MENTORS IN ORTHOPEDICS

IS THERE A PLACE FOR MPFL RECONSTRUCTION IN A TOTAL KNEE ARTHROPLASTY?

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SUMMARY

Background: Patellofemoral instability (PFI) is a significant cause of failure following total knee arthroplasty (TKA), manifesting as anterior pain, component wear, or dislocation. While often attributed to component malalignment in the axial, frontal, or sagittal planes, PFI also results from soft-tissue imbalance or improper trochlear design.

Objective: This article evaluates the diagnostic framework for post-TKA patellar instability and describes the indications and surgical technique for medial patellofemoral ligament (MPFL) reconstruction as a corrective procedure.

Key Points: Diagnosis requires a comprehensive physical examination and radiographic assessment, including computed tomography (CT) to quantify component rotation. Combined internal rotation of the femoral and tibial components exceeding 8° is strongly associated with dislocation. While implant revision is preferred for severe malalignment, MPFL reconstruction using a pedunculated quadriceps tendon strip offers a lower-morbidity alternative for patients with correctly positioned implants or those unsuitable for major revision. The technique involves harvesting a 10-cm graft from the mid-third of the quadriceps tendon, maintaining its patellar attachment, and securing it at the femoral isometric point with an interference screw at 30° of flexion. Clinical series indicate that MPFL reconstruction, often combined with lateral retinacular release or tubercle medialization, effectively prevents recurrent dislocation and improves functional outcomes.

Conclusion: MPFL reconstruction is a viable therapeutic option for managing patellar instability after TKA when primary implant positioning is satisfactory. Success depends on precise patient selection and addressing concomitant soft-tissue or bony deficiencies to ensure stable patellar tracking.

KEYWORDS

Arthroplasty, Replacement, Knee; Joint Instability; Medial Patellofemoral Ligament Reconstruction; Patellofemoral Joint; Quadriceps Muscle

INTRODUCTION

Patellofemoral instability (PFI) is one of the causes of failure after total knee arthroplasty (TKA).[1,2] It can be the cause of most patellar complications, including anterior pain, abnormal wear or loosening of the patellar component, possibly even dislocation.[3]

Patellar instability is not entirely due to patellofemoral technical errors, but can also result from balancing errors, especially in the axial plane with wrong rotational alignment of the components. Any surgery will put greater tension on the lateral retinaculum, reduce it on the medial side, or increase the Q angle, which affects patellar balance and results in this instability. The technical causes of PFI can be grouped into four main categories:[4]

- Component malpositioning, especially in the axial plane (rotation), frontal plane (valgus alignment) or sagittal plane (increase or reduction in anterior space);[5]
- Unsuitable trochlear component design;[6]
- Improper or non-existent patellar preparation;[7]
- Soft-tissue imbalance.[8]

PFI can therefore be prevented by using the correct implant and applying the main accepted principles for knee arthroplasty[4] . Applying these basic rules should result in stable and centred patellar tracking:

- correct limb alignment, avoiding valgus,[9]
- neutral or external rotation of the femoral component (avoiding internal rotation), lateralized as much as possible (without overhang) to centre the patella-trochlear space
- tibial implant centred on the medial third of the ATT
- a patellar cut parallel to the anterior patellar surface, with the implant positioned medially on the cut surface to ensure the prosthetic and native patellar thicknesses are identical
- a patellofemoral space identical in size to the native knee, balanced by the size and anterior placement of the femoral component, and by the patellar thickness, designed to restore anterior offset
- surgical approach selection based on the deformity:
- for a valgus deformity, an isolated medial arthrotomy without lateral retinacular release can lead to uneven tension in the retinacula
- Frank et al.[10] showed that preoperative patellar tilt is a predictive factor of secondary patellar resurfacing, especially persistent tilt.

DIAGNOSIS

Due to the wide range of symptoms for patellofemoral instability, the surgeon should aim to identify any objective instability. Patients may complain of simple anterior peripatellar pain, but also present with stiffness in flexion due to permanent patellar dislocation.

Malpositioning and instability in the patellofemoral joint can be revealed by a targeted physical examination. Overall limb alignment (in valgus), patellar tracking in active flexion–extension, and patellar mobility can be used

to diagnose any static or dynamic instability. In addition in hanging position when sitting, abnormal external rotation of the forefoot is a sign for excessive internal rotation of the tibial implant.

These clinical signs will help guide the subsequent radiology examination, which should begin with plain images (AP, lateral and axial view of the patella flexed at 45°). The diagnosis is positive when the patella is partially or totally dislocated. The differential diagnosis includes patellar loosening, patellar fracture, and extensor apparatus disruption.

