#### Ankle Distraction Arthroplasty

### What is ankle distraction arthroplasty?

Ankle distraction arthroplasty is an exciting, innovative procedure for treating ankle arthritis in select patients. Unlike ankle fusion and ankle replacement distraction arthroplasty focuses on joint restoration. These other procedures, while appropriate in many cases, sacrifice the ankle joint in an effort to decrease pain from arthritis. Distraction arthroplasty uses mechanical unloading of the diseased joint to reverse the effects of arthritis and significantly lower pain without damaging the ankle joint. Additionally, ankle motion is preserved! This concept of joint restoration has been embraced by many foot and ankle specialists including both orthopaedic surgeons and podiatrists. Although it is relatively new in the United States, it has been performed successfully in Europe for many years. This surgery is rapidly gaining popularity, but your local orthopedist may not be aware of its benefits or may not know which centers perform this procedure.



Case Study: Clara Williams

A Climber's Tale

Clara is a vibrant and charismatic woman whose passion is rock climbing and the great outdoors. After sustaining a severe ankle fracture from a fall while rock climbing, Clara's first thought was that she might never climb again. She fell from 30 feet and landed onto her right ankle shattering the joint into many small pieces. She underwent reconstructive surgery to fix the broken bones with a stainless steel plate and screws. Despite a valiant effort by her orthopaedic doctor, she went on to develop debilitating ankle arthritis. At 27 years old she was unable to walk without taking frequent breaks. With no shortage of vitality she would climb at her local indoor climbing gym, but her ankle pain made it impossible to ascend more than several feet. On the days that she did manage to climb the following day she would be in so much pain that walking around the house was a challenge. She underwent ankle arthroscopic surgery to clean out the arthritis from her joint and worked hard through several months of physical therapy. Despite these measures her pain persisted. Her doctors offered her an ankle fusion, a procedure that would freeze her ankle joint permanently, to relieve her pain. They warned her that her ability to climb after such a procedure would be slim to none. Her new life as a sedentary and dependent person was changing her once positive outlook on life and was gnawing at her identity. She was desperate to regain control of her life and get back to the sport she loved. It was at this point that she came to the Hospital for Special Surgery (HSS). Here she was informed her of the exciting results obtained with a novel procedure: ankle distraction arthroplasty. Soon after, she underwent ankle distraction surgery. Clara needed to wear an external fixator on her right ankle for 10 weeks to pull



apart the joint surfaces to allow new cartilage growth.

(Figure 1. Shows the RAD, the ankle distraction external fixator that Dr.s Rozbruch and Fragomen developed specifically for this surgery) A vigorous athlete, she

wasted no time in getting back into the climbing gym even while she was



undergoing active treatment.

(Figure 2. Clara rock climbing while wearing the external fixator on her right ankle.) After the 10 weeks the external fixator was removed, and she transitioned into a temporary walking boot. As the weeks went by she was able to tolerate more activity and returned to rock climbing outside. Now, 1 year after removing the device, she is able to hike 3 miles to her favorite climbing site, climb a sheer rock face for several hours, and then hike back out with minimal pain. What is more, the following day she is able to do it all over again. She does not wear a brace and does not use a cane.



(Figure 3. Clara's favorite climbing spot in the Pacific

Northwest, six months after fixator removal.)

Clara's success is due to a combination of the progressive thinking at HSS and her willingness to try an innovative procedure that was not yet mainstream in the United States. Since that time Dr.s Fragomen and Rozbruch have presented their clinical data at several orthopaedic meetings including the American Academy of Orthopaedic Surgeons. Their peer-reviewed scientific article on ankle distraction arthroplasty was published in the highly respected orthopaedic journal, *Foot & Ankle International,* in April 2009.

# How does distraction arthroplasty work?

To understand how the procedure works you must first have a little knowledge about arthritis. Arthritis is the loss of articular cartilage (the smooth surface that covers the ends of our bones in our joints) from the joint surfaces. This is often seen as a loss of joint space on X-ray and MRI. (Figure 4)



This loss of cartilage causes pain and stiffness in the joint which is often life altering. Arthritis also causes a hardening of the bone underneath the cartilage which further damages the already injured cartilage cells. The exact mechanism of action of distraction at the microbiological level is not yet fully understood, but it is clear that distraction arthroplasty acts by restoring some of this lost cartilage through the body's natural repair mechanisms. "Distraction" is achieved by literally pulling the joint surfaces apart. This allows the dense bone underneath the cartilage to soften, re-vascularize, and produce a healing response. Recent MRI studies of several patients have shown dramatic regenerative tissue growth on the arthritic bone surfaces one year after the procedure. (Figure 5)



This neo-cartilage is thought to be responsible for the pain relief people experience.

