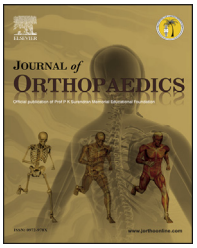
Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jor



Editorial

# Patellar instability – Changing beliefs and current trends

Patellar instability may be defined as inability of the patella to contain itself in the trochlear groove throughout the normal arc of knee movement. It encompasses a variety of injuries including patellar subluxation, dislocation and recurrent symptomatic instability interfering with the day to day living activities.[1] It largely affects young active individuals with a female preponderance.[2] It is associated with long-term arthritis and there is renewed interest in the understanding of the pathophysiology of patellar instability.[3] In the past, a variety of different treatments have been tried with varying degrees of success. There have recently been substantial advances in the understanding of the biomechanics of patellar instability. Newer treatments and techniques have been developed as a result of better understanding of the basic pathology, which seem to provide superior results for the management of this disorder.[4]

This article discusses the current developments in the understanding of anatomy and biomechanics of patellar instability as well as the relevant clinical features with imaging and management of this complex problem. A thorough clinical examination is mandatory to suggest a treatment protocol for each patient. The treatment in patellar instability should be individualised and "one size fits all" approach should not be adopted.

## 1. Imaging

Standard radiographic evaluation begins with weight bearing posteroanterior in 45° (Rosenberg view) lateral and merchant views. These views help to assess reduction, identify avulsion fractures of MPFL, osteochondral fractures and evaluate for the anatomic variations predisposing to patellar instability thus guiding treatment. Three joint radiographs are helpful to detect malalignment and hip pathologies. Patella alta is defined using the modified Insall-Salvati ratio (>2.0); Caton-Deschamps Index (>1.3) and the Blackburne-Peel ratio (>1.0).[13–15] The lateral radiograph is mandatory to assess the trochlear dysplasia. The "crossing sign" in the lateral radiograph is representative of a flat trachlea.[6] Dejour et al defined dysplasia as a trochlear depth less than 4 mm, a positive crossing sign or a trochlear bump greater than 3 mm.[6] Merchant view gives the measure of the sulcus angle. An average sulcus angle is 138° and values greater than 145° are suggestive of Trochlear dysplasia.[16] Lateral patellofemoral angle, or Laurin angle is useful in assessment of the patellar tilt and greater than zero in the normal population.

In addition to the standard X-rays, computer tomography (CT scans) and magnetic resonance imaging (MRI) scans has become an important adjuncts in the evaluation bony and soft tissue constraints of the patellofemoral instability. CT scans are used to assess the trochlear morphology, TT-TG distance, patellar tilt, femoral and tibial torsions.[16] A TT-TG distance greater than 20 mm is abnormal and indicates lateralization of tibial tuberosity. MRI scans are used to detect the soft tissue injury especially injury to the medial retinaculum, tearing of VMO and MPFL. It also helps to detect the osteochondral fractures, chondral loose bodies and bone bruises of medial facet of patella and lateral femoral condyle in acute cases. The TT-TG angle as well as femoral version and tibial torsion may be detected on MRI, making it superior to CT scans for evaluating patellar instability.

## 2. Nonoperative treatment

Nonoperative treatment begins with immobilization in extension in cast, posterior splint or brace for four to six weeks. In a long-term study by Maenpaa et al it was found that patients with primary patellar dislocations treated in casts for 6 weeks had the lowest risk of redislocation but the highest rates of stiffness. whereas, patients treated with just a patellar brace had 3 times the risk of redislocation but least stiffness.[18] Current dictum is judicious immobilisation using posterior splint for the pain and oedema to subside and begin range of movement exercises at the earliest to prevent stiffness and improve articular cartilage nutrition.[19] Post immobilisation rehabilitation should be directed towards strengthening of VMO and gluteal muscles along with the core muscles.[20]

Closed chain exercises has been found to be superior than open chain exercises.[7] Closed chain exercises involving the gluteal musculature increases the external rotation of the femur and decreases the Q angle. Patellar taping has been shown to improve the VMO activity onset, reduce pain and improve patellar tracking but the mechanism of action remains unknown.[21] In a long term study of nonoperative treatment by Sillanpaa et al it was found that preinjury level was regained by fewer patients who sustained MPFL tears at the femoral origin when compared with midsubstance or tears at patellar insertion.[21] Higher rates of redislocation and surgical intervention were seen in these groups of patients.[22] As a whole, first-time dislocators were found to have a low rate of subsequent dislocation.[23] Many studies have shown no significant differences in nonsurgical and surgical treatment groups on long term followup.[24,25]