With a positive diagnosis of PFI, the possible aetiology should be further evaluated by using plain x-rays for mediolateral positioning, implant size and limb alignment. Rotational malalignment can be assumed but needs confirmation with CT scan.

A bilateral CT scan is essential for obtaining official confirmation of rotational problems with the femoral and/or tibial components. In TKA patients with PFI the relevant measurement is the rotational alignment of the components relative to the landmarks of the knee. Malpositioning of the components must be measured by the posterior condylar angle for the femur (posterior condylar line to epicondylar axis) and anterior tibia tubercle angle for the tibia (AP line of tibia surface to TTA – Tibia tubercle to PCL line). The combined internal rotation of the tibia and femur component is directly correlated to the degree of patellofemoral instability (1–4° combined component rotation = lateral tracking and tilting; 4–8° = subluxation; >8° = early patellar dislocation with risk of loosening).[11]

In patients with clinical severe torsional malalignment of the leg the overall torsional leg alignment should be measured with a full leg rotational profile (femoral neck, posterior condylar line knee and bimalleolar axis). Although severe torsional malalignment of the leg has an influence on the gait and patella tracking, derotational osteotomies of the leg are done in younger patient only. Derotational osteotomies are rare in older patients with TKA to deal with PFI.

Finally, bone scintigraphy can identify patellofemoral impingement between the lateral patellar facet and femoral component, as a result of tilting. Currently our standard practice is to perform a combined CT and bone scan, such as SPECT-CT or a Tomoscan (multislice nuclear scintigraphy plus scan).

INDICATIONS

Patellofemoral instability usually is caused by a structural defect meaning that non-surgical therapy is unlikely to succeed (crutch, vastus medialis strengthening).

The medial peripatellar structures help stabilize the patella, especially the medial patellofemoral ligament (MPFL), which accounts for 50–60% of the medial stabilization when the patellar is forced into the trochlea groove during first 30° of flexion.[12] This ligament is unavoidably cut when using the medial parapatellar capsular incision for the majority of TKAs. In patients with any preoperative valgus the medial approach destabilizes patellar balance even further, since the medial structures are under placed tension.

MPFL reconstruction in cases of patellofemoral instability after TKA was first described in 2008 by Asada et al. who reported a case of permanent traumatic dislocation of the patella with a very good result.[13] In our experience, although MPFL reconstruction is sometimes used alone, it is very often combined with other procedures, depending on the indication. In fact, there are two main diagnostic situations for MPFL reconstruction after TKA:

1. Objective patellar instability with patellar dislocation

These patients have total or partial lateral dislocation of the patella (Fig. 1). The cause is rotational malalignment of the femur and/or tibia implant (Fig. 2) or severe torsional limb malalignment with increased femur anteversion or excessive tibia internal rotation or both.

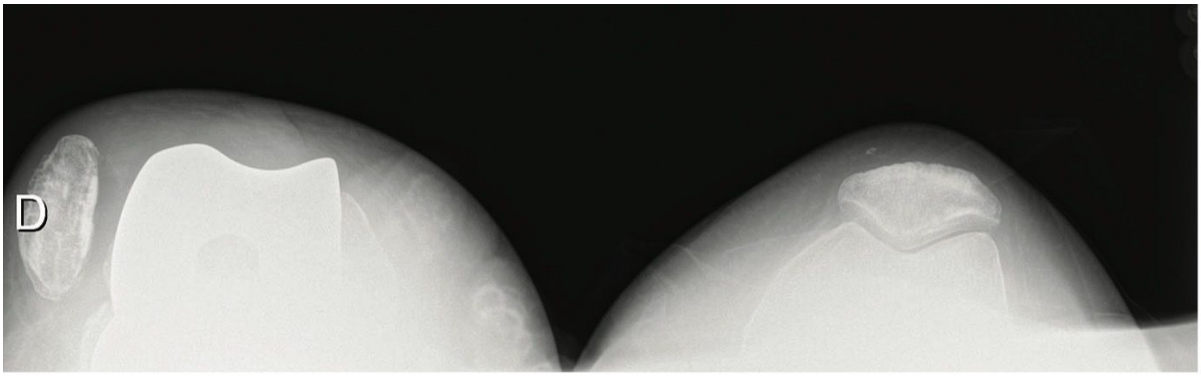


Figure 1: Permanent patella dislocation left with TKA and normal patella tracking in the natural knee right.

