

The Use of Acellular Dermal Matrix for the Treatment of Posttraumatic Radioulnar Heterotopic Ossification

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Summary: Posttraumatic distal radioulnar heterotopic ossification (DRU HO) is a rare condition characterized by impaired pronosupination due to bone formation between the radius and ulna. Proposed management techniques have included physical therapy, radiation, medication, limited resection, ostectomy, and arthrodesis. However, no single technique has emerged as the standard of care due to high rates of persistence and recurrence. Some authors have described the use of autologous interposition grafting or the placement of cadaveric tensor fasciae latae, but these methods are associated with donor-site morbidity and difficulty with availability, respectively. We report the application of human acellular dermal matrix (ADM) as an interposition material for the treatment of posttraumatic DRU HO in a 21-year-old male patient. The patient sustained displaced distal radius and ulnar fractures following a motorcycle collision, which were treated with open reduction and internal fixation, along with volar forearm fasciotomy. After the initial treatment, the patient developed stiffness and discomfort. Imaging revealed severe ossification, prompting resection and ADM placement. Postsurgery, the patient experienced significant improvement, achieving nearly full motion with 90 degrees of supination and 70 degrees of pronation, with no complications or recurrence after 11 months. This is the third case of successful treatment with ADM interposition material, adding to evidence for its use as a simple and durable option for posttraumatic DRU HO. ADM offers numerous benefits over other techniques, including no donor-site morbidity, low cost, and wide availability, making it a safe and effective alternative. (*Plast Reconstr Surg Glob Open* 2025;13:e6661; doi: 10.1097/GOX.00000000000006661; Published online 24 March 2025.)

Posttraumatic radioulnar synostosis secondary to the development of heterotopic ossification is a debilitating sequela of forearm injury, characterized by progressive painless formation of bridging heterotopic ossification between the radius and ulna, resulting in reduced pronation/supination of the forearm.¹ Risk factors include bone fractures at the same level, severe soft tissue injury, high energy mechanism, and remnants of fracture fragments overlying the interosseus membrane. Iatrogenic risk factors include delay in surgical treatment,

overly long cortical screws, prolonged immobilization, and delayed initiation of rehabilitation protocols.^{1,2}

Direct excision of heterotopic ossification is the key-stone of treatment, although recurrence with simple excision alone has been reported to be as high as 32%.³ Good outcomes have been reported with radioulnar barrier interposition during excision, but the effectiveness of different interposition materials remains uncertain.^{4,5} Silicone sheets,^{2,6} free fat grafts,^{4,7} adipofascial grafts,⁴ and tensor fasciae latae grafts^{1,5} have shown mixed results. Autologous grafts, while effective, have drawbacks such as increased operation time and donor site morbidity.^{5,8} Cadaveric fascia lata grafts are safer but not clearly superior.⁵

Recently, Gould et al⁸ described the use of human acellular dermal matrix (ADM) as an interposition material for the treatment of posttraumatic distal radioulnar heterotopic ossification in 2 patients with favorable outcomes. Here, we present the third case of successful treatment utilizing a similar principle of ADM interposition.

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Fig. 1. Serial plain radiograph demonstrating heterotopic ossification between the distal radius and ulna at the level of injury at 12 weeks after index procedure.



Fig. 2. Intraoperative photograph demonstrating the complete excision of the bridging callus, proximal to fourth extensor compartment, and the AlloMax ADM rolled and secured to itself using 4-0 PDS suture in a cigar fashion.

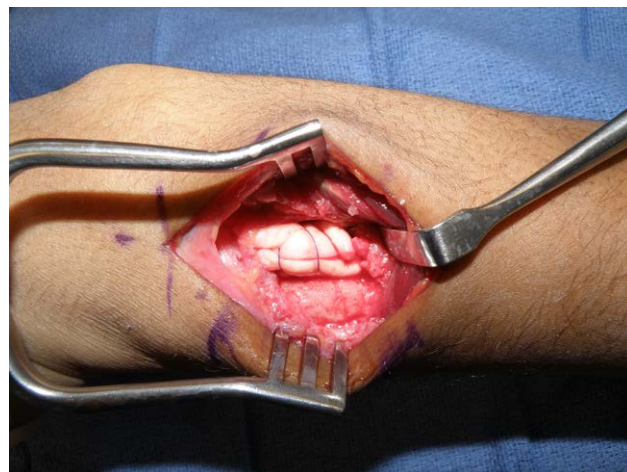


Fig. 3. Intraoperative photograph of AlloMax ADM placed and secured to the radial periosteum.

