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Research Article

The Patellofemoral Pain Syndrome Signs Normalization

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Abstract

The Patellofemoral pain syndrome (PFPS) is the most common knee complaint seen in adolescent and young adults. Pain in the knee is usually anterior, not well localized, and diffuse. The purpose of this study was to analyze which of the presumed physical examination signs which can be present in an asymptomatic population are a consequence of intrinsic risk factors for this disease. 263 patients were included in the study. Each participant completed a demographic questionnaire and underwent a physical and radiographic evaluation. The X-ray analysis was normal. Patellar subluxation or patellar tilt were both absent. Patellar congruence angles were normal. No tibiofemoral osteoarthritis was present. The prevalence of asymptomatic signs in patients without stretching deficit was: crepitus: 9% (OR 48.3 (5.16 - 452), p < 0.0001, Passive patellar grind test: 0% (OR infinite), Clarke´s sign: 20% (OR 7.5 (0.86 to 65), p 0.05). The comparison between asymptotic prevalence of signs with poor elongation and symptomatic: Crepitus: symptomatic: 92.1% (does not become significantly different: OR 1.94 (0.6 - 6.24), p < 0.3, Passive patellar grind test: 57.9% (that is clearly higher than the percentage of asymptotic patients with stretching deficits: OR 5.5 (2.21 - 13.63), p < 0.0001, Clarke´s sign: 92.1% (clear difference from asymptotic with poor elongation: OR 17.5 (6.7 - 45.68), p < 0.0001. Our findings suggest that we should have a more focused behavior in disease prevention. These recommendations depend entirely on careful clinical evaluation. Undoubtedly, physical examination of the patellofemoral articulation needs to be methodical. The examiner must differentiate normal from abnormal biomechanics. Treatment is predicated on changing the underlying fundamental abnormalities that lead to the patient's complaints.

Keywords: *Patellofemoral Pain Syndrome; Signs; Evaluation*

Introduction

The Patellofemoral pain syndrome (PFPS) is the most common knee complaint seen in adolescent and young adults [1]. Pain in the knee is usually anterior, not well localized, and diffuse. Once, started, the PFPS frequently becomes a chronic problem, forcing the patient to stop sports and other activities. Usually, pain is worse during or after activities that overload this joint, such as those that demand vigorous quadriceps contraction or during stair climbing or descending, and even during prolonged sitting with the knees flexed is a classical situation. Locking in extension episodes are usually momentary, but in some cases can last for longer periods due to quadriceps and hamstrings contracture and can be really painful. Catching may be produced by cartilage damage or irregularities in the patella and/or trochlea [2]. Instability or feeling of instability is not a common complaint in these patients.

The PFPS differentiates from Patellofemoral instability secondary to an augmented femoral anteversion or genu valgum, abnormal tibial torsion, troclear o patellar dysplasia, or high patella. There is not a laterally displaced or tilted patella. Thus, the J sign is absent and the Tilt test is negative. Muscle stiffness is usually evident in the hamstrings, in the quadriceps, or both. Moreover, we have to consider in this patients not only quadriceps atrophy and weakness but also the timing of vastus medialis oblique muscle (VMO) contraction.

There is rarely a history of swelling or effusion of the knee. The fat-pad and soft tissues along the sides of the patellar tendon are typical areas of tenderness. As instability is not a problem, the apprehension test is negative. Three typical findings are [3,4]: pain on the direct compression of the patella against the femoral condyles with the knee in full extension (passive patellar grind test), pain with isometric quadriceps contraction against suprapatellar resistance with the knee in 15° of flexion (Clarke's sign), and patellar crepitus [5]. But these signs can be also present in an asymptomatic population. Johnson., *et al*. [6] found crepitus in 94% of women who had never had knee complaints.

Shortening of the quadriceps and plantarflexor muscles, mainly, and shortening of the hamstrings and the iliotibial band/tensor fascia lata (ITB/TFL) complex, have all been associated as intrinsic factors for the development of PFPS. Several researchers showed that PFPS is also associated with specific quadriceps muscle atrophy, especially in the VMO [7-9].

The purpose of this study, therefore, was to analyze, with a multicenter case-control study design, which of the presumed physical examination signs which can be present in an asymptomatic population are a consequence of these intrinsic risk factors.

Material and Methods

Participants

A total of 587 patients were admitted in our office at the Spanish Hospital in Buenos Aires, and examined during the 2012 calendar year. For the study, the inclusion criteria were defined as: being between 18 and 70 years, to have the ability to read and understand the informed consent form. Exclusion criteria included: Iwano grade 3 or more patellofemoral osteoarthritis [10] and/or Kellgren and Lawrence grade 3 or more tibiofemoral osteoarthritis [11,12] in the radiographic evaluation, infection, malignancy, musculoskeletal or neurological lower extremity involvement, systemic arthritis. We also excluded patients with dynamic knee valgus and/or in clinical examination.

