

Tibial Tubercle Osteotomy for Management of Pseudopatella Baja and Patellar Dislocation After Revision Knee Arthroplasty

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Abstract

Patellar complications take a considerable amount of space after failed total knee arthroplasty (TKA). Especially pseudopatella baja is seen more often after revision knee arthroplasty cases. We present a technique where the patient has an elevated joint line as well as a dislocated patella after prior knee surgeries. Tibial tubercle osteotomy was done for the management of pseudopatella baja and the patellar component was revised along with a lateral retinacular release. The patient is now on two-year follow-up with a functional extensor mechanism and without any component failure. This technique shows an efficient and simple way of managing pseudopatella baja occurring after revision knee arthroplasty.

Keywords: *Pseudopatella Baja, Revision Knee Arthroplasty, Osteotomy*

Introduction

Pseudopatella baja remains one of the most common complications encountered after revision knee arthroplasty. To differ between true patella baja and pseudopatella baja, one must pay attention to the joint line. True patella baja is the consequence of a shortened patellar tendon, whereas pseudopatella baja is the consequence of an elevated joint line. In true patella baja, Insall-Salvati ratio (ISR) and Blackburne-Peel ratio (BPR) will both be abnormal. In pseudopatella baja, Insall-Salvati ratio will be normal, but Blackburne-Peel ratio will be low.[1] In this case, due to prior surgeries, an elevated joint line resulted in patellar maltracking and subsequently patellar dislocation. Current management options to deal with patellar maltracking include lateral retinacular release, component revisions, medial patellofemoral ligament (MPFL) reconstruction, extensor mechanism realignment procedures and corrective osteotomies.[2] In various cases, the combination of these procedures is performed to overcome coexisting problems. Reconstruction of MPFL along with a lateral retinacular release has been showed to be effective in treatment of patellar dislocation after revision knee arthroplasty. In addition to that tibial tubercle osteotomy was also performed to manage insufficient correction. [3]

First, rotational malalignment must be examined for both tibial and femoral components. A pre-operative Computerized Tomography (CT) must be performed to assess rotational malalignment. Femoral rotation is examined relative to the transepicondylar axis, while the tibial rotation is examined relative to the tibial tuberosity.[4] If revised, patellar component position can also be examined, which may be a potential cause in dislocation of the patella.[5] Component malrotation has several treatment options such as MPFL augmentation or reconstruction, tibial tubercle osteotomy, lateral retinacular release and lateral patellar facetectomy.[4–6] Once the rotational malalignment has been excluded, as in our case, it is important to distinguish true patella baja from pseudopatella baja since restoration of the joint line is essential. A distally located patella in relation to the femoral trochlea is confirmed by measuring the ISR and BPR ratios.[7,8] Surgical treatment of iatrogenic patella baja is challenging due to multiple prior procedures the patient has undergone. Different techniques of proximalization of the tibial tubercle have been described to cope with this condition.[8]

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As literature suggests, patellar dislocation following revision knee arthroplasty is a multifactorial issue in which each patient must be assessed delicately.[4,5,7] Although multiple techniques have been defined to address pseudopatella baja and patellar dislocation after total knee arthroplasty (TKA), there is a gap in literature in managing these problems after revision knee arthroplasty. We present a patient-specific technique based on preoperative and perioperative findings to deal with pseudopatella baja encountered after revision knee arthroplasty.

Case Presentation

A 58-year-old male patient was admitted to our clinic with chronic patellar dislocation. He mentioned three prior surgeries consisting of primary TKA, soft tissue procedure and revision knee arthroplasty. The soft tissue and revision procedures was done because of recurrent patellar dislocations after primary TKA. He had 70° of flexion and the patella dislocated after 70°; the knee was stiff on physical examination due to the chronic dislocated patella. Preoperative radiographic examination of modified ISR revealed a value of 1.22, showing no evidence of patella alta and an abnormal BPR value of 0.45, indicating a trouble with the joint line and preoperative ISR was measured as 0,77 barely near the normal range. (Figure 1) This might be due to the prior surgeries the patient had resulting in a change in patellar morphology and therefore we took the modified ISR into consideration.[9] Preoperative CT scan showed no rotational problems regarding the femoral and tibial components. (Figure 2) After intense preoperative calculations, Elmslie-Trillat procedure to proximalize and medialize the tibial tubercle was planned to overcome recurrent patellar dislocation.[10] A written informed consent was obtained from the patient.

