Osteoid Osteoma of the Talus Treated With an Acellular Connective Tissue Matrix: A Pilot Case Study

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STATEMENT OF PURPOSE

We herein present a case of delayed diagnosis of talar osteoid osteoma involving an under reported location of the talar body. In addition, a novel technique of autologous bone grafting mixed with an Acellular Connective Tissue Matrix (ACTM) is demonstrated. Literature review and bench top study results are highlighted showing promising application of ACTM in Foot and Ankle Surgery.

LITERATURE REVIEW

Osteoid osteoma is a benign, osteoblastic well circumscribed tumor of spongy bone. It represents 2-11% of all bone tumors located in the foot and ankle(1). Incidents of these boney lesions being reported in the talus involve the talar neck more than 90% of the time (2). These tumors are a rare cause for ankle pain and may be misdiagnosed particularly when presented in the setting of concurrent trauma.

Treatment options have included conservative care in smaller lesions that are self-limiting, to surgical excision through arthroscopic and open techniques. In larger lesions, or lesions involving the body and articular surface of the talus, bone grafting has been described to back-fill the void left after surgical excision(3,4). Bone grafting can consist of autogenous grafts or bone graft substitutes. Biological augmentation can help facilitate both graft incorporation and healing potential(5).

Recently, the biocompatibility of an ACTM with human osteoblasts was evaluated. The adhesion, proliferation and osteogenic activity of osteoblasts on ACTM were compared with negative control ultra low adhesive polystyrene surface or conventional cell culture substrate of tissue culture treated polystyrene. The bench top data showed the following: (1)The presence of CTM particulates is required for the adhesion of human osteoblast (HO) cells. (2) ACTM particulates not only support the cell adhesion but also support the proliferation of HO cells. (3) In comparison with the conventional cell culture surface, HO cells on ACTM-coated surface maintained a better osteogenic activity(5).

CASE STUDY

A 21-year-old male was referred to our clinic with a history of an ankle sprain four years prior and subsequent chronic ankle pain. He had been previously diagnosed with chronic ankle instability and was treated with immobilization, physical therapy, and anti-inflammatories without resolutions of symptoms. On exam he had anterior medial swelling and tenderness over the ankle joint.

His plain radiographs were unremarkable and advanced imaging was obtained. MRI of his left ankle demonstrated a heterogeneous signaled bone lesion in the medial aspect of the talus just below the talar dome measuring 1.1cm x1.5cm x 1.5cm. There was noted to be sclerotic margins and the medial border of the lesion appeared to breach the medial cortex of the talus (Fig 1 A,B).

TREATMENT & RESULTS

The patient was consented for staged excision and curettage of the lesion with autogenous bone grafting. The autogenous bone graft would also be augmented with ACTM.

The patient under went a medial malleolar osteotomy with excision and curettage of the boney lesion to the medial talar body. The removed specimen was sent for histiopathic evaluation. The osteotomy was fixated back in place with 4.0mm Cannulated screws. He was placed into a posterior splint to remain non-weight bearing. Pathology results were consistent with osteoid osteoma of the talus, and the patient was consented for bone grafting of the lesion.

Two weeks following the excision and curettage, the patient was brought back to the operating room. An autogenous graft was harvested from the calcaneal body using a powered trephine and was then mixed with ACTM (Fig 2). The prior medial malleolar osteotomy was taken down by removing the 4.0mm screws and the excision site in the talus was identified. The autogenous bone and ACTM graft was packed into the talus to backfill the lesion. The medial malleolar osteotomy was again fixated with 4.0mm screws and a medial malleolar plate(Fig 3). The patient was placed into a posterior splint with instructions to remain strictly non-weight bearing.

Four weeks post-operatively the patient began protected weight bearing in a CAM walker and physical therapy was initiated. At eight weeks post-op the patient transitioned into regular shoe gear and began to increase activities as tolerated. He healed uneventfully without complications. Follow up imaging with computed tomography at four months demonstrated incorporation of the graft without evidence of boney lesions (Fig 4 A-B). The patient returned to the clinic for a twelve month follow up. He has returned to full activity and remains asymptomatic.

