcaneal Stance*	2.7	0.15

These parameters were associated clinically meaningful with +LRs

Table 7 Predictors of Intervention Success* (95% confidence interval shown in parentheses)

Predictor of Success	Sn (CI)	Sp	+LR	-LR	Cuttoff Score
Tibial Angulation	0.89 (0.46-0.78)	0.591	2.17	0.18	$>5^0$ varus
A.Dorsiflexion with knee flexed	0.643 (0.50-0.78)	0.75	2.5	0.4	$\leq 15^0$
Patellar Tilt	0.98 (0.88-1.0)	0.51	2.1	0.03	Tilt above horizontal
Relaxed Calcaneal Stance	0.893 0.89-0.98)	0.70	2.7	0.15	$> 4^0$

Success defined as an immediate 50% pain reduction or moderate improvement on Global Rating of Change Scale.

Observations

Inter-rater reliability was done using Cohen kappa coefficient for categorical variables ranged from 0**.**29 to 0.81. Symbolized as (k) - Kappa values of the variables is shown in Table No 2. Moderate (0.40 to 0.60)of kappa value, to good reliability based on the threshold of 0.40 or more for kappa values is obtained.[49] For the continuous data ,p value was obtained using 'Z' test and is shown in Table No 3 .The difference between the parameters had no significant change in values. So both the examiners are seen equally reliable.

Twenty eight out of 50 subjects (56%) were considered to have successful intervention based on 50% improvement on final composite NPRS or a score of at least +4 on the GRC. The mean improvement in success group was (12 ± 2.06). While in non success group was the mean improvement was (18.59 ± 2.49).

Four characteristics were identified as predictors of intervention outcome based on their positive LRs. The Sensitivity, Specificity, LRs and cutoff score for the predictors are shown in Table No.7. The four characteristics identified were Tibial angulation, Ankle dorsiflexion with knee flexed, Patellar tilt and Tibial angulation .Out these four characteristics two were identified by logistic regression analysis to form the CPR for intervention success and those were Tibial varum > $5^0$and Positive Patellar tilt test.

DISCUSSION

PFPS is a complex and a significant clinical problem. Although the etiology of syndromes remains unclear, most investigators and clinicians concur that there are subgroups of patients with different features that may contribute to the development disorder. [65]Similarly it is likely that there are subgroups of with distinct characteristics that will respond best to specific interventions[87].

The aim of this study was to identify the characteristics of patients with PFPS that were predictive of an immediate successful response to patellar taping with a medial glide component. The clinical utility of any examination item is determined largely by the accuracy with which it identifies the presence of the target condition. And the accuracy measure that is most helpful for determining that a target condition is present is the positive LR.

Jaeschkle and colleagues proposed that +LR greater than 2.0 and - LR less than 0.5 can generate a clinically meaningful changes.[41] Based on these guidelines 4 characteristics in this study were associated with clinically meaningful LRs :Tibial angulation (+LR= 2.1), Ankle dorsiflexion with knee flexed (+ LR =2.5) , Patellar tilt test (+ LR= 2.1) and relaxed Calcaneal stance (+ LR = 2.7)

CPR

A CPR by definition is an optimum number of clinical examination items used for predicting a diagnosis or prognosis. Two items were identified by logistic regression model to comprise this CPR. The patellar tilt test and Tibial angulation. Specifically, the CPR consisted of a positive patellar tilt test and tibial varus > 5^0.[61]

Predictors of Intervention Success

One of the key predictors of treatment success in this was patellar tilt test. The patellar tilt test was originally described as a convenient clinical measure to determine if a patient has a tight lateral retinaculum [47,89]. Kolowich *et al* [47] proposed that an excessively tight lateral retinaculum is identified by the inability of the examiner to lift the lateral border of patella above the true horizontal plane (with the patient supine and relaxed and knee in full extension).If the lateral border of patella can be tilted above the horizontal plane ,the test is considered positive (i.e positive angle with respect to horizontal) [47] Findings in this study indicated that subjects with positive patellar tilt test that responded favorably to medial glide taping. Presumably, individuals with a positive patellar tilt have a flexible lateral retinaculum. While a positive tilt does not imply that the individual has a hyper mobile patella. It is interesting o relate our findings with that of Witvrouw and collegues who reported in their prospective study that a hyper mobile patella was 1 of 4 intrinsic risk factors that played a dominant role in the genesis of anterior knee pain.[96]