Patellar tracking was abnormal, and the patella dislocated during flexion. A medial parapatellar approach was done and an osteotomy along with a lateral release was planned to medialize and proximalize the tibial tubercle approximately 1 cm each. After the lateral retinacular release, a 10mm to 20 mm wide and a 10mm thick osteotomy was performed 10 cm distally from the joint line, by an oscillating saw, from medial to lateral.[10,11] (Figure 3). This enabled an osteotomy of 7 cm in length, as recommended previously. [12,13]The patellar polyethylene was extremely deformed and eroded due to the recurrent dislocations. (Figure 4). Polyethylene was revised by thinning the patellar bone additionally and placing the new implant more proximally and medially. Tibial tubercle was proximalized and medialized 1 cm each with temporary k-wires. (Figure 5) After proximalization and medialization of the tibial tubercle, fixation was achieved using 3 cancellous screws. While the lateral retinaculum was kept in place with the use of a towel clamp, the knee was performed from full extension to full flexion ensuring the stability of the patella and the osteotomy. After plication of the medial retinaculum and closure of the lateral retinaculum, "the no thumb test" was performed to check the patellar tracking. (Figure 6) The knee was immobilized for the first week and passive mobilization was proceeded immediately after day 7 to overcome any stiffness that might reoccur. Weight bearing was initiated partially at 3 weeks and fully at 2 months postoperatively.

Postoperative radiographic examination of modified ISR was 0.73 and BPR was 0.50; indicating that the BPR has fallen into the normal range and the elevation of the joint line was achieved as desired. Postoperative abnormal modified ISR and ISR are not meaningful due to the relative shortening of the patellar tendon. (Figure 7) At the two-year postoperative follow-up, the patient is free of patellar subluxation, is painless, has a good range of 0° to 120° of flexion and is satisfied with the outcome.

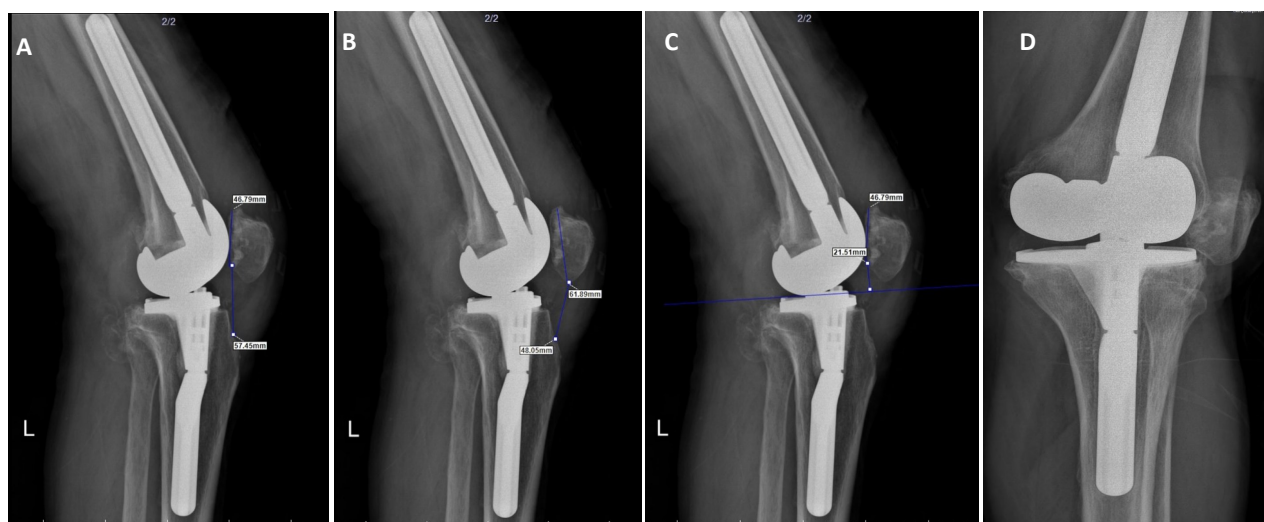


Figure 1. Preoperative lateral radiographs of the left knee, showing (a) Modified ISR (57,45/46,79) is 1,22; (b) ISR is (48,05/61,89) is 0,77 and (c) BPR (21,51/46,79) is 0,45. Preoperative anteroposterior radiograph (d) of the left knee showing the laterally dislocated patella.

