
Hallux Rigidus: What Lies Beyond Fusion, Resectional Arthroplasty, and Implants

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CONDENSATION

Introduction

Most cases of hallux rigidus, the painful limitation of motion at the first metatarsophalangeal joint (MTPJ), occur secondary to degenerative arthritis and the condition is seen in 2.5% of adults over 50 years-of-age. Procedures to treat hallux rigidus by preserving the joint include cheilectomy, phalangeal osteotomy, and first metatarsal osteotomy. Joints that have deteriorated to the point that they are only partially salvageable are treated with cartilage resurfacing, interpositional arthroplasty, or arthrodiastasis. Joints that cannot be salvaged are treated with excisional arthroplasty, implant arthroplasty, or arthrodesis.

Procedures and Patient Selection

Many articles have been published relating symptoms to treatment methods. Patients with osteoarthritis and cartilage damage to the MTPJ who experience pain through the mid-region of motion have poor results if treated with cheilectomy. Treatment methods such as fusion, arthrodesis, and nonoperative methods are not a satisfactory option for most young or active patients because of the loss of joint motion or the prospect of continued joint deterioration.

Joint Resurfacing

Hallux rigidus is linked to osteoarthritis and cartilage damage. If the lesion is solely on the upper third of the metatarsal head, a single cheilectomy is sufficient to remove the lesion and will often reduce symptoms. Lesions that are more centrally located on the joint may be resurfaced with fibrocartilage stimulation or transfer of hyaline cartilage. Fibrocartilage stimulation techniques, such as debridement, subchondral drilling, or microfracture have been shown to be effective in young to middle-aged patients with moderate primary osteoarthritis. Repair or regrowth of native hyaline cartilage within a joint would be ideal, but a successful technique to stimulate hyaline carti-

lage regeneration has not been developed. Periosteal resurfacing of the metatarsal head with an anterior tibial graft was shown to be successful, but it has not been tested in a large series of patients. Transfer of hyaline cartilage through an osteochondral autograft transplant system (OATS) can be used if the defect is isolated and the cause is an acute injury, but it is not suitable for patients with degenerative injuries.

Interpositional Arthroplasty Capsular interpositional arthroplasty using autograft or allograft biologic soft tissue as physical interpositional spacers has been used to successfully treat grade III symptomatic hallux rigidus. This procedure requires less bony resection, provides greater preservation of metatarsal length, provides better joint stabilization and motion, and may reduce the risk of foreign body reaction. Active patients may benefit most from this procedure, but it should not be used if a patient has poor vascular status, an infection, or neuropathy.

Autograft Interposition Three popular techniques of interpositional arthroplasty are tendocapsular, capsular, and capsule-periosteum interposition. All three use an autograft. Tendocapsular interposition has been performed successfully using a one-third cheilectomy and the resection of < 25% of the base of the proximal phalanx. The extensor hallucis brevis is incised 4 cm proximal to the MTPJ and passed along with the joint capsule and extensor hood through the MTPJ and sutured to the flexor hallucis brevis just distal to the sesamoids. Successful tendocapsular interposition also has been performed using the plantaris tendon. A section of the plantaris tendon is harvested and rolled into a ball. A cheilectomy is followed with the harvesting of a 20° to 30° dorsal wedge from the proximal phalanx and a spherical cutter is used to create a concavity. The harvested tendon is then placed in the concavity and the suture is anchored in a cruciate fashion. Others have reported success using a gracilis tendon graft.

Patients with grade IV hallux rigidus treated with a minimal proximal phalanx resection and a medial capsular interpositional arthroplasty have shown clinical improvement. At surgery, the joint capsule was elevated off the medial eminence while its distal attachment to the proximal phalanx was preserved, creating a tongue-shaped flap that was transversely interposed onto the joint and sutured to the lateral capsule. The joint was positioned in 5° of valgus and 10° to 15° of extension and held in place for 3 weeks with Kirschner wires. Patients with severe hallux rigidus were treated with a distally based flap fastened to the under surface of the metatarsal head using drill holes parallel to the first metatarsal-sesamoid articulation and Kessler-Kleinert locking sutures. The patients have shown improvement and generally were satisfied with the results.

