Case Report | Journal of Orthopaedic Case Reports 2025 February:15(2):Page 22-27

Novel Use of Tricortical Iliac Crest Bone Allograft to Reconstruct the Lateral Tibia Plateau Articular Surface: A Case Series

Luke Benjamin Schwartz[1,2], Matthew Kingery[1,2], Abhishek Ganta[1,2], Kenneth Egol[1,2], Sanjit Konda[1,2]

Learning Point of the Article:

An iliac crest bone graft to resurface the tibial plateau may be a viable surgical technique to delay the need for arthroplasty and preserve bone stock before total knee replacement.

Abstract

Introduction: A tricortical iliac crest graft can be used to reconstruct the lateral proximal tibial articular surface.

Methods/Surgical Technique: Anterior tricortical iliac crest autograft from the ipsilateral pelvis is harvested to approximate the contour of the native tibial plateau. A lateral proximal tibial locking plate is used to fix the bony construct to the surrounding native bone.

Case Report: Functionally, patients have been able to return to ambulation with and without an assistive device.

Conclusion: Reconstruction of the joint surface with a tricortical iliac crest graft represents a novel surgical technique that may delay the need for arthroplasty and preserve bone stock for eventual knee replacement.

Keywords: Iliac crest bone graft, tibial plateau, reconstruction

Introduction

The use of autologous or allogeneic structural bone graft to reconstruct articular bony deformities, reconstitute native joint anatomy, and restore function has proven to be a reliable technique in select orthopedic procedures. Michel Latarjet described the use of the coracoid to reconstruct the anterior glenoid nearly 70 years ago, and the technique has since become the gold standard for treating recurrent anterior glenohumeral instability in the setting of bone loss [1, 2]. Similarly, a distal tibial allograft can be used to reliably reconstruct the glenoid in the setting of more severe bone loss.

The management of lateral tibial plateau fractures with severe bone loss and erosion of the articular surface represent a challenge for the orthopedic traumatologist, particularly when the patient is not a good candidate for total knee arthroplasty (TKA) with revision components. We present a novel technique for reconstructing the lateral tibial plateau in which a tricortical iliac crest autograft or allograft is used to recreate the weight-bearing surface of the proximal tibia. Just as the coracoid approximates the contour of the native anterior glenoid in the Latarjet procedure, the inner table of the pelvic brim can be used to approximate the contour of the lateral tibial plateau.

This technique can be utilized in cases in which the articular surface has eroded (e.g., infection), there is severe bone loss, and/or the weight-bearing surface is otherwise determined to be non-reconstructable, and the patient is deemed to be a poor candidate for TKA. Patients' may be considered poor candidates for TKA if they have significant medical comorbidities, obesity, neuromuscular disease, osteoporosis, etc. [3, 4]. This surgical procedure may serve as a potential interlude before definitive irrevocable TKA. The primary goals of this treatment are to achieve a stable weight-bearing surface and restore the bone

Access this article online

Website: www.jocr.co.in

DOI: https://doi.org/10.13107/jocr.2025.v15.i02.5214

Author's Photo Gallery


Dr. Luke Benjamin Schwartz


Dr. Matthew Kingery


Dr. Abhishek Ganta


Dr. Kenneth Egol


Dr. Sanjit Konda

[1]Department of Orthopedic Surgery, NYU Langone Orthopedic Hospital, New York, NY, USA,
[2]Jamaica Hospital Medical Center, Queens, NY, USA.

Address of Correspondence:
Dr. Sanjit Konda,
Department of Orthopedic Surgery, NYU Langone Orthopedic Hospital, New York, NY, USA.
E-mail: sanjit.konda@nyulangone.org

Submitted: 26/11/2024; Review: 12/12/2024; Accepted: January 2025; Published: February 2025

