Surgical Repair of a Delayed Union to the Radius Diaphysis Using ViviGen® Cellular Bone Matrix in a Division I Football Athlete

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CASE STUDY

Delayed union to the radius diaphysis is a challenging injury to treat.[1] High-level athletes face additional obstacles to fracture healing due to their accelerated return to high impact activities.[2] One bone-grafting option for fusing fractures 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] The use of allografts can avoid these downsides. 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] Such findings may have relevance in cases where bone fusion has presented a unique challenge.

The following describes the use of ViviGen to treat a challenging delayed union to the radius diaphysis case.

Patient

A 22 year old, male, defensive back for a major football program had previously sustained a fracture to the shaft of the radius.

He underwent open reduction internal fixation with a 7-hole 3.5 mm dynamic compression plate. The patient was allowed to return to weight lifting at approximately three months from surgery. While weight lifting, the patient had sudden pain to the forearm.

Radiographs taken at the time showed a delayed union to the radius and the previously applied plate to be bent **(Figs. 1, 2).** The patient was referred from an outside institution for further management of delayed union of the radial shaft with a bent plate **(Fig. 3).**

Procedure

The patient was brought back to surgery approximately three months from the original injury and underwent open reduction internal fixation of the radial shaft plate, placing a longer 3.5 mm anatomical forearm plate and 1 cc of ViviGen. Close attention was made to place ViviGen on the radial side of the radius fraction, and not the ulnar side to prevent potential cross union between the radius and ulna **(Figs. 4, 5).**

Results

Radiographs at the 2 month mark show no loosening of the plate and early bone formation where ViviGen graft was placed **(Fig. 6).** Radiographs at six months show solid union of the radial shaft, with excellent bone formation across the fracture site (**Figs. 7, 8).**

Conclusion

The patient was cleared to play in the upcoming 2018 football season without any restrictions and cleared back to weight lifting without any limits. Treatment using ViviGen successfully induced fusion within six months in this high-level athlete.

Figure 1.
Anterior-posterior radiograph demonstrated a delayed union following open reduction internal fixation of the radial shaft fracture.

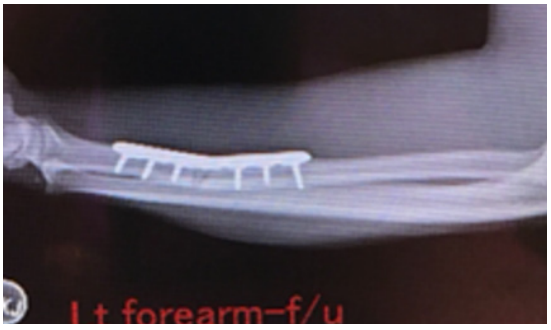

Figure 2.
Lateral radiograph of the same patient approximately 3 months out demonstrated the delayed union of the radial shaft fracture with a bent plate.

Figure 3.
Photograph of the bent stainless steel plate following removal as seen laterally.

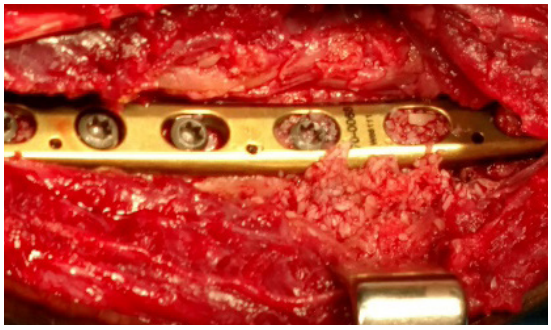

Figure 4.
Intraoperative photograph demonstrating revision of the delayed union of the radial forearm fracture and ViviGen graft being placed primarily on the radial side of the delayed union site.

Figure 5.
Lateral intraoperative fluoroscopic view demonstrating the forearm plate with good compression at the delayed union site.

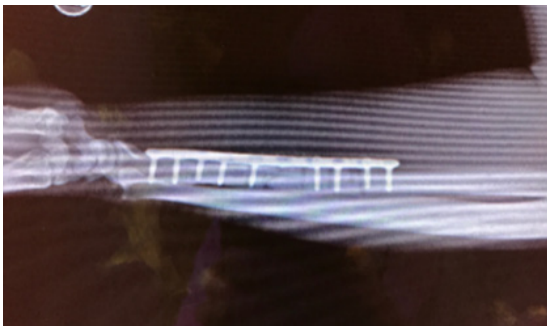

Figure 6.
Lateral radiograph at approximately two months demonstrating no loosening of the hardware and early bone consolidation.

Figure 7.
Six month postoperative anterior-posterior radiograph view showing solid healing at the delayed union site. Note the excellent bone formation across the delayed union site following use of ViviGen.

Figure 8.
Lateral radiograph showing excellent consolidation at the delayed union site at six months post operatively. There was no loosening of the hardware.

References

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