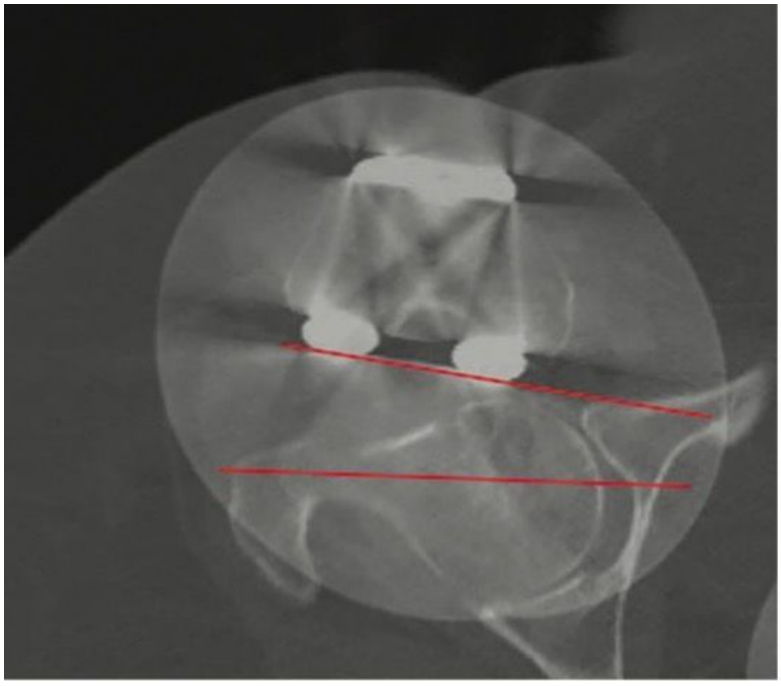


Figure 2: Shows reduced antetorsion of 8° of the femur (left) and internal malrotation of the femoral component 7° relative to the epicondylar line (right).

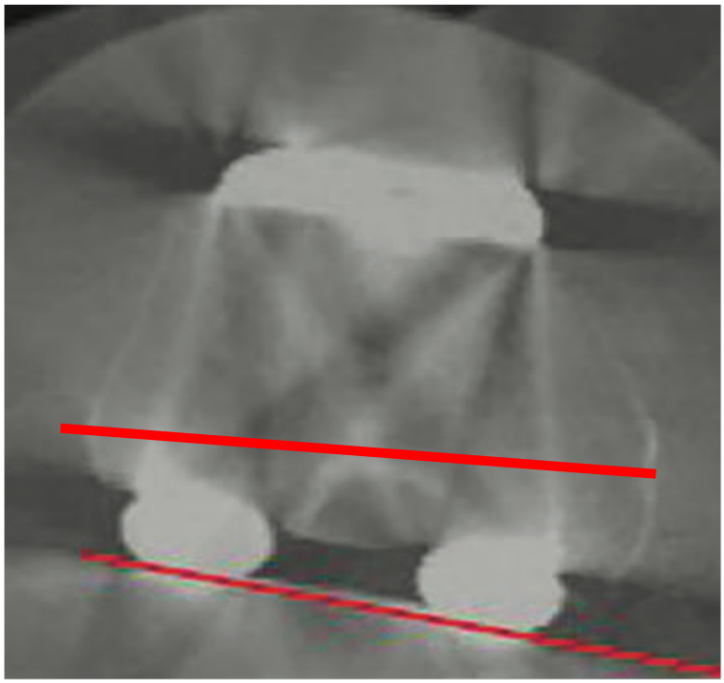


Figure 2: Shows reduced antetorsion of 8° of the femur (left) and internal malrotation of the femoral component 7° relative to the epicondylar line (right).

Implant revision is preferable, even with a rotating-platform tibial component since the mobile insert will not be able to compensate the malrotated components.[14]

The treatment options available for correctly aligned implants without malrotation or persistent intraoperative instability encompass several techniques, which can be used alone or combined with the aim of restoring correct patellofemoral alignment:

- proximally, with lateral retinacular release and with or without vastus medialis plasty,[15]
- or partial or total release of subquadriceps adhesions,
- distally, by medialization of the ATT,[16]
- medially, by medial patellofemoral ligament (MPFL) reconstruction.