DOI: https://doi.org/10.13107/jocr.2025.v15.i02.5214

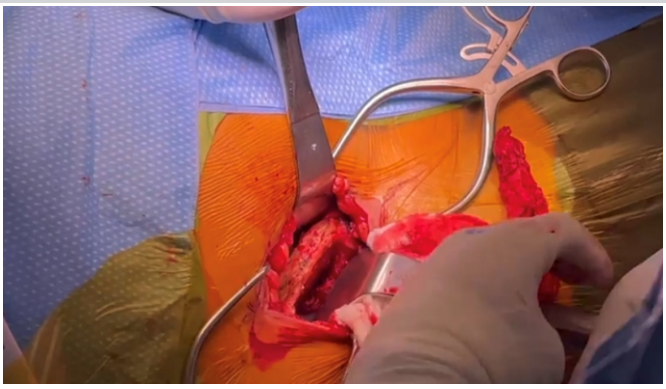

Figure 1: Blunt dissection is performed along the medial aspect of the iliac crest to elevate the iliopsoas muscle off the inner table of the pelvis. The hip abductors are then elevated off the outer table of the pelvis first with sharp dissection and then bluntly using a broad Hohmann retractor. Retractors are placed on either side of the iliac crest to expose the inner table, outer table, and pelvic brim.

Figure 2: The tricortical graft is harvested using a reciprocating saw and osteotome. Curettes can be used to harvest additional cancellous autograft from between the inner and outer tables of the brim.

stock of the proximal tibia, which will simplify later knee arthroplasty when the reconstructed plateau undergoes the expected post-traumatic degenerative changes.

Case Report

Case 1

This was a 61-year-old female pedestrian, community ambulator at baseline, who presented after being struck by a motor vehicle and sustaining numerous injuries including a right tibial plateau fracture. Given the patient's osteoporosis, there was severe comminution of the lateral articular surface. Any fragment that was able to be salvaged was elevated into place, although there remained a 2.5 cm by 2.5 cm central defect of missing articular cartilage. To accommodate this void in the articular surface, a tricortical iliac crest allograft was cut to the size of the defect, and the plateau was reconstructed as described.

Despite post-operative physical therapy, she experienced persistent pain and stiffness of her knee and therefore underwent manipulation under anesthesia and arthroscopic lysis of adhesions 3 months after the initial surgery. 100° of flexion was obtained intraoperatively, but she continued to report stiffness and underwent a second manipulation under anesthesia 1 year after her initial surgery (as well as intramedullary nailing of an ipsilateral femoral shaft fracture). Her knee was able to be flexed to 120° intraoperatively.

18 months after her injury, she reported that she was improving with respect to her pain, knee range of motion, and quadriceps strength. Her knee range of motion is 5–110°, and she is able to ambulate in her house without an assistive device and uses a cane or walker when ambulating in the community. The patient reported satisfaction with the operation.

Case 2

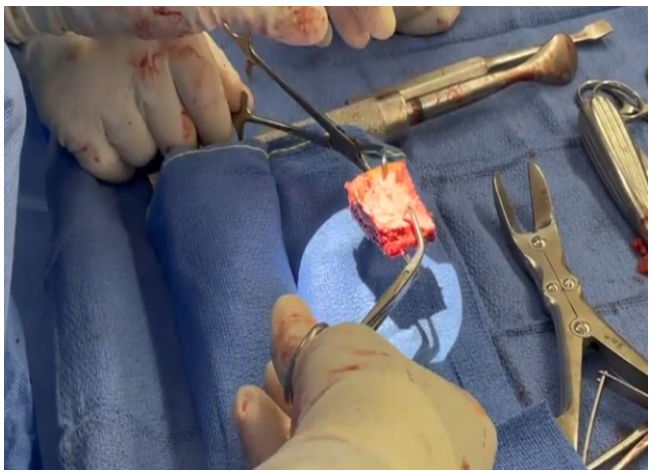

Figure 3: The iliac crest graft is shaped to match the anatomy of the native lateral plateau articular surface.

Figure 4: The graft is placed into the region of the eroded articular surface and the fit is evaluated fluoroscopically.

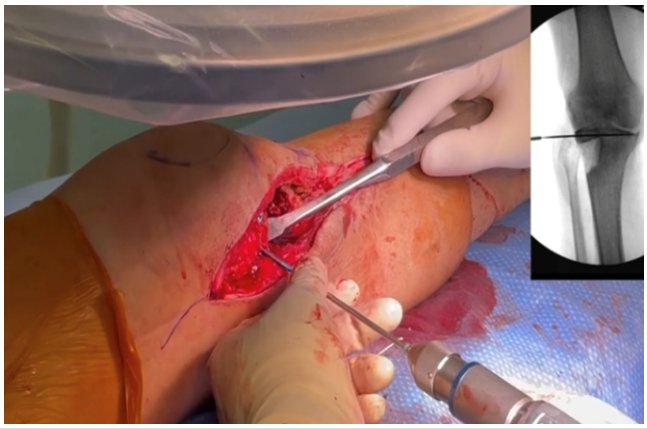

Figure 5: The tricortical graft is secured with cortical screws directed into the native medial plateau. Ensure that the screw heads are countersunk sufficiently as a proximal tibia locking plate will be placed over this region.

