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Proximal Tibiofibular Joint in Knees with Arthroplasty

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1. Introduction

Because proximal tibiofibular joint (PTFJ) is a diarthrodial joint encased in a synovial-lined articular capsule, it is possible to observe disorders at synovial joints, such as traumatic dislocation, osteoarthritis, inflammatory arthritis, ganglion cysts, pigmented villonodular synovitis, and infection.

Because of its close proximity to the knee joint, PTFJ may be the cause of lateral knee pain. This issue is important, especially in knees with arthroplasty. However, knee arthroplasty may exacerbate PTFJ. Consequently, the joint should be examined in detail before and after knee arthroplasty operations.

2. Embryology and postnatal development

Before 12 weeks of fetal age, PTFJ does not create a cavity (Bozkurt et al., 2003; Resnick et al., 1978). Subsequently, narrow cavities, which may be separated from the lateral femorotibial joint by a small amount of loose fibrous or areolar tissue, are apparent (Resnick et al., 1978). Subsequent development of the PTFJ includes the formation of articular cartilage, synovial tissue, synovial recesses, and a fibrous capsule (Resnick et al., 1978). Ossification usually begins in the proximal tibia within the first three months following birth. The tibiofibular joint morphology has considerable morphologic variation, and the joint may communicate with the knee joint (Ogden, 1984).

3. Anatomy

PTFJ is a diarthrodial joint between the lateral tibial condyle and fibular head; it is located posterolaterally on proximal tibia (Bozkurt et al., 2003). PTFJ has certain characteristics of synovial joints, such as synovial membrane, hyaline cartilage, and a fibrous capsule (Bozkurt et al., 2003; Resnick et al., 1978). The stability of the joint is provided by anterosuperior and posterosuperior capsular ligaments (Ogden, 1974; Resnick et al., 1978; Gray, 1977). The tendon of the biceps femoris muscle inserts into the anterior part of the fibular head and enforces the anterosuperior ligament of the joint (Bozkurt et al., 2003; Marshall et al., 1972).

Communication between the knee joint and PTFJ is reported to be 10-63% (Bozkurt et al., 2003; De Franca, 1992; Eichenblat et al., 1983, Veth et al., 1984). Communication between the

proximal tibiofibular and the knee joint occurs via the subpopliteal recess-associated defect in the posterior ligament of the fibular head (Dirim et al., 2008). The relation of the defect to trauma or developmental deficiency is unclear (Dirim et al., 2008).

Two types of PTFJ were defined according to joint line inclination; oblique (inclination $> 20^\circ$) and horizontal (inclination $< 20^\circ$) (Ogden, 1974). Moreover, planar, trochoid and double trochoid types of PTFJ have been reported (Espregueira-Mendes & Vieira, 2006).

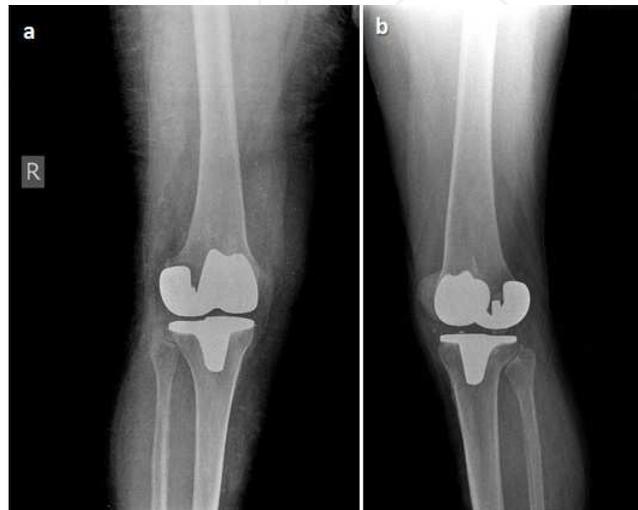


Fig. 1. Horizontal (a) and oblique (b) type PTFJ

3.1 Functional anatomy

Primary functions of PTFJ include the following:

