

# Magnetic Resonance Imaging Evaluation of Hinged Ankle Distraction Combined with Intra-articular Injection of Human Growth Hormone

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## Purpose

- To evaluate subchondral bone thickness, cartilage thickness, and subchondral bone cysts of the ankle joint using pre- and postoperative ankle magnetic resonance imaging (MRI) of patients who underwent hinged ankle joint distraction with external fixation and intra-articular injection of human growth hormone.

## Literature Review

- Current literature supports the benefit of ankle distraction for the treatment of ankle arthritis.<sup>1-4</sup>
- Only one study has reviewed MRI findings after ankle distraction.<sup>5</sup>
- Growth hormone is known to increase the formation of cartilage, but the benefit during distraction has not been reported.<sup>6</sup>
- No studies have evaluated the effects of intra-articular injection of growth hormone on the ankle joint.

## Methods

- Of 51 patients who underwent the procedure, the medical records of 12 were reviewed. These 12 patients had preoperative and 1-year postoperative MRI scans available for evaluation.
- A digital caliper (Cabela's Inc., Sidney, Nebraska) was used to measure subchondral bone thickness, cartilage thickness, and size of subchondral bone cysts on the MRI scans. The number of subchondral bone cysts was also recorded.
- All patients had hinged ankle joint distraction with external fixation for 3 months.
- Intra-articular ankle injections of synthetic human growth hormone (10 mg per injection) were given as a series of three injections (the first and second month after surgery and at the time of external fixation removal). Confirmed with arthrogram.
- Preoperative and postoperative data were analyzed using the paired-sample t-test using SPSS version 10.0 (SPSS, Inc., Chicago, IL). The level of significance was set at  $p \leq 0.05$ .

### CASE EXAMPLE

## Post-traumatic Ankle Arthritis



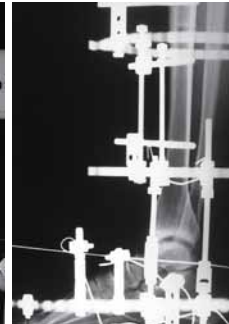
Preoperative anteroposterior view radiograph of the ankle.

Preoperative lateral view radiograph shows anterior ankle impingement.

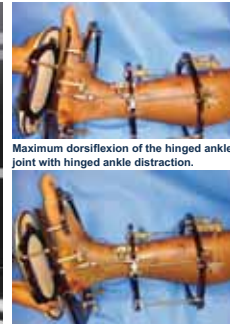
Intraoperative lateral view fluoroscopic radiograph after anterior ankle osteophyte resection.



Postoperative anteroposterior view radiograph with hinged ankle joint distraction (approximately 8 mm).



Postoperative lateral view radiograph with symmetrical hinged ankle distraction (approximately 8 mm).



Maximum dorsiflexion of the hinged ankle joint with hinged ankle distraction.

Maximum plantar flexion of the hinged ankle joint with hinged ankle distraction.

### CASE EXAMPLE

## Growth Hormone Injection



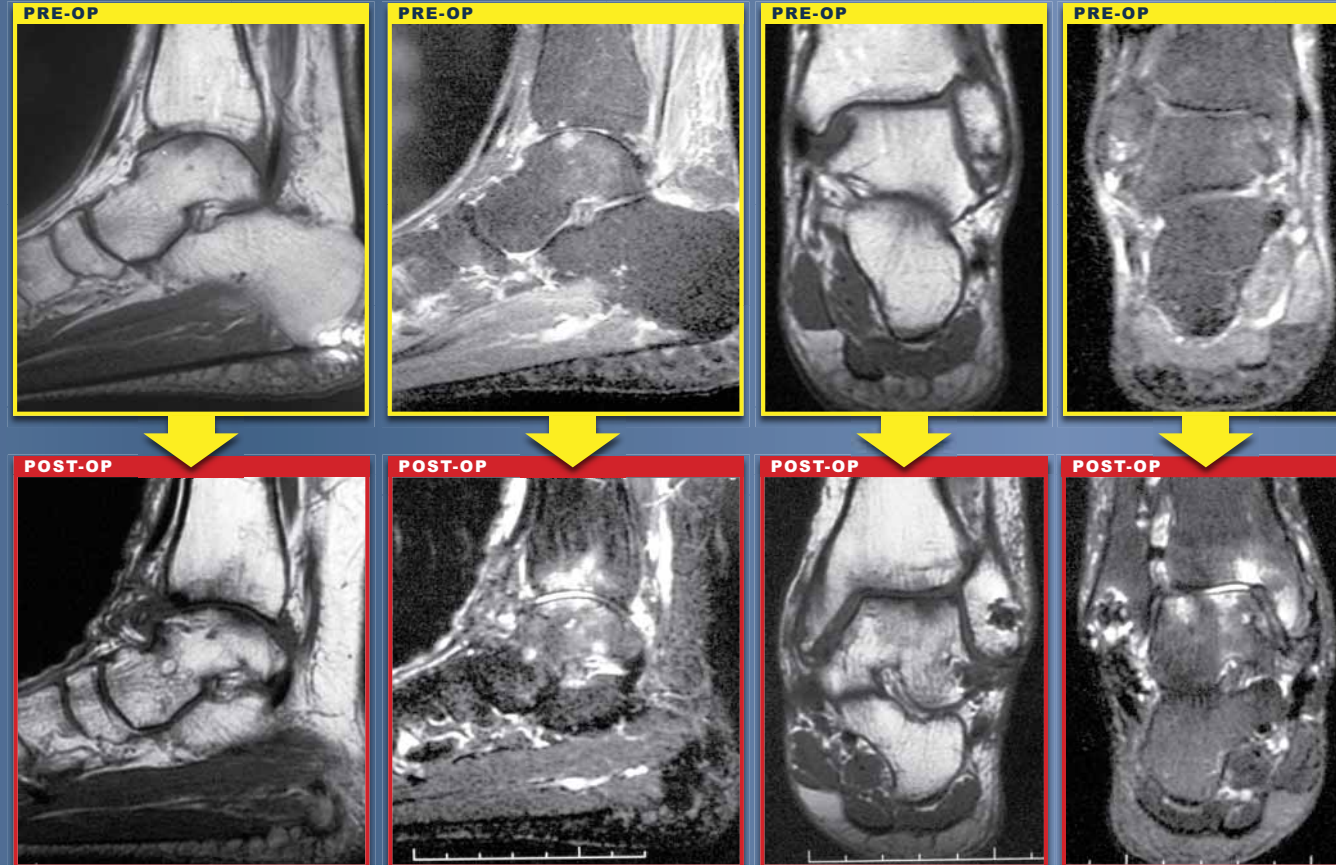
Clinical photograph of syringes and omipaque dye, saline solution, and human growth hormone used for the injection.