Figure 6: Iliac crest allograft is placed perpendicular to the reconstructed articular surface to provide structural support against axial loading of the joint surface. The remaining bone void is then filled with additional autograft and/or allograft to provide additional structural support. Cancellous bone graft is then packed around the structural grafts and tamped down to create a dense fusion mass.

This was a 60-year-old male who sustained a motor vehicle collision resulting in a right tibial plateau fracture. He initially underwent standard open reduction internal fixation with a lateral locking plate but quickly developed an infection requiring multiple debridements with removal of hardware. He was noted to have complete erosion of the lateral articular surface with fragmentation of the periarticular bone that was determined to be non-reconstructable.

Despite being instructed to remain non-weight-bearing, the patient continued to bear weight on his operative leg in a hinged knee brace. After a prolonged antibiotic course and negative cultures, he underwent reconstruction of the lateral tibial plateau using a tricortical iliac crest autograft as described.

Four weeks after plateau reconstruction, the patient reported minimal knee pain and had range of motion from 5° to 90°. The patient again reported bearing weight on his operative leg since the time of surgery. Radiographs at this time demonstrated mild subsidence of the reconstructed lateral plateau. At 8 weeks postoperatively, knee range of motion was 5–110° and radiographs demonstrated interval consolidation of the graft. At 8 months postoperatively the patient was ambulating without assistive device. Knee range of motion was 5–120°, and his primary complaint was knee instability. Radiographs demonstrated consolidation of the graft, but interval degeneration of the joint space.

Figure 7: The reconstructed articular surface and associated structural graft are secured to the native proximal tibia using a contoured locking plate. The proximal screws should be placed as rafting screws to minimize the risk of graft subsidence.

Case 3

This was a 44-year-old female with a history of multiple chronic illnesses who sustained a right tibial plateau fracture after being struck by a car as a pedestrian. She underwent knee-spanning external fixation, but due to the onset of the COVID-19 pandemic, her definitive fixation was delayed by several months. Intraoperatively, due to the now remote nature of the injury, there was copious fibrous tissue that was debrided and her articular surface fragments were not reconstructable leaving a 2.5 cm by 3 cm articular surface void in the lateral tibial plateau. She subsequently underwent lateral plateau reconstruction using a tricortical iliac crest autograft as described.

The patient did not follow up in the office postoperatively. However, during a virtual follow-up appointment, she noted that she was satisfied with her post-operative recovery and was ambulating in her house without an assistive device. Eight months after her plateau reconstruction, she was admitted with congestive heart failure and died shortly after.

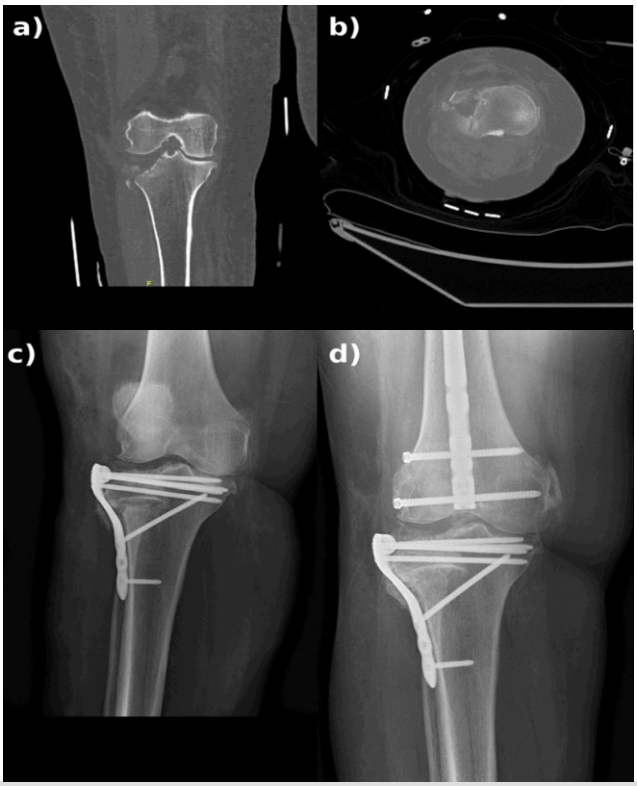

Figure 8: (a-d from top left) Case # 1 (a) pre-operative computed tomography (CT) image in the coronal plane and (b) CT image in the axial plane; (c) post-operative X-ray 1-month after surgery and (d) X-ray 9-months postoperatively.

