



Treatment With Autograft Interposition Arthroplasty in Advanced Hallux Rigidus

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Hallux rigidus is a term that is used to describe restricted motion of the hallux metatarsophalangeal (MTP) joint secondary to degenerative arthritis. In the early stages of disease, cheilectomy is recognized as the treatment of choice for improving joint motion and functional outcomes. Traditionally, arthrodesis has been employed for its benefit in reducing pain as well as for controlling deformity in advanced hallux rigidus by eliminating MTP joint motion. However, we present an alternative to fusion; an interposition arthroplasty technique using the dorsal MTP joint capsule and extensor hallucis brevis tendon as interposed tissues. This technique has demonstrated efficacy in reducing arthritic pain and improving bony contour via osteophyte debulking, all while preserving MTP joint motion in active patients. Oper Tech Orthop 28:79-83 © 2018 Elsevier Inc. All rights reserved.

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Introduction

The term “Hallux Rigidus,” coined by Cotterill in 1888, refers to restricted motion of the first metatarsophalangeal (MTP) joint secondary to osteophytosis. Degenerative changes between the head of the first metatarsal and base of the proximal phalanx of the great toe produce dorsal kissing spurs that inhibit the natural motion of the first MTP joint. Osteoarthritis of the first MTP joint can present with various clinical symptoms, including pain from MTP motion, altered foot mechanics, or skin irritation over prominent osteophytes by shoe wear, which suggest the need for an orthopaedic consultation. Incessant impact of the MTP joint plays a role in the genesis and progression of the degenerative process; this can be seen with activities involving repetitive loading at the balls of the feet, which is common in athletes, ballet dancers, and daily activities such as squatting. Associated conditions such as metatarsus primus elevatus, hallux valgus, first ray hypermobility, tight heel cord, metatarsal length, and head

configuration may also contribute to joint deterioration.¹ Combining clinical and radiographic assessment can help establish an understanding that guides treatment. Classification schemes, including Hattrup and Johnson, Regnault, and Roukis, have been used variably. However, the Coughlin and Shurnas classification, proposed in 2003, has gained more popularity.²⁻⁵

Initial care for managing hallux rigidus involves avoiding or decreasing aggravating activities, wearing less restrictive shoes to accommodate the osteophytes, using foot wear with thicker and less flexible soles, using higher and wider toe box rocker sole shoes, and weight loss.^{2,6,7} Steroid injections may be considered in cases of advanced arthritis that are refractory to initial care. If symptoms continue to worsen after exhausting all nonoperative options, surgical treatment may be considered. Coughlin and Shurnas⁴ found that patients with grade 1, 2, and 3 hallux rigidus could be treated successfully with cheilectomy alone, having demonstrated improvement in postoperative range of motion (20°-25° of MTP dorsiflexion) and significantly increased AOFAS scores.⁴ Arthrodesis was suggested for patients with grade 4 disease or with greater than 50% cartilage loss. Although the significant pain relief afforded by arthrodesis is appealing, the potential for decreased functional capacity from limited joint mobility can be devastating, especially for active, young, and middle-age patients. Efforts to develop surgical techniques that preserve maximum MTP joint motion in joints with severe destruction have been reported.

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Figure 1 Incision is made through extensor expansion and dorsal capsule just medial to EHL tendon (arrow).

Keller resection arthroplasty has been commonly used for treatment of painful hallux valgus in the early half of the last century as a means of preserving motion and relieving pain.¹⁰ Complications, however, included pain, rigidity, push-off weakness, loss of stability of the plantar plate apparatus, shortening of the MTP that resulted in transfer metatarsalgia or lesser metatarsal stress fracture, and cock-up deformity.⁹⁻¹²

Gould⁸ used Silastic single-stem implants in 39 of the 51 patients who demonstrated the most advanced arthritis and found that pain and swelling, including implant reaction, disappear within 3 months in all patients. This option has fallen out of favor secondary to problems with adverse reactions to silicone. Other synthetic arthroplasties using metals and plastic have been introduced and have a range of results.^{13,14} Daniels et al¹⁷ reported outcomes after Poly Vinyl