2. Symptomatic patellar tilt

Patellar tilt is relatively common in descriptive studies.[17] It can cause painful impingement between the lateral patellar facet and femoral implant,[18] in turn due to improper patellar preparation (Figs. 3 & 4) or after medial approach with dehiscence of the capsular closure.[19]

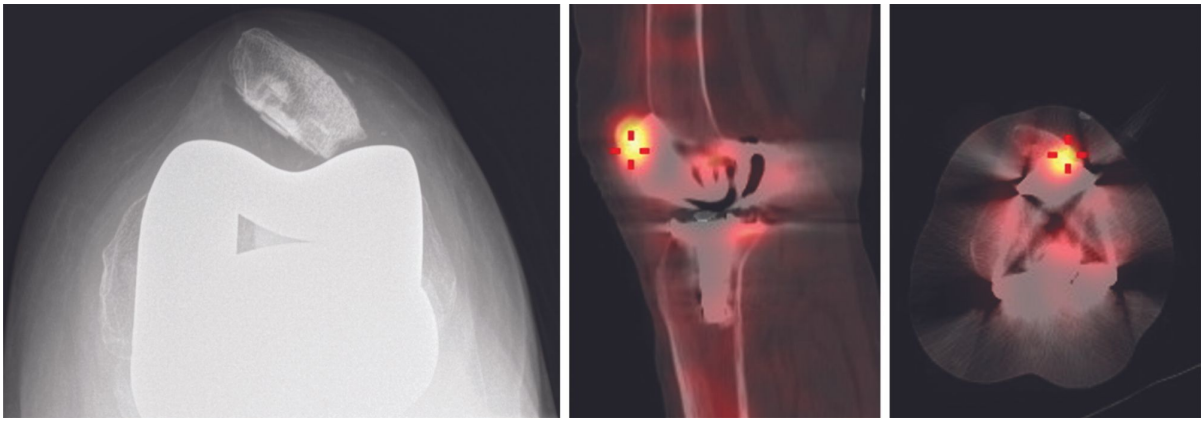


Figure 3: Lateral impingement with patellar tilt. and positive SPECT-CT with hot spot at the patella. Preoperative patellar thickness = 20mm

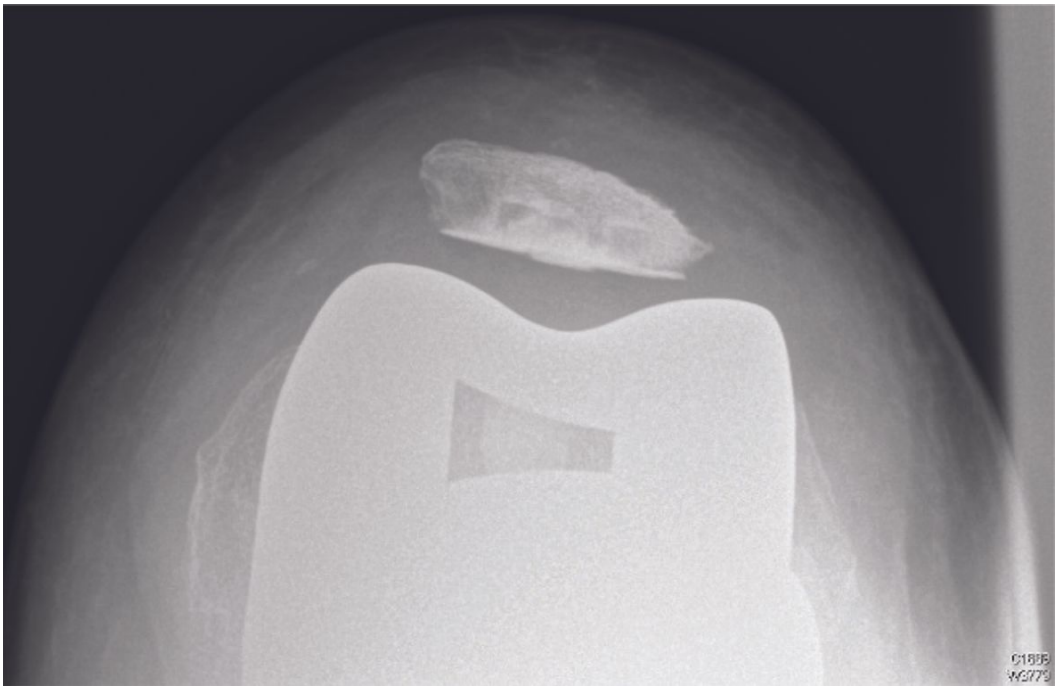
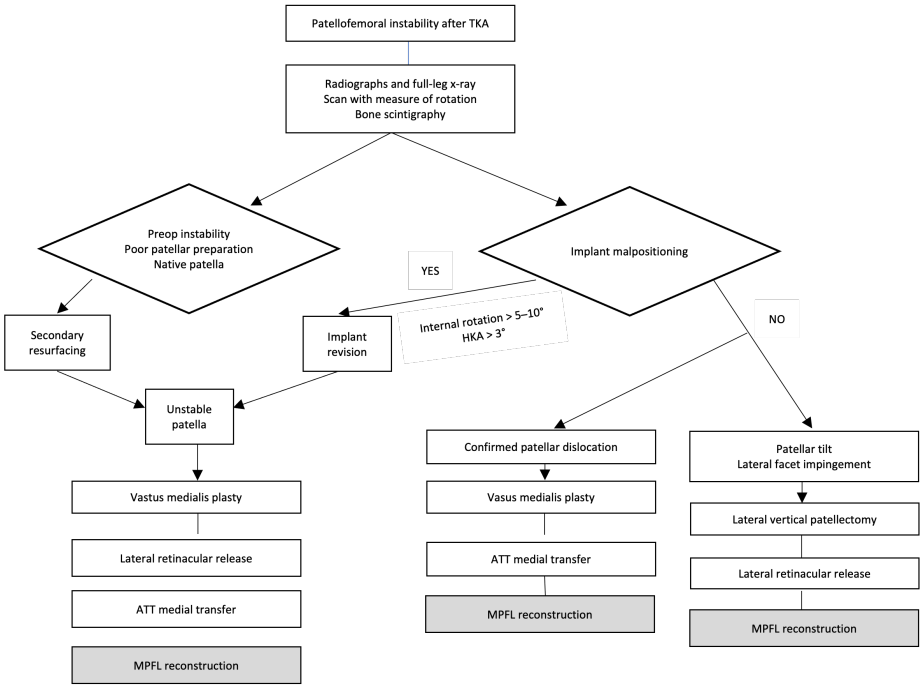