Methods/Surgical Technique

Autologous iliac crest harvest

When autologous bone graft is being used, the iliac crest is harvested by first making an incision along the pelvic brim toward the anterior superior iliac spine. Superficial dissection is performed through the subcutaneous tissue to the confluence of the external oblique muscle fascia medially and the hip abductor fascia laterally. The dissection is continued in this intermuscular plane until the pelvic brim is reached (Fig. 1). A reciprocating sternal saw is used to cut a roughly 3 cm wide by 4 cm deep tricortical portion of the iliac crest, which is then completed using an osteotome (Fig. 2). Alternatively, an iliac crest allograft can be used in lieu of autograft (Case #1).

Tibial plateau reconstruction

A standard anterolateral approach to the proximal tibia is used. The iliac crest graft is prepared on the back table by cutting it into the size and shape of the missing lateral plateau articular surface (Fig. 3). Importantly, the concave inner table of the crest is used to approximate the concave surface of the native lateral plateau.

A trial fit of the graft is then performed (Fig. 4). A tamp can be used to impact the graft against the lateral distal femoral condyle to contour the tricortical crest to the patient's femur. Two 2.7 mm cortical screws are placed laterally to medially into the subchondral bone of the native medial plateau (Fig. 5).

Remaining tricortical iliac crest autograft or additional iliac crest allograft is then used to provide structural support to the bone void inferior to the reconstructed articular surface. The structural graft is cut to size and placed perpendicular to the joint surface (Fig. 6).

Following the reconstruction of the articular surface and filling of the bone void, a proximal tibial locking plate is applied (Fig. 7). The final construct and congruence of the reconstructed joint surface are evaluated fluoroscopically.

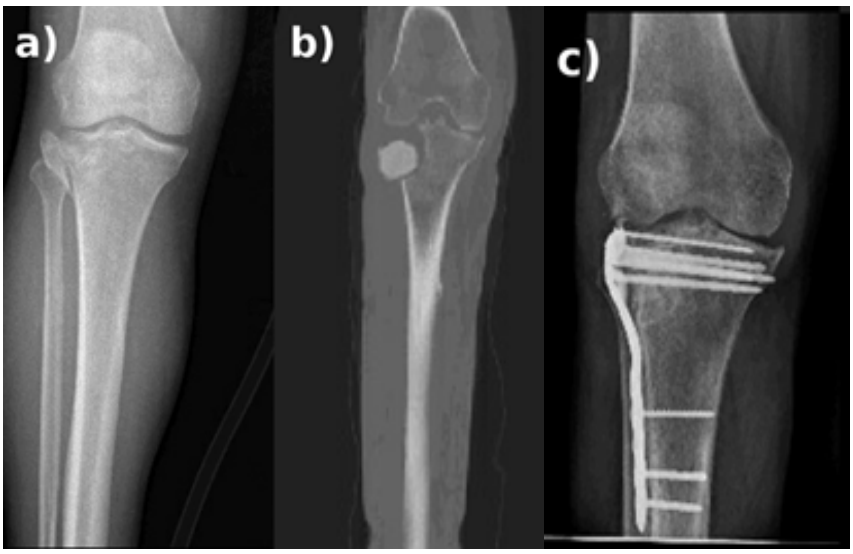

Figure 9: (a-c from top left) Case # 2 (a) pre-operative X-ray image in coronal plane; (b) computed tomography image in coronal plane; and (c) post-operative X-ray 3 months postoperatively.

Discussion

Tibial plateau fractures with significant bone loss at the osteoarticular surface often present a challenge for the treating surgeon. To preserve a bone stock in the proximal tibia and potentially delay the need for TKA, we present a novel reconstruction technique using a tricortical iliac crest bone graft. This technique builds on the concept of using a bone graft to mimic the bony anatomy elsewhere in the body, similar to the Latarjet procedure [5-7].