In addition, we found that individuals with tibial angulation more than 5 degree of varum responded favorable to the patellar taping intervention. In the study of healthy population without known impairment or pathology, the mean value of tibial angulation range from 6 degree to 8 degree [54, 15] In the study by Jonathan D and Thomas G, the mean value for tibial angulation of patients with symptomatic PFPS was approximately 2 degree varum. Using nomogram, application of a likelihood ratio for tibial varum measure alone decreases the post-test probability of treatment success from 52% to 18%. Clinically, therefore it may be more useful to consider that an examination finding of tibial varum less than or equal to 5 degree, including tibial varum will decrease the probability of a successful response to patellar taping with a medial glide component.

Possible mechanism of pain reduction

The result of previous investigations purports that patellar taping leads to pain reduction in 1 of 2 probable ways:

1. Via mechanical realignment of the patella. [51,80,84]
2. By providing cutaneous sensory input and improvement kinesthetic awareness.[63,64]

The evidence for patellar taping causing a realignment of the patella is controversial. Several investigation have demonstrated an unchanged patellar taping position following taping in symptomatic patients using a variety of imaging techniques [33,97,95.] Other studies have shown a medical displacement of the patella after taping ,but the realignment was temporary.[51,80,86] .Several researchers suggested that the clinical benefits of patellar taping are not due to change in position but rather due to the effects of cutaneous stimulation.[97,55,65] Proponents of this theory believe that cutaneous input from the taping leads to analgesic effect by increasing activity of the vastus medialis oblique muscle.[15] Pain modulation via the gating mechanism[62,4] and/or improved proprioception and kinesthetic awareness of patellofemoral joint. [8] In one of the recent study of the effects of four different taping methods (medial, lateral, neutral or untaped) Wilson *et al* [95] reported that the greatest reduction in pain was seen in the neutral and lateral groups. The neutral group consisted of subjects who simply had tape applied in front of knee (neutral) without any attempt to alter patellar position.

The patellar tilt test was a key predictor of intervention success. Kolowich and colleagues[47] proposed that patients with a negative patellar tilt have excessively tight lateral retinaculum and presumably a laterally tracking patella. According to McConnell[91] these patients will respond well to taping with a medial glide component, by stretching the tight lateral retinaculum and shifting the patella medially, centering it within the femoral trochlea groove. However, the subjects in this study who responded best to medial glide patellar taping technique were those associated with a supple lateral retinaculum. Based on this finding and on the recent evidence discussed in this preceding paragraph, its believed that it is unlikely that the symptoms reduction seen in the responders in this study was due to alteration in patellar alignment .Since there was no imagining technique used and therefore we don't know if a change in patellar position occur following the taping procedure.

Inter-rater Reliability

Inter-rater reliability of the measurements was obtained of the collected data**,** kappa was demonstrated for the categorical variables. The variables ranged from 0.29 to 0.81[49] and for the continuous data p value was obtained using 'Z'test .The measure of tibial angulation was slightly higher than the range of values [54 ,88] and is reported in earlier two studies. For patellar tilt test the kappa coefficient value of 0.40 was also somewhat higher than the range of values (0.29-0.35) reported in previous study.[89]

CONCLUSION

The diagnosis of PFPS was done clinically based on inclusion criteria of the study. These patients subsequently were subjected to clinical examination items which were 13 in total. Of these 13 clinical examination items Positive Patellar tilt test and Tibial Varum > 5^0 were statistically found to be the most sensitive and specific. Results suggested that patients with positive Patellar tilt test and Tibial Varum > 5^0 will favourably response following patellar taping with a medial glide component. Based on the results of this study, patients with PFPS who have 1 of the 2 characteristics identified in the CPR may benefit from patellar tape with a medial glide component as an initial treatment strategy. Validation of CPR should be the goal of future randomized clinical trial and is required before it can be widespread used.

