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ORIGINAL RESEARCH

Predictors for Identifying Patients With Patellofemoral Pain Syndrome Responding to Femoral Nerve Mobilization

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Abstract

Objective: To identify the predictors for successful neurodynamic management in patients with patellofemoral pain syndrome.

Design: Prospective cohort, prediction rule study.

Setting: Hospital.

Participants: Patients with patellofemoral pain syndrome (N=51) underwent clinical examination and measurement of physical parameters, including femoral slump test, lower-extremity alignment, flexibility and muscle strength, and functional level.

Intervention: Patients received 6 treatment sessions of femoral nerve mobilization within 2 weeks.

Main Outcome Measures: Pain level during functional testing was assessed before and after the first and sixth session of treatment. Patients were then grouped into responder and nonresponder groups. Criteria for the responder group was a pain score decrease ≥50% or Global Rating Scale score ≥4. Chi-square and independent *t* tests were used to identify potential variables with a significance level of .10, and stepwise logistic regression was used to find predictors with a significance level of .05.

Results: Twenty-five patients responded to the initial treatment (immediate effect), and 28 patients responded after 6 sessions (longer-term effect). A positive femoral slump test was identified as the predictor for the immediate treatment effect. The prediction factors for the longer-term effect included responding to femoral nerve mobilization the first time and a bilateral difference in hip extension angles. Application of the clinical predictors improved the success rate to 90% for 1 treatment session and 93% for 6 treatment sessions.

Conclusions: Clinicians could use the positive femoral slump test and a bilateral difference in hip extension angles during the femoral slump test to determine whether or not patients with patellofemoral pain syndrome might benefit from femoral nerve mobilization.

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Patellofemoral pain syndrome is a common knee disorder characterized by pain over the anterior aspect of the knee during activities (eg, squatting, stair climbing).[1-3] Patellofemoral pain syndrome has been linked to factors such as abnormal patellar tracking, muscle imbalance, or overuse.[1,4] However, some researchers observed that certain patients with patellofemoral pain syndrome demonstrated symptoms which might indicate peripheral nerve damage (eg, numbness around the patella, altered threshold for detecting temperature change). This suggests that minor nerve disorders might be another mechanism causing patellofemoral pain syndrome.[3,5]

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Neurodynamics describes the ability of nerve tissues to move or stretch in relation to surrounding tissues. Mechanosensitivity of the nerve represents the ease with which the neural tissues become active when mechanical force is applied.[6,7] Previous reports revealed that mechanosensitivity of the nerve could be changed without any axonal damage.[8,9] For example, short episodes of ischemia caused by excessive local pressure over the patella might trigger neural proliferation and sensitize nerve tissues in the area.[10,11] Mobilization of nerve tissues is the neurodynamic approach for treating symptomatic conditions where there is an alteration in nerve mechanosensitivity.[6,7] The femoral slump test has been shown to have diagnostic validity for a range of spinal conditions and is considered useful in the diagnosis of peripheral

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nerve pathologies, including femoral nerve injury.[12-16] Lai et al[12] reported a specificity for the femoral slump test between 75% and 83% when assessing patients with experimentally induced anterior knee pain of nonneural origin. Lin et al[14] found that about one third of patients with patellofemoral pain syndrome showed a positive femoral slump test (reproduction of clinical knee pain symptoms), and patients exhibited increased mechanosensitivity of the femoral nerve (decreased hip extension angle) compared with asymptomatic controls.

The conventional interventions for patellofemoral pain syndrome focus on correction of malalignment or muscle imbalance.[17-20] Although these methods usually result in significant improvement, a small number of patients have reported residual symptoms.[2,20] It has been suggested that subgrouping the patients with patellofemoral pain syndrome might lead to more targeted interventions and therefore more effective treatments.[18,21,22] Despite evidence showing increased mechanosensitivity of the femoral nerve in some patients with patellofemoral pain syndrome, few studies address this issue in the assessment or treatment of patellofemoral pain syndrome. Therefore, the purpose of this study was to describe the clinical effects of neurodynamic treatment (femoral nerve mobilization) and to identify predictors which could be used as a clinical guide for choosing the neurodynamic approach for patients with patellofemoral pain syndrome.

