Case Report

REVISION WITH PROXIMAL TUBE REALIGNMENT SURGERY AND SOFT-TISSUE REBALANCING IS A VIABLE OPTION FOR PATELLAR INSTABILITY AFTER TOTAL KNEE REPLACEMENT IN SELECTED CASES

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ABSTRACT

Patellar instability is a complication after total knee replacement and a clear causative factor for patients' dissatisfaction. With modern implants, the design of the components does not appear to be a causative factor, as it can often be due to technical surgical errors such as the mispositioning of the components (mostly in internal rotation). To treat patellar instability and restore the proper geometry and biomechanics of the replaced knee, we performed the proximal "tube" realignment of the patella, as described by Insall. Preoperatively, knees were studied for any malrotation with CT, according to Berger's protocol. Satisfactory clinical outcomes were recorded, with no recurrence at the last follow-up, with the technique described and the use of a dome-shaped patellar component that can be forgiving for stability despite its propensity for increased contact stress.

KEYWORDS: *patellofemoral instability, TKA, arthroplasty, knee biomechanics, Insall, proximal realignment, TT-TG angle*

INTRODUCTION

Patellofemoral (PF) instability after total knee arthroplasty (TKA) has been reported in up to 20% of TKAs. Most often, it is caused by technical errors during surgery. Given the complexity of TKA biomechanics, several technical parameters are susceptible to error. Therefore, in most cases, PF instability cannot be traced back to a single cause. More likely, multiple contributors play a role (1, 2).

The major risk factors of PF instability after TKA are the following:

1. excessive preoperative valgus alignment;
2. individual components mispositioning;

Received: 13 August 2024
Accepted: 18 September 2024

3. improper patella preparation for prosthetic substitution;
4. soft-tissue imbalance.

Excessive preoperative valgus alignment leads to a mismatch of the trochlear groove and the extensor vector of the leg, the fact that encumbers proper patellar tracking and may cause the patella to tilt, subluxate, or even dislocate. A similar mechanism takes effect when a normal Q-angle is not restored. Especially patients with severe preoperative valgus or external rotational deformity, preoperative mal tracking, and loss of bone stock in the distal lateral condyle are at risk. In patients with pronounced preoperative valgus, the main culprit for this predisposition is usually the retraction of the lateral retinaculum.

Beyond the overall leg alignment, individual component positioning is the most important contributor. Internal rotation of the femoral or the tibial component, medialization of the femoral component and incorrect placement of the patellar component appear the most obvious. An internally rotated femoral component shifts the trochlear groove medially, thus increasing the distance to the patella, which tracks laterally relative to the femur. Through the tension exerted by the lateral retinaculum, the patella is pulled sideways. This may lead to patellar tilt, subluxation, or even dislocation. On the other hand, an internally rotated tibial component causes the tibia to rotate externally during knee flexion. This drives the tibial tubercle laterally, which increases the Q-angle and thus leads to lateral tracking. Depending on the severity, this may again lead to patellar tilt, subluxation, or dislocation (1, 3).

Placement of the prosthetic patella also plays a decisive role in determining PF stability. A patellar button that is too far laterally placed will increase the tension in the lateral retinaculum. This, in turn, can displace the center of the patella medially and thus lead to a lateral pull and subsequent lateral tracking with the known consequences (3, 4).

Resection of more bone from the medial facet is necessary to obtain a symmetric patellar cut parallel to the anterior surface since the medial facet is thicker than the lateral one in a normal patella. Overstuffing of the PF joint tightens the lateral retinaculum and increases the risk of lateral patellar tracking. In the knee with optimal femoral component size, this can be caused by increased thickness of the resurfaced patella. In the knee with an optimal patella size, this may be due to the use of an oversized femoral component (5, 6). Medialization of the patellar component on the cut surface of the patellar bone allows the patellar button to be centralized in the trochlear groove and improves patellar tracking by decreasing lateral patellar subluxation forces (1, 7).

CASE PRESENTATION

The case involves a 68-year-old female patient who underwent TKA surgery in March 2021 at another hospital and came to our attention one year after surgery due to knee pain and instability during daily activities. The Corin brand prosthesis used for TKA surgery consisted of a cemented size 4 femoral component, a cemented size 5 tibial component, and an 11-mm polyethylene insert. Preoperative X-rays taken in October 2022 (Fig. 1) and an objective examination performed demonstrated lateral patella instability. CT scan pointed a tibial tuberosity–trochlear groove (TT-GT) angle of 20.7°, which, together with the intra-rotation of the tibial component, justified the lateral dislocation of the patella. Clinically, the patient showed permanent patella instability in both knee flexion and extension (Fig. 2).

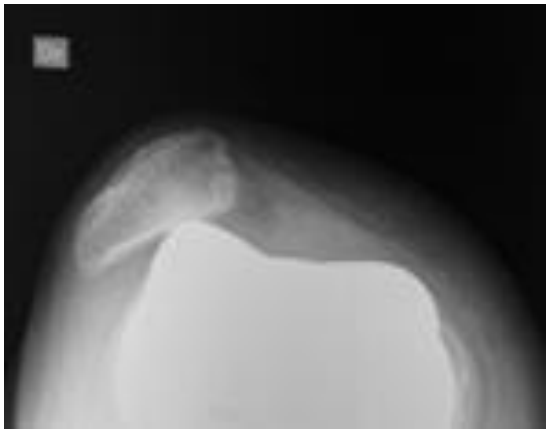

Fig. 1. *Preoperative X-rays, October 2022.*

Fig.2. *Pre-operative patellar lateral instability in extension and flexion*

The surgical procedure we chose involved Insall proximal realignment of the patella for recurrent dislocation or subluxation, consisting of a lateral release and advancement of the vastus medialis. First, a prosthetic 29x8 mm dome-shaped Nexgen All-poly patella was implanted to compensate for limited degrees of patellar tilt and rotation by maintaining acceptable contact congruency, especially in the mid-flexion range. Consequently, the proximal "tube" realignment was performed. A lateral parapatellar incision of skin and a detachment of the fibers of the iliotibial tract and the lateral retinaculum from the lateral patella were achieved, followed by a medial capsular incision extending from the quadriceps tendon over the patella into the patellar ligament. Finally, the vastus medialis was advanced and sutured onto the middle and distal aspects of the patella (Fig. 3). This surgical procedure ensured the achievement of patellar tracking, as confirmed by postoperative X-rays (Fig. 4).

