International Journal of Research in Orthopaedics
Balakondaiah K et al. Int J Res Orthop. 2026 May;12(3):790-793
http://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20261232

Case Report

Management of severe varus knee osteoarthritis with unconstrained cruciate-retaining total knee arthroplasty using tibial stem and bone grafting: a case report

K. Balakondaiah, P. Ramanaidu, S. Rajkumar*

Department of Orthopedics, KIMS Hospital, Nellore, Andhra Pradesh, India

Received: 12 December 2025
Revised: 17 February 2026
Accepted: 02 April 2026

***Correspondence:**
Dr. S. Rajkumar,
E-mail: rajkumaryadav3219@gmail.com

ABSTRACT

Severe varus knee osteoarthritis associated with medial tibial bone loss presents significant challenges during total knee arthroplasty, particularly in achieving stable alignment while preserving ligament balance. We report the case of a 68-year-old female who presented with severe right knee pain, progressive varus deformity, and inability to ambulate independently. Radiographic evaluation revealed tricompartmental osteoarthritis with collapse of the medial tibial plateau and significant coronal deformity. The patient underwent primary unconstrained cruciate-retaining total knee arthroplasty using a tibial stem extension combined with reconstruction of the medial tibial defect using autologous bone graft and screw fixation. Intraoperative assessment demonstrated intact posterior cruciate and collateral ligaments, allowing the use of a cruciate-retaining implant despite severe deformity. Postoperative radiographs confirmed restoration of mechanical alignment and stable fixation of the components. At one-year follow-up, the patient achieved satisfactory range of motion, pain relief, and functional improvement without evidence of loosening or instability. This case highlights that cruciate-retaining total knee arthroplasty with tibial stem support and bone grafting can be an effective and cost-efficient treatment option for severe varus knees with preserved ligament competence, avoiding the need for constrained implants.

Keywords: Severe varus knee, Unconstrained, Cruciate retaining, Tibial stem, Bone grafting, Total knee arthroplasty

INTRODUCTION

Varus knee osteoarthritis is one of the most common patterns of degenerative knee disease and frequently involves progressive medial compartment destruction with associated ligament imbalance and bone loss. Severe deformity often results from collapse of the medial tibial plateau, osteophyte formation, and soft-tissue contracture, leading to altered biomechanics and functional disability.[1] Constitutional varus alignment has also been reported to predispose individuals to accelerated medial compartment degeneration.[9]

Total knee arthroplasty is the definitive treatment for end-stage osteoarthritis; however, severe varus deformity presents technical challenges in achieving proper alignment, stability, and implant longevity. Correction of deformity requires meticulous soft-tissue balancing, appropriate bone resection, and management of bone defects.[2,3] Medial tibial defects may compromise component fixation and load distribution if not adequately reconstructed. Options for management include cement filling, metal augments, structural bone grafting, or stem extensions depending on defect size and containment.[17,18]

Although posterior-stabilized or constrained implants are often preferred in severe deformity, several studies have demonstrated satisfactory outcomes with cruciate-retaining prostheses when the posterior cruciate ligament and collateral ligaments are intact.[5,6,11] Preservation of

native ligament function may maintain more physiological knee kinematics and reduce implant stress.[19] The present case describes the successful use of an unconstrained cruciate-retaining total knee arthroplasty with tibial stem extension and autologous bone grafting in a patient with severe varus deformity and medial tibial bone loss.

CASE REPORT

A 68-year-old female presented with severe right knee pain for five years, progressively worsening over the preceding year, associated with increasing deformity and inability to walk without support. There was no history of trauma, inflammatory arthritis, or previous surgery. The pain was aggravated by weight bearing and relieved partially with rest and analgesics. The patient reported difficulty in performing activities of daily living, including climbing stairs and rising from a sitting position.

On clinical examination, the patient had a pronounced varus deformity of the right knee with antalgic gait. The deformity was partially correctable but associated with medial joint line tenderness and crepitus on movement. Range of motion was restricted from 10° flexion contracture to 90° of flexion. Ligamentous examination revealed intact collateral ligaments without gross instability. Neurovascular status of the limb was normal.

Radiographs demonstrated tricompartmental osteoarthritis with marked narrowing of the medial joint space, osteophyte formation, subchondral sclerosis, and collapse of the medial tibial plateau resulting in severe varus alignment. Preoperative planning indicated a substantial contained medial tibial defect requiring reconstruction.

The patient underwent primary total knee arthroplasty through a medial parapatellar approach. Extensive osteophytes and contracted medial soft tissues were identified intraoperatively, and sequential medial release was performed to achieve balanced flexion and extension gaps. The posterior cruciate ligament and collateral ligaments were intact and functional, permitting the use of a cruciate-retaining implant. Following tibial preparation, a significant medial tibial bone defect was encountered. Reconstruction was performed using autologous cancellous bone graft harvested from resected bone, secured with screw fixation to restore the tibial plateau surface. A tibial stem extension was used to enhance load transfer and provide additional stability to the reconstructed area. Trial components demonstrated satisfactory alignment and stability before implantation of the final prosthesis with bone cement.

Postoperative radiographs confirmed restoration of mechanical alignment with well-positioned components. Early mobilization was initiated with physiotherapy. At one-year follow-up, the patient reported significant pain relief and functional improvement, with knee range of motion from 0° to 115°. No instability, infection, or radiographic loosening was observed, and the patient was able to ambulate independently.

Figure 1 (A-D): Pre OP and intra OP images.

Figure 2 (A and B): Post operative images.

