

‘Femoropatellar’ Dysfunction: A new description of an old problem
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There may be more to solving the complex puzzle of patellofemoral dysfunction than first meets the eye. To date, the general consensus is that malalignment of the patella in relationship to the femur is the cause of patellofemoral dysfunction.

Altered soft tissue¹ and inadequate activity and timing of the vastus obliquus musculature² are believed to cause lateral tracking of the patella. In actuality, the patella may be getting too much attention.

The origin of the dysfunction may be a maligned femur that has resulted from an angulation abnormality in the pelvis. Looking closely at the kinetic chain above the knee may significantly improve the outcome of the patient with anterior knee pain.

Conservative treatment has been reported to be successful in more than 75 percent of patients.³ However, 70 percent of patient treated conservatively are symptomatic 12 months following the intervention.⁴ Conservative treatment has typically consisted of taping, bracing and quadriceps strengthening. In order to reduce pain and edema, electrical stimulation, ice and ultrasound are commonly introduced into the treatment regimen. Patients are ordinarily instructed by their physician to use non-steroidal anti-inflammatory medication in conjunction with the above physical therapy modalities.

Commonly, if medication and physical therapy fail, one or more of the following surgical procedures is performed: subpatellar grinding, lateral release, tibial tubercle transfer or tibial osteotomy.

All the efforts of the clinician, physician and most importantly the patient, may fail when evaluation and treatment techniques do not include the pelvifemoral joint. Typically, angulation abnormalities at the hip are not addressed when treating patients with patellofemoral dysfunction.

The underlying cause and return of symptoms in patients with patellofemoral dysfunction may be a biomechanical “imbalance” in the ipsilateral or contralateral pelvifemoral joint. The imbalance occurs when one or both innominants tilt anteriorly or rotate forward and cause internal rotation of the femur.^{5,6}

Miserable Malignant

The term “miserable malignant” has been used by previous authors to describe increase hip internal rotation in combination with bilateral squinting patellae, genu recurvatum, patella alta, increase external tibial rotation, tibial varum and compensatory pronation.⁷ Further up the kinetic chain there is an anteriorly rotated pelvis with compensatory increased thoracic kyphosis, cervical extension and a forward head.

The lower extremity, lumbar, thoracic and cervical posture adjustments/compensations that stem from pelvic tilting are necessary to assure that the center of gravity (point at which

gravity acts) and the line of gravity (vertical line through the center of gravity) remain within the base of support.

If there is motion loss in the hip in the kinematic chain, compensatory movement further up the chain occurs and there is an alteration in the intricate neuromuscular connection between postural muscle activity and the way these postural muscles synergistically and antagonistically work together.

In other words, there is a loss of coordinated muscle activity between the lumbopelvic region and the hip. Thus, the individual is unable to maintain pelvic stability.

Suboptimal pelvifemoral position alters the length-tension relationship and overall tone of the muscles that statically and dynamically affect pelvic and knee stability. Hypertonic positionally shortened hip flexors (psoas, TFL), secondary to an anterior pelvic tilt, functionally limit hip extension. The ability of the posterior gluteals (gluteus medius and maximus) and hamstrings to posteriorly rotate the pelvis is also limited.

The gluteus maximus and hamstrings play an important role in posteriorly rotating the pelvis and directly and indirectly stabilizing the knee. The gluteus maximus and hamstrings indirectly stabilize the knee by stabilizing the pelvis through the reduction of an excessive anterior pelvic tilt and accompanying femoral internal rotation. The hamstrings further affect patellar stability by directly controlling internal and external rotation of the tibia.⁷ The hamstrings become long and hypertonic secondary to an anterior pelvic tilt. Unnecessary stress may be placed on the quadriceps and patellar tendon to extend the knee and support the trunk during contralateral nonstance /open chain activity. Hence, rotational stability of the tibia is lost, and the ability to maintain a neutral pelvis is further compromised.

In this scenario, the hip flexors and knee extensors are ultimately unopposed and overused and the abdominals are lengthened and underused. The consequence is femoralpatellar dysfunction.⁸

Femoralpatellar Dysfunction

Ultimately, there is increased quadriceps tension and patellofemoral contact pressure in the patient with an internally rotated femur.⁹ Normally, during the “toe off” phase of gait, both the tibia and femur externally rotate. Computed tomography images have shown in individuals with anterior knee pain that external rotation of the tibia with respect to the femur, i.e., version, occurs.¹⁰ One can extrapolate that subluxation of the patella occurs as the tibia externally rotation on a femur that won’t externally rotate during “toe off” in the patient with “femoralpatellar dysfunction.”

The patella is a passive reflection of the rotary position of the long axis of the femur.¹¹ Therefore, evaluation of hip internal and external rotation, hip extension through the Thomas test, and hip adduction through the Ober test are recommended when examining patients with patellofemoral dysfunction. Abdominal oblique strength testing is also very

important. If the patient is positive for one or more of the above test, he should be placed on an abdominal oblique strengthening and a hip repositioning program.

The external obliques by the nature of the muscle's origin and insertion are able to control anterior pelvic rotation during lower extremity dynamic movement. Therefore, this muscle group is essential to achieving a balanced position between the pelvis, thoracolumbar spine and knee. Cinematography has shown that one-fourth to one-third of total hip flexion movement results from posterior rotation of the pelvis and this movement begins in the first eight-degrees of hip flexion.¹² Thirty-degrees of fixed hip flexion can be hidden by increasing lumbar lordosis.¹³ Consequently, the external obliques will over-contract in a lengthened position and will be unable to offer stability to the pelvis. An appropriate pelvic to femur relationship must be maintained in order to properly strengthen the pelvic stabilizers. "Protonics" may be utilized in this case.

New form of Resistance

Protonics offers a new form of resistance, which is unlike isotonics, isometrics and isokinetics. Protonics is resistance that is programmable, variable and independent of speed and gravity. This type of resistance has been shown to significantly improve function and reduce pain in subjects with patellofemoral pain.¹⁴

Currently, protonics resistance is being offered through the use of a system that looks like a typical postoperative knee brace. Most knee braces have two upright bars that lie on both sides of the lower extremity and run from the leg to the thigh. These upright bars are split in the middle by a hinge, which lies on either side of the knee. On a protonics system, there are two modules located where hinges would normally be found.

Protonics resistance has been shown via EMG to increase hamstring activity¹⁵ This increased hamstring activity assist in posterior rotation of the pelvis, and allows for unopposed movement of the femur in relationship to the pelvis. With the femur in a balanced position, there is an increase in the mechanical advantage of the appropriate stabilizers of the hip and knee (hamstrings). Furthermore, there is decrease demand on inappropriate lateral leg musculature (vastus lateralis, biceps femoris, and tensor fascia latae) for postural support.

As a result of improved pelvifemoral alignment, knee instability is reduced.

In conclusion, the pathologic entity responsible for increase lateral petellofemoral force may be due to the underlying torsional direction of the femur's lumbopelvic position.⁸ To ultimately eliminate dysfunction of the patellofemoral joint, the relationship of the femur to the patella must be addressed. If a patient is not ipsilaterally or bilatearaly limited in active or passive hip extension, adduction, flexion or rotation, only then can he be diagnosed as having "true" patellofemoral pain. If the patient is particularly limited in hip adduction and extension, and has a forwardly rotated and anteriorly tilted pelvis, "femoralpatellar dysfunction" may be a more appropriate diagnosis.

Changing the name of the diagnosis is not the answer to alleviating anterior knee pain. However, understanding that patellar malalignment in relationship to the femur may not be the cause of the pain and, therefore, attaining appropriate patellofemoral position should be the focus of treatment.

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