Scope of Study

A three step process for developing and testing a CPR has been recommended.61 First; CPRs are derived prospectively using multivariate statistical methods to examine the predictive ability of selected groupings of clinical variables3. The second step involves validating the CPR in a randomized controlled trial to reduce the risk that the predictive factors developed during the derivation phase were selected by chance. The use of these predictors as an inclusion criterion for a future randomized clinical trial will strengthen the investigation by targeting the sample to a classification of patients who are likely to respond to patellar taping. The third step involves conducting an impact analysis to determine the extent that the CPR improves care, reduces costs, and accurately defines the targeted objective.[52,61]

Limitation

1. In this study only one aspect of patellar taping is employed, although McConnell states that tilt, glide and rotation components must be corrected prior to initiation an exercise regimen with patellar taping.[60]
2. Because this study was not a randomized clinical trial, we were unable to determine whether the subject's response was solely due the intervention.
3. Development of nomogram, to facilitate the use of LRs was not established.
4. CPR developed in this study was based on establishing the predictive validity of a limited number of examination variables.

Summary

Background and Aim

Patellofemoral pain syndrome (PFPS) is a significant clinical problem and most prevalent knee disorder.[28,46,72] Despite its prevalence or frequent occurrence, patellofemoral pain syndrome remains a difficult condition for all of us to treat, it is not only difficult to treat but also to assess its gravity of pathology.

Aim*:* To determine the inter-rater reliability of related clinical examination items for identifying patients who respond to patellar taping. To determine the predictive validity of same related clinical examination items for identifying patients who would respond to patellar taping. To develop a CPR derived from selected clinical examination items that would incorporated fewer clinical variables and provide the most certain outcome.

Result

Tibial angulations, Ankle dorsiflexion with knee flexed, Patellar tilt and Tibial angulationsare major four characteristics in the study and two were identified by logistic regression analysis to form the CPR for intervention success and those were Tibial varum > $5^0$and Positive Patellar tilt test.

