Current Advancements in Ankle Arthrodiastasis

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KEYWORDS

• Ankle distraction • Ankle arthritis • Ilizarov • Supramalleolar osteotomy
• External fixation • Arthrodiastasis

KEY POINTS

- Ankle arthrodiastasis allows the clinician to follow a continuum of care before commitment to joint destruction procedures, such as ankle implant arthroplasty or fusion.
- The optimal distance for distraction should exceed 5 mm to withstand axial loading force during weightbearing.
- The application of hinged distraction with the use of Ilizarov hinges, in line with Inman's axis, allows for optimal modulation of ankle hydrostatic pressure and nourishment to the articular cartilage during distraction.
- Physiologic changes have been shown to occur at the cellular level in response to ankle distraction, which assists in diminishing subchondral sclerosis and pain from end-stage ankle arthritis.
- Simultaneous deformity correction is a viable option and should be considered in the setting of posttraumatic ankle arthritis.

INTRODUCTION

The devastating sequelae of ankle arthritis is comparable to hip arthritis and end-stage heart failure in quality-of-life measurements.[1,2] Most instances of ankle osteoarthritis develop after inciting traumatic events and affect both the pediatric and adult population.[3–5] Patients with posttraumatic arthritis tend to be younger, with joint preservation techniques shown to be desirable in improving overall lifestyle.[6] Options such as arthrodesis are effective, but will result in compensation and often adjacent joint arthrosis, particularly with cases of malunion.[7]

The term arthrodiastasis was formulated by the word stems of arthro (joint), dia (through), and tasis (to stretch out) by Aldegheri and colleagues[8] from Verona, Italy. Volkov and Oganesian[9] in 1975 performed the first hinged distraction of the elbow and knee and demonstrated it to be a viable treatment option. A few years later Judet

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and Judet[10] in 1978 performed the first hinged distraction of the ankle joint and proved it to be a viable method to achieve joint separation and maintenance of anatomic motion. Increased popularity in Europe was gained from work by Marijnissen and associates with their work showing benefits of distraction in the treatment of end-stage osteoarthritis within the ankle joint.[11]

The treatment of ankle joint osteoarthritis continues to evolve with innovation in joint-sparing and joint-destructive interventions. Ankle arthrodiastasis continues to be a viable treatment option to decrease pain and increase function in the younger patient with ankle osteoarthritis while preserving the native ankle joint. In this article, we aim to review contemporary perspectives on arthrodiastasis of the ankle and present a case reports illustrating these concepts.

HYPOTHESIS/RATIONALE

The rationale behind arthrodiastasis is a continuous, reparative process to counteract the destruction of native, articular cartilage.[11] The procedure involves weightbearing with an external fixator to place traction across the joint space. It is speculated that mechanical unloading through distraction allows for chondrocytes to repair in the intermittent intraarticular fluid pressure environment.[12] Additionally, stress shielding occurs, which allows for subchondral cyst resorption and less subchondral bone sclerosis.[11] Fibrocartilage is formed during the distraction process, which seals the cartilage to the cystic area and eliminates synovial fluid of cysts, thus decreasing pain.[11] It is also hypothesized that arthrodiastasis has an effect on decreasing the arthritic impetus in the ankle joint by on an unknown effect of proteoglycans.[12] These benefits alleviate stiffness within the joint and improve motion and pain for the patient.

Arthrodiastasis is a surgical technique used to promote morphoangiogenesis and serves to decrease subchondral sclerosis adjacent to joint surfaces through stress shielding. Nociceptive fibers are located within the joint capsule, ligaments, periosteum, and subchondral bone.[13] Distraction allows for decreasing intraarticular pressure and thereby diminishes the nociceptive influence. Additionally, control of the catabolic environment and oxidized stress to chondrocytes by unloading the joint surface and regulation of the cytokine cascade creates regenerative effects to osteochondral damage.[14–16]

INDICATIONS

The ideal surgical candidate for ankle arthrodiastasis is often less than 50 years of age and presents with isolated unilateral primary or posttraumatic osteoarthritis of the ankle. Ankle joint plain film radiographs and further workup in the form of a computed tomography scan assesses the amount of joint space involved. It is not uncommon to visualize ankle joint narrowing from an anteroposterior or mortise view, yet the joint space is often maintained on a true lateral view (**Fig. 1**). These patients would benefit most from a supplemental ankle arthrotomy and adjunctive tibial and talar exostectomy. Further patient considerations include pain that is disabling and failure with offloading strategies to include rocker bottom shoes, injections, and other forms of conservative therapy. Numerous reports have demonstrated efficacy with hip avascular necrosis in pathology such as Legg-Calvé-Perthes, which could be implemented in the management of talar avascular necrosis as well.[17]

CONTRAINDICATIONS

At this time, based on thorough gleaning of the literature the authors do not believe there to be a body mass index cutoff for surgical arthrodiastasis. However, patients