

Surgical Repair of Tibial and Fibular Metaphyseal Defects in Pilon Fractures Using ViviGen® Cellular Bone Matrix

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CASE STUDY

Pilon fractures typically occur due to high-energy trauma and cause the comminuted metaphyseal bone to collide against the tibial articular surface.¹ Metaphyseal bone defects, which remain after the stabilization of the fractures, can pose a challenge for treatment.² One bone-grafting option for fusing defects is autograft bone. Autograft bone can provide the osteoconductive, osteoinductive, and osteogenic properties needed for successful bone fusion; however, its retrieval can cause pain and morbidity at the harvest site.³ Even in cases in which autograft is desired, there is a limit to the volume that can be harvested without compromising the donor site. Allograft bone can be used as an autograft extender or even eliminate the need for a second surgery site altogether. One particular allograft, ViviGen, also provides all three properties necessary for bone fusion. ViviGen contains viable lineage-committed bone cells embedded in cortico-cancellous chips as well as demineralized bone particles or fibers. Preclinical studies involving porous ceramic scaffolds seeded with either osteoblasts or mesenchymal stem cells (MSCs) have suggested that bone cells may provide a higher degree of bone deposition than MSCs.^{4,5} Findings from these studies suggest that viable bone allografts may have greater relevance in cases where bone fusion is anticipated to be challenging.

The following describes the use of ViviGen to treat challenging tibial and fibular metaphyseal defects in nonunion, pilon fractures.

Patient

31-year-old, healthy, smoker, female

Patient sustained a Grade 3A open fracture on the left distal tibia with an associated distal fibula fracture.

She was treated with emergent incision and drainage (I & D), along with external fixation, with repeat (I & D) five days later. She was placed on intravenous antibiotics for six weeks, and presented to the office three and a half months after her injury. At the initial visit, she had a well-healed 7 cm oblique wound over her medial malleolus, and clean external fixator pin sites. X-rays (**Figure 1**) showed a reasonably well aligned distal tibia fracture and associated fibula fracture, with obvious osteopenia and metaphyseal bone loss. On the lateral view, there was apex anterior angulation of the fracture. A pre-operative CT scan (**Figure 2**) showed just a shell of cortical bone and a significant metaphyseal void.

Procedure

The patient's external fixator was removed, and the fractures were opened and debrided. The tibial and fibular metaphyseal defects were filled using 15 cc of autograft and 5 cc of ViviGen, respectively. The fractures were then reduced and open reduction and internal fixation (ORIF) was performed.

Results

At seven months post-operative, the fractures had healed, and the patient was able to return to full activity with no pain or limp (**Figure 3**).

Conclusion

This case highlights the successful use of ViviGen as a bone graft to fill metaphyseal defects in nonunion, pilon fractures.

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CASE STUDY

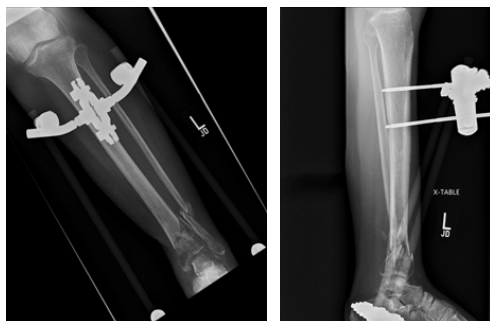


Figure 1. Anterior-posterior radiographs demonstrated a nonunion following open reduction external fixation of the radial shaft fracture.

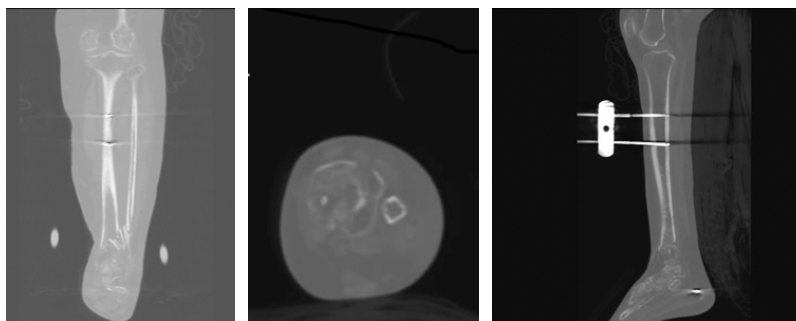


Figure 2. A pre-operative CT scan showed just a shell of cortical bone and a significant metaphyseal void.

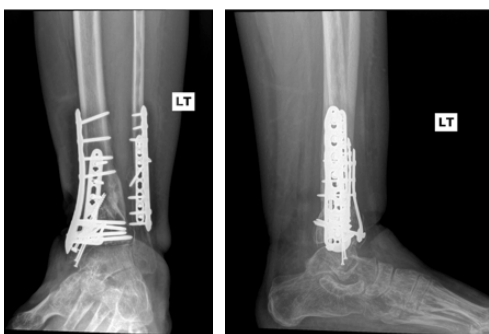


Figure 3. At 7 months post-operative, the fractures had healed, and the patient was able to return to full activity with no pain or limp

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