

First Metatarsophalangeal Joint Degeneration

Arthroscopic Treatment



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KEYWORDS

- Hallux rigidus • First metatarsophalangeal degeneration • Arthroscopic debridement
- Arthroscopic fusion

KEY POINTS

- Arthroscopic treatment of hallux rigidus is appropriate after failed nonoperative treatment.
- Debridement with cheilectomy, and fusion are the main indications for arthroscopic treatment of hallux rigidus.
- If the cartilage damage is extensive and the patient has consented, then a fusion is performed at the same sitting.

INTRODUCTION

Although numerous causes have been proposed for hallux rigidus, its exact cause has yet to be elucidated. Several biomechanical and structural factors have been suggested. These factors include metatarsus primus elevatus,¹ a long^{2,3} or a short^{4,5} metatarsal, hypermobility of the first ray,^{6,7} pronation, hallux valgus,^{8,9} metatarsus adductus, and Achilles or gastrocnemius tendon tightness.⁷ In addition, shoe wear and occupation might play a role in the development of hallux rigidus. However, studies have failed to prove a clear relationship between these factors and osteoarthritis of the first metatarsophalangeal (MTP) joint.^{10–13}

Coughlin and Shurnas¹⁴ identified a correlation between bilateral hallux rigidus and hallux valgus interphalangeus, MTP joint shape, female gender, and a positive family history.

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Nilsson² classified hallux rigidus into 2 distinct age groups. He considered the adolescent form a primary deformity, whereas the adult form would be a secondary deformity resulting from the development of degenerative arthritis. However, Bingold and Collins⁷ proposed that the 2 entities were simply a continuum of the same degenerative process. Similarly, Coughlin and Shurnas¹⁴ found no evidence to support a requirement for a distinction based on age.

Goodfellow¹⁵ and McMaster¹⁶ were the first to describe acute or chronic trauma as a cause for hallux rigidus. Goodfellow reported 3 patients with osteochondral lesions of the metatarsal articular surface. Subsequently, McMaster described 7 patients with similar findings. He also demonstrated consistent histologic changes to be a cleavage of articular cartilage with detachment from, but not involvement of, subchondral bone. Therefore, he proposed the term chondritis dissecans.¹⁶ Both suggested that adolescent hallux rigidus is a condition secondary to osteochondritis dissecans of the first metatarsal head; this seems to particularly hold true for unilateral hallux rigidus.¹⁴

At the authors' institution, operative procedures after failed nonoperative treatment include debridement, cheilectomy, fusion, and resection arthroplasties in selected cases. In addition, the authors' institution is involved in a prospective randomized trial evaluating the effectiveness of a new polyvinyl alcohol implant (Cartiva) to treat contained cartilage defects of the first metatarsal head.

Of the aforementioned operations, debridement, cheilectomy, and fusion can be done arthroscopically.

FIRST METATARSOPHALANGEAL ARTHROSCOPY

The first author to describe MTP arthroscopy was Watanabe in 1972.¹⁷ However, it was not until after various authors described the technique¹⁸⁻²⁰ in the 1990s that the procedure gained clinical importance.

Since then, treatment of various pathologic abnormalities is described in literature including removal of pigmented villonodular synovitis, degenerative disease with early osteophytosis, chondromalacia, osteochondral defects, loose bodies, arthrofibrosis, synovitis, gouty arthritis,²¹ medial sesamoidectomy,²² excision of a recurrent ganglion,²³ hallux valgus,^{24,25} and EHL (extensor hallucis longus) lengthening.²⁶

Concerning arthroscopic treatment of hallux rigidus, Iqbal and Chana²⁷ reported 15 arthroscopic dorsal cheilectomies in 1998 with rapid recovery and rehabilitation, maintained pain relief, and good metatarsophalangeal joint power and motion.

Davies and Saxby²⁸ published the first outcome series of arthroscopic debridement in 1999 with no or minimal pain, decreased swelling, and an increased range of movement of the affected joint after a mean follow-up of 19 months.

