

# Evaluation of Plain Film Radiographs and Computed Tomography to Determine Which Imaging Modality is More Effective at Showing Bony Fusion of Rearfoot Joints Following Arthrodesis

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## STATEMENT OF PURPOSE

Currently, bony fusion in rearfoot joint arthrodesis is being assessed using plain film radiographs. Although limited studies have been performed to date, it was found that standard radiographs overestimate the magnitude of joint fusion when compared to computed tomography (CT) scans. The purpose of this study was to determine whether plain film radiographs or CT scans are more reliable in identifying bony fusion in rearfoot joints following arthrodesis.

## METHODOLOGY

A retrospective study was performed on 9 patients who underwent arthrodesis of rearfoot joints. The surgical procedure was performed by the same two surgeons, authors KK and AB, at Bethesda Hospital East between April 2017 and August 2017. Of the nine patients who were identified, 6 patients met our inclusion criteria. Inclusion criteria included:

- 1) Undergone primary arthrodesis of subtalar joint (STJ) and/or talonavicular joint (TNJ)
- 2) Serial postoperative plain film radiographs and CT scans
- 3) Follow up for minimal 20 weeks postoperatively
- 4) No prior history of Charcot Neuroarthropathy.

Three of the nine patients were found to have Charcot Neuroarthropathy and were therefore excluded from the study. Serial plain film radiographs and CT scans were performed postoperatively until bony fusion was achieved. All postoperative imaging was reviewed by author HP to assess for bony bridging across the joint. Criteria for bony fusion was met when imaging showed cortical bridging and osseous trabeculae across the arthrodesis site. Postoperatively, the radiograph and CT scans were compared to determine which imaging modality was more effective at showing bony fusion.

## PROCEDURE

General anesthesia was performed by anesthesia services. The lower extremity was prepped in the usual aseptic technique and a thigh tourniquet was applied. For STJ fusion, an incision was made from the posterior aspect of the fibular lateral malleolus to the sinus tarsi. Sinus tarsi ligaments were transected. The STJ was distracted and the articular surfaces were resected down to cancellous bone and subchondral drilling was performed. STJ was placed into 5 degrees of valgus. Fixation was achieved using two 6.5 or 7.0mm cannulated screws. Intraoperative fluoroscopy was utilized to confirm positioning. Soft tissue closure was performed in layers using a combination of sutures and staples after placing of drain as needed.

For TNJ fusion, an incision was made from the tibial medial malleolus to the navicular tuberosity. Dissection was performed down to the level of bone with the periosteum reflected medially and laterally. The TNJ was distracted and the articular surfaces were resected down to cancellous bone and subchondral drilling was performed. Fixation was performed across the TNJ using a 4.0 or 4.5mm cannulated screw medially and 2 ratcheting compression plates (RCP) medially and dorsally. Intraoperative fluoroscopy was utilized to confirm positioning. Soft tissue closure was performed in layers using a combination of sutures and staples.

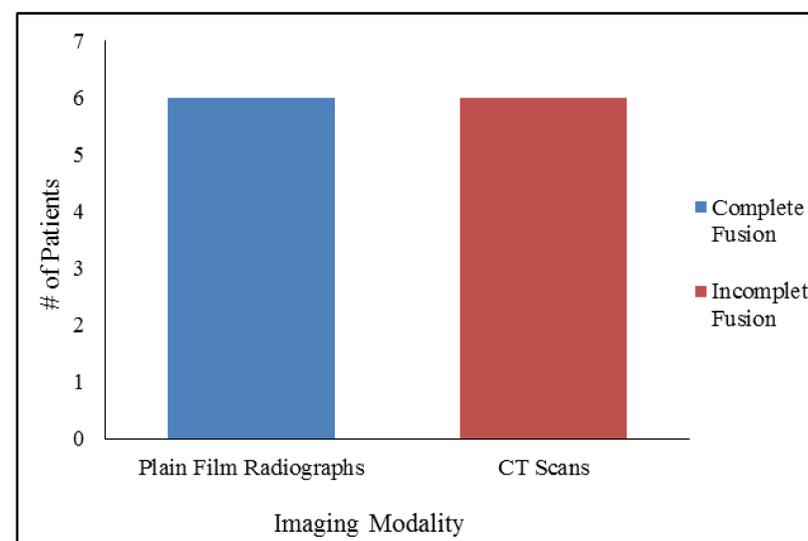
## PROCEDURES CONTINUED

If necessary, the following procedures were completed:

