INVISION™ Total Ankle Replacement System with PROPHECY™ Preoperative Navigation

Revision of a Failed Agility Total Ankle Replacement

CASE STUDY

Patient History

The patient was a 65-year-old female who was referred to me in 2005 for right ankle post-traumatic arthritis. She had a remote history of right femoral and tibial fractures that required surgical repair and fixation. Her femur was well-aligned, but radiographs of the tibia demonstrated 1 to 1.5 cm of lateral displacement of the distal segment. She demonstrated external rotation malalignment of about 15 to 20°. The patient had recently undergone arthroscopic debridement, drilling, and microfracture for what was thought to be an isolated talar osteochondral lesion. She went through an appropriate post-operative protocol but continued to have worsening pain. She had little to no relief and was referred to me for total ankle replacement.

In 2006, the patient underwent an Agility total ankle arthroplasty (Depuy Sythes) performed by me. The patient did well in the immediate postoperative period with reported relief of ankle joint pain, however her recovery was compromised by an early fall. No obvious fracture was identified, but she developed increased pain. She did reasonably well for several years but never had complete relief of her pain. During that time, a she encountered a number of confounding problems that undoubtedly contributed to her persistent pain: she was diagnosed with idiopathic neuropathy, rheumatoid arthritis, post-traumatic subtalar arthritis, and stress overload due to ipsilateral hip arthritis and chronic regional pain. In 2012, she underwent a subtalar fusion in an attempt to alleviate the pain, which was marginally successful. Following the subtalar fusion, the patient's course of treatment was focused on bilateral hip replacement.

Contributed by:

William C. McGarvey, MD

Memorial Hermann Katy Hospital

Katy, TX

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Examination and Radiography

Twelve years after her ankle replacement surgery, the patient returned for re-evaluation due to increasing pain. Clinical examination at that time demonstrated tenderness throughout the ankle articulation. She had reasonable alignment but exhibited increased external rotation with gait and static stance. Her range of motion in plantarflexion was "good" at 30-35° and dorsiflexion was "fair" at 5°. Inversion/eversion was restricted as expected due to the subtalar arthrodesis.

Radiographic studies demonstrated some subsidence of the Agility talar component and lucency around the malleolar borders of the tibial component, particularly the lateral side. (FIGURES 1A, B, and C).

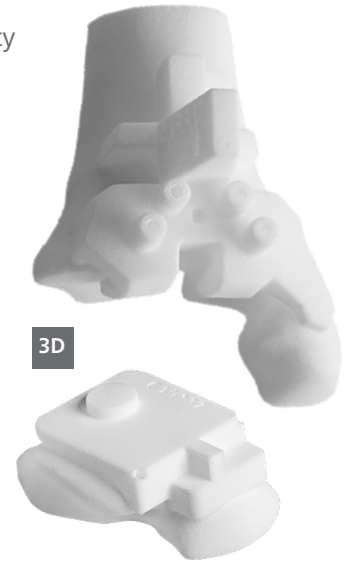
CT confirmed the radiographic findings and showed solid subtalar fusion (FIGURES 2A, B, C, and D).

FIGURE 1. Preoperative AP (1A), Oblique (1B), and Lateral (1C) x-rays. Lateral displacement of the tibia from a previous fracture can be seen. The Agility implant shows subsidence of the talar component and lucency around the tibial component.

FIGURE 2. Preoperative coronal (2A, B, C) sagittal (2D) CT scans confirming the existance of multiple radiolucencies adjacent to the agility implant and subsidence of the talar component and solid subtalar joint fusion.

Treatment Plan

The patient had tried and failed conservative treatment including rest, activity modifications, footwear adjustments, medications, and physical therapy. Finally, the patient felt that she no longer wished to accept the pain associated with the ankle.



We elected to use INVISION Total Ankle Revision with PROPHECY Preoperative Navigation to aid in the preoperative planning and orientation of the new implant. Using CT scans of the ankle, a PROPHECY alignment plan was created, reviewed, and adjusted (FIGURES 3A, B, and C). Alignment guides were then manufactured (FIGURE 3D). The perceived advantage of the system was the opportunity to determine appropriate alignment with respect to the mechanical axis of the native tibia despite the malunion of the original fracture. Additionally, rotational control could be evaluated based on real anatomic landmarks such as malleolar axis in reference to the tibial tubercle, which could only be "eyeballed" without three-dimensional information provided by the PROPHECY CT data.

