

Hallux Rigidus

OVERVIEW

Hallux rigidus refers to a degenerative condition of the articular cartilage in the joint that is formed between the 1st metatarsal head and the base of the proximal phalanx of the hallux. This condition can cause pain and loss of range of motion in the hallux that can limit weightbearing activities. Conservative and surgical therapies are available in the treatment of this condition that can improve symptoms and function.

ANATOMY

The hallux metatarsophalangeal joint involves the spherical head of the 1st metatarsal and the concave surface of the base of the hallux proximal phalanx. The joint also consists of the articulation between the plantar surface of the metatarsal head and the sesamoid complex, which includes the tibial and fibular sesamoids. The hallux MTP joint has multiple planes of motion, with its main function being to provide plantarflexion and dorsiflexion of the hallux. However, the joint can also provide motion in the coronal and axial planes as well, with some degrees of abduction/adduction and pronation/supination. There are ligamentous supports to the joint, including medial and lateral collateral ligaments that prevent varus and valgus instability. The plantar plate is an important ligamentous restraint between the distal poles of the sesamoid complex and the base of the proximal phalanx, which provides stability for the joint in the sagittal plane. Normal weightbearing alignment of the hallux MTP joint involves neutral rotation, 10-15 degrees of valgus alignment and 15-20 degrees of dorsiflexion.

BIOMECHANICS

The function of the hallux MTP joint is critical to the weightbearing function of the foot in general. The ability of the joint to dorsiflex in conjunction with the power that is generated from plantarflexion of the hallux MTP joint are both integral in the normal gait cycle, specifically the push off of the forefoot that is necessary for the transition from stance phase

to swing phase. It is also important during athletic activities in the generation of push off power of the forefoot, which is critical for explosive push off strength that is seen during sprinting and jumping activities.

PATHOGENESIS

Arthritis of the hallux MTP joint is most commonly attributed to previous trauma, including fractures involving the articular surfaces of the joint as well as discrete chondral injuries to the articular surfaces of the joint that can occur after repetitive microtrauma or significant compression injuries to the chondral surfaces. Ligamentous injuries, including plantar plate ruptures, can lead to joint instability, which can also result in aberrant motion and resultant injury to the cartilage surfaces of the joint. Degenerative changes to the hallux MTP joint can also be the result of inflammatory arthritic processes, such as rheumatoid arthritis, as well as in the setting of recurrent crystalline arthropathies, such as gouty arthropathy. Chronic deformity can also lead to degenerative changes, including hallux valgus or hallux varus deformities.

CLINICAL PRESENTATION

Plain radiographs are the main imaging study of choice in the evaluation of hallux rigidus. A weightbearing series of radiographs including AP, oblique and lateral views of the foot should be obtained, in addition to radiographs of the contralateral side for comparison. Radiographs should be evaluated for the presence of any deformity, including the alignment of the hallux MTP joint and the entire medial column of the foot. The joint space between the 1st metatarsal head and the base of the proximal phalanx should be evaluated, and will progressively narrow as the condition worsens. The oblique view of the foot is the most sensitive view for determining the degree of joint space narrowing. Peri-articular osteophytes are also commonly seen, specifically over the dorsal aspect of the 1st metatarsal head and base of the proximal phalanx. Irregularity of the subchondral bone and osteochondral defects should also be note if present. In advanced cases, subchondral cyst formation and subchondral sclerosis can be seen. If arthritis of the articulation between the sesamoids and metatarsal head is suspected, dedicated "sunrise" sesamoid views can demonstrate morphology and joint space narrowing.

Advanced imaging is usually not necessary in the routine evaluation of hallux rigidus. However, there are specific instances where CT or MRI can be helpful. In the setting of significant or complex deformity, a CT scan can be a useful tool to better understand the alignment of the joint and the rest of the foot. MRI can be useful in the evaluation of isolated osteochondral injuries, or in cases that involve localized osteonecrosis of the 1st metatarsal head.

IMAGING STUDIES

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TREATMENT

Conservative management for hallux rigidus includes medical management as well as orthotic devices. Medical management includes the use of oral non-steroidal anti-inflammatory

medications, as well as the use of short courses of oral steroid therapy. Topical anti-inflammatory medications can also be useful, considering the proximity of the hallux MTP joint to the skin surface. Corticosteroid injections can also be useful treatment options for more advanced cases of hallux rigidus. Shoe wear modifications can also be a useful modality. Specifically, stiffer soled shoes and shoes with a larger toe box can provide some relief of pain. Stiffer shoes prevent excess range of motion, specifically dorsiflexion of the hallux MTP joint, which can lead to decreased impingement and inflammation. A larger toe box prevents pressure from the shoe on the dorsal aspect of the hallux. Avoidance of high heels will also decrease stress across the hallux MTP joint. Orthotic devices are a useful component of conservative therapy as well. The main orthotic option is a Morton's extension carbon fiber insert, which also serves to limit the dorsiflexion and range of motion of the hallux during weightbearing activities.

Surgical treatments include both joint sparing and joint sacrificing options. For less advanced cases, a hallux MTP joint debridement with synovectomy and dorsal cheilectomy is a reasonable option, which can improve range of motion and decrease impingement and pain. For focal osteochondral defects, a microfracture procedure can be considered. In the setting of deformity, correctional osteotomies can be considered if there is some remaining articular cartilage. For example, a Moberg osteotomy will redirect the proximal phalanx into a more functional dorsiflexed position.

In cases of plantar hallux IP joint ulceration or for lower demand patients, a Keller resection arthroplasty can be considered. Metallic joint implant arthroplasty is not a favorable option, due to increased likelihood of early failure and difficulty with revision to arthrodesis due to shortening and bone loss.

Active patients who wish to maintain MTP range of motion may benefit from joint resurfacing options. Interposition arthroplasty using dorsal capsule or allograft/xenograft dermal tissue has demonstrated promising midterm outcomes and a low rate of conversion to arthrodesis. Recently, MTP hemi-arthroplasty using a polyvinyl alcohol hydrogel implant was shown to result in equivalent pain relief and functional outcomes when compared to arthrodesis. Less than 10% of patients were converted to arthrodesis during the FDA trial, and results were comparable regardless of the severity of hallux rigidus.

The main joint sacrificing option for advanced cases of hallux rigidus is an arthrodesis of the hallux MTP joint. Particular attention must be paid to appropriate positioning of the hallux

MTP joint at the time of arthrodesis to ensure the ability to comfortably wear shoes, and to ensure appropriate forefoot weightbearing mechanics.

CONCLUSION

Conservative and surgical treatment options are available, both having the ability to provide pain relief when employed in the appropriate setting.

*Written by Brian Clowers, MD
Reviewed by Joseph Park, MD
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