Figure 4: Postoperative result (secondary resurfacing + MPFL + LRR). Postoperative patellar thickness = 12mm.

In the specific case of painful patellofemoral impingement with a tilted or eccentric patella, solely reconstructing the MPFL can effectively recentre the patella. It may sometimes be combined with a lateral patella facetectomy to resolve the impingement and/or a lateral retinacular release to help recentre. Finally, patellofemoral instability after TKA with a native patella is a possible indication for secondary resurfacing. Persistent patellar instability during the procedure should prompt the surgeon to use one of the procedures described above.

Our indications for MPFL in TKA are summarized in Table 1.



MPFL RECONSTRUCTION TECHNIQUE

(Figs. 5–10)

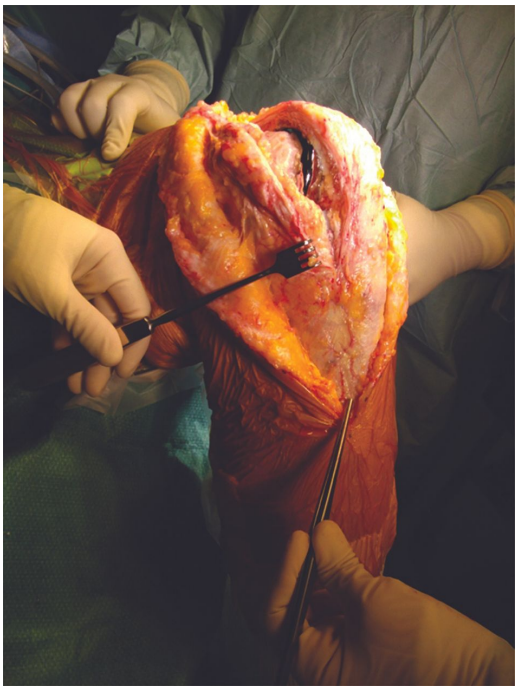


Figure 5: Anteromedial arthrotomy in the quadriceps tendon.