References

1. Aminaka N, Gribble PA., Patellar taping, patellofemoral pain syndrome, lower extremity kinematics, and dynamic postural control. *J Athlete train 2005, oct-dec 40(4);341-351.*
2. Beattie P, Nelson R. Clinical prediction rules: What are they and what do they tell us? *Aust J Physiotherapy* 2006; 52:157-163.
3. Beynnon BD, Johnson RJ, Coughlin KM. Relevant biomechanics of knee Joint. In: DeLee JC, Drez D, Miller MD, eds. *Orthopedics Sports Medicine:*
4. Bockrath K, Wooden C, Effects of patellar taping on patellar position and perceived pain. *Med Sci Sports Exer.1993;25:989-992*
5. Bizzini M, Childs JD, Piva SR, Delitto A. To study was to develop a grading scale to judge the quality of randomized clinical trials (RCTs). *Am J Sports Med.1992; 23:465-471.*
6. Brehaut JC, Stiell IG, Visentin L, Graham ID. How a widely disseminated rule is used in everyday practice. *Acad Emerg Med 2005; 12:948-956.*
7. Carina D. Lowry, Joshua A. Cleland, Kelly Dyke . Patellofemoral Pain Syndrome Using a Multi-Modal Approach: A Case Series *J orthop Sports, Epub 11 Aug 2008 10.2519/ jospt 2008.*
8. Callaghan MJ, Selfe J Effects of patellar taping on knee joint proprioception in patients with patellofemoral pain syndrome. *Jospt, Nov 2006, Vol 28 No5.*
9. Caylor D, Fites R,The relationship between quadriceps angle and anterior knee pain syndrome. *J Orthop Sports Phys Ther 1993; 17:11-16.*
10. C Brushøj**,** P Hölmich**,** M B Nielsen,E Albrecht-Beste **,** The study was to investigate acute anterior knee pain on findings of clinical examination and ultrasound/MRI examination. *AM J Sports Med .2007; 32:621-628.*
11. Childs JD Cleland Ja Development and application of clinical prediction rule to improve decision making in physical therapist practice. *Phy therapist 2006;86;122-133.*
12. Childs JD, Cleland JA. Development and application of clinical prediction rules to improve decision-making in physical therapist practice. *Phys Ther* 2006; 86:122-131.
13. Chistopher M Powers :*JOSPT Nov 1998 ,Vol 28 No 5 345-353*
14. Christian J. Barton, Kate E. Webster , Evaluation of the Scope and Quality of Systematic Reviews on Non-Pharmacological Conservative Treatment for Patellofemoral Pain Syndrome. DOI: 10.2519*/jospt. 2008.2861.*
15. Christou EA, Ng, Gabriel *Y* Patellar tape increases vastus medialis oblique in the presence of patellofemoral pain. *J Electromyogr Kinesiol 2004;14;495:504.*
16. Clement DB, Taunton JE, Smart GW, McNicol KL. A survey of overuse running injuries. *Physician Sportsmed 1981; 9:47-58.*
17. Cowan, sallie m; bennell, kim; crossley, kay m.; hodges, paul w.; mcconnell, jenny *January 15, 2002, Vol. 75 No. 2, Medicine & Science in Sports & Exercise. 34(12):1879-1885, December 2002.*
18. Crossely, Bennell K, Green S, Cowan S, mConnell. Physical therapy for patellofemoral pain syndrome. A randomized double blinded placebo controlled trail. *Am, J Sports Med 2002;30;857-865*
19. Crossley K, Bennell K, Green S, McConnell J. A systematic review of physical interventions for patellofemoral pain syndrome. *J Orthop Sports Phys Ther. 1999 Nov 29(11):661-7.*
20. Donatelli R, The Biomechanical of Foot and Ankle Philadelphia PA *FA Davis Company, 1996.*
21. Ernst GP, Kawaguchi J, Saliba E. Effect of patellar taping on knee kinetics of patients with patellofemoral pain syndrome. *November 2002, 12:6 >*
22. Farrar Jt, Young JP, werth Jl, Poole, intensity measured on a 11 point numerical pain scale. *Pain 2001;94:149.158*
23. Freedman D.A note on screening regression equations *Am Statistician 1983 :94:149-158*
24. Fu FH, Seel MJ, Berger RA. Patellofemoral biomechanics. In: Fox JM, Del
25. Fujikawa, K *et al* Biomechanics of patellofemoral joint. A study of contact and congruity of patellofemoral compartment and movement of patella. *Engr Med 12:3-11, 1983.*
26. Fulkerson Awareness on the retinaculum in evaluation of patellofemoral pain .*Am J Sports Med 1982; 10:147-149.*
27. Fulkerson IP in evaluation of patellofemoral pain and management *Am Accad Orthop Surg 1994 ;2:124-132.*
28. Fulkerson IP Diagnosis and treatment of patients with PFPS. *J sports Med 2002,30:124-132*
29. Goddard, Damian, A critical appraisal and literature critique on the effect of patellar taping--is patellar taping effective in the treatment of patellofemoral pain syndrome? *July 2006, J Ortho Sports.*
30. Grelsamer RP, and Klien JR The biomechanics of PF joint *J ortho Sports Phys Therapy 28:286.1998*.
31. Gross MT. Lower quarter screening for skeletal malalingment suggestions for orthotics and shoewear.*J Orthop Sports Physical Therap 1995; 389-405.*
32. Guyatt GH, Rennie D .User's Guides to the Medical Literature. Essentials of Evidence Based Clinical Practiced Chicago IL: *American Medical Association. 2002 ,*
33. Harris C. Kinematic MRI assessment of McConnell taping before and after exercise*. Am J Sports Med. 2004;32:621-628*
34. Harwin SF and Stern Subcutaneous lateral retinaculum release for chondromalacia patella. A preliminary report. *Clinic orthop 156:207-210, 1981.*
35. Hier DB, Edlestein G. Deriving clinical prediction rules from stroke outcome research. *Stroke* 1991; 22:1431-1436.