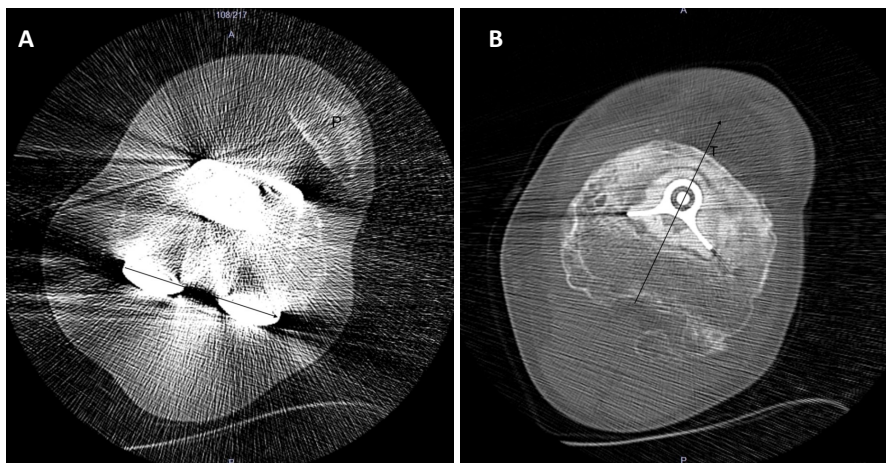


Figure 2. Preoperative axial CT images assessing rotational alignment of (a) the femoral component in line with the epicondylar axis (arrow) and (b) the tibial component in line with the anteroposterior axis (arrow) of the tibia. (A: anterior, P: posterior, T: tibial tuberosity, P: patella)

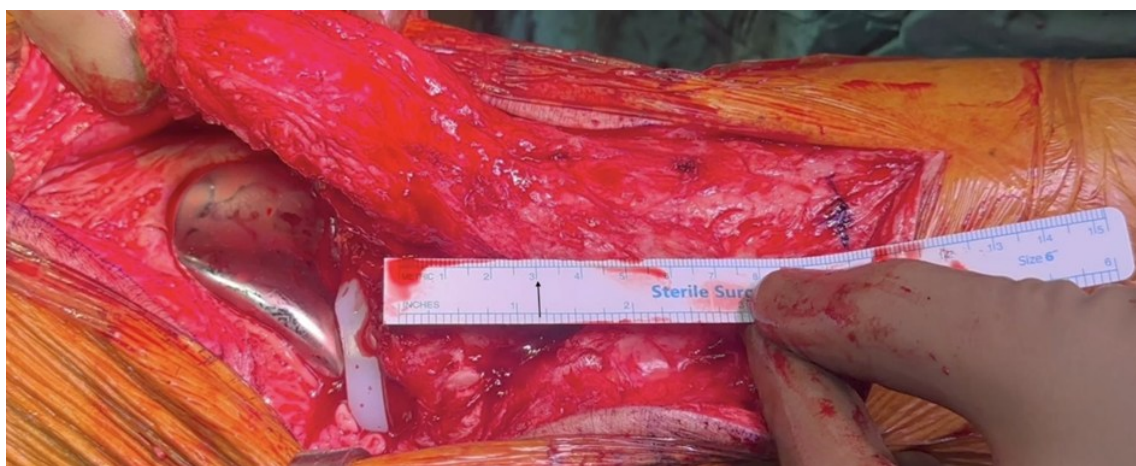


Figure 3. Intraoperative demonstration of the planned osteotomy, 10 cm distally from the joint line (lined with a sterile marker in blue color) and 7 cm in length (arrow points to the patellar tendon insertion).

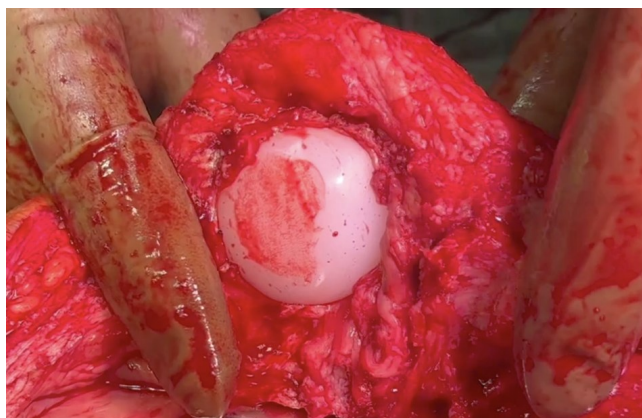


Figure 4. Intraoperative image of the eroded patellar implant.

