Treatment of Early Stage Freiberg Disease with a Lesser Metatarsal Head Implant
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Statement of Purpose
The purpose of this case is to present our surgical approach of using a metallic lesser metatarsal head hemi-implant for the treatment of painful, early stage Freiberg disease, which to our knowledge, has not been published in peer reviewed literature.

Literature Review
Freiberg disease is an osteochondral condition that manifests in the metatarsals heads, with the second metatarsal being most commonly affected (68% of the time)1,2. Although the exact etiology is unknown, it is believed to be multifactorial, including trauma, vascular compromise, systemic conditions and abnormal biomechanics3,4. Patients present with localized pain to the affected joint with palpation, range of motion and weight-bearing activity2,4. Radiographic findings may include joint space narrowing that occurs at three to six weeks, subsequent increased subchondral bone density and flattening of the metatarsal head with ultimate progression to arthrosis5. MRI may be utilized for early detection and confirmation1.

Case Study and Surgical Procedure
A 43 year-old female school teacher presented with a gradual onset of pain over 6 months at her right second MPJ with no history of trauma. She failed conservative treatment, including: limited activity, oral steroidal and anti-inflammatory medications, steroid injections and custom orthotics. The patient did not have any medical problems or past surgeries. The physical exam revealed a flexible pes planus foot type with a semi-hypermobile first ray and lateral deviation of her hallux. She had pain with direct dorsal palpation of the right second MPJ. Weight-bearing plain films revealed a hallux valgus deformity with no obvious pathology at her second MPJ (Figure 1). A MRI without contrast revealed subchondral flattening with full thickness loss of cartilage of her second metatarsal head and mild reactive narrow edema (Figure 2).

Figure 1 Pre-operative X-rays.

A closing base wedge osteotomy with one 3.0 mm cannulated screw fixation was performed. A dorsolinar incision was fashioned over the second MPJ using sharp and blunt dissection through layers. The extensor digitorum longus tendon was transected at the level of the MPJ and reflected. Soft tissue release was performed to expose the metatarsal head, revealing a full thickness loss of cartilage centrally with metatarsal head flattening (Figure 3). A sagittal saw was used to perform an osteotomy of the distal second metatarsal head perpendicular to the weight bearing surface. The correct sizer instrument was placed over the prepared metatarsal head and a 0.045 inch K-wire was inserted through the sizer hole. The cannulated reamer was used to ream the medullary canal until the depth stop was encountered. A broach was then used to square the medullary canal in preparation of the hemi-implant. The implant trial was inserted to check for range of motion and fit before finally inserting the size 2 hemi-implant. An impactor was used to completely seat the hemi-implant, which had an excellent fit with normal range of motion at the MPJ. The operative site was irrigated, the extensor tendon was re-approximated and layered closure was achieved using vicryl and nylon.

Figure 2 MRl STIR Coronal, T1 Sagittal.

Figure 3 Intra-operative picture.

Results
The patient remained strict non-weight bearing with a CAM walker for 7 weeks. She transitioned to weight-bearing as tolerated with the CAM walker for 3 weeks with instructions for passive range of motion exercises. Physical therapy was started at 12 weeks post-op for 4 weeks due to moderate stiffness and edema. Weight-bearing plain films at 3 months (Figure 4) revealed a completely seated second metatarsal head hemi-implant with no signs of subsidence or implant failure. At the 10 month follow-up visit, the patient was able to perform daily activities without pain.

Discussion
Freiberg disease is diagnosed clinically and confirmed with imaging, which can detect early stages of the disease3. Later stages of Freiberg disease is usually surgically managed1. Surgical procedures have been divided into two categories that either address the underlying pathophysiology (core decompression or osteotomies) or arthritic development (debridement, corrective osteotomy, bone grafting, and arthroplasty)5. Literature has shown complications that include: metatarsal shortening (that average 4 mm with dorsal closing wedge osteotomies), transfer metatarsalgia, implant failure, synovitis, forehead imbalance, and an unstable digit with arthroplasty of the base of the proximal phalanx2,3,4. Our surgical approach helped to restore a pain-free range of motion by resurfacing the metatarsal head and replacing it with an implant. The hallux valgus deformity was addressed first in order to correct the underlying abnormal biomechanics affecting the second MPJ. The length of the second metatarsal and range of motion was maintained with minimal resection of the metatarsal head, which avoided complications that include: transfer metatarsalgia, implant failure and subsidence around the implant. There were no complications, and the patient was able perform daily activities without pain. We believe this is a viable surgical option for early stage Freiberg disease.

References