

# ARTHRODIASTASIS OF THE ANKLE JOINT, AN ALTERNATIVE TO FUSION

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### INTRODUCTION

Presently, we know of two major forms of osteoarthritis, both of which can be severely disabling. In primary osteoarthritis the cause is generally unknown, and in secondary osteoarthritis the cause is generally traumatic in origin. Both forms present with similar clinical symptoms, which include pain, decreased range of motion, and swelling. Radiologically, there is a decrease in the joint space, and presence of osteophytes and subchondral cysts with sclerosis of subchondral bone. Extracellularly, articular cartilage has two principle components. Collagen that gives it shape and tensile strength and proteoglycans, that give articular cartilage its compressive properties. In osteoarthritis there is an imbalance between the synthesis and the release of these two components. This leads to both a disruption of the collagen network and a loss of proteoglycans. These biochemical changes that occur appear to have no diagnostic clinical correlation, especially in the early stages of the disease process.

Treatment of osteoarthritis has included antiinflammatory medications and exercise. Also, arthroscopic joint lavage coupled with subchondral bone drilling has been used. None of these modalities have proven to provide significant improvement in symptoms, let alone a cure. The ultimate end for patients with osteoarthritis is complete destruction of the articular cartilage with resultant need for arthrodesis or arthroplasty of the affected joint.

### THE PROCEDURE

Recently, five patients who were candidates for arthrodesis of the tibiotalar joint as a result of either primary or secondary arthritis were offered another treatment option, diastasis of the tibiotalar joint using external fixation. The goal of the surgery was to eliminate mechanical stress on the ankle joint by preventing contact between the tibia and the talus.

It should be noted that adjunctively, arthroscopic lavage could be performed at the same time as frame application.

The primary reason that this particular procedure was chosen is because it has been reported that when intermittent hydrostatic pressure is applied to human osteoarthritic cartilage in tissue culture the result was a significant increase in the synthesis of proteoglycans. Recall that proteoglycans provide articular cartilage with its compressive properties. Thus, hypothetically, when intermittent intraarticular hydrostatic pressure is applied to human articular cartilage, in the absence of mechanical stress, the result could be a reparative activity by the chondrocytes in the osteoarthritic cartilage. A secondary reason for making this choice is that this procedure is not joint destructive.

Under general anesthesia, one of two types of external fixation was applied. These included either the Ilizarov ring apparatus or a mono lateral fixator. Application of the Ilizarov apparatus involved two leg rings applied to the tibia and attached with screw-threaded rods. A footplate was then applied with two wires in the calcaneus and two wires through the metatarsals. The footplate was then fixed to the leg rings with two hinged rods and one screw-threaded rod posteriorly to initially prevent ankle motion for the first two weeks postoperatively. The mono lateral fixator involved placement of half pins into the tibia, talus and calcaneus. Fixation of the ankle joint was also maintained for the first two weeks postoperatively.

Distraction was achieved on the operating table and was then carried out until approximately 5mm of joint space was achieved. The patients were encouraged to ambulate to tolerance on the first postoperative day. Load bearing on the distracted joint was essential in order for there to be an increase in the intraarticular hydrostatic pressure. After two weeks, ankle joint motion was allowed with the use of hinges. Exercises for range of motion were performed and ambulation was encouraged. During the treatment period with either fixator there

instances the author uses a Jones compression dressing. This type of cast is used during the initial postoperative phase as it provides a measure of protection for the external frame. Although this is not a necessity, it does generally provide a certain level of comfort and security for the patient until they can become adjusted to the presence of the frame. The cast is usually discontinued within the first week or so after the surgery.

In some patients the distraction process will result in deviation of the toe due to the tension that is placed on the flexor or extensor tendons. A number of authors have described inserting a Kirschner-wire into the associated digit, and at times across the metatarsophalangeal joint as it is believed by some that the use of the wire will tend to mediate this effect. The author has not found that this is a problem, and a pin is not used routinely in the associated toe. However, there have been some patients where the toe required some additional splintage with tape during the lengthening process to overcome this type of problem.

### Postoperative Care

As noted above, the patient is usually placed into a Jones compression cast initially. The patient is maintained nonweightbearing until it is deemed that sufficient lengthening and healing have occurred. At two weeks after surgery the patient will begin the distraction process, turning the apparatus one-quarter turn every six hours. Radiographs are then made periodically to assess the amount of lengthening which has been achieved, and once this is felt to be sufficient, the patient is instructed to discontinue the distraction process. Should the metatarsal be overlengthened, the reverse process can be employed, that being shortening of the metatarsal until a sufficient length has been achieved.

Afterwards, the patient is evaluated periodically with radiographs to determine when there has been sufficient healing for initial weightbearing. Once this interval has been achieved, the author will allow the patient to begin initial weightbearing with the pins and frame in place. It is felt that this provides some measure of protection against excessive weight-bearing forces on the newly lengthened area of bone. The author has seen some patients where sagittal plane deformity has developed in the metatarsal once weightbearing was instituted. In those circumstances, it was usually due to the fact that the frame was removed prior to the institution of weightbearing.

