

## WATERMANN PROCEDURE FOR HALLUX LIMITUS

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There are several surgical approaches involved in the treatment of hallux limitus. The Watermann procedure is only one of them and is not intended for exclusive treatment of hallux limitus or rigidus. With a wide variety of procedures ranging from soft tissue release, osteotomies, to joint fusion, and joint replacement, it is important to understand the concepts and indications of the Watermann osteotomy in order to achieve better results with the treatment of such a frustrating pathology as hallux limitus.

Dr. Von H. Watermann first described the osteotomy in 1927, before the mechanism and cause of hallux limitus was understood.<sup>1</sup> In the original version of the Watermann osteotomy a trapezoid wedge of bone, with its base dorsal, was removed from the distal metaphysis of the metatarsal (Figure 1). Since then, the osteotomy has undergone many changes with the most significant change described as the Green-Watermann procedure where a chevron type of osteotomy with the dorsal cut perpendicular to the bone is created.<sup>2</sup> A wedge of bone is then taken out of the dorsal aspect of the first metatarsal. With this procedure the first metatarsal is slightly plantarflexed and shortened. The original description of this procedure involves removal of a trapezoid wedge including its plantar cortex. This left the capital fragment unstable and caused a mild amount of shortening. Drago et al, in 1984, described a modification of the procedure leaving the plantar cortex intact providing more stability and preventing injury to the sesamoid apparatus<sup>3</sup> (Figure 2).

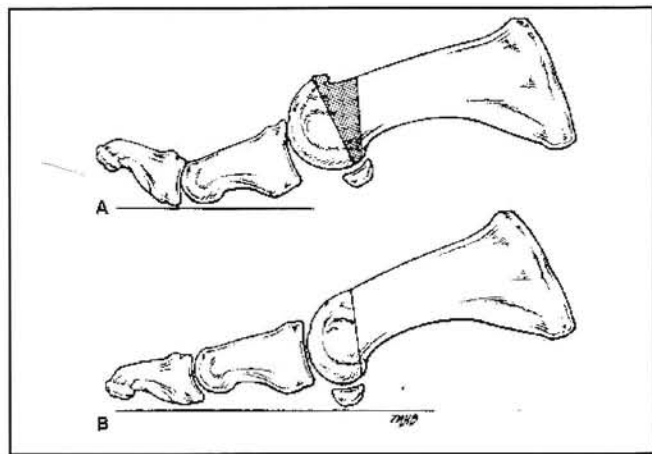


Figure 1. The original Watermann osteotomy. A trapezoid bone wedge is removed from the distal metaphysis of the metatarsal.

In 1987, Bernbach and McGlamry described using a stepwise approach to hallux limitus. Included in their approach was joint decompression osteotomies after excision of the dorsal spur.<sup>4</sup> Cavallo et al mention that cheilectomy alone yields the presence of raw cortical bone surface without changing the articular mechanism of the joint. This makes the joint more prone to recurrence of the deformity<sup>5</sup> (Figure 3).

## INDICATIONS AND ADVANTAGES

The Watermann osteotomy will decompress the internal cubical content of the joint without shortening the first metatarsal.<sup>5,6</sup> It is an ideal procedure for a short first metatarsal where mild to moderate hallux limitus deformity is present. No plantar declination of the metatarsal is created, which may prevent the formation of hallux malleus or a nonpurchasing hallux postoperatively. Other shortening osteotomies may cause transient floating hallux, subsecond metatarsal pain, second ray stress fractures, and a short hallux. The osteophytes surrounding the first metatarsophalangeal joint are usually excised with this procedure. Because in most cases of hallux limitus the dorsal aspect of the first metatarsal

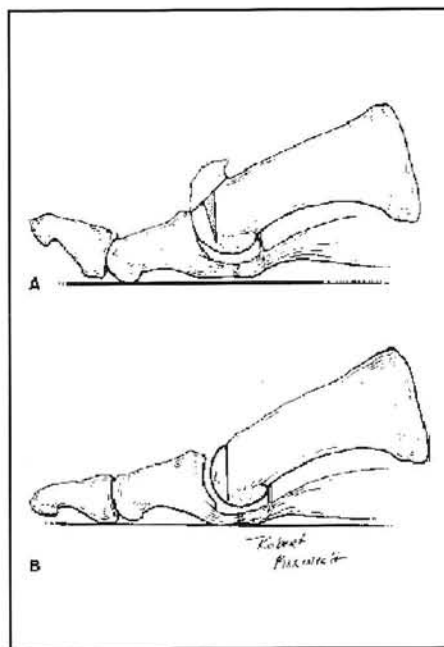


Figure 2. The Drago et al modification that leaves the plantar cortex intact.

