

Recorrection Osteotomies and Total Knee Arthroplasties After Failed Bilateral High Tibial Osteotomies

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Abstract

This article reports the case of a 58-year-old man with failed bilateral opening wedge high tibial osteotomies. Because of excessive valgus deformities, each total knee arthroplasty (TKA) was combined with a recorrection osteotomy. TKAs were performed consecutively. Recorrection osteotomy using a long-stemmed tibial component and a derotation plate corrected the valgus malalignment and maintained native ligament stability in each posterior cruciate ligament-retaining TKA.

High tibial osteotomy has proved successful in treating unicompartmental arthritis in young, active patients.¹⁻³ However, this procedure fails over time because the other compartments deteriorate.⁴ The next step is conversion of the osteotomy to total knee arthroplasty (TKA). Conversion results vary, with several authors reporting poor outcomes⁵⁻⁹ and others reporting outcomes equal to those of primary TKA.¹⁰⁻¹⁴

The long-term success of TKA depends on proper restoration of the mechanical axis and soft-tissue balancing.¹⁵ Preexisting extra-articular deformity may adversely affect outcomes. A deformity of more than 15° may make it difficult to obtain intra-articular correction of an extra-articular deformity through soft-tissue balancing alone.¹⁶

In this article, we report the unique case of a patient whose bilateral high tibial osteotomies failed because of excessive extra-articular deformity. TKAs were performed consecutively, in 2 separate

settings. Each TKA was combined with a recorrection tibial osteotomy in a single operation, allowing for re-creation of normal knee alignment with ligament balance. The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A 58-year-old man (weight, 250 pounds; body mass index, 30) underwent staged bilateral medial opening wedge osteotomies using distraction osteogenesis. A uniplanar external fixator was used for fixation on each knee. Before surgery, anatomical axis was 2° (right knee) and -1° (left knee) (Figure 1A), and tibial slope was 9° (right) and 8° (left) (Figures 1B, 1C). The procedures were performed 10 months apart. After surgery, anatomical alignment was 17° valgus (right knee) and 12° valgus (left knee) (Figure 2), and tibial slope was 20° (right) and 13° (left).

The patient received mild relief of his arthritis symptoms. Fifty-six months after the index operation, he decided to undergo conversion of the right high tibial osteotomy to TKA because of progressive painful arthritis of the knee. Exces-

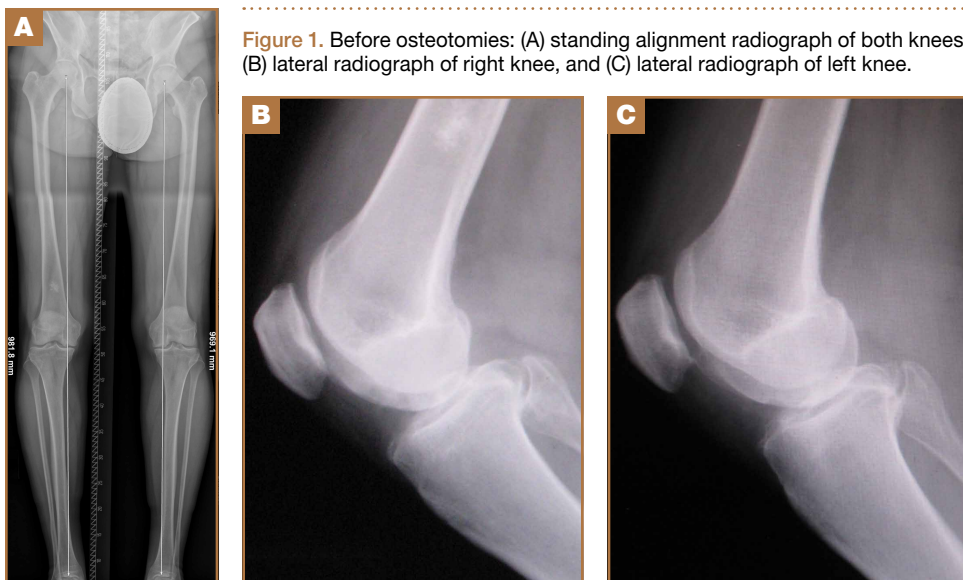


Figure 1. Before osteotomies: (A) standing alignment radiograph of both knees, (B) lateral radiograph of right knee, and (C) lateral radiograph of left knee.