A second case series with 19 of 20 patients becoming pain free after debridement of various intra-articular pathologic abnormalities was reported in 2006.²¹

In 1998, van Dijk and colleagues¹⁹ reported a prospective study enrolling 24 consecutive patients including 17 high-level athletes treated arthroscopically for different pathologic abnormalities. Pain, swelling, sports, and work involvements were recorded. There was one persistent loss of sensitivity of the hallux. Although 8 of 12 patients after removing dorsally located osteophytes and 3 of 4 patients treated for osteochondritis dissecans showed good or excellent results, results after sesamoid bone removal and treatment of hallux rigidus were less favorable.¹⁹

The usually stated benefits of arthroscopic procedures compared with open procedures are reduction of wound complications, faster rehabilitation, and shorter hospital stays. Arthroscopic ankle fusion was shown to be superior to open fusion regarding ankle osteoarthritis scores after 1- and 2-year follow-up.²⁹ To date, no studies

comparing arthroscopic with open hallux rigidus operations are available. However, in the authors' experience, patients may have less swelling and faster recovery after arthroscopic first MTP fusion as compared with open fusion.

Indications

- Dorsal osteophytes amenable to cheilectomy
- Osteochondral defects amenable to debridement
- Symptomatic advanced degeneration of the first MTP joint

Contraindications

- Osteophytes blocking access (relative)
- Bone loss or deformity requiring plate fixation for fusion

Preoperative Planning

1. Standing anteroposterior (AP) and lateral views: alignment, orientation of osteophytes (**Fig. 1**)
2. MRI (optional): beneficial for assessment of cartilage, joint capsule
3. Computed tomography (optional) to assess bony anatomy
4. For consent: possible change to an open procedure or a fusion should be added

SETUP AND SURGICAL TECHNIQUE

Preferably general or spinal anesthetic in combination with a thigh tourniquet is installed. Alternatively, with a popliteal nerve block, a calf tourniquet can be used. However, this might cause tightness of the flexor hallucis longus and flexor digitorum longus, impeding distraction of the MTP joint. In some cases, experienced surgeons



Fig. 1. AP (A) and lateral view (B) of a patient with end-stage arthritis of the first MTP joint.

can perform MTP arthroscopy under local anesthetic without using a tourniquet because Zaidi and colleagues³⁰ showed that ankle arthroscopy could be performed reliably without tourniquet.

The patient is placed in the supine decubitus position with a beanbag under the ipsilateral buttock to ascertain an upright position of the foot. The surgeon sits at the bottom of the bed, and the scope tower is next to the head of the bed on the opposite side of the bed to the operative limb to ensure easy visibility of the monitor during the procedure (Fig. 2).

Flexing and extending the joint with one hand helps to palpate the joint line with one finger of the other hand. A 6-gauge needle is placed dorsally into the joint, either medial or lateral to the extensor tendon, and the c-arm is used to confirm proper intra-articular positioning. To avoid damage to the dorsal lateral digital nerves, the portals need to be placed slightly plantar, and the incision is limited to the skin while a blunt instrument is used for deep dissection through the capsule. To prevent cartilage damage, a small cannula is inserted using a blunt probe. A 1.9-mm or 2.4-mm scope is used and preferably placed dorsomedially while placing the instruments dorsolaterally. Use of a c-arm is helpful in entering the joint on confirming the proper placement of the instruments in the joint.

If desired, a finger trap can be used to apply continuous traction. By pulling the toe with the hand and placing a blunt instrument into the joint, specific areas of the joint can be visualized in different positions of flexion and extension and the sesamoid articulation with the metatarsal head can be visualized.

Often the synovium dorsally and in the medial and lateral gutter has to be resected using the shaver to improve visualization of the joint.