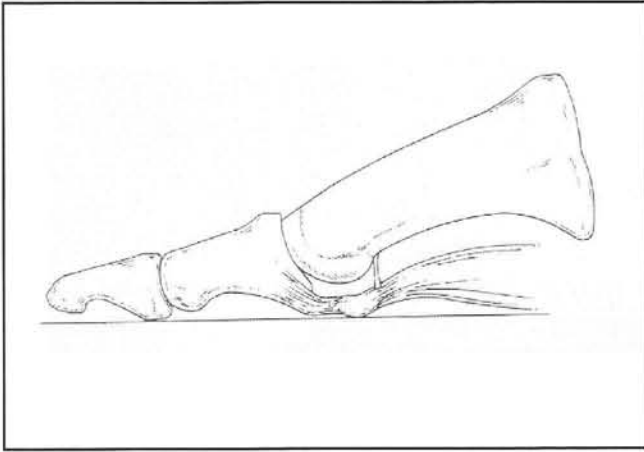


Figure 3. Cheilectomy alone does not change the articular mechanism of the joint, making the joint more prone to deformity recurrence.

and the proximal phalanx compress each other limiting the range of motion, decompressing the dorsal aspect of the joint will help regain some motion. The joint is preserved and made more congruous allowing the patient to walk with a propulsive gait postoperatively. The patient may also be full weight bearing postoperatively.

### CONTRAINDICATIONS AND DISADVANTAGES

Disadvantage of the Watermann osteotomy include risk of injuring the sesamoid apparatus.<sup>6</sup> If the plantar hinge is fractured, the osteotomy can become extremely unstable and technically harder to fixate. This osteotomy is not intended for patients with severe joint degeneration where a more aggressive joint destruction procedure may be warranted. The presence of viable hyaline cartilage on the anteroplantar aspect of the first metatarsal head is needed.<sup>7</sup> If other coexisting metatarsal deformities are found, such as long, elevated, or short metatarsal, other osteotomies should be considered to address these problems. Postoperatively, early and persistent range of motion exercises need to be performed to maintain the range of motion and to prevent the joint from becoming limited again.

### SURGICAL TECHNIQUES

The procedure begins with the standard bunion approach where a linear incision is created over the dorsal medial aspect of the first metatarsophalangeal joint. Anatomic dissection of the first metatarsophalangeal joint should be used to allow easy closure of the tissues in layer. The adductor tendon and the fibular metatarsos sesamoid

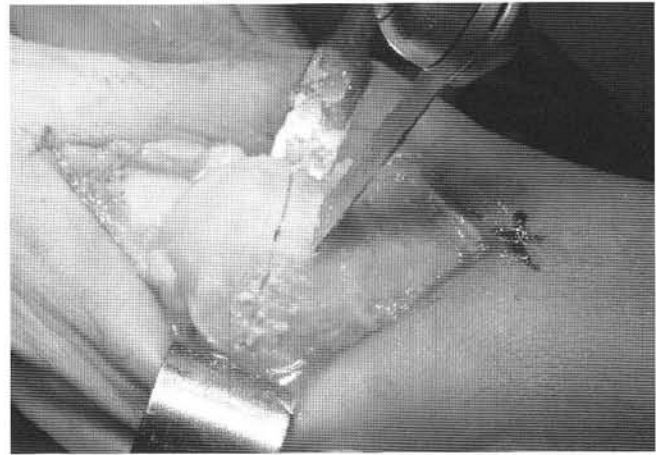


Figure 4. The distal aspect of the osteotomy is parallel with the joint surface. The proximal aspect of the osteotomy determines the amount of bone removed.

ligament are released. This should already provide some increased range of motion. A dorsal capsular and periosteal incision is created slightly medial to the EHL tendon. A vertical capsulotomy on the medial aspect of the joint helps increase visualization but should be avoided if possible. The medial capsular tissues are dissected free from the medial aspect of the joint. Normally when performing bunion correction the dorsal plica is preserved, however, with this osteotomy the plica is sacrificed as the periosteum is reflected off the first metatarsal head. At this time a dorsal cheilectomy is performed. The dorsal aspect of the base of the proximal phalanx should be inspected because excessive bone growth at this location can significantly limit range of motion. When the cheilectomy is performed, care should be taken to resect a generous portion to the spur. The exostosis should be removed in line with the dorsal aspect of the base of the proximal phalanx.

The osteotomy is then created. The distal cut is parallel with the joint surface of the metatarsal and is located into the distal metaphases (Figure 4). Care should be taken not to go through the plantar cortex but to leave it intact so it can work as a hinge and provide extra stability. The proximal aspect of the osteotomy is created with the base of the wedge dorsally (Figure 5). The thickness of the base will determine the amount of decompression at the joint. It may be safer to resect less bone and reciprocal plane the osteotomy later (Figure 6). Once the wedge is resected, the head of the metatarsal is compressed on the metatarsal metaphysis and the osteotomy may be planned or fixated using threaded or smooth k-wires or sutured with steel sutures. The author prefers using a smooth k-wire utilizing the lock-pin technique (Figure 7). The subchondral bone may be drilled at areas where the cartilage is absent.