CASE REPORT

An otherwise healthy 21-year-old man presented following motorcycle collision with another motor vehicle and was found to have sustained closed displaced fractures of the left distal radius and ulna, along with concomitant left humerus fracture, right first metacarpal base fracture, and vertebral body fractures. On postinjury day 4, he was taken to the operating room for treatment of the left radius and ulnar fractures. Given the degree of soft tissue swelling, a no-tourniquet 2-incision approach was utilized, with concurrent performance of a volar fasciotomy to the level of the elbow. Successful open reduction and internal fixation was achieved, and all wounds were closed primarily. The patient was placed into a volar resting splint per our routine protocol and discharged from the hospital shortly after.

Outpatient follow-up was initiated as standard at 1 week, with transition to a removable orthoplast splint and referral to occupational hand therapy for range of motion protocol. Initial progress was as expected with improvement in all axes of motion; however, beginning at 7 weeks, the patient began to complain of decreasing range of motion in the pronation/supination arc. This was confirmed on examination by an occupational hand therapist and the senior author, and it progressively worsened over the course of the next 24 weeks. Serial plain radiographs (Fig. 1) during this period revealed progressive formation of heterotopic ossification between the distal radius and ulna in the region of the prior fractures, and computed tomography scan confirmed dense bony bridging.

Twenty-five weeks after index fixation, the patient returned to the operating room. Bridging callus was successfully excised via a dorsal approach proximal to the floor of the fourth extensor compartment, with full resection confirmed under both direct visualization and fluoroscopic examination. A 4 × 4 cm piece of AlloMax ADM (Davol Bard, Warwick, RI) was rolled and secured to itself using 4-0 PDS suture in a cigar fashion (Fig. 2). This was placed into the resection space and secured to the radial periosteum via additional 4-0 PDS sutures (Fig. 3). Full on

Table 1. Postoperative Range of Motion Measurements Following Revision Surgery With ADM Placement, Demonstrating Immediate Improvement in Pronation/Supination Arc Without Recurrent Loss of Motion

	Prerevision	1 Wk	2 Wk	12 Wk	49 Wk
Supination, degrees	10	60	60	60	90
Pronation, degrees	15	70	90	70	70
Flexion, degrees	80	—	50	—	70
Extension, degrees	70	—	50	—	70
Ulnar deviation, degrees	—	—	—	—	30
Radial deviation, degrees	—	—	—	—	25

table supination/pronation arc of motion was confirmed, followed by layered soft tissue closure and application of a volar resting splint in mild wrist dorsiflexion. Outpatient follow-up after the revision operation consisted of both clinical and radiographic monitoring, as well as re-enrollment into the occupational hand therapy program. Two weeks postoperatively, the patient's range of motion improved to 60 degrees supination, 90 degrees pronation, and 50 degrees on flexion and extension. By 12 weeks, he had returned to work as an automobile mechanic. At 11 months, the patient achieved nearly full range of motion with 90 degrees supination and 70 degrees pronation and there was no radiographic evidence of disease recurrence (Table 1). The patient did not experience any postoperative complications.

DISCUSSION

ADM serves as a biodegradable scaffold for neovascularization, essentially allowing for repopulation of connective tissue. This property makes it an extremely useful material that has long been utilized by plastic and reconstructive surgeons for head and neck surgery, abdominal wall and hernia repair, burn treatment, and breast reconstruction with good results.⁹ The prevalence, affordability, and easy storage and use of ADM make it advantageous over the use of autografts and allografts, which must be harvested or ordered and are usually expensive. Silicone and Integra (silicone/dermal sheet) share the advantages of ADM; however, they carry a higher risk of infection, as the silicone component cannot be integrated and is rather encapsulated by the body, creating a potential nidus for future complication.⁸

Gould et al⁸ described 2 successful outcomes of radioulnar synostosis treated with excision and placement of FlexHD, a type of ADM. FlexHD is an aseptic cadaveric material, with a shelf life of approximately 3 years.¹⁰ Application of FlexHD added approximately \$1600 to the cost of the surgery.⁸ When used in breast reconstructive surgery, FlexHD has been associated with seromas, infection, and flap necrosis. In contrast, our patient received AlloMax, a terminally sterilized cadaveric material with a shelf life of 5 years.¹⁰ At our institution, AlloMax costs approximately \$21–28 per square centimeter. A direct price comparison between FlexHD and AlloMax is necessary to draw conclusions regarding cost-effectiveness. Furthermore, AlloMax has not been associated with infection, seroma, or foreign body reactions, as terminal sterilization may reduce the risk of infection.

This case report presents the third successful outcome using ADM interposition, demonstrating its efficacy as a simple and durable treatment option for posttraumatic distal radioulnar heterotopic ossification. Although these results are promising, further research is necessary to quantify the comparative benefits of this technique over alternative treatment methods.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

ETHICAL APPROVAL

This research was conducted in full compliance with all applicable human and animal rights regulations and guidelines.

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