This novel procedure can be considered when there is a need to salvage an otherwise non-reconstructable tibial plateau in a patient who is not a good candidate for arthroplasty [8-10]. The poor prognosis of these patients makes it difficult to gauge the effectiveness of the

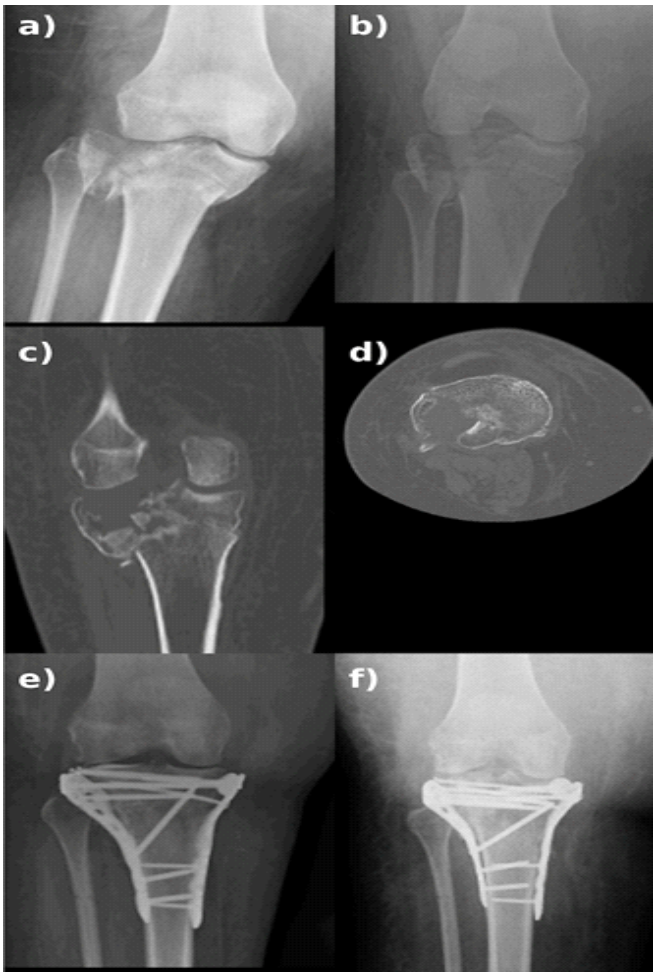

Figure 10: (a-f) Case #3 (a and b) pre-operative coronal X-ray T1/T2; (c) pre-operative coronal computed tomography (CT) image and (d) pre-operative axial CT image; and (e and f) post-operative X-ray T1/T2 imaging on the same day as procedure.

procedure. However, the patients in this small sample have been able to ambulate without an assistive device following reconstruction.

The primary benefit of this technique may be the opportunity to preserve bone stock in the proximal tibia following injuries with severe bone loss. Bone stock preservation can be important for the success of a TKA, especially in revision surgery. Adequate bone stock provides a stable foundation for implant fixation, ensures proper load distribution and minimizes the risk of complications such as implant loosening or subsidence [11]. Additionally, it facilitates precise alignment of prosthetics, essential for restoring joint mechanics to achieve optimal outcomes. In cases of revision TKA, insufficient bone stock can pose significant challenges. These challenges include limited ability to achieve secure implant fixation, compromised alignment of prosthetic components and reduced likelihood of joint mechanics. Advanced reconstruction strategies may be necessary in cases of advanced reconstructive strategies, necessitating the use of metaphyseal cones, augments, and custom implants [12]. These may complicate the course of care and result in suboptimal outcomes, leaving joint arthrodesis or less favorable options as the only alternatives [13].

Post-operative radiographs in our case series have demonstrated adequate consolidation of the bone graft with the native proximal tibia. Restoring the anatomy of the tibial plateau by reconstructing the articular surface and filling the bony void may prevent the need for revision components at the time of the arthroplasty. For this reason, this alternative use for tibia plateau articular surface reconstruction may be warranted and ought to be explored further. (Fig 8-10).