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sive valgus alignment caused by the initial osteotomy raised concerns about being able to correct the extra-articular deformity intra-articularly while maintaining kinematic ligament balance. For this reason, a recorrection osteotomy was performed concurrently with the TKA. A posterior cruciate

ligament-retaining (PCL-retaining) knee design (NexGen, Zimmer) was selected.

The procedure began with bone cuts for the TKA. Initial cuts were made on the femur. The tibial cut was made in valgus corresponding to the preoperative valgus deformity. The tibial recorrection osteotomy was made at the level of the original osteotomy site. A stemmed tibial component was used to cross the osteotomy site, correcting the valgus deformity and providing stability at the osteotomy site. A 3.5-mm locking compression T-plate (Synthes) was medially placed to prevent loss of correction and control rotation of the osteotomy during healing. The patient began range of motion on postoperative day 1. Continuous passive motion was not used. Protective weight-bearing continued for 6 weeks. After 6 weeks, and once there was radiograph evidence of healing at the osteotomy site, full weight-bearing was allowed.

After 4 months, the patient decided to undergo a similar procedure on the left knee. Postoperative rehabilitation was the same. A year after the bilateral TKAs, the patient maintained a Knee Society Score of 95 and a functional score of 90. After surgery, anatomical alignment was 6° (right knee) and 3° (left knee) (Figure 3), and tibial slope was 6° (right) and 7° (left) (Figures 4A, 4B). In each knee, the PCL was preserved with ligament balance.

Discussion

Clinical outcomes of TKA after high tibial osteotomy vary. Windsor and colleagues⁹ reported that knee arthroplasties after tibial osteotomy were less successful than primary TKAs. In small studies, both Staeheli and colleagues¹⁷ and Katz and colleagues⁵ found that TKA outcomes after osteotomy were satisfactory compared with outcomes of primary TKA without previous osteotomy. A meta-analysis by Ramappa and colleagues¹⁸ showed no difference in outcomes between TKAs with and without previous osteotomy. In addition, there were no differences in outcomes between TKAs performed after opening wedge versus closing wedge osteotomies.¹⁹

An arthritic knee compartment is unloaded when a high tibial osteotomy produces an extra-articular deformity. Neyret and colleagues⁷ reported difficulties in correcting angulations of 9° or more through soft-tissue release. Cameron and Welsh¹⁶ suggested pre-knee arthroplasty correction of the extra-articular deformity for malalignments of more than 15°. In cases of severe malalignment produced by an osteotomy, Katz and colleagues⁵ also suggested that a second osteotomy be performed to correct alignment before TKA.

For TKA after high tibial osteotomy, a neutral plateau resection removes more bone medially than laterally, creating medial laxity. Without correction of the tibial deformity, lateral release (or, as Krackow and Holtgrewe²⁰ advocated, medial advancement) is required for ligament stability. Both technically demanding options may not provide complete stability throughout the arc of motion. In addition, neither corrects for rotational or sagittal deformities (the concern with correcting an extra-articular deformity with intra-articular ligament balancing).

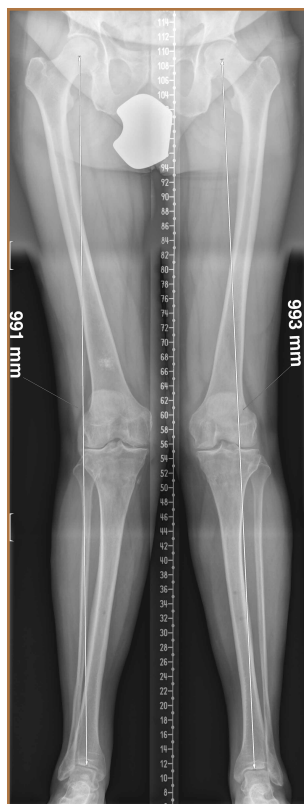


Figure 2. After osteotomies: standing alignment radiograph of both knees.