36. Hefzy, MS *et al* Effects of tibial rotation on patellar tracking and patellar contact area. *J Biomed Eng 14:329, 1991.*
37. Holleman M Jr, Simel DL. Quantitative assessment from the clinical examination. How should clinicians integrate the numerous results? *Gen Intern Med 1997; 12:167-171.*
38. Insall, Falvo KA,Wise Dw Chondromalacia patellae. A prospective Study. *J Bone Joint Surg Am, 1976; 58:1-8.*
39. Insall, Falvo Wise DW Condromalacia patellae, A prospective study *J Bone jt Surg 1976;58a:1-8*
40. Jaeschke R, Singe J, Guyatt GH, Measurement of health status Ascertaining the minimal clinically importance difference Control Trails.*1989; 10; 407-415.*
41. Jaesckle R Guyatt GH, Sackett DL. User's guides to the medical literature 111.How to use an article about a diagnostic test. B. What are the results and will they help me in caring for my patients? The *Evidence -Based Medicine Working Group. JAMA.1989; 10:407-415.*
42. Jenny MF Cheng, The effects of patellar taping on pain and neuromuscular performance in subjects with patellofemoral pain syndrome Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, 2002
43. Jonson SR Gross MT,. Intraexaminer reliability, Interexaminer reliability and mean values for nine lower extremity skeletal measures in healthy naval midshipmen. *J Orthop Sports Phy Ther.1997; 25:253-263.*
44. Juniper EF,Guyat Gh, Willan A Griffith S. Determining a minimal importance change in a disease specific quality of life Questionnaire *J Clinical Epidemiol 1994;47:81-87.*
45. Kannus P, Nittymaki S. Which factors predict the nonoperative treatment of patellofemoral pain syndrome? A prospective follow up study. *Med Sci Sports Exer 1994; 26:289-296.*
46. Kannus P, Aho, H, Jarvinen M, Nittymaki S Computerised recordings of visits to an outpatient sports clinic. *Am J sports Med.1987,15:79-85*
47. Kolwich PA, Paulos LE, Rosenberg T D, Farsworth S. Lateral release patella: indications and contraindications *Am J Sports Med.1990; 18; 359-365.*
48. .Kuijpers T, van der Heijden GJMG, Vergouwe Y, et al. Good generalizability of a prediction rule for prediction of persistent shoulder pain in the short term. *J Clin Epidemiol* 2007; 60:947-953.
49. Landis JR, Koch CG. The measurements of observer agreement for categorical data.*Biometrics.1977; 33159-174*.
50. Larsen *et al* Patellar compression syndrome .Surgical treatment by lateral retinacular release. *Clinical orthop 134:158-167, 1970*.
51. Larsen JR, Andtreasen E, Urfer A, Mickelson MR, Newhouse KE. Patellar taping: a radiographic examination of medial glide technique. *Am J Sports Med.1992; 23:465-471*.
52. Laupacis A, Clinical prediction rules, *JAMA. 1997;277;488-494*.