## 3. Surgical treatment

There has been no clear guidelines for the operative interventions for patellar instability with more than 100 procedures described. This has been due to the lack of understanding of the basic pathoanatomy of patellar instability. Current developments have put more light towards better management of this difficult problem. The fundamental surgical principle in the reconstruction of unstable joints (Shoulder, Knee, Ankle) is restoration or reconstruction of the injured structure that restrains the abnormal movements. This approach applies to patellofemoral instability too. Current surgical procedures are aimed to recreate normal anatomy, rather than impose a nonanatomic restraint to motion. Decision for surgical intervention is related to patient pain and functional restriction produced by constant feeling of apprehension on walking. Surgical interventions may be divided into soft tissue (lateral release, medial plication, MPFL repair or reconstruction) and bony (tibial tubercle transfer, derotational tibial and femoral osteotomies and trochleoplasty) realignment procedures.

**Soft tissue realignment procedures: Lateral release:** This has been a widely used procedure in the past for lateral patellar instability but many studies have shown that it has no role when used in isolation for treating patellar instability.[26] It may be used to centralise the patella as an adjunct to proximal and distal realignment procedures as well in lateral patella compression syndromes. It is recommend that a lateral release be used only when there is residual positive patellar tilt sign after restoration of the medial retinacular structures. Overzealous lateral release may lead to medial patellar instability and paradoxical worsening of lateral instability. **Medial plication:** Medial imbrication and lateral release has been a favourite procedure for patellar instability in the past. A study by Ostermeier et al found that combination of lateral release and medial placation resulted in significantly medialized and internally tilted patellar movement.[27] Medial imbrication is a nonanatomic procedure which fails to address the primary problem of MPFL injury at femoral attachment leading to abnormal tracking and excessive medialization of the patella. **MPFL repair or reconstruction**: MPFL repair is indicated for acute cases presenting with MPFL femoral avulsion. Chronic cases have got higher failure rates with MPFL repair.[28] MPFL reconstruction have given a more predictable results than repair. MPFL reconstruction is done using autografts like gracilis, semitendinosus, quadriceps tendon or allografts. Various techniques have been described for MPFL reconstruction. Placement of the femoral tunnel and proper tensioning of the graft are the two critical steps determining the success of the surgery. Femoral placement should be done using fluoroscopy. The appropriate knee flexion angle at which to tension the graft is controversial. Tensioning the graft at 30–45° of knee flexion is advocated by many.[27] Knee flexion depended in which position patella engaged well in the femoral traochlea and comparable to opposite normal patella movements. Long term studies for MPFL reconstruction are not available. There is ample evidence to prove that the MPFL acts as the critical soft tissue restraint against lateral patellar translation. It may be presumed that residual laxity in the healed MPFL is responsible for the increased patellar mobility after the initial injury in majority of cases in addition to the anatomical abnormality. In a cadaveric study, Ostermeier et al demonstrated that reconstruction of the MPFL was better than medial transfer of tibial tuberosity for stabilising patellar movement under laterally directed force.[27] MPFL reconstruction alone may be sufficient for cases with mild degrees of trochlear dysplasia. Complications of MPFL reconstruction include overtightening of MPFL resulting in medial patellofemoral arthrosis, patella fracture and hardware problems.

## 4. Bony realignment procedures

1. Tibial tubercle transfers

The main indication for these procedures are high Q angles and increased TT-TG distances. Anteromedialisation of the tibial tuberosity using Fulkerson type osteotomy are the currently favoured techniques. The Fulkerson procedure offloads the distal articular cartilage of the patella that have been damaged by repeated episodes of instability and improves the patellar stability by allowing patella to engage earlier in the trochlear groove along with medialisation of the tibial tuberosity. Pidoriano et al found correlation between clinical outcomes and preoperative location of patellar articular lesions. Patients with lateral facet and distal patellar articular lesions had better outcomes than medial facet and proximal patellar articular lesions.[29] Tibial tubercle distalisation may be performed for patellar instability following patella alta but it involves concerns regarding raising patellofemoral pressures and predisposing to pain and late onset patellofemoral arthritis. Many times, it is combined with anteromediaisation of the tuberosity. Careful patient selection is mandatory for success of the procedure. Complications include medial patellofemoral arthritis, non-union of the tubercle fragment,