1. Dissipation of torsional stresses applied at the ankle. With external rotation of the fibula about its longitudinal axis during dorsiflexion of the ankle joint, the proximal fibula rotates a few degrees externally (Barnett & Napier, 1952). The amount of external rotation is much greater in horizontal-type PTFJs (Barnett & Napier, 1952).
2. Dissipation of lateral tibial bending movements. Tensile and torsional forces influence the proximal-middle fibula in contrast to the distal fibula, which is affected by compressive forces (Ogden, 1974).
3. Transmitting axial loads in weight-bearing. Approximately one-sixth of the static load is applied at the ankle being transmitted to the PTFJ (Lambert, 1971).

4. Pathologies of PTFJ

It is possible to observe all disease at the PTFJ, similar to other synovial joints. Pathologies of this joint include primary osteoarthritis (Bozkurt et al., 2004; Öztuna et al., 2003; Özcan et al., 2009), trauma (Ogden, 1974; Resnick et al., 1978), infection, and inflammatory arthritis (Resnick & Niwayama, 1995), synovial osteochondromatosis (Bozkurt et al., 2007; Heybeli et al., 2009; Weiss et al., 1975), neoplasms (Forster et al., 2007), ganglion cysts (Miskovsky et al., 2004; Mortazavi et al., 2006; Ward & Echardt, 1994), and pigmented villonodular synovitis (Ryan et al., 2004).

4.1 PTFJ in knees with severe primary osteoarthritis

PTFJ can be affected by primary osteoarthritis (Öztuna et al., 2003). The degree of osteoarthritis of the proximal tibiofibular joint strongly correlates with the degree of arthritis

in tibiofemoral joints (TFJ) that have severe degenerative joint disease (Boya et al., 2008). Inflammatory enzymes passing between the joint spaces through possible anatomical communication between the TFJ and PTFJ may contribute to the advancement of arthritis in the respective compartments (Boya et al., 2008; Bozkurt et al., 2003). As with other joints, osteophytes, subchondral cysts, subchondral sclerosis, and joint-space narrowing are typical imaging findings (Forster et al., 2007).

Although primary degenerative disease of the PTFJ is commonly associated with primary degenerative disease of the knee joint, radiographic findings of the PTFJ in patients with severe degenerative knee osteoarthritis and varus misalignment do not correlate with clinical findings (Özcan et al., 2009).

4.2 PTFJ in other pathologies

Various neoplasms can affect the proximal tibiofibular joint, including osteochondroma, osteblastoma, osteosarcoma, and nerve sheath tumors (Schwannomas and neurofibromas) (Forster et al., 2007).

Tuberculosis lesions at the fibular head can destroy PTFJ and mimic tumoral lesions (Abdelwahab et al., 2003-2004).

Synovial chondromatosis is a chronic, progressive disease of the synovial tissue in which free chondral loose bodies are formed after metaplasia (Bozkurt et al., 2007; Heybeli et al., 2009; Weiss et al., 1975).

A ganglion is a tumorlike, cystic lesion that arises from the joint, tendon sheath, or muscle (Miskovsky et al., 2004). It is a rare pathology at the PTFJ but can cause three different pathologies: asymptomatic mass, symptomatic fluctuant mass, and mass with peroneal nerve dysfunction (Forster et al., 2007).

PTFJ is affected similarly to other synovial joints in rheumatoid arthritis. Peroneal nerve dysfunction due to subluxation, dislocation of dextrated PTFJ is a pathologic entity of the joint with RA (Ishikawa & Hirohata, 1984). Moreover, it is possible to observe radiological deterioration of the PTFJ in patients with ankylosing spondylitis (Hong et al., 2009).

Pigmented villonodular synovitis (PVNS) is an uncommon proliferative disease of the synovium, which is usually monoarticular, presenting as chronic monoarthritis of the knee (Forster et al., 2007). PVNS is characterized by synovial hypertrophy with diffuse or focal hemosiderin deposition in the joint (Ryan et al., 2004). The disease can affect the PTFJ similarly to other synovial joints.