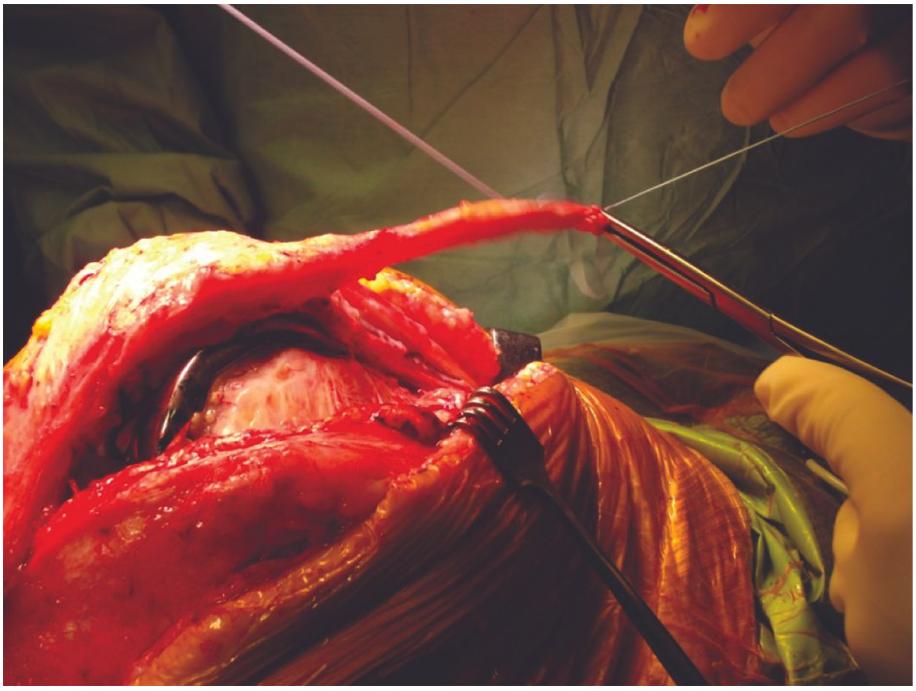


Figure 6: Removal of the quadriceps tendon.

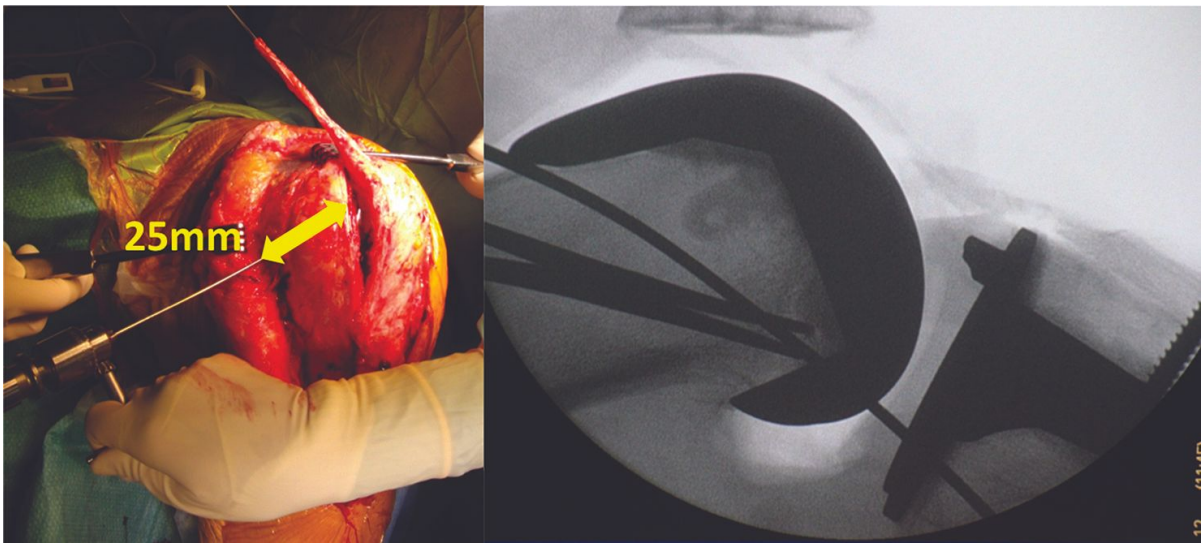


Figure 7: Fluoroscopic-guided femoral tunnel placement.