Conclusion

The novel procedure in our study can be considered a salvage procedure – a last-ditched attempt to restore the functional integrity of the anatomy following significant complication. There may be additional uses of this novel procedure as well. TKA is a difficult procedure when coinciding with a valgus deformity, and rates of failure increase in these cases of depressed plateaus. Restoring the bony anatomy of the tibial plateau by reconstructing the articular surface of the tibial plateau with a tricortical iliac crest allograft may prevent the necessity of a revision surgery or a knee arthrodesis. These revision operations tend to lead to worsened physical limitations for patients. For this reason, this alternative use for tibia plateau articular surface reconstruction may be warranted and ought to be explored further.

Clinical Message

The viability of the tricortical iliac crest bone graft should be further evaluated as a potential option for patients' with significant tibial plateau fractures who want to delay definitive total knee replacement.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

References

1. Latarjet M. Technic of coracoid preglenoid arthroereisis in the treatment of recurrent dislocation of the shoulder. Lyon Chir 1958;54:604-7.

2. Boylan MR, Strauss EJ, Jazrawi LM, Virk MS. The Latarjet-patte procedure past, present, and future. Bull Hosp Jt Dis (2013) 2022;80:80-7.

3. Askari A, Mohammadpour M, Jabalameli M, Naeimipoor N, Goodarzy B, Jafari B, et al. Predictors of health-related quality of life after total knee arthroplasty: A case-control study. Sci Rep 2024;14:14176.

4. Harris AB, Lantieri MA, Agarwal AR, Golladay GJ, Thakkar SC. Osteoporosis and total knee arthroplasty: Higher 5-year implant-related complications. J Arthroplasty 2024;39:948-53.e1.

5. Robinson SP, Patel V, Rangarajan R, Lee BK, Blout C, Itamura JM. Distal tibia allograft glenoid reconstruction for shoulder instability: Outcomes after lesser tuberosity osteotomy. JSES Int 2021;5:60-5.

6. Hurley ET, Schwartz LB, Mojica ES, Campbell KA, Matache BA, Meislin RJ, et al. Short-term complications of the Latarjet procedure: A systematic review. J Shoulder Elbow Surg 2021;30:1693-9.

7. Campana V, Milano G, Pagano E, Barba M, Cicione C, Salonna G, et al. Bone substitutes in orthopaedic surgery: From basic science to clinical practice. J Mater Sci Mater Med 2014;25:2445-61.

8. Nishikawa M, Kaneshiro S, Takami K, Owaki H, Fuji T. Bone stock reconstruction for huge bone loss using allograft-bones, bone marrow, and teriparatide in an infected total knee arthroplasty. J Clin Orthop Trauma 2019;10:329-33.

9. Lei PF, Hu RY, Hu YH. Bone defects in revision total knee arthroplasty and management. Orthop Surg 2019;11:15-24.

10. Castano-Betancourt MC, Fruschein Annichino R, De Azevedo E Souza Munhoz M, Gomes Machado E, Lipay MV, Marchi E. Identification of high-risk groups for complication after arthroplasty: Predictive value of patient's related risk factors. J Orthop Surg Res 2018;13:328.

11. Huff TW, Sculco TP. Management of bone loss in revision total knee arthroplasty. J Arthroplasty. 2007 Oct;22(7 Suppl 3):32-6. doi: 10.1016/j.arth.2007.05.022. PMID: 17919590.

12. Meyer M, Leiß F, Götz JS, Holzapfel DE, Grifka J, Weber M. Bone Mineral Density is Associated With Adverse Events but not Patient-Reported Outcomes in Total Hip and Knee Arthroplasty. J Arthroplasty. 2024 Feb;39(2):320-325. doi: 10.1016/j.arth.2023.08.056. Epub 2023 Aug 20. PMID: 37607640.

13. Mancino F, Di Matteo V, Mocini F, Pietramala S, Singlitico A, De Fazio A, La Vergata V, Gasparini G, Maccauro G, De Martino I. Short-Term Survivorship of 3D-Printed Titanium Metaphyseal Cones in Revision Total Knee Arthroplasty: A Systematic Review. Orthop Rev (Pavia). 2022 Jun 27;14(4):35891. doi: 10.52965/001c.35891. PMID: 35769657; PMCID: PMC9235418.

Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this case report

How to Cite this Article

Schwartz LB, Kingery M, Ganta A, Egol K, Konda S. Novel Use of Tricortical Iliac Crest Bone Allograft to Reconstruct the Lateral Tibia Plateau Articular Surface: A Case Series. Journal of Orthopaedic Case Reports 2025 February;15(2): 22-27.