DISCUSSION

Management of severe varus deformity during total knee arthroplasty is challenging due to bone loss, ligament imbalance, and altered joint mechanics. Traditional approaches often favor posterior-stabilized or constrained implants to ensure stability.[14] However, several studies have shown that cruciate-retaining implants can provide comparable outcomes in appropriately selected patients with intact ligament structures.[5,6,11] In the present case, preservation of ligament competence allowed the use of a cruciate-retaining prosthesis despite significant deformity, consistent with reports demonstrating acceptable survivorship of such implants in severe varus knees.[19]

Medial tibial bone defects are common in advanced varus osteoarthritis and must be addressed to ensure stable component fixation. Structural bone grafting restores bone stock and facilitates biological incorporation, particularly in contained defects.[17,18] Autologous grafting in this case provided anatomical reconstruction while avoiding the need for metallic augments. The addition of a tibial stem extension redistributed stresses to the diaphysis and reduced the risk of loosening, supporting studies advocating stem use in severe deformity.[4,7,16]

Soft-tissue balancing is a critical determinant of postoperative stability. Sequential medial release techniques are often required to correct deformity while maintaining ligament integrity.[2,3,12] Failure to achieve balance can result in instability, abnormal wear, and early implant failure.[20] Adequate balancing in this patient contributed to the favorable outcome observed.

Preservation of the posterior cruciate ligament has been associated with more physiological knee kinematics and potentially lower implant stresses.[11,19] Additionally, cruciate-retaining implants require less bone resection and are generally more cost-effective than constrained designs, making them advantageous in resource-limited settings.[15,22] The favorable functional outcome at one year in this case is consistent with previously reported studies on management of severe varus deformity.[7,24]

CONCLUSION

Severe varus knee osteoarthritis with medial tibial bone loss presents complex surgical challenges during total knee arthroplasty. This case demonstrates that unconstrained cruciate-retaining arthroplasty combined with autologous bone grafting and tibial stem extension can achieve satisfactory correction of deformity, stable fixation, and good functional recovery when ligament competence is preserved. Careful surgical planning, meticulous soft-tissue balancing, and appropriate defect reconstruction are essential for successful outcomes. This technique may serve as a cost-effective alternative to constrained implants, particularly in elderly patients and settings with limited resources. Long-term follow-up is required to confirm durability of these results.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Mullaji AB, Shetty GM. Correction of varus deformity during TKA. J Arthroplasty. 2015;472(1):126-32.
2. Engh GA, Ammeen DJ. Bone loss management in revision TKA. Clin Orthop Relat Res. 2009;467:121-34.
3. Whiteside LA. Soft tissue balancing in TKA. J Bone Joint Surg Am. 1999;81:151-8.
4. Lombardi AV Jr, Berend KR, Adams JB. Tibial stem use in complex primary TKA. J Arthroplasty. 2007;22(2):44-50.
5. Laskin RS. Total knee replacement with PCL retention in severe varus deformity. Clin Orthop Relat Res. 1996;331:29-34.
6. Kubiak P, Archibeck MJ, White RE Jr. CR TKA with ≥15° coronal deformity. J Arthroplasty. 2008;23:366-370.
7. Hegde V, Bracey DN, Brady AC, Kleeman-Forsthuber LT, Dennis DA, Jennings JM. Prophylactic tibial stem reduces aseptic loosening in severe varus. J Arthroplasty. 2021;36(7):2319-24.

8. Ranawat CS, Insall JN, Shine JJ. Correction of severe varus deformity in TKA. Clin Orthop Relat Res. 1976;120:144-52.
9. Bellemans J, Colyn W, Vandenneucker H, et al. Constitutional varus knee. J Bone Joint Surg Br. 2012;94:11-7.
10. Matsuda S, Miura H, Nagamine R, et al. Posterior condylar offset in TKA. J Bone Joint Surg Am. 1999;81:171-8.
11. Scott RD. Cruciate-retaining TKA outcomes. Clin Orthop Relat Res. 2001;392:54-61.
12. Ritter MA, Berend ME. Medial release in varus TKA. J Arthroplasty. 2008;23:45-9.
13. Krackow KA. The technique of TKA in severe deformity. J Arthroplasty. 1991;6(1):S87-92.
14. Morgan H, Battista V, Leopold SS. Constraint in primary TKA. J Am Acad Orthop Surg. 2005;13:515-24.
15. Vince KG. Complex primary TKA: stems and augments. Orthopedics. 2006;29:947-9.
16. Berend KR, Lombardi AV Jr. Stem extensions in primary TKA. J Surg Orthop Adv. 2010;19:30-35.
17. Pagnano MW, Trousdale RT, Rand JA. Bone graft for tibial defects in TKA. Clin Orthop Relat Res. 1995;321:161-8.
18. Rand JA. Bone grafting of tibial defects during TKA. J Bone Joint Surg Am. 1991;73:1127-35.
19. Ritter MA, Faris PM. Long-term outcomes of CR vs PS TKA. Clin Orthop Relat Res. 1989;248:79-85.
20. Dennis DA. Ligament balancing in TKA. Orthop Clin North Am. 2001;32:685-696.
21. Insall JN, Scott WN. Surgery of the Knee. 5th ed. Elsevier. 2012.
22. Barrack RL. Management of bone loss in primary TKA. J Arthroplasty. 2003;18(1):80-82.
23. Freeman MA, Samuelson KM. Long-term results of knee replacement. Clin Orthop Relat Res. 1986;205:46-52.
24. Rodriguez JA, Bhende H, Ranawat CS. Correction of severe varus deformity. Clin Orthop Relat Res. 2001;392:25-31.

Cite this article as: Balakondaiah K, Ramanaidu P, Rajkumar S. Management of severe varus knee osteoarthritis with unconstrained cruciate-retaining total knee arthroplasty using tibial stem and bone grafting: a case report. Int J Res Orthop 2026;12:790-3.