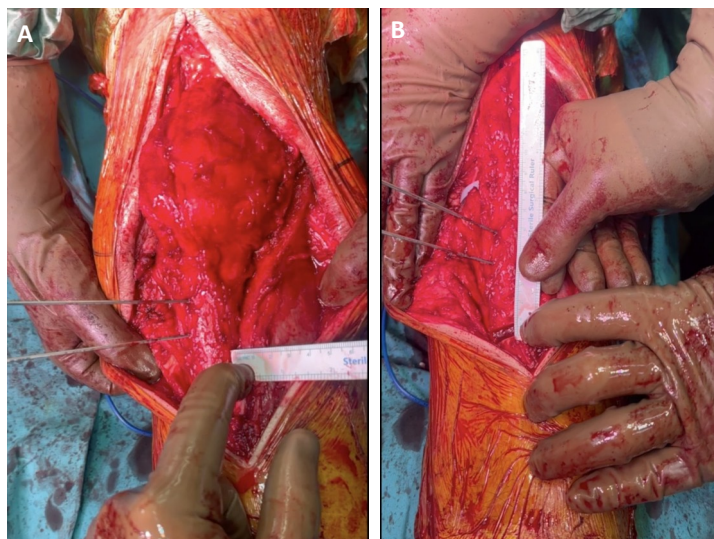


Figure 5. Intraoperative presentation of (a) 1 cm of medialization and (b) 1 cm of proximalization with a sterile ruler. Tibial tubercle is temporarily fixed with two k-wires.

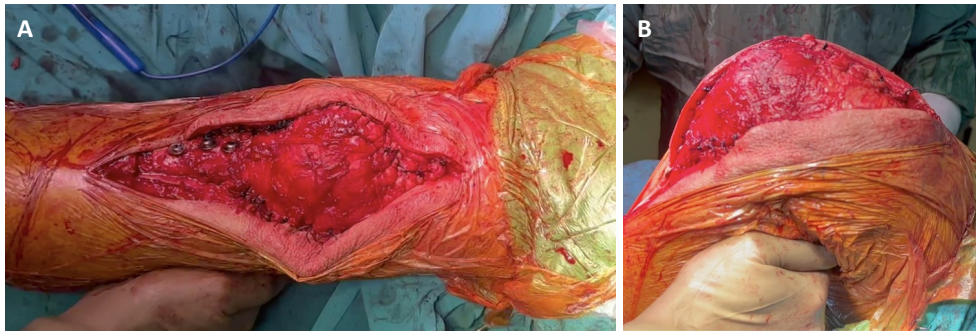


Figure 6. Intraoperative demonstration of "the no thumb test" with (a) the knee in full extension and (b) the knee in full flexion, proving that the patella is in place.

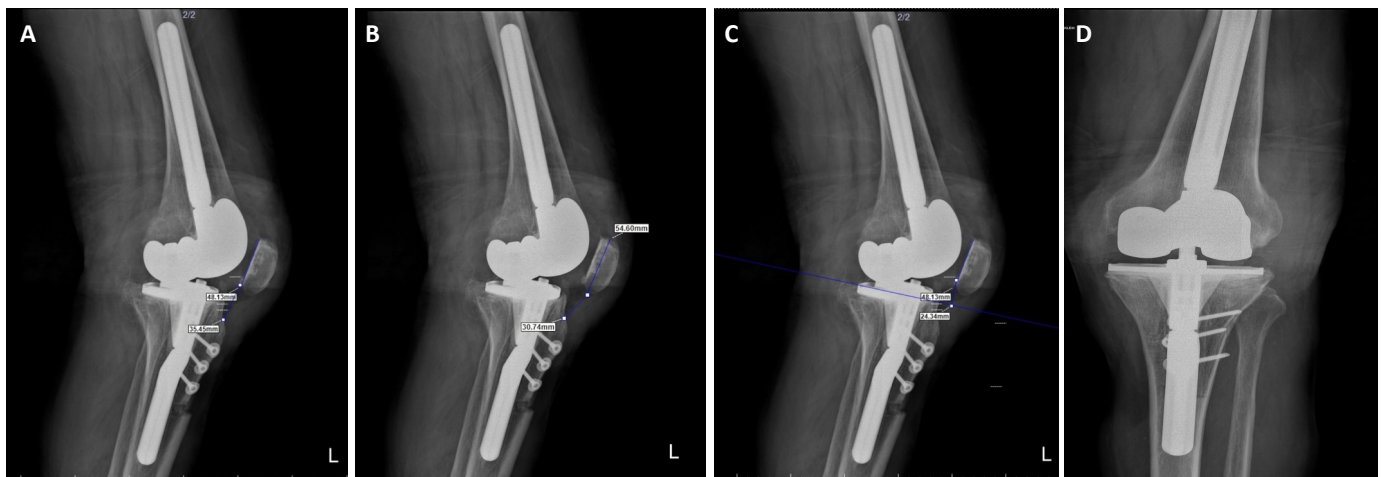


Figure 7. Postoperative lateral radiographs of the left knee, showing (a) modified ISR (35,45/48,13) is 0,73; (b) ISR is (30,74/54,60) is 0,56 and (c) BPR (24,43/48,13) is 0,50. Postoperative anteroposterior radiograph (d) of the left knee with the patella in place.

