Imaging of the Patellofemoral Joint

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The patellofemoral joint, as a part of the knee joint, is a very complex articulation with high functional and biomechanical requirements. The osseous and soft tissue structures maintain the balance between knee mobility and stability. In order to treat all different pathologies appropriately, a knowledge base of the anatomy and function is essential. Patellar instability is a common problem. Various predisposing factors for patellar instability have been reported, including trochlear dysplasia, patella alta, patellar tilt, malrotation of the femur, genu valgum, and abnormally lateralised tibial tuberosity. In this lecture, imaging of the PF joint are reviewed, including imaging techniques and imaging-based measurements of radiographic, CT and MRI.

Trochlear dysplasia

In Dejour’s classification, the "crossing sign" is a line represented by deepest part of trochlear groove, crossing the anterior aspect of condyles, assessed on lateral radiographs. "Double contour sign" is a double line at anterior aspect of condyles, and seen if medial condyle is hypoplastic. Skyline view also can show decreased trochlear depth and large sulcus angle (>150 degree). Lateral trochlear inclination, trochlear facet asymmetry and trochlear depth, are used to judge trochlear dysplasia by MRI. Type A - normal shape of trochlea, but shallow trochlear groove, type B - markedly flattened or even convex trochlea, type C - trochlear facet asymmetry, with too high lateral facet, and hypoplastic medial facet, type D - type C features + vertical link between facets ('cliff pattern').

Patella alta

Patellar height is one of the important predisposing factors. Insall-Salvati index and Caton index are useful to detect patellar height. The normal Caton index equals 1, the patella considered as being high with an index of 1.2 or greater. Severe patella alta is remaining problem. Tsuda, et al. reported that isolated tibial tubercle transfer should not be indicated for recurrent patellar dislocation with severe patella alta.

Patellar tilt: patellar tilting is detected by skyline view (knee flexion at 30, 45, 60, 90
degrees) or CT. Patellar tilting angle, measure by skyline view, is defined as the angle subtended by a line joining the medial and lateral edges of the patella and the horizontal. The radiograph (skyline view) is taken with the knee at 30 degrees flexion. The mean tilt angle of a group of patients with signs and symptoms suggesting patellofemoral malalignment was 12 degrees (+/- 6 degrees)\(^3\)

**Abnormally lateralised tibial tuberosity**\(^4,5,6\)

Tibial tuberosity to trochlear groove (TT–TG) distance is an index for lateralization of the tibia in reference to the femoral groove. TT–TG distance can be measured on superimposed computed tomography (CT) or magnetic resonance (MR) images using the slice that includes the deepest point of the trochlear groove and tibial tuberosity. Normal distance ranges from 10 to 15 mm, and the pathologic threshold indicating patellar instability has been reported to be 20 mm. Although there are some differences between CT and MR imaging evaluations in the values of TT–TG distance, increased TT–TG distance has been indicated as a risk factor for patellar instability\(^7\).

**References**