Fig. 3. *Suture of the advanced vastus medialis on the middle-distal aspect of the patella.*

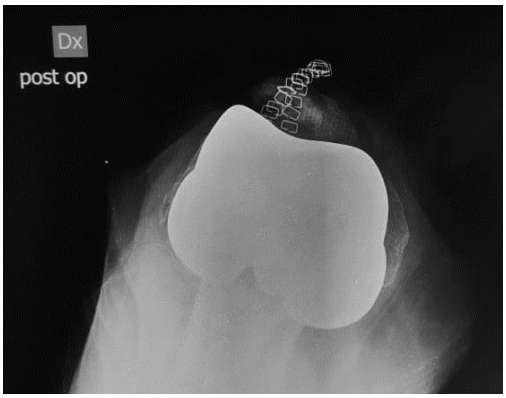

Fig. 4. *Post-operative X-rays: patellar tracking achieved.*

Fig. 5. *Three-month follow-up.*

At a six-week clinical follow-up, the patient showed complete extension and flexion of the knee in both seated and supine positions. During the early postoperative six weeks, the patient was instructed to wear a knee brace locked in extension with the recommendation of protected loading through crutches for the first four weeks. She kept the brace unlocked and rehabbed with the Kinetec CPM device 0-90° for the last two weeks. Six weeks after surgery, the patient

was advised to wear a knee brace with a patellar hole for the subsequent six weeks. At the three-month clinical follow-up (Fig. 5), the complete flex extension of the knee was preserved, and a normal alignment of the prosthetic components with a slight lateral patellar dislocation in axial projection was appreciated on X-rays. Finally, one year after surgery, the patient reached a full range of motion of the knee with no pain and functional restrictions (Fig. 6).

Fig. 6. *One-year follow-up.*

DISCUSSION

According to the literature, component malposition during surgery is one of the most common causes of patellar instability (8-12). A tendency to place the components in internal rotation in the transverse plane increases the Q angle of the knee joint. It predisposes to lateral patellar mal-tracking and patellar instability (2). Radiographic evaluation of the patella primarily uses the lateral view and the sunrise or Merchant's view. Computed tomography is the most reliable method of assessing component alignment and positioning (13) and rotation. The latter is determined using 4 scans: the medial and lateral epicondyles, the tibial plateau immediately below the tibial base plate, the tibial tubercle, and through the tibial insert (14). The rotation of the femoral component is determined by measuring the angle formed by the line drawn through the medial and lateral epicondyles and the line connecting the posterior flanges of the implant. Tibial component rotation is determined by superimposing the geometric center of the proximal tibia onto the image with the tibial tubercle. On the patient's CT, we measured the tibial tuberosity (TT) to trochlear groove (TG) distance, given its diagnostic accuracy to guide the treatment of PF instability. After drawing the line along the posterior femoral condyles and the two lines perpendicular to it, the first bisecting the TT and the second bisecting the trochlear TG, we measured a TT-TG angle of 20.7° (Fig. 7).

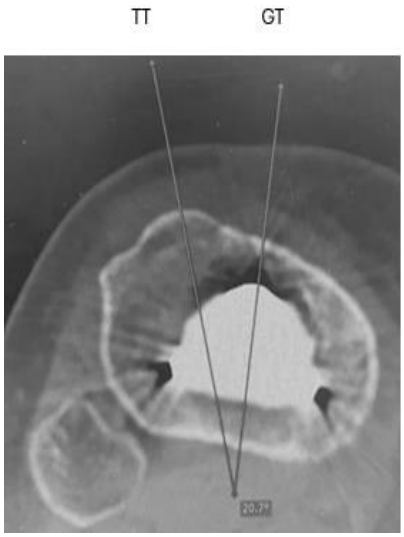

Fig. 7. *TT-GT angle measured on the pre-surgery CT scan.*

The femoral component showed no improper rotation in both pre-operative (CT scan) and intra-operative examination. Although we noticed an intra-rotated tibial component, which, together with the pathological TT-TG angle,

might have warranted a total/tibial revision, we thought it worthwhile to perform soft tissue surgery as described by Insall and implant patellar prosthesis only since the femoral and tibial components were well fixed and stable. Axial radiographs of the patella in follow-up show slight lateralization of the patella. Still, despite this, the clinical examination is suitable, and the patient is pleased, has resumed normal activities of daily living, and no longer complains of pain and sensation of sagging/instability, which depicts the success of the choice of intervention.

CONCLUSIONS

Although patellar instability is a relatively uncommon complication after TKA surgery, its causes lie in multiple risk factors, such as preoperative anatomical conditions, intraoperative positioning of the prosthetic components, and unhealthy soft tissue. Before any prosthetic revision, techniques such as Insall proximal realignment of the patella should be considered, as they can provide satisfactory short- and long-term results.

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