Discussion

Internal rotation of the femoral and/or tibial components, excessive valgus osteotomy of the distal femur, excessive release of the medial soft tissues and inadequate lateral release are among the technical factors affecting patellofemoral instability after TKA.[10] In this case, since we were not able to find out what was done in the initial TKA and the implants were rotationally decent, we can estimate that the issue was due to a soft tissue problem.

Pseudopatella baja can occur after primary or revision TKA because of a tibial under-resection or femoral over-resection by preservation of the patellar tendon length. This is the consequence of an excessively done proximal femoral condyle osteotomy, an overly large tibial insert or an excessive release of the soft tissue requiring the elevation of the joint line to provide stabilization. [14–16] We think that pseudopatella baja was encountered in this patient due to an extensive medial release because of the accompanying recurrent patellar dislocations. In addition to that, although the patient mentions one additional soft tissue procedure to overcome his problem, it is evident that the procedure has become a failure. His primary TKA components may have been implanted in internal rotation, but preoperative and perioperative findings in our case point out that the revision components were rotationally normal. This directed us to investigate the modified ISR and BPR values on preoperative radiographs.

To our knowledge, there has been one study which investigates these values in 26 patients (13 revision TKAs vs 13 control) who has been diagnosed with pseudopatella baja. Vandeputte et al. defined pseudopatella baja as a modified ISR of >1.0 and a BPR of <0.55 . Their results showed that patients whom tibial tubercle was moved >1 cm proximally had better outcomes than those whom tibial tubercle was moved <1 cm.[11] Other studies focused on tibial tubercle osteotomies for stiffness and decreased range of motion caused by true patella baja. [12,13,15,16] Drexler et al. proximalized the tibial tubercle 1.5 cm, whereas Schmidt et al. had 1 to 2 cm of proximalization. [12,13]

Vives-Barquiel et al. had an average of 1 to 1.5 cm of patella proximalization and 15 patients had the patella resurfaced.[16] We agreed on a 1 cm proximalization along with a 1 cm medialization to overcome both the recurrent dislocation and elevated joint line issues. Furthermore, we decided to revise the patellar polyethylene perioperatively because of the large eruption on the implant. The reason why we did not move the tibial tubercle more than 1 cm is that the additional medialization was necessary to cope with recurrent patellar dislocations.

The modified ISR showed less inter- and intra-observer variability than the former ISR; thus, revealing its superior use to assess true patella baja. However, BPR is commonly used to assess pseudopatella baja since it is independent of the length of the patellar tendon. Consequently, BPR has been showed to have superior reliability and interobserver correlation after TKA.[17–19] Moreover, due to biomechanical changes after TKA, it is not clear if the same thresholds are applicable to distinguish pathological values from normal.[18] While Schmidt et al. defined patella baja as $BPR \leq 0.5$, it was defined as $BPR < 0.55$ by Vandeputte et al.[11,13] We think that the postoperative BPR value of 0.5 was acceptable, since the patient is free of subluxation of the patella and taken into account that he had three past surgeries. In our opinion, he did not require a MPFL reconstruction because the patella was stable from full extension to 135° of flexion perioperatively.

The only study to perform the Elmslie-Trillat procedure for recurrent patellar subluxation after TKA is done by Nakajima et al. Two weeks after performing a lateral release along with patellar resurfacing, the patient had subluxation once again. Afterwards, they osteotomized the tibial tubercle, rotated it medially and secured it with 2 cancellous screws.[10] Since our preoperative modified ISR was 1.22, like other studies featuring pseudopatella baja, we focused primarily on BPR (preoperatively 0.45) and combined the Elmslie-Trillat procedure with a proximalize osteotomy of tibial tuberosity (POTT).[10,11,16] Our technique is a patient-specific one, based on preoperative and perioperative findings, and has not been previously defined.

Conclusion

In conclusion, delicate care is essential in differentiating pseudopatella baja from true patella baja to properly address the underlying problem after revision knee arthroplasty. This technique is unique for being the first demonstration of addressing two problems of TKA comprising pseudopatella baja and patellar subluxation and managing both problems with a medio-proximalizing osteotomy of the tibial tuberosity. This procedure offers a promising solution to manage such cases, although more comprehensive data is necessary to consolidate its application.

List of Abbreviations

TKA: total knee arthroplasty

ISR: Insall Salvati ratio

BPR: Blackburne Peel ratio

MPFL: medial patellofemoral ligament

CT: computerized tomography

POTT: proximalize osteotomy of tibial tuberosity

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgement

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