Finally, 263 patients underwent a physical examination. As a consequence of this, three groups of patients were conformed in the study. The first group of patients included healthy individuals with no history of patellofemoral pain syndrome but muscle stretching deficit (n = 140). The second group included healthy individuals with no history of patellofemoral pain syndrome and normal muscle stretching (n = 10). Finally, the third group included patients suffering PFPS (n = 113). One of us (F.A.) examined the patients consecutively admitted. In all three groups, clinical signs and muscle stretching measurements were made twice– at the entry into the study and one week after the start of the study. After the second examination patients were sent to the different groups. Radiographic documentation of the knee was obtained. Informed consent was obtained in each case.

Group 1 and 2

A total of 200 asymptomatic patients who complained about an upper limb pain were randomly referred for physical knee examination. A detailed history was obtained regarding a previous personal knee injury or disease. Patients were excluded from the asymptomatic group if evidence for previous disease or knee surgery was confirmed. Patients with muscle stretching deficit were sent to Group 1 (n = 140), and patients without muscle stretching deficit were sent to Group 2 (n= 10).

Group 3

A total of 387 symptomatic patients who complained about anterior knee pain were examined. Individuals were eligible to be in this group if they were diagnosed with PFPS after a second examination. To be considered a PFPS, subjects had to have anterior knee pain for more than 6 weeks (that is, retropatellar pain during physical activities such as jumping, squatting, and going up or down stairs, or during prolonged sitting with the knees flexed); exhibit two of the following clinical criteria on assessment (4): positive passive patellar grind test, tenderness of the posterior surface of the patella on palpation, pain on resisted knee extension, positive Clarke´s Sign. Previous studies indicate that these criteria are sensitive and specific for diagnosing PFPS [13,14].

Exclusion criteria for this group included previous patellar dislocation or positive apprehension test, previous knee surgery, concomitant known or suspected diagnosis of: internal knee derangement, meniscal tear, ligamentous knee injury or laxity, plica syndrome, Sinding-Larsen-Johansson's disease, Osgood Schlatter's disease, or patella alta in the radiographic evaluation (n = 113).

Measurement

Each participant completed a demographic questionnaire. Subjects' age, gender, height, weight, prior history of knee problems, mechanism of injury, current episode duration, and symptom location were recorded.

Physical Examination

No analgesic pre-medications were administered or allowed.

Flexibility testing of the quadriceps and hamstrings was assessed.

Quadriceps tightness was quantified by measuring the heel to gluteus distance with the patient lying prone while the examiner gently flexed the knees. Care was taken to avoid anterior tilting of the pelvis and/or extension of the lumbar spine. Both the absolute value and side-to-side differences were recorded. A distance greater than 10 cm or/and a difference of 5 cm with the contralateral knee were considered positive.

In assessing hamstring tightness, the patient lied supine on the exam table and flexes the hip 90° of the tested side with the untested leg extended and flat against the exam table to avoid excessive posterior pelvic tilt. The examiner passively extended the knee of the leg tested. The popliteal angle is measured and can be compared with the contralateral side using a gravity goniometer. An angle greater than 10° or/and a difference of 10° with the contralateral side were considered positive.

In the symptomatic group subjects had one lower extremity tested unless they had bilateral symptoms, in which case the most symptomatic side was tested. The most symptomatic knee was determined by the patient's self-report.

Dynamic Knee Valgus: We performed a Single Squat Test; patients were asked to place their hands on their hips and stand on one limb and flex the opposing limb to 90°. Then they were instructed to perform a Single Squat to 45° of knee flexion and then return to a fully extended knee position. Patients performed this test 3 times in a row on each leg. The investigator used visual inspection to note any abnormal response; which consisted of arms flailing, the Trendelenburg sign, or collapse of the supporting knee into valgus [15].

Clarke´s Sign: All participants were positioned supine with both lower extremities supported on the examination table. The examiner then placed the web space of his thumb and index against the superior pole of the participant´s patella. The examiner asked the participant to perform an isometric quadriceps contraction. A positive test was indicated by the presence of pain sufficient to prevent the participant from maintaining a quadriceps contraction against resistance longer than 2 seconds. A negative test meant the participant could contract the quadriceps and hold it for 2 seconds while pain free [16].