53. Lie FJ Perry J Quads function: An anatomical and mechanical study using amputee limbs. *Bones jt surgery.1986;50a :535-5148*
54. Lohmann KN, Rayhel HE, Schneider wind WP, Danoff JV. Static measurement of tibia vara. Reliability and effects of lower extremity position. *Phy Ther 1987; 67:196-202.*
55. Macgregor K,Mellor R,Cutaneous stimulation from patella tape causes a differential increase in vasti muscle activity in people with patellofemoral pain *Orthop Res.2005;23:351-358.*
56. Magee Dj. Orthopedic Physical Assessment. Philadelphia Pa .W.B. Sanbders Company; 1997.
57. Malek MM, Mangine RE. Patellofemoral pain syndrome: a comprehensive and conservative approach. *J Ortho Sports Therapy 1981; 2:108-116.*
58. Mark G Koweell , MD Patellar Taping in the Treatment of Patellofemoral Pain December 2002, 34:12,
59. Mark s. john, D.O., Patellofemoral Pain Syndrome: A Review and Guidelines for Treatment *Am Fam Physician 1999;60:2012-22.*[93]
60. McConnell JS The management of chondromalacia patella a long term role *Aust J Physiotherapy 1986 .32 215-223.*
61. McGinn TG, Guyatt GH, Wyer PC, Naylor CD, Stiell IG, Richardson WS. How to use articles about clinical prediction rule. *JAMA 2002; 284:79-84.*
62. McPoil TG, Wyer PC, The management of choromalacia patellae. A long term solution. *Australian J Physio 1986:32:215-223.*
63. Messier SP, Davis SE, Curl WW, Lowery RB, Pack RJ, Etiologic factors associated with patellofemoral pain syndrome in runners. *Med Sci Sports Exesssrc.1991, 23:1008-1015.*
64. Natri A, Kannus P, Jarvien M. Which factors predict the long term outcome in chronic patellofemoral pain syndrome? A 7-yrs prospective follow up study. *Med Sci Sports Exer 1998:30:1572-1577*
65. Ng Gy, Cheng JM The effects of patellar taping on pain and neuromuscular pain syndrome. *Clin Rehabil, 2002 16 82-827.*
66. Nordin M and Frankel, VH:Basic Biomechanics of skeletal system, ed 2 Lea and Febiger, Philadelphia, 1989.
67. PaErik Witvrouw, Roeland Lysens, Johan Bellemans, Dirk Patellar taping is clinical success supported by scientific evidence. *Man Ther.2005; 5:142-150.*
68. Patellofemoral Pain Syndrome Using a Multi-Modal Approach: A Case Series. *J orthop Sports, Epub 11 Aug 2008 10.2519/ jospt 2008.*
69. Picciano AM, Rowlands ms,Worrell T.Rliability of open and closed kinematic chain subtalar joint neutral position and navicular drop test *J Orthop Sports Phy Ther 1993 ;18;553-558.*
70. Pizzo W, eds. The Patellofemoral Joint. New York, N.Y.: McGraw-Hill,
71. Porteny L, Watkins M, Foundations of Clinical Research: Applications to practice 2nd edition Uppercase Saddle River*, NJ, Prentice Hall Healt;2000*