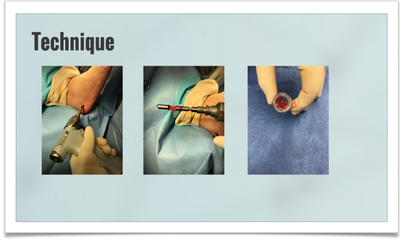

Figure 2. Technique demonstrating harvest of autologous bone graft and Acellular Connective Tissue Matrix (ACTM) Augmentation

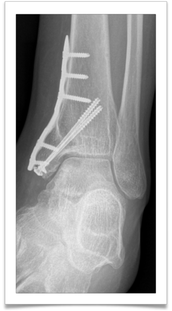

Figure 3. Six week Post-op Radiograph

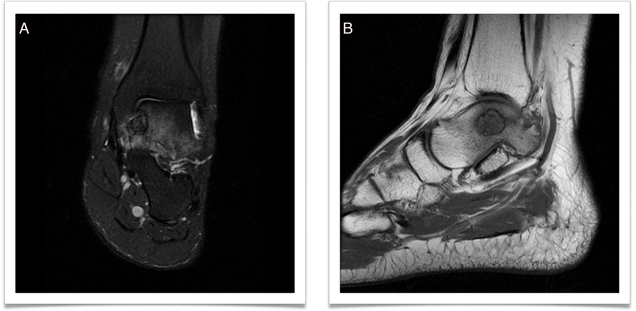

Figure 1. (A) MRI Gadolinium Contrast showing bone lesion breaching the medial talar cortex. (B) T1 MRI showing well circumscribed lesion involving the talar body

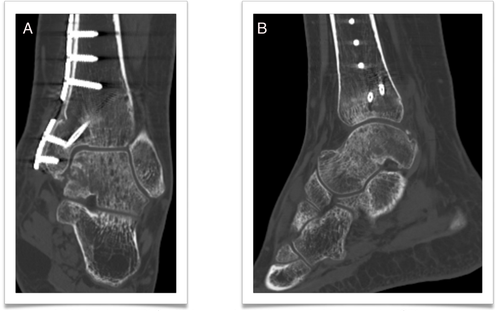

Figure 4. (A) Axial and (B) Sagittal reconstructed computed tomography (CT) images demonstrating incorporation of talar graft without evidence of boney lesion

DISCUSSION

Osteoid osteoma typically present with local pain that is most severe at night and that can be relieved by non steroidal anti-inflammatory drugs. Depending on the location of the bony lesion, patients may present with local swelling and tenderness, bony deformities, gait disturbances or muscle atrophy(7,8). Because of an often misleading clinical presentation, the diagnosis of periarticular osteoid osteoma will be a challenge for most clinicians(9). When clinical symptoms and pain progress and fail to respond to medications and conservative care, invasive treatment options need to be considered. Treatment options include open or arthroscopic excision of the lesion, and are dictated according to location and size(9).

This case study details our treatment of a rarely reported lesion involving the Talus. To our knowledge, examples of these tumors being treated in the Talar body are rare, and there are no cases of surgical excision and repair using an ACTM. Extended curettage is the most common mode of the treatment of benign bone tumors with a reported success rate as high as 90%(10). Failure of bony ingrowth, and pathological fracture have lead to recommendations for the defects to be back-filled with grafts or substitutes. Bone graft substitutes like calcium phosphate and hydroxyapatite are available but their interference with inflammatory cells and immunological reaction is concerning, and their efficacy is also questionable(11,12). Autografts are free of disease transmission or immunological reactions and have ideal properties of osteogenesis, osteoinduction and osteoconduction, but the potency of these properties can be affected by the biological make-up of the host both in age and health.

To help overcome these variables, augmentation with an extracellular matrix may facilitate cell attachment and bone formation. Bench top data supports that an environment rich in ACTM is a tremendous substrate for cellular proliferation and ultimately a release in growth factors to support healing(6). Our treatment of an osteoid osteoma utilizing an acellular connective tissue matrix and autogenous bone grafting led to a successful outcome, and an expedited return to activity. We believe that the isolated case studies involving ACTM being utilized in Foot and Ankle surgery are promising. These early results warrant further investigation and should be examined in higher level studies to prove their efficacy in bone healing.

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