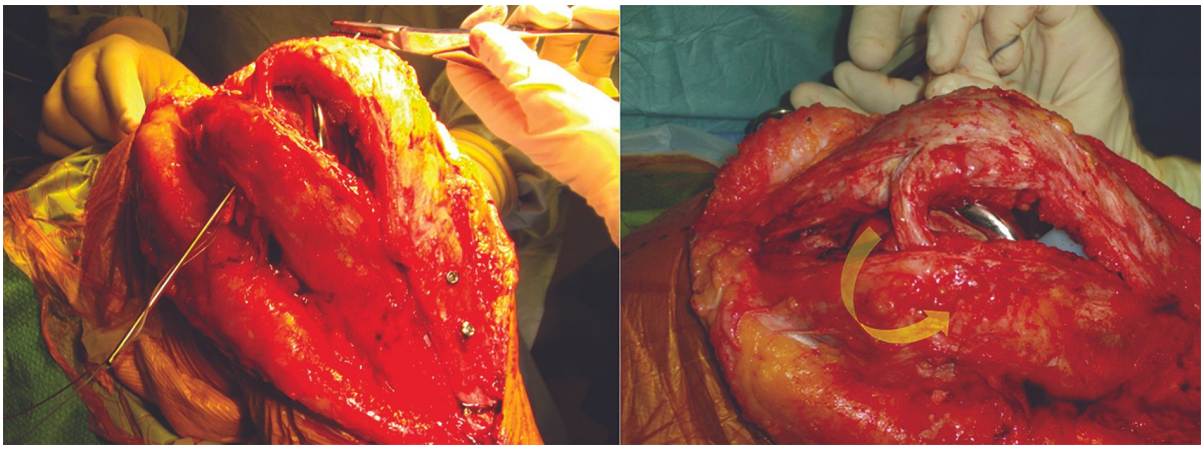


Figure 8: Inserting the quadriceps graft.

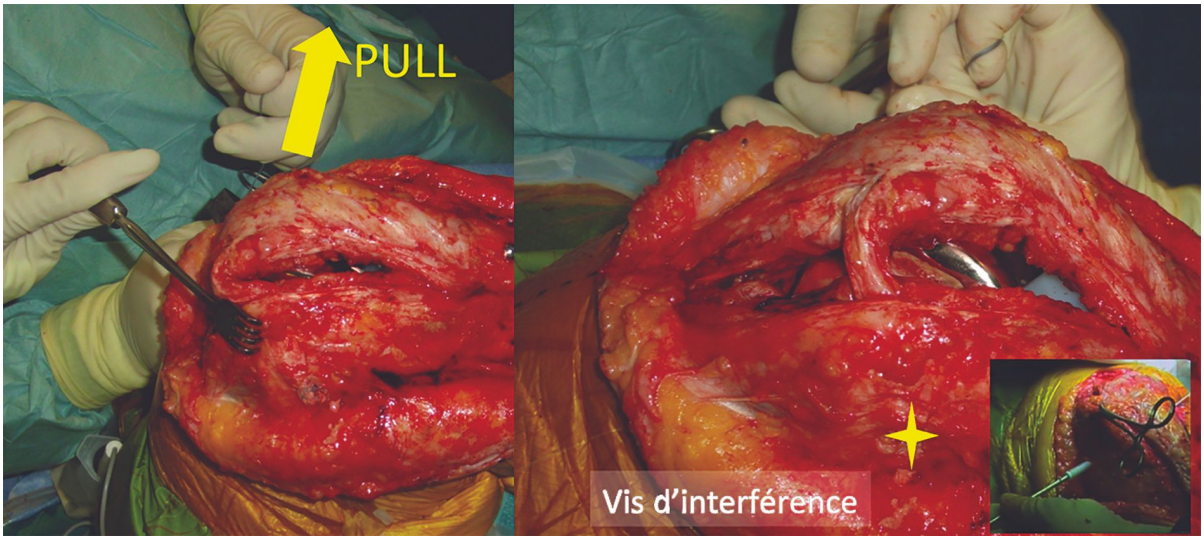


Figure 9: Fixation at 30° of flexion.

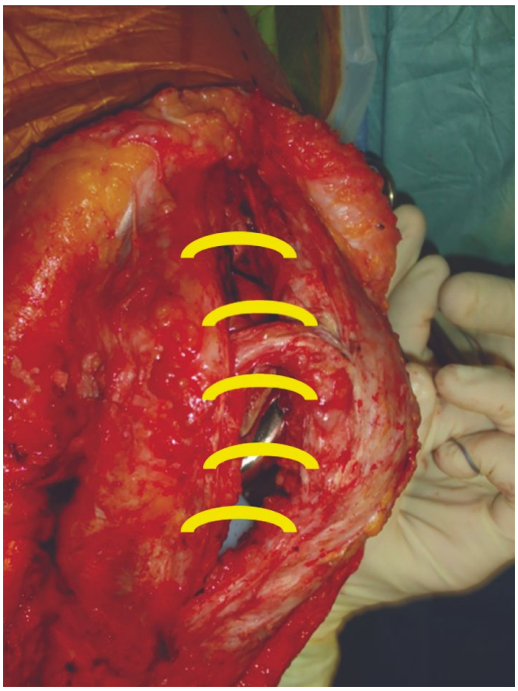


Figure 10: Closing the arthrotomy.

We prefer to reconstruct the MPFL using a strip of quadriceps tendon still pedunculated to the upper pole of the patella. This technique appears to have lower patellar morbidity because it avoids the need to make tunnels or impact an anchor into a bone that may already have been weakened by the implant of the patellar component with its three posts.