Passive patellar grind test: It was performed with the patients in supine position. The patella was pressed with one hand against the femoral groove in an upward and downward vertical direction. It was considered positive when the patients referred pain during the maneuver.

Patellofemoral crepitus: It was considered positive when the knee extends and a crepitant sensation is palpated by the examiner while manually compressing the patella and passively ranging the knee.

Radiographic evaluation

Merchant axial view was performed in a standardized manner to reveal patellar subluxation, tilt, or a combination of both [17]. Through this view, patellar congruence angles and patellar tilt angles were assessed, and the determination of abnormal subluxation and/or tilt was contemplated. We also appreciated bone quality and patellofemoral cartilage space remaining. Further plain radiographs, such as an AP, lateral, and a notch view, were included with the initial x-ray series to discard (tibiofemoral) osteoarthritis.

Statistical Analysis

Results

The age and sex distribution in three groups of patients were similar. In the asymptomatic groups, the mean age was 56.6 ± 1.1 years (SEM) and 79 percent of these patients were male; in the symptomatic group, the mean age was 56.5 ± 0.8 years (SEM), and 79 percent of the patients were male.

The X-ray analysis was normal. Patellar subluxation or patellar tilt were both absent. Patellar congruence angles were normal. No tibiofemoral osteoarthritis was present.

The prevalence of asymptomatic signs in patients without stretching deficit was: crepitus: 9% (OR 48.3 (5.16-452), $p < 0.0001$, Passive patellar grind test: 0% (OR infinite), Clarke´s sign: 20% (OR 7.5 (0.86 to 65), $p < 0.05$).

	Clarke´s Sign	Passive patellar grind test	Crepitus
Symptomatic signs with stretching deficit	92.1%	57.9%	92.1%
Asymptomatic signs with stretching deficit	40%	20%	85.71%
Asymptomatic signs without stretching deficit	20%	0%	9%

Table 1

The comparison between asymptotic prevalence of signs with poor elongation and symptomatic: Crepitus: symptomatic: 92.1% (does not become significantly different: OR 1.94 (0.6 - 6.24), p 0.3, Passive patellar grind test: 57.9% (that is clearly higher than the percentage of asymptotic patients with stretching deficits: OR 5.5 (2.21 - 13.63), $p < 0.0001$, Clarke´s sign: 92.1% (clear difference from asymptotic with poor elongation: OR 17.5 (6.7 - 45.68), $p < 0.0001$.

Discussion

As stated previously, several signs of patellofemoral damage (e.g. passive patellar grind test, Clarke's sign and patellar crepitus) have been described largely in symptomatic patients and are generally considered to be typical signs of PFPS. However, these signs are also present in a high percentage of asymptomatic individuals, who have shortening of the quadriceps and plantarflexor muscles, mainly, and shortening of the hamstrings and the iliotibial band/tensor fascia lata (ITB/TFL) complex. At first, the intrinsic risk factors may cause no symptoms, but damage, so clinical signs can be present.

In addition, treatment may relieve symptoms and can also improve the mechanical function of the joint, but signs are probably permanent, since they imply joint damage. However, in the absence of pain, the first thing to do is to design a physical therapy program to overcome the abnormal biomechanics which predispose to the patient's condition. Therapy prescriptions need to be precisely tailored to the working diagnosis addressing the presumed underlying biomechanical deficiency. Tight quadriceps, hamstrings, or iliotibial bands should be progressively stretched. The next step is strengthening. The quadriceps, especially the vastus medialis obliquus is targeted.

Conclusion

Muscle flexibility deficits occur very commonly in the general population (93%). When this occurs, we recommend stretching focusing on all tight muscle groups and retinacular constraints. Combining knowledge of the mechanics and natural history of patellofemoral problems with information from the history and physical examination, even in the absence of anterior knee pain, but in presence of muscle tightness, a rational treatment should begin.

Although the importance of positive signs in asymptomatic patients has not been defined, we believe that muscle flexibility deficit it is not only an intrinsic risk factor for PFPS, but it also involves progressive damage to the patellofemoral joint. Moreover, it may identify a subset of patients prone to suffer of PFPS, whose prognosis might be improved by early preventive measures. Thus, not all heavy smokers have chronic obstructive pulmonary disease, but all heavy smokers damage their lungs every day.

As one can see, the impressive findings demonstrated in our study suggest that we should have a more focused behavior in disease prevention. These recommendations depend entirely on careful clinical evaluation. Undoubtedly, physical examination of the patellofemoral articulation needs to be methodical. The examiner must differentiate normal from abnormal biomechanics. Treatment is predicated on changing the underlying fundamental abnormalities that lead to the patient's complaints.

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Conflict of interests

None declared.

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