Clinical photograph shows injection of human growth hormone.

Ankle arthrogram under fluoroscopy to ensure injection of growth hormone. Note that the dye is intra-articular.

### CASE EXAMPLE

## MRI Results One Year Postoperatively



**T1-weighted MRI scan:** Postoperative the tibia and talus have increased signal, adjacent to the subchondral bone. Note the increased joint space. The anterior tibial osteophytes have been resected and the talar neck deepened.  
**T2-weighted MRI scan:** Postoperative the joint cartilage thickness is wider after surgery. The subchondral bone thickness after surgery has also decreased. Note the increased width of the joint space postoperatively.

## References

- Tellis N, Fragomen A, Kleinman D, O'Malley MJ, Rozbruch SR. Joint preservation of the osteoarthritic ankle using distraction arthroplasty. *Foot Ankle Int* 30(4):318-325, 2009.
- Paley D, Lamm BM, Purohit RM, Specht SC. Distraction arthroplasty of the ankle—How far can you stretch the indicators? *Foot Ankle Clin* 13(3):471-484, 2008.
- Paley D, Lamm BM. Ankle joint distraction. *Foot Ankle Clin* 10(4):685-98, 2005.
- Eh-Khoury GY, Alliman KJ, Lundberg HJ, Rudert MJ, Brown TD, Saltzman CL. Cartilage thickness in cadaveric ankles: measurement with double-contrast multi-detector row CT arthrography versus MR imaging. *Radiology* 233(3):768-773, 2004.
- Lamm BM, Gourdine-Shaw M. MRI evaluation of ankle distraction: a preliminary report. *Clin Podiatr Med Surg* 26(2):185-191, 2009.
- Dunn AR. Morphoangiogenesis: a unique action of growth hormone. *Microvasc Res* 63(3): 295-303, 2002.

## Results

- All patients reported subjective pain relief.
- Adjuvant procedures performed included posterior muscle group lengthening, core decompression of the talus, partial resection of the tibia and deepening of the neck of the talus, and tibial or fibular osteotomy.

### Statistically Significant Values

- Tibial and talar subchondral bone thickness decreased by an average of 0.5 mm (range, 0.5-1.5 mm) ( $p=0.03$ ) at 1 year post-op.
- Cartilage thickness increased by an average of 0.5 mm (range, 0-2.0 mm) ( $p=0.02$ ) at 1 year post-op.
- Subchondral bone cysts of the talus and tibia decreased in number by an average of two cysts ( $p=0.01$ ) (range, 0-4.0 mm) and size by an average of 1.5 mm in greatest width (range, 0-3.0 mm) ( $p=0.01$ ) at 1 year post-op.

## Discussion

- Our method of ankle distraction is known to be beneficial for reduction of pain and increase in function for patients.<sup>5</sup>
- This MRI study shows ankle distraction with intraarticular injection of human growth hormone results in a statistically significant decrease in subchondral bone thickness, increase in cartilage thickness, and decrease in number and size of subchondral bone cysts.
- Therefore, this study indicates that human growth hormone in conjunction with ankle distraction offers the most superior method for ankle joint preservation.