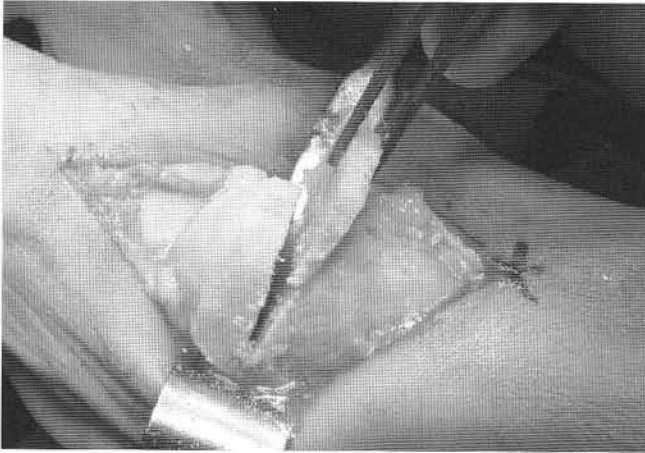


Figure 5. The wedge of bone is removed.

Standard layered closure is performed. A compressive dressing should be used. The patient may be weight bearing after surgery in a standard postoperative shoe, however passive range of motion exercises must begin 7 to 10 days after surgery. This will help prevent the joint from “freezing” after surgery. The patient should be aware that early range of motion exercises can increase edema. Postoperative orthotic control may be beneficial.

## CONCLUSION

The Watermann procedure is a capital osteotomy of the first metatarsal. A wedge of bone is removed with its base dorsally to decompress the joint without shortening the first metatarsal. This osteotomy helps decompress the dorsal aspect of the first metatarsal where the base of the proximal phalanx and the head of the metatarsal lock on each other. This procedure redirects the effective motion of the joint allowing more dorsiflexion of the hallux. It is this restoration of more normal dorsal cartilage and mechanics that may be responsible for the decreased tendency for reformation of the first metatarsal osteophyte. The internal cubic content of the joint is also increased, relaxing the soft tissues structures around the joint. Cochrane described one of the major cause of hallux limitus and rigidus as being the contracture and spasm of the soft tissues structures around the first metatarsophalangeal joint.<sup>8</sup> This would cause jamming of the dorsal proximal phalanx on the metatarsal head.

This procedure is highly effective for mild to moderate hallux limitus deformities, without metatarsus elevatus, or a long metatarsal, and allows for immediate weight bearing following surgery. Immediate postoperative range of motion exercises should be included in the postoperative management.

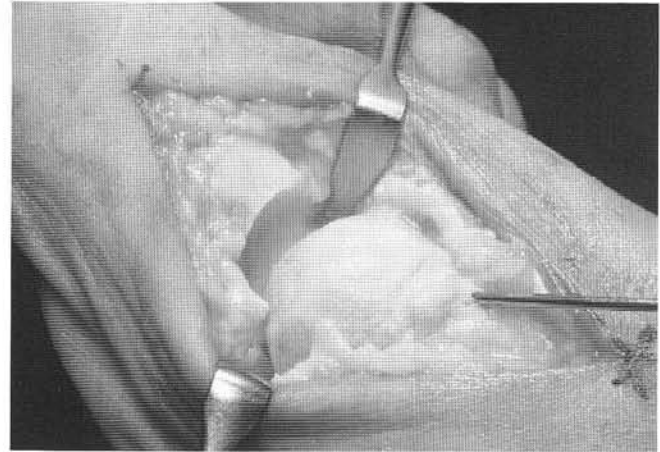


Figure 6. The capital aspect is compressed on the proximal aspect of the first metatarsal with careful reciprocal planning. Note the amount of decompression.

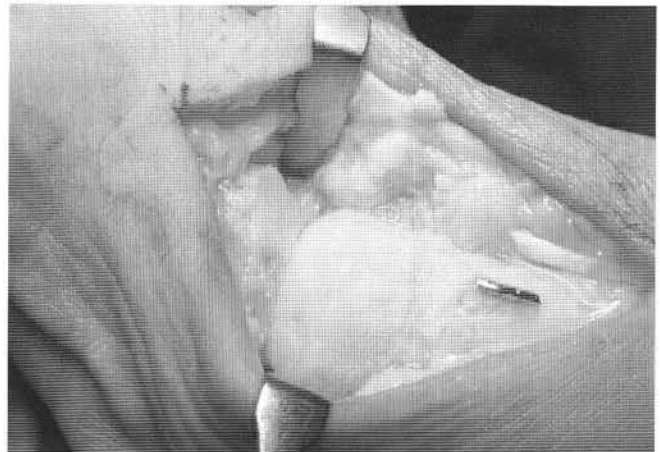


Figure 7. Final fixation utilizing the lock pin technique.

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