We use a strip that is 1cm wide, 10cm long and 5mm thick, harvested from the mid third of the quadriceps tendon, taking care to preserve continuity. The distal end is left pedunculated to the patella. The free end of the graft is then prepared with a suture, 25mm along.

Femoral fixation is achieved in exactly the same way as for a MPFL on a native knee: a blind tunnel is made at the isometric point [20] above the adductor magnus tubercle, either using the same approach or by making a counter incision a few millimetres opposite.

The graft is passed outside the capsule. Finally, graft tension is adjusted at 30° of flexion. The patella must be centred and mobile, but not to the point of allowing dislocation. Make sure the patella is not too tight medially. Lateral movement of 7–9mm is recommended. The graft is then fixed with a resorbable interference screw.

Post-operative care after a MPFL reconstruction is fairly standard: immediate weight bearing with the support of sticks, and an articulated splint for the first few days until quadriceps recovery. We do not place any limit on flexion, and recommend gentle physiotherapy. Obviously, this should be postponed if there were any additional procedures, especially on the ATT.

DISCUSSION

Our indications for MPFL reconstruction in TKA are selective and restricted to patellar instability, eccentricity or tilt, where the implant was initially correctly positioned (Fig. 11). It is important to understand that any soft tissue procedure will fail over time without correcting the malpositioned components. During revision surgery for malposition of the components additional MPFL might be helpful.

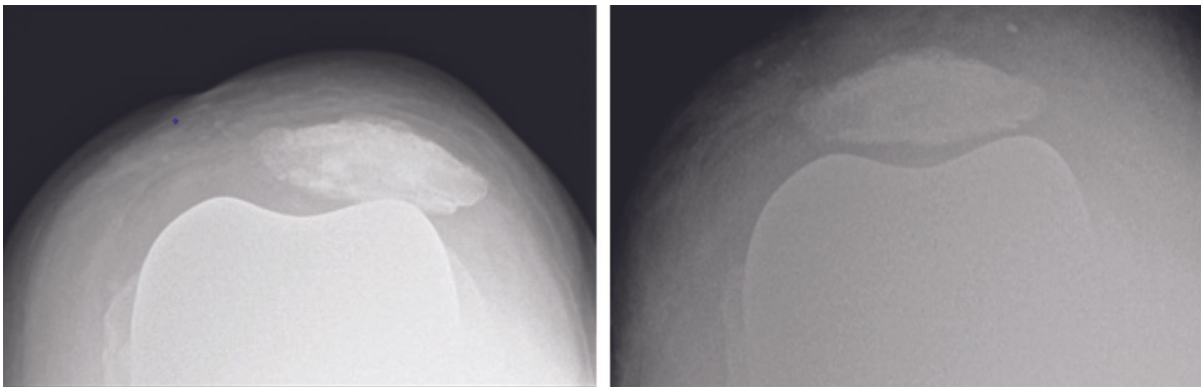


Figure 11: MPFL for patellar tilt due to dehiscence of the medial knee cap structures

There is not much literature on this subject, but the results are relatively good. As well as the first case described by Asada,[13] who recorded no dislocation recurrence at two years, Gotto et al.[21] also describe a case involving a 78-year-old lady who had ruptured the medial arthrotomy sutures and presented with permanent patellar dislocation. There was no evidence of patellofemoral instability at the one-year follow-up. Gennip et al.[22] report on a series of nine MPFL reconstructions with systematic lateral release and two ATT transfers. They used the quadriceps tendon if viable, otherwise they opted for a tendon allograft fixed using two anchors. A median follow-up of 33 months they found no new dislocations. Lamotte et al [23] review six cases of MPFL reconstruction using a gracilis autograft and two anchors for fixation. One reconstruction was combined with a change of implant (combined internal rotation 8°). No patient suffered any dislocation recurrence and clinical scores improved across the board. This same series also includes the particular case of an 81-year old man with a long medical history who presented with permanent patellar dislocation due to internal femoral rotation of 7°. Revision was deemed too risky so only MPFL reconstruction was performed. He still experienced subjective instability, but there was no dislocation recurrence. There is little consensus for which TKA knees with PFI such ‘palliative’ procedures of MPFL reconstruction or TTO with medialization of the tibia tubercle are indicated to compensate for components malrotation without revision surgery. In selected patients it represents an interesting option because it has low morbidity and can offer a simple solution for patients where revision is tricky and there is a reliable expected functional benefit.

CONCLUSION

MPFL reconstruction for patellar instability after TKA is one of the tools available, among a wide range of therapeutic options for recentring the patella subject to the chosen indications. We almost always combine it with other procedures, whether on the bone or soft tissues.

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