In a mild hallux rigidus, a chondral defect is usually found dorsally or centrally at the basis of the phalanx or dorsally at the metatarsal head, while the subchondral bone usually remains intact. Two parallel K-wires are inserted from proximally to distally to guide the cheilectomy (Figs. 3 and 4). The bone resection is carried out alongside these K-wires using a lightning burr or a small osteotome (Figs. 5 and 6). Small residual chondral defects after cheilectomy are debrided and drilled. Remaining defects larger than 50 mm² and subchondral cysts are significant predictors of unsatisfactory



Fig. 2. Positioning of the surgeon with respect to the toe. In this case, the 2.9 arthroscope was used, but the 2.4 arthroscope may be easier to maneuver.



Fig. 3. Placement of the K-wires to outline the extent of the dorsal resection for a cheilectomy. The wire positions are confirmed on the c-arm. The positions of the tips of the wires are confirmed on arthroscopy to be at the edge of the cartilage rim. Two wires assist in the correct orientation of the resection. In this case, the 2.4 arthroscope is used.

clinical outcomes³¹ after drilling of the metatarsal head, and a fusion might be appropriate in these cases.

Severe cases with substantial cartilage defects and sesamoid involvement are prone to failure after cheilectomy and debridement. If the patient gave consent, fusion is carried out in the same procedure. Straight and bent curettes and the shaver are used to completely remove the cartilage from the joint, and the subchondral bone is drilled using a 2.0-mm drill. After transfixation with a K-wire in appropriate position



Fig. 4. Confirmation of position of the K-wires on c-arm.

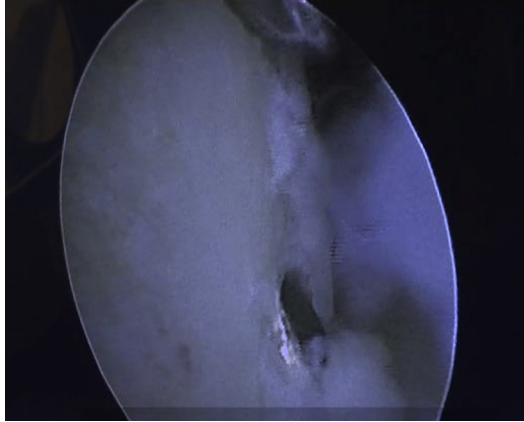


Fig. 5. The view of the tips of the K-wires from the arthroscope penetrating at the cartilage margin.

and confirming adequate bone-to-bone contact by the c-arm, 2 to 4 crossed fully threaded 3.5-mm screws are placed percutaneously to properly fix the joint.

After completion of the procedure, the tourniquet is deflated, possible bleeding is controlled, the wounds are closed with 3-0 nylon suture, and a dressing is applied.

Postoperatively, 1 to 2 weeks of non-weight-bearing suffices to allow wound healing and prevent formation of a sinus by joint fluid extravasation.

After a cheilectomy and debridement, the patient is then allowed to return to full weight-bearing in regular shoes.

After fusion, a walker boot or a shoe with a stiff sole is used to immobilize the fusion site for another 8 weeks. With this protection, weight-bearing as tolerated is allowed. Radiographs are performed at 6 and 12 weeks (**Fig. 7**), and return to sports is allowed at 4 months.



Fig. 6. Image during resection of the dorsal osteophytes. Further bone needs to be removed to complete the resection.



Fig. 7. Anterior posterior (A) and lateral views (B) of the case in **Fig. 1** after arthroscopic fusion and percutaneous screw placement.

SUMMARY

The arthroscopic technique allows better assessment of the cartilage surface and the ability to salvage the joint successfully. Before surgery, debridement or fusion at the time of surgery is discussed. If the joint can be salvaged, then the dorsal osteophyte excision is performed using the technique described. If the cartilage damage is extensive and the patient has consented, then a fusion is performed at the same sitting by debriding the residual cartilage and placing 3 to 4 percutaneous screws to hold the joint in a neutral position until fused.

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