Using this planning system, an INBONE™ tibial tray was identified to restore joint height and compensate for the bone loss related to the original implant. The 3mm thick INVISION talar plate would not only provide excellent perimeter coverage but also cover the talar fin defect left by the Agility implant.

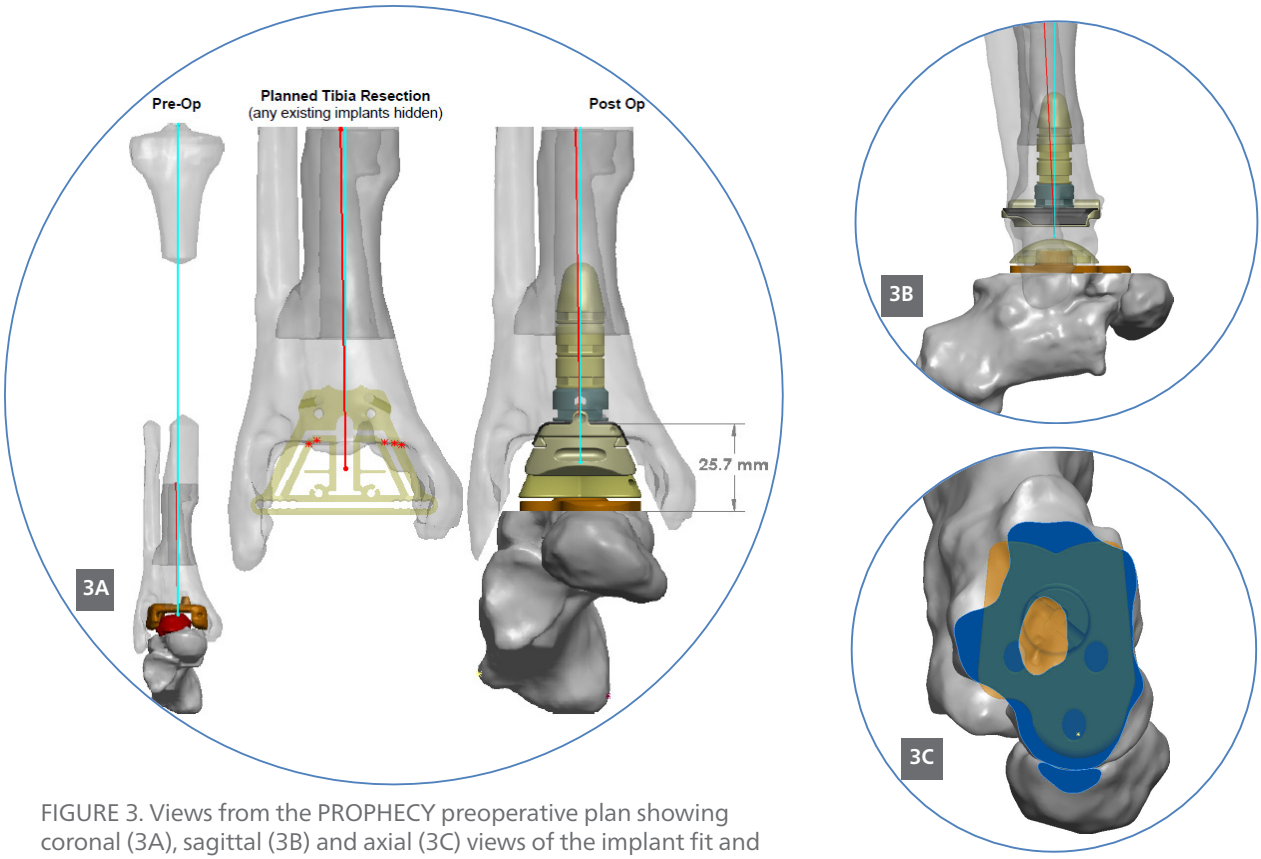


FIGURE 3. Views from the PROPHECY preoperative