72. Powers CM, Heino JG, Rao S, Perry Rehabilitation of patellofemoral joint disorders a critical review. *J Ortho sports phys Ther.1998, 28:345-354*.
73. Powes Cm Heino Jg, Rao S, Pery J, The influence of PFP on lower limb loading during gait. *Clin Biomech (Bristol, Avon) 1999; 14:722-728.*
74. Price DD, Bush FM, Long S, A comparison of pain measurement characteristics of mechanical visual analogue and simple numerical rating scales. *Pain 1994; 28:345-354.*
75. Price DD, McGrath P, Buckingham B.The validation of visual analogue scale measures for chronic and experimental pain. *Pain 1983; 17:45-56.*
76. Principles and Practice. 2nd ed. Philadelphia, Pa.: Saunders, 2003:1590.
77. Radin EL A rational approach to treatment of PFPS. *Clinic Orthop* 144:107-109,1979
78. Randolph A, Guyatt H, Calvin JE, Doig G, Richardson WS. Understanding articles describing clinical prediction tools. *Crit CareMed* 1998; 26:1603-1612.
79. Reilly BM, Evans AT. Translating clinical research into clinical practice: Impact of using prediction rules to make decisions. *AnnIntern Med* 2006; 144:201-209.
80. Roberts JM. The effects of patellofemoral alignment. Manipulative Therapist of association of Australia conference*. Man Therapy association of Australia; 1989* 19;93:49.
81. Ronald, P Grelsamer John Klien: The biomechanics of patellofemoral joint *JOSPT, Nov 1998; Vol 28 No 5: 286-290 running injuries. Physician Sports med 1981; 9:47-58.*
82. *Salsich GB, Brechter JH,* The effects of patellar taping on knee kinetics, kinematics, and vastus lateralis muscle activity during stair ambulation in individuals with patellofemoral pain. *J Orthop Sports Phys Ther. 2003 Jan; 33(1):4-20.*
83. Salsich GB, Bresher JH, Farwell D, Powers CM, The effects of patellar taping on patellar position on knee kinetics and kinematics and vastus lateralis muscle activity during stair ambulation in individuals with PFPS. *J orthop Sports Therp 2002; 32:3-10.*
84. Sameer Dixit, M.D., and John P. Difori, M.D., University of California, Los Angeles, Los Angeles, California, Management of Patellofemoral Pain Syndrome. *Am Fam Physician 2007; 75:194-202, 204. 2007 American Academy of Family Physicians.*
85. Skalley, TC, *et al* The quantitative measurement of normal passive medial and lateral patellar motions limits. *Am J Sport Med 21:728, 1993.*
86. Somes S, Worrell TW, Effects of patellar taping on open and closed kinetic chain :a preliminary study. *J Sports Rehabil.1997; 6:299-308.*
87. Sutlive TG, Mitchell SD, Maxfield SN, *et al*. Identification of individuals with patellofemoral pain whose symptoms improved after a combined program of foot orthoses use and modified activity. *Phy Ther.2004; 84:49-61.*
88. Van Gheluwe b, Sara Piva, Kelley Fitzgerald, Reliability and accuracy of biomechanical measurements of lower extremity *J Am Potiatr Med Assoc.2002;92:317-326.*
89. Watson CJ, Leddy HM, Dynjan Td, Parham JL. Reliability of lateral pull test and tilt test to assess patellar alignment in subjects with symptomatic knees: student raters. *J Orthop Sports Ther.2001; 31:368-374.*
90. Werner S Knutsson E, Eriksson E Effects of taping the patella on concentric and eccentric torque and EMG of knee extensor and flexor muscle in patients with PFPS, *Knee Surg Sports Traumatol Arthrosc.1993;1:169-177.*
91. Whittingham M Palmer S Macmillan F. Effects of taping on pain and function in patellofemoral pain syndrome a randomized controlled trail. *J Ortho Sports Ther 2004, 34,504-510.*
92. Wiberg G, Roentgraphic and anatomic studies on the patellofemoral joint. *Acta Orthop Scand 12:319-409.*
93. Wilk Ke, Davies GJ, Mangine.pf jt disorders, a classifying system and clinical guidelines for non operative rehabilitation. *J orthop Sports Phy the, 200434; 504-510.*
94. Williams PL, and Warwick R (eds) Gray's anatomy ed 38 WB Saunders, Philadelphia 1995.
95. Wilson T, Carter N, A multicenter, single masked study of medial, neutral, and lateral patellar taping in individuals with patellofemoral pain syndrome. *J Ortho Sports Phys Ther. 2002; 33:437-443.*
96. Witvrouw E, Lysens R, Bellemans J, Cambier d, Vanderstraen G. Intrinsic risk factors for the development of anterior knee pain in an athletic population. A two -yrs prospective study*, Am J Sports Med.2000; 28:480-489.*
97. Worrell t, Effects of patellar taping and bracing on patellar position as determined by MRI in patients with pain. *J Athl Train.1998; 3316-20.*

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