Figure 3. After combined recorrection osteotomies and knee arthroplasties: standing alignment radiograph of both knees.



Figure 4. After combined recorrection osteotomies and knee arthroplasties: (A) lateral radiograph of right knee and (B) lateral radiograph of left knee.

Another option is valgus tibial resection, which maintains native ligament balance at the cost of excessive valgus alignment. In the low-demand patient, a condylar constrained implant provides a means of correcting the malalignment with knee stability.^{8,13,17} The increased restraint produces greater forces at the implant–bone interface and may risk early loosening.

The case presented here represents a unique situation of failed bilateral high tibial osteotomies with excessive valgus malalignment. In a similar situation, Papagelopoulos and colleagues²¹ suggested correcting fracture deformities before or at time of knee arthroplasty. Yoshina and colleagues²² reported using a stemmed tibial component with TKA in treating nonunion of a high tibial osteotomy. As mentioned, Katz and colleagues⁵ and Neyret and colleagues⁷ suggested preoperative correction of the osteotomy in cases of severe malalignment. Others have suggested combining recorection osteotomy and knee arthroplasty in either consecutive operations or a single operation.^{23–26} Wolff and colleagues²⁷ and Uchinou and colleagues²⁸ described recorection osteotomy performed concurrent with TKA. The present article is the first to report a case involving concurrent bilateral recorection osteotomy and TKA.

In one setting, the recorection osteotomy is performed after the bony cuts are made for the TKA. The initial tibial plateau resection is performed in valgus at the same degree of malalignment as the osteotomy. This allows the plane of the tibial resection to parallel the floor once the recorection is finished. With use of a tibial stem crossing the osteotomy site and a derotation plate, adequate fixation of the osteotomy is obtained. The recorection osteotomy prevents the ligaments from overlengthening, allows the native ligament balance of the knee, and preserves the PCL—which lets the surgeon obtain ligament balance for the TKA throughout the arc of motion, avoiding midstance instabilities and achieving knee alignment rotationally and in the coronal and sagittal planes.

The TKA used in the present case was a PCL-retaining design. Both posterior-stabilized and PCL-retaining designs are reasonable options for use in combination with recorection osteotomy. A stemmed tibial component is needed to cross the osteotomy site. In our patient's case, use of a PCL-retaining design was based on surgeon preference and experience.

Patella infera has been noted as a problem in studies on converting high tibial osteotomy to TKA.^{9,12,29} A postulated cause is scarring of the infrapatellar tendon after high tibial osteotomy. In addition, a higher incidence of lateral retinacular release has been identified.^{9–11} Patella infera did not occur in either knee in the present case, and lateral release was not required.

Our patient's lateral radiographs (Figures 4A, 4B) showed persistence of the osteotomy plane anterior to the tibia. The osteotomy healed posteriorly but not completely anteriorly. This raises the issue of risk for nonunion when recorection osteotomy is performed with TKA. Use of a stemmed tibial implant with a derotation plate provides the benefit of intramedullary fixation for the recorection osteotomy. If the recorection osteotomy were performed in a separate setting before TKA, plate fixation would be the primary fixation option. Should nonunion occur at the recorection osteotomy

site, revision of the tibial plateau with a new stemmed implant would be required in combination with plate fixation. Madeline and colleagues³⁰ reported on a series of 15 severe varus knees treated with both osteotomy and TKA. Two nonunions occurred. Fixation was a staple in one case and a cement wedge in the other. Risk for nonunion may be reduced with the combination of stemmed tibial implant and internal fixation with a derotation plate. Protective weight-bearing is recommended for the first 6 postoperative weeks.

Conclusion

Ligament imbalances produced by high tibial osteotomy and exacerbated by conversion to TKA are difficult to address. In this report, we have described successful single-stage high tibial osteotomy recorection and TKA performed bilaterally in separate settings. With use of a stemmed tibial component and a derotation plate, solid fixation was obtained with an excellent clinical outcome. The malalignment was corrected while ligament balance was maintained for a PCL-retaining TKA design.

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