The distraction procedure.

Distraction arthroplasty is a minimally invasive surgery that relies on the use of external fixation to pull the joint surfaces apart. An external fixator or "frame" is a scaffolding assembled around the leg that remains outside the body during treatment. (Figure 6)



It is surgically applied to the ankle in the operating room under anesthesia. The rings are attached to the leg by way of pins and wires. These piercings are much like earrings just in the skin of the lowerlimb. The distraction of the joint is achieved in the operating room by pulling the rings apart and then locking them. The frame has hinges built-in that allow for unrestricted ankle mobility. The distraction is typically combined with cartilage stimulating procedures as well. Most patients have bone spurs (osteophytes) that have grown in their ankle joints and often restrict motion. These spurs are removed at the time of surgery. The areas of the joint that have the worst cartilage damage are also stimulated. *Microfracture* technique is performed in these locations to encourage new reparative cartilage formation. The process of neo-cartilage tissue formation is thought to require the transformation of mesenchymal *stem cells* into cartilage forming cells. To speed this process we are harvesting *stem*  injecting them into the ankle joint. This combination of approaches provides our patients with the most comprehensive treatments available today giving them maximal benefit from the distraction procedure.

#### Rehabilitation after distraction arthroplasty.

Patients are admitted to the hospital for 2 days where they are encouraged to walk on the operated leg twice daily with physical therapy. They are discharged home with physical therapy and oral pain medication that is taken as needed. Weight bearing as tolerated ambulation is encouraged. Daily showers to wash the leg and the fixator are a part of routine pin care. Patients are allowed to swim in a chlorinated pool as well. Ankle range of motion exercises start early and continue until frame removal. The frame is worn for 10 weeks in most cases. This amount of time is needed in order to complete the slow process of tissue growth in the joint.

# External Fixator (Frame) Removal

Frame removal is performed in the operating room under sedation. This is an ambulatory (you go home the same day) procedure. In the operating room a walking boot is placed on the foot for patient comfort.

### What are the risks?

The most common problem is pin infection. Infection is prevented by cleaning these piercings daily and is treated with antibiotic pills. The beauty of distraction arthroplasty is that it "does not burn any bridges." In the unlikely event that the patient is not satisfied and elects to have fusion or joint replacement, the joint has been preserved and these procedures can still be done without increased complications. The same cannot be said of fusion or replacement where failure carries a high cost.

### Am I a candidate?

The Limb Lengthening and Reconstruction Institute at HSS is one of the few centers in the United States that performs distraction arthroplasty with regularity. We have recently published our experience with distraction arthroplasty in the

premier, peer-reviewed foot and ankle journal, *Foot and Ankle International*. Having been on the forefront of this technique we have developed indications and contraindications for the procedure. Typical candidates have ankle arthritis (also called chondromalacia, osteochondritis, joint space collapse or narrowing) and have some mobility of the ankle joint. The best way to know if you are a candidate for distraction arthroplasty is to be evaluated at our institute.

# Out -town-patients.

We have developed a large experience with treating out-of-town patients from California to Scotland. We have had great success in this group of patients as well. Although air travel is awkward it has not presented a significant obstacle to our patients and has not negatively impacted the results.

# Further reading:

Tellisi N, Fragomen A, Kleinmann D, O'Malley MJ, Rozbruch SR. Joint preservation of the osteoarthritic ankle using distraction arthroplasty. Foot Ankle Int 2009 Apr;30(4):318-25

Ploegmakers JJ, van Roermund PM, Van Melkebeek J, et al. Prolonged clinical benefit from joint distraction in the treatment of ankle osteoarthritis. Osteoarthritis Cartilage 2005 Jul;13(7):582-8

Marijnissen AC, van Roermund PM, van Melkebeek J, et al. Clinical benefit of joint distraction in the treatment of severe osteoarthritis of the ankle: proof of concept in an open prospective study in a randomized controlled study. Arthritis Rheum 2002 Nov;46(11):2893-902

Inda JI, Blyakher A, O'Malley MJ, Rozbruch SR. Distraction Arthroplasty for the Ankle Using the Ilizarov Frame. Tech Foot Ankle Surg 2003; 2(4):249-253.