5. Importance of PTFJ in knees with arthroplasty

The PTFJ can be considered the fourth compartment of the knee joint because of its communication with the knee joint cavity (Bozkurt et al., 2003). PTFJ can be a source of lateral knee pain because of its pathologies. However, frequently it is overlooked because of its lack of emphasis in the literature (Forster et al., 2007). For this reason, the PTFJ should be carefully evaluated for osteoarthritis in patients being considered for a total knee arthroplasty operation. If it is overlooked as an etiology of a patient's lateral knee pain, pain from the diseased PTFJ may continue post-operatively. Furthermore, pathologies of the PTFJ may cause peroneal nerve dysfunction in patients with knee arthroplasty (Gibbon et al., 1999). PTFJ stability is important in cases with knee arthroplasty, especially in patients with rheumatoid arthritis. In those patients, the PTFJ may become unstable. Because of proximal movement of the fibular head, it may impinge to extruded bone cement under the tibial base

plate posterolaterally (Otani et al., 1998). This possibility should be considered during cementing of the tibial base plate; posterolateral cement excursion should be avoided in patients with inflammatory arthritis.

PTFJ pathologies can affect the arthroplasty results. Conversely, knee arthroplasty can produce PTFJ pathologies. It is possible to inadvertently destroy the PTFJ during an erroneous lower-level tibial cut; this may produce joint-related symptoms after a knee arthroplasty operation. Knees with aseptic loosening of the prosthesis produce inflammatory mediators and polyethylene particles can migrate to the PTFJ via communication between the knee and proximal tibiofibular joints. This can result in deterioration of the PTFJ and subsequent symptoms (Crawford et al., 1998).

6. Conclusion

The degree of osteoarthritis of the proximal tibiofibular joint strongly correlates with the degree of arthritis in tibiofemoral joints that have severe degenerative joint disease. Although primary degenerative disease of the PTFJ is commonly associated with primary degenerative disease of the knee joint, radiographic findings of the PTFJ in patients with severe degenerative knee osteoarthritis and varus misalignment do not correlate with clinical findings. It is possible to observe all disease at the PTFJ, similar to other synovial joints. Because of its close proximity to the knee joint, PTFJ may be the cause of lateral knee pain. This issue is important, especially in knees with arthroplasty. However, knee arthroplasty may exacerbate PTFJ. Consequently, the joint should be examined in detail before and after knee arthroplasty operations.

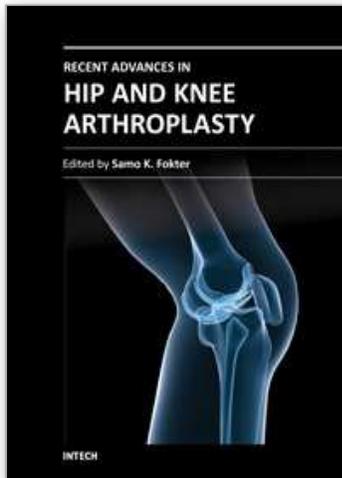
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The purpose of this book is to offer an exhaustive overview of the recent insights into the state-of-the-art in most performed arthroplasties of large joints of lower extremities. The treatment options in degenerative joint disease have evolved very quickly. Many surgical procedures are quite different today than they were only five years ago. In an effort to be comprehensive, this book addresses hip arthroplasty with special emphasis on evolving minimally invasive surgical techniques. Some challenging topics in hip arthroplasty are covered in an additional section. Particular attention is given to different designs of knee endoprotheses and soft tissue balance. Special situations in knee arthroplasty are covered in a special section. Recent advances in computer technology created the possibility for the routine use of navigation in knee arthroplasty and this remarkable success is covered in depth as well. Each chapter includes current philosophies, techniques, and an extensive review of the literature.

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