Allograft Interposition Fascia lata allograft has been used by some surgeons to treat hallux rigidus because it eliminates donor site morbidity and reduces surgical time. It is especially appropriate for elderly and other low demand patients, as

well as smokers and others who have a risk of arthrodesis failure. At surgery, a thin resection of the phalanx (not exceeding 10% of its length) is followed by the insertion of a quadripa-rallel-shaped piece of fascia lata that is fitted and held in place with a Kirschner wire. The Kirschner wires were removed at 6 weeks. Treatment with fascia lata grafts is effective, but the surgeon must be aware of several potential problems, including limited supply, lack of pliability, and the possibility of tearing. Other grafts that have been used include AlloDerm (LifeCell Corporation, Branchburg, NJ), an acellular dermis processed from human cadaveric skin, and GRAFTJACKET (Wright Medical Technology, Inc., Arlington, TN), a human acellular dermal regenerative tissue matrix. Studies involving GRAFTJACKET indicate that it may enable young and active patients to enjoy an active lifestyle and enable the patient to pursue additional surgical options if the condition progresses.

Arthrodiastasis

The purpose of arthrodiastasis is to restore function to a stiff ankylosed joint by stage lengthening of shortened ligaments and to distract the articular surface by applying traction. The plan is to reduce intrinsic and extrinsic muscular imbalances and restore function to the articular surfaces. Early studies of distraction following the Keller arthroplasty for the treatment of hallux rigidus indicated a good to excellent result in 87% of cases, but these results were not much better than results after a standard Keller arthroplasty without distraction.

Clinical studies of arthrodiastasis that have been published since 2006 show better results than the early studies, possibly because of better techniques. Early distraction was most commonly applied using an intramedullary wire or an external staple. The most recent technique studied was a cheilectomy of the metatarsal head and application of a straight monolateral fixator. The joint was distracted up to 5 mm and left static for 5 to 7 days, then the patient increased the distraction 0.5 mm per day for the next 14 days. The joint was then left static for an additional 14 days, after which the distractor was removed and range of motion exercises were initiated. Early results indicated the increase in range of motion of the MTPJ was more than 100% for 89% of the patients.

Another study compared Kirschner wire fixation to distraction following Keller-Brandes arthroplasty. Kirschner wire fixation was performed at the level of the mid metatarsal and distraction was performed with a wire in the distal phalanx of the hallux. Following surgery, the Kirschner wire group wore firm-soled shoes while those in the distraction group wore plaster castings. At follow-up, instability was not seen in any patient in the Kirschner wire group, but was seen in 14% of those treated with distraction. Very good or good results were seen in 83% of those in the Kirschner wire group and in 88% of those in the distraction group. Patients in the distraction group were more satisfied with their cosmetic appearance.

Discussion

No known conservative approach can reverse the progression of the disease, and when it comes time for surgical intervention, arthrodesis is the gold standard. Young to middle age patients who are active must be given the option of selecting a treatment method that can minimize bony resection, provide symptomatic relief, and maintain or restore motion and strength.

REFERENCES

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COMMENTARY

The authors successfully targeted valid surgical options outside of arthrodesis with variable reported levels of evidence and follow-up from their respective surgeons. We feel that hyaline cartilage regeneration and hyaline transplant via the OATS procedure offer good results given the appropriate patient selection, but less predictable than what is seen with arthrodesis. Furthermore, interpositional arthroplasty is a relatively new technique. Thus far, there is a limited amount of literature regarding this technique, however there appears to be some reports that suggest that this is a viable option. Literature regarding this subject matter suggests different techniques utilizing allograft and autograft. In a similar manner, documented studies by Talarico, et al. showed improvement in the AOFAS scores with arthrodiastasis after 3 years of follow-up.¹ A main point that should be considered is addressing the cause of this hallux limitus/rigidus and reviewing how the surgeons operated on those patients. More specifically, if the patients at any specific series presented with biomechanical imbalances that preceded the first MTP joint pathology, then it would be safe to deduce that procedures like Keller and OATS would ultimately lead to less than favorable long-term outcomes, since the underlying pathology remains unanswered. The surgeon must evaluate the ground reactive forces and this imbalance in order to provide these suggested procedures a good chance for a favorable outcome. The procedures of arthrodiastasis and interpositional arthroplasty do not alter the overall function of the first ray. Some of those biomechanical issues include unstable/hypermobile first rays and equinus deformities of the leg, which lead to abnormal first MTPJ loading. A review of procedures addressing those aforementioned deformities in conjunction with what the authors presented would be warranted for a complete evaluation of first ray function with hallux rigidus salvage procedures.

REFERENCE

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