- 1) A drain was placed to prevent formation of a hematoma postoperatively
  - 2) A bone wedge allograft was inserted into the STJ if significant valgus deformity was present
  - 3) Bone marrow aspirate was obtained from the calcaneus and used at the STJ and TNJ fusion sites
  - 4) A gastrocnemius recession was performed if an equinus deformity was diagnosed
- Postoperatively:
- 1) Patient was instructed to be non-weightbearing (NWB) until fusion was achieved
  - 2) Patient followed up every 2 weeks for cast change, and plain film radiographs and CT scans were performed until bony fusion was noted

## RESULTS

The plain film radiographs and CT scans for all 6 patients were recorded as complete fusion or incomplete fusion of the specific joint. Fusion across the arthrodesis site was deemed complete when cortical bridging and osseous trabeculae was seen across the posterior facet of the subtalar joint or the talonavicular joint. Upon postoperative examination of serial plain film radiographs and CT scans for each patient, the rearfoot joints were found to show complete bony fusion earlier on plain film radiographs when compared to CT scans in 6 out of 6 patients (100%). When CT scans were evaluated at the time that plain film radiograph showed complete bony fusion, CT scans showed complete fusion on 0 out of 6 patients (0%).



**Figure:** CT scans were found to show incomplete bony fusion in 6 out of 6 patients when examined at the time when plain film radiographs first showed complete fusion for all 6 patients upon postoperative evaluation following rearfoot arthrodesis

## DISCUSSION & CONCLUSION

Currently, plain film radiographs are the primary imaging modality used to assess healing at a fusion site. The basis of this study was to compare plain film radiographs and CT scans to determine which imaging modality was more accurate in identifying bony fusion following arthrodesis of rearfoot joints. If patients were allowed to return to unprotected activity or full weightbearing prior to proper healing, the increasing micromotion across the joint may lead to a delayed union or nonunion, causing pain. Although this may prolong immobilization and non-weightbearing, this will give an overall better outcome due to proper fusion leading to decreased pain and improved function long term.

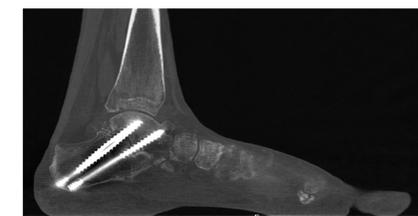
CT scans more accurately identified cortical bridging across arthrodesis sites than plain film radiographs. Upon evaluation of rearfoot joint on serial imaging, plain film radiographs falsely showed complete bony fusion when compared to CT scans. As a result, it was determined that CT scans were more specific than plain film radiographs at assessing fusion. In conclusion, CT scans should be ordered post-operatively once fusion is determined on plain film radiographs to confirm complete fusion before allowing the patient to return to unprotected activity or full weightbearing. Two major limitations in our study was the small sample size and implant artifact on CT and radiographic imaging.



**Image 1:** Lateral foot plain film radiograph at 20 weeks postop showing complete bony fusion following subtalar joint arthrodesis



**Image 2:** AP ankle plain film radiograph at 20 weeks postop showing complete bony fusion following subtalar joint arthrodesis



**Image 3:** Sagittal foot CT scan at 20 weeks postop showing incomplete bony fusion following subtalar joint arthrodesis



**Image 4:** Coronal ankle CT scan at 20 weeks postop showing incomplete bony fusion following subtalar joint arthrodesis

## REFERENCES

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