Imaging of the Patellofemoral Joint

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KEYWORDS

• Magnetic resonance imaging • Patellofemoral joint • Patellar instability
• Patellar malalignment

KEY POINTS

- The patellofemoral (PF) joint is a complex articulation, with interplay between the osseous and soft tissue structures to maintain the balance between knee mobility and stability.
- Disorders of the PF joint can be a source of anterior knee pain.
- Imaging of the knee is important for evaluating patients with knee pain.

INTRODUCTION

The patellofemoral (PF) joint is a complex articulation, dependent on both dynamic and static restraints for its function and stability. Disease in the PF articulation is implicated in anterior knee pain (AKP), which has a reported prevalence affecting between 20% and 40% of the adolescent population, with a higher prevalence in athletes.[1] AKP is a common symptom and accounts for up to 10% of all visits to orthopedic and musculoskeletal clinics.[2] The biomechanics of the PF joint are complex, because it transmits tensile force from the quadriceps to the patellar tendon. The patella centralizes the divergent forces of the quadriceps muscles and transmits the tension around the femur to the patellar tendon. The patella increases the mechanical advantage of the extensor muscles by increasing the knee extension moment arm through the entire range of knee motion.[3] Imaging of the knee is important for evaluating patients with knee pain.

IMAGING OF THE KNEE

Radiographs

Conventional radiography is commonly the first imaging modality in evaluating knee pain. A standard radiographic examination of the knee includes frontal, lateral, and axial views. Frontal views are usually obtained as anterior-posterior projections, with or without weight bearing, and are the least useful view for evaluating the patella.

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Lateral views are usually obtained in mild flexion (approximately 30°) in a lateral recumbent position, but may be obtained cross-table especially in the setting of trauma. Axial/tangential views (often generically referred to as sunrise views) are obtained to evaluate the PF articulation, including the morphology of the patella, size of the patella with respect to the trochlea, and sulcus angle. There are several positioning methods to obtain the axial images. One common method is the Merchant view, which is a superior-to-inferior projection obtained with the patient's knees flexed 45° over the edge of the table and the beam angled 30° to the femora.[4] The Laurin technique is an axial image obtained with the beam projection from inferior to superior and the knee in 20° of flexion; it is considered more sensitive for patella subluxation, which occurs between 20° and 30° of flexion.[5]

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI), with its superior soft tissue contrast resolution and multiplanar capability, is an excellent modality to view the PF joint. Imaging is performed using a dedicated multichannel knee coil, preferably on a high field unit (≥1.5 T). Standard sequences should include a fat-suppressed sequence, which improves conspicuity for marrow edema patterns and fluid collections by allowing better use of the full dynamic range of the gray scale.[6]

An intermediate echo-time two-dimensional (2D) non–fat-suppressed fast/turbo spin-echo image provides good differential contrast between the intermediate signal intensity of articular cartilage, the low signal intensity of fibrocartilage, and the high signal intensity of synovial fluid and allows imaging of the grayscale stratification of cartilage (**Fig. 1**), which corresponds to cartilage zonal anatomy.[7] Newer three-dimensional (3D) fast spin-echo techniques or fat-suppressed T1-weighted

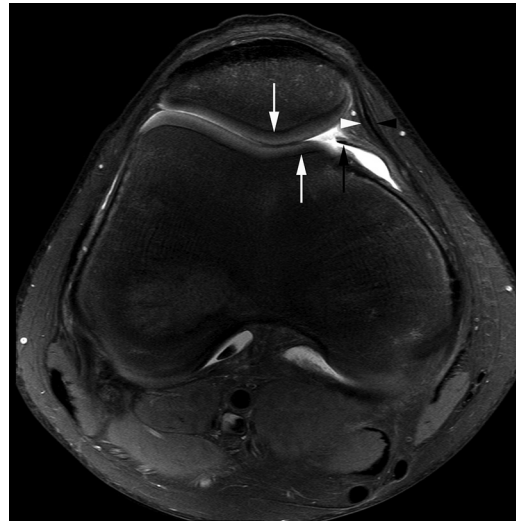

Fig. 1. Fat-suppressed proton-density-weighted transverse MRI of the knee shows normal patellar and trochlear cartilage (*white arrows*). Note the grayscale stratification of the cartilage with lower signal intensity in the radial zone (close to the bone) and the higher signal intensity in the transitional zone (closer to the surface). Note also the distal portion of the medial patellofemoral ligament (*white arrowhead*), tendinous fibers of the vastus medialis obliquus (*black arrowhead*), and mediopatellar plica (*black arrow*).