The patient is then re-evaluated two weeks later, at which time the distal and proximal pins are removed from the external fixator. Weightbearing continues for an additional two weeks with only two of the remaining pins in place. At that time, the remaining pins and external fixator are removed. This allows the osseous tissues to adapt to weight-bearing stress over time, reducing the likelihood of plastic deformation of the more immature bone substance.

The greatest drawback to this type of procedure is the lengthy period of nonweightbearing that may be required in some patients. On average, it takes about three months before patients are ready to begin full weight-bearing without the external fixator when a lesser metatarsal has been addressed. However, patients undergoing surgery on the first metatarsal generally require a much more lengthy interval of nonweightbearing, sometimes extending up to six months.

### Complications

Potential complications with this approach are generally minor and usually will consist of some type of digital deformity due to the altered tension on the tendons. Mild cases of dorsal nerve entrapment have also been encountered, but these have responded well to local injections of corticosteroid. Furthermore, in some patients the degree of scarring in the skin can be objectionable. This is due to the fact that linear tension is being applied to the scar during the initial healing interval. Therefore, the author attempts to warn all patients prior to undergoing the procedure that this may be a factor after surgery. This may be particularly important when patients are undergoing the procedure primarily for cosmetic reasons. However, the scar can certainly be excised and primarily closed at a later time, rendering a more appealing scar for the foot.

### Conclusion

Overall callous distraction is a viable alternative in a select patient group to address shortening of a metatarsal. However, the author's preference in most situations is to employ a sagittal Z osteotomy, if feasible. This approach is simple, effective, and involves less recovery time than if callous distraction or bone grafting is required. Nonetheless, callous distraction is effective, and may be preferable in most situations where previous infection has been a problem.

was radiographic evidence of increased joint space with the patient full weight bearing. The assumption was made that the weight bearing surfaces of the tibia and the talus did not come into contact during the time of distraction. Total time of distraction was between five and six weeks. The frame was then removed and the patients continued with physical therapy and ambulation to tolerance.

The resultant effect of diastasis of the tibiotalar joint is an elimination of normal mechanical stress placed on the articular cartilage due to the absence of contact between the joint surfaces and an intermittent increase in intraarticular hydrostatic pressure. As previously mentioned, in tissue culture, cartilage displays reparative activity when placed in these conditions. The primary reparative activity noted was that of increased proteoglycan production by more than 50%. It can be speculated that this increase in synthesis of proteoglycans may be the reason for the increase in joint space. It has also

been suggested that by distraction of the joint there is a subsequent increase in the circulation of synovial fluid that provides nutrition to the articular cartilage. For whatever reason, diastasis of the ankle joint, with elimination of mechanical stress, leads to improvement in the articular cartilage and a reduction of the symptoms of osteoarthritis.

The purpose of performing diastasis of the tibiotalar joint in patients with severe osteoarthritis was to delay the need for arthrodesis. Thus far, five patients have been treated in this manner. Clinically all patients continue to experience a reduction in pain, an increase in joint range of motion, and radiographic appearance of joint space. With this positive clinical evidence it appears that ankle joint diastasis, with either the Ilizarov apparatus or a monolateral fixator, may delay the need for arthrodesis in patients with primary or secondary osteoarthritis.



Figure 1. Preoperative AP radiograph of the ankle



Figure 2. Post distraction AP radiograph with frame



Figure 3. Postoperative clinical AP view of external fixator.

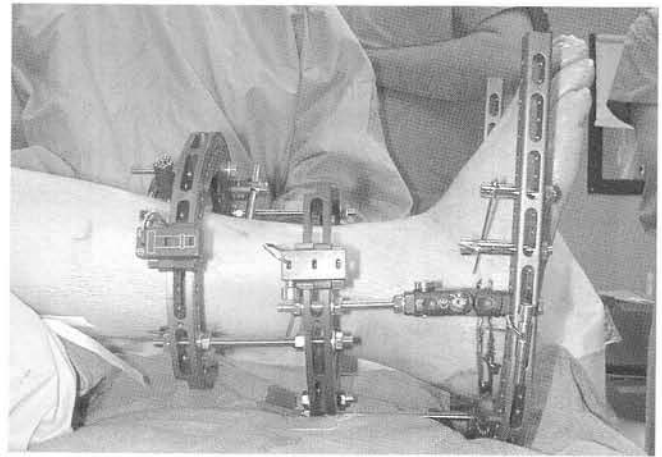


Figure 4. Postoperative lateral view of external fixator.



Figure 5. Postoperative AP radiograph of ankle at 1 year.



Figure 6. Postoperative lateral view of ankle at 1 year.