Alcohol (PVA) Hydrogel implants at 5-year follow up in hallux rigidus grade 2, 3, and 4. They found that the PVA implant had 96% survivorship while earlier silastic implants demonstrated higher failure rates due to implant loosening, subsidence, fracture, wear debris, and bony erosion. They also reported that patients with PVA hydrogel implants had significant improvement in pain VAS, FAAM ADL, and Sports.¹⁷

Multiple modifications of interposition arthroplasty have been developed with similar goals, which aim to maintain the natural loading of the first metatarsal and mitigate adverse effects on MTP stability. Hamilton and associates¹¹ used the extensor hallucis brevis (EHB) and capsule as an interposition autograft and showed that the capsular interposition arthroplasty is a reliable procedure for patients with severe hallux rigidus. They reported preservation of plantar flexion power of at least grade 4 out of 5 and an average dorsiflexion of 50°. Modification of this technique was described in 2003 by Mroczek, Miller and colleagues¹⁵ involving an oblique osteotomy of the phalangeal base, dorsal-distal to plantar-proximal, all while preserving the insertion of the flexor hallucis brevis (FHB) tendons to maintain plantar flexion power and hallux length. Kolker and Weinfeld¹⁶ used Acellular cadaver dermal matrix (ACDM), which is acellular dermis processed from human cadaver skin for use as a biologic spacer for interposition technique. Aynardi and associates¹⁸ reported outcomes after interposition arthroplasty with autograft (joint capsule/extensor hallucis brevis) or allograft (acellular dermal matrix) in 133 patients and showed excellent outcomes in 65%, good outcomes in 24.5%, and failure in 3.8% of patients with an average follow-up time of 62.2 months. However, they found no clinical difference between failure rates when comparing the autograft to allograft groups. Also, they found that reoperation rates were low on the hallux after index surgery, like those reported in the short term. Herein, we present EHB autograft with joint capsule for the interposition arthroplasty technique, which has been performed by one of our senior surgeons in our institute for more than decade.

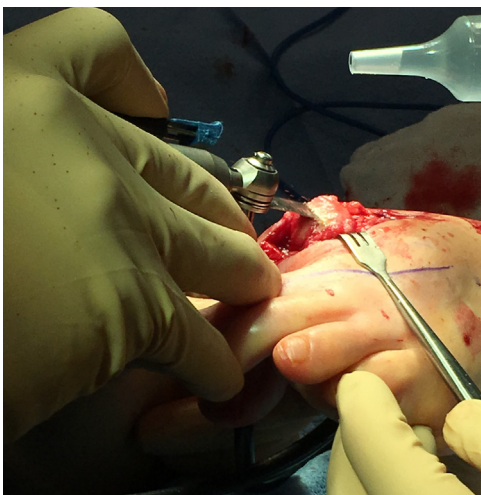


Figure 2 A total of 25%-50% of metatarsal articular surface can be resected by using microsagittal saw.

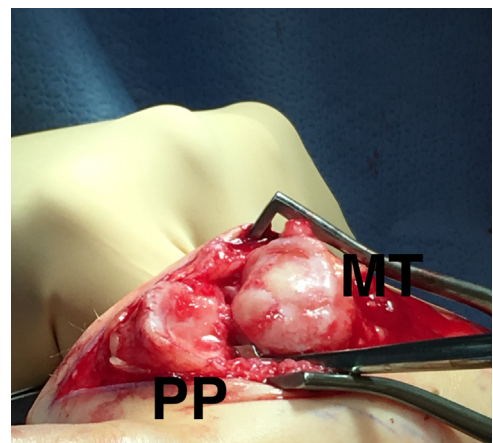


Figure 3 Release of medial, lateral collateral ligament, and plantar plate helps plantar flexion of proximal phalanx for better exposure of articular surface (MT, metatarsal; PP, proximal phalanx).

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