Methods

Participants

Fifty-one patients (14 men, 37 women; mean, 34.9±14.2y) with patellofemoral pain were screened and recruited by a licensed physical therapist (B.-Y.H.), and the diagnosis was confirmed by an orthopedic surgeon (H.-L.M.). Inclusion criteria were as follows: (1) 18 to 60 years old; (2) patellar pain during prolonged walking, squatting, or stair climbing; and (3) at least 2 positive results from the following patellofemoral pain–specific tests: Clarke sign, Waldron test, active patellar grind test, patellar compression test, and palpation of the medial/lateral articular border of the patella. Patients with the following conditions were excluded: symptoms or signs of any intra-articular knee derangement, ligament problems, or meniscal tears; surgery on knee, hip, or lumbar spine; systemic disease; recent physical therapy treatment for patellofemoral pain syndrome; and advanced knee osteoarthritis. After a detailed explanation of the purpose and study protocols, patients had to sign informed consent to be included. This study was approved by the Institutional Review Board of National Yang-Ming University, Taipei, Taiwan (no. 1000049).

Testing procedure

All of the testing and measurements were executed by one of the authors (B.-Y.H.). Figure 1 shows the flowchart of the study. First, the patient's demographic data, the characteristics of their patellofemoral pain (duration of symptoms, time since previous episode, history of knee locking or giving away, crepitus), and whether or not the patient had a history of lower back pain were recorded. Afterward, patients underwent physical measurement of lower-extremity alignment, flexibility, and muscle strength in the symptomatic leg (or the worse symptomatic leg).[14,23,24] The alignment measurement included the quadriceps angle, tibial torsion, hip anteversion, and navicular drop test. The flexibility of the iliopsoas, hamstrings, iliotibial band, and quadriceps and the strength of the quadriceps, hamstrings, hip abductors, and gluteus maximum were measured (appendix 1).[14,23,24] The femoral slump test was then performed, followed by the first session of femoral nerve mobilization and the first outcome assessment. Over the following 2 weeks, patients came back for another 5 treatment sessions and the final outcome assessment. In addition, patients were instructed not to change their daily routines or to receive other forms of therapeutic exercise during this period. Patients were also referred for radiograph, and sulcus angle, congruence angle, and lateral patellar angle were measured.[23] The range of joint movement was measured using a universal goniometer and an inclinometer, and the muscle strength was measured using a handheld dynamometer (Power Tract II[a]). The measurement repeatability of these tests was examined in our pilot study, and the intraclass correlation coefficient (ICC) ranged between .92 and .99 (see appendix 1).

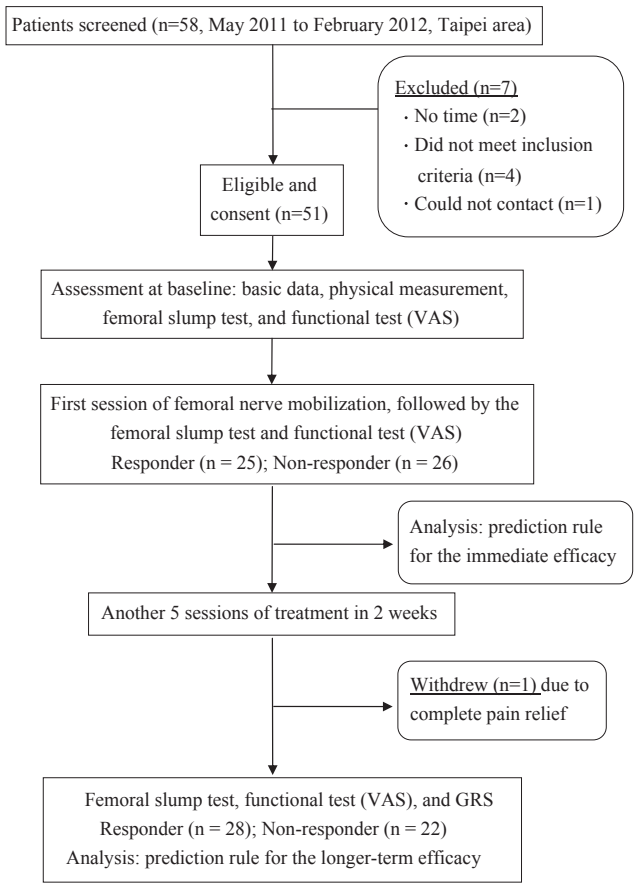

Fig 1 Flowchart of the study.

Femoral slump test

The testing was performed by one of the authors (B.-Y.H.), and the procedure was adopted from Lin,[14] without the suspension system (fig 2). The hip extension angle was measured, and the pain intensity was assessed using a 10-cm visual analog scale (VAS) (where 0 is no pain, and 10 is worse imaginable pain).[12] If the

List of abbreviations:

GRS Global Rating Scale
ICC intraclass correlation coefficient
VAS visual analog scale