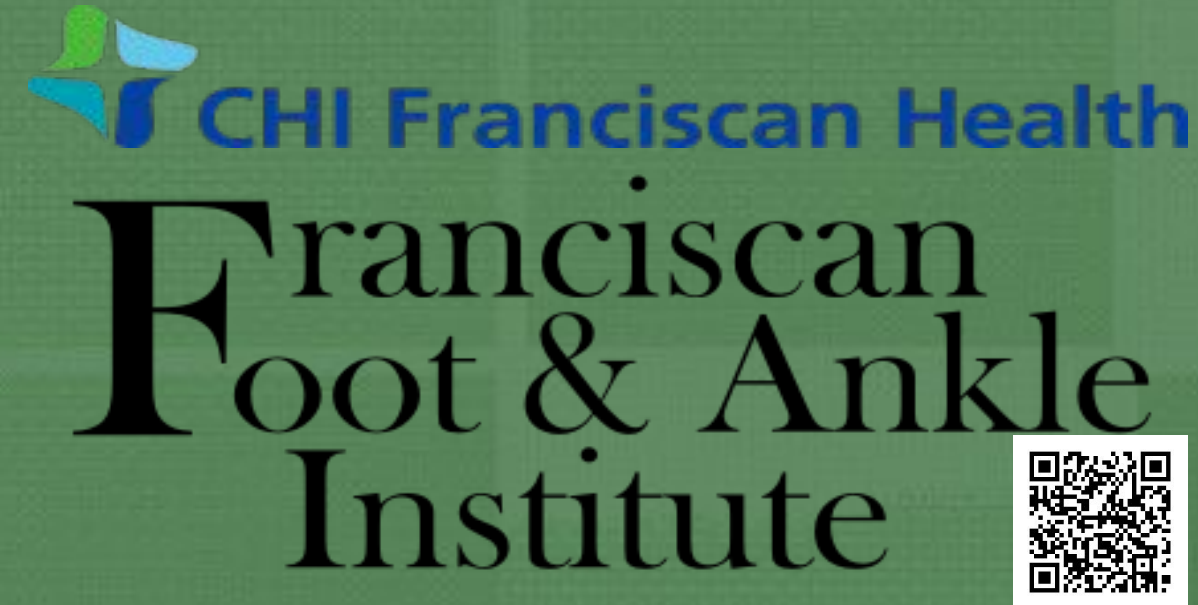


Microfracture Repair of First Metatarsal Osteochondral Defect with Micronized Allogenic Cartilage and Platelet-Rich Plasma

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Statement of Purpose

Osteochondral lesions (OCLs) of the foot and ankle most commonly occur following traumatic injuries. In the lower extremity, these injuries are commonly seen in the talus, and less frequently described in the forefoot. The following case reviews treatment and outcomes of an OCL of first metatarsal head using particulated allograft articular cartilage and platelet-rich plasma as an adjunct to standard microfracture technique.

Literature review

A variety of treatment modalities exist for hindfoot OCLs, however there are limited approaches reported in the forefoot. These small lesions often measure fifteen millimeters or less, which is the threshold cited for successful outcomes following microfracture alone². Microfracture leads to the development of fibrocartilage, which is less dense and less resistant to shear stress when compared to hyaline cartilage. Although effective in short term follow up, microfracture generally has variable long-term outcomes past two years⁵. Adjuvant procedures have been explored, including particulated juvenile cartilage allograft transplantation with promising results. Van Dyke et al found, 78% of patients had no pain with recreational activities or further procedures at 3.3 years⁷. Biomedical advancements aim to restore lesions with hyaline cartilage through use of particulated articular cartilage scaffolds. Recent studies support the addition of these scaffolds to increase longevity of repairs, particularly in lesions beyond fifteen millimeters^{1,3,4,6}. Robust randomized control studies are needed for further conclusions in foot and ankle literature.

Case report

A 19-year-old athlete with pes planovalgus and equinus suffered a turf toe injury one year prior to presentation and continued to have pain and degenerative changes of the first metatarsal phalangeal joint (MTPJ). Metatarsus primus elevatus with hallux valgus and lateral deviation of sesamoids was seen radiographically, but no acute fracture or dislocation was appreciated. MRI evaluation revealed tibial sesamoiditis with marrow edema to the first metatarsal head. There were degenerative changes seen on the subarticular cartilage of the metatarsal head, but no plantar plate injury or tendon tear. The patient attempted and failed conservative measures including orthotics and activity modifications. Thirteen months following the initial injury, the patient elected surgical intervention to assist in return to college athletics.

Figure 1

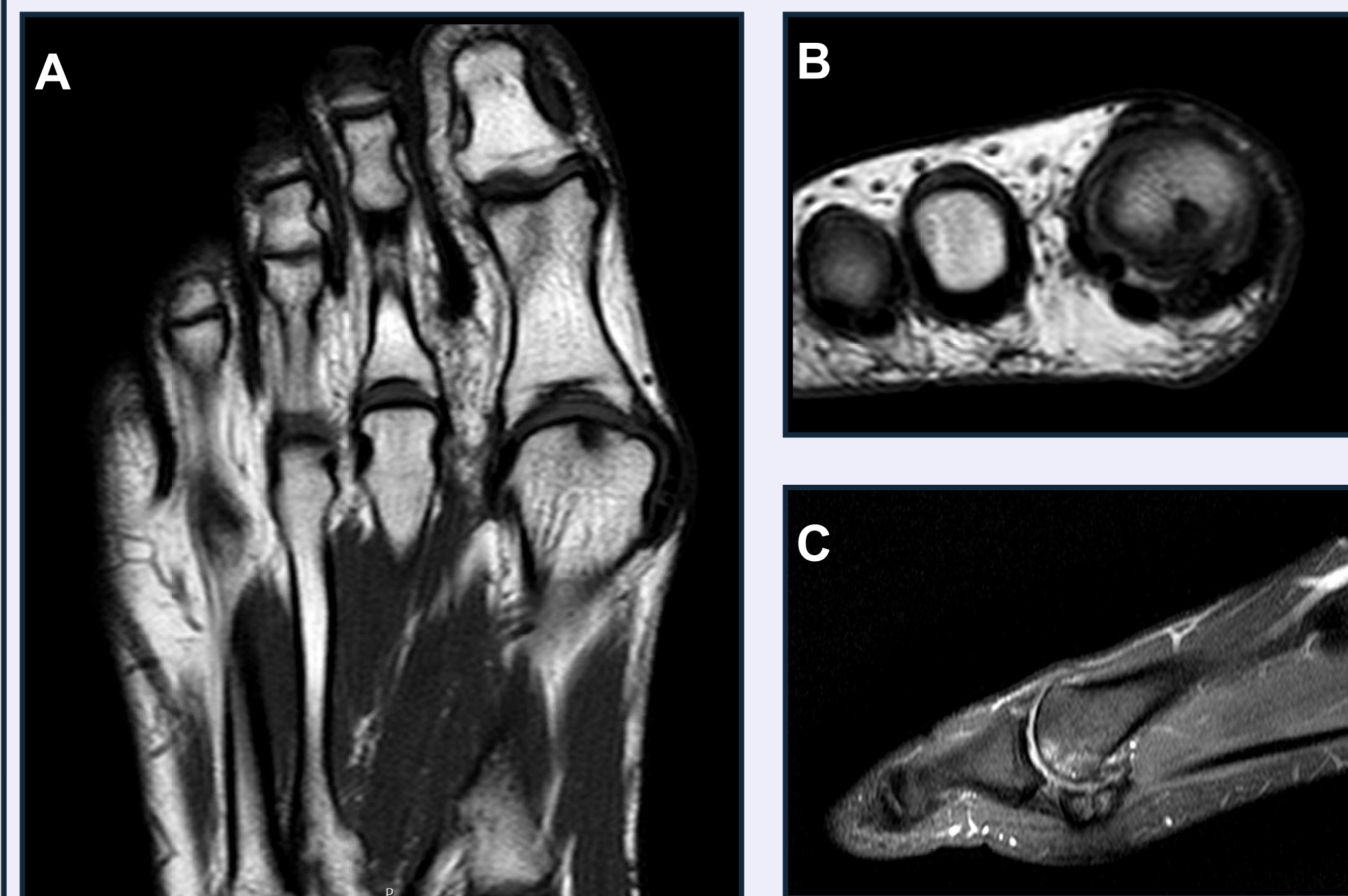


Figure 2

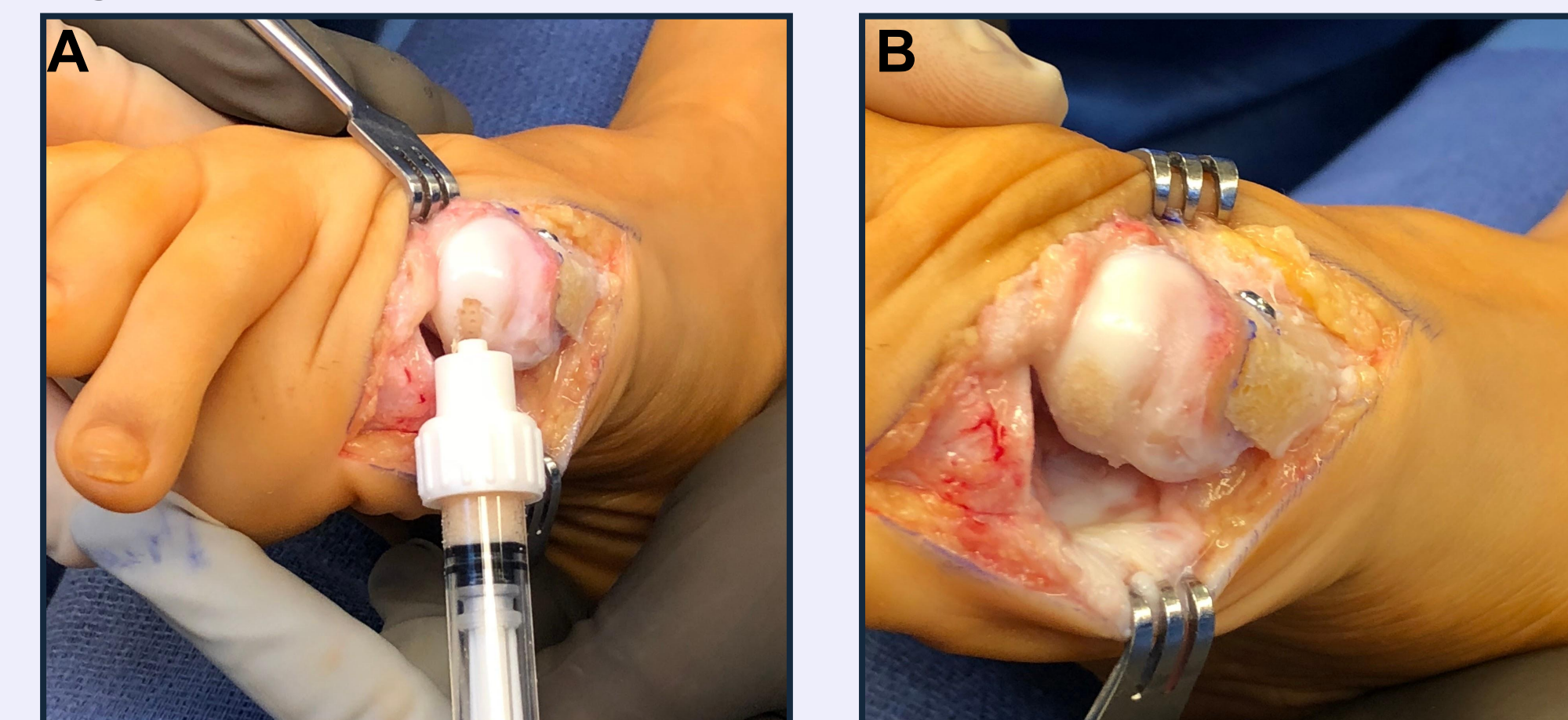


Figure 1 A-C. T1 and T2 MRI with centrally located cartilaginous defect with surrounding marrow edema
Figure 2 A. OCL with debridement of lesion, microfracture and placement of particulated allograft articular cartilage.
Figure 2 B. Post application of allograft with fibrin glue.

Procedure

Delay in treatment and the patient's biomechanics magnified stress to the first metatarsal head. Surgical recommendations included not only intervening at the first MTPJ, but by also addressing the patient's equinus, calcaneal valgus, and mild hallux valgus. A medializing calcaneal osteotomy, strayer gastrocnemius recession and first metatarsal chevron osteotomy was performed to address these deformities. Intraoperatively the first MTPJ demonstrated significant tenosynovitis and hypertrophied medial joint capsule. Visualization of the sesamoid apparatus revealed mild fraying without significant destructive changes. The articular cartilage of the first metatarsal head had a 1.0 x 0.5 cm OCL plantar central, which was debrided and the subchondral bone was drilled with a 0.045 K wire. The void was filled with particulated allograft articular cartilage, platelet-rich plasma and sealed with fibrin glue.

Post-operatively the patient remained non-weight bearing and began first MTPJ range of motion at three weeks. At six weeks, she began weight bearing and increased her activity. She progressed without limitations, returning to participation in college athletics. A year and a half following surgery, the patient continues to compete athletically without discomfort and minimal subjective joint stiffness.

Analysis and Discussion

Small symptomatic OCLs are effectively treated with microfracture technique providing variable long-term durability. Biologic scaffold adjuncts, such as particulated allograft articular cartilage combined with platelet-rich plasma have been shown to safely and effectively improve outcomes of these lesions when compared to microfracture alone⁴. While the use of this method has been described in the lower extremity, there are no published studies involving the forefoot. This single case demonstrates promising outcomes a year and a half following repair. Future research is required involving long term follow up and larger treatment groups for evaluation of longevity of this treatment method. Overall, this is a simple, low risk technique that can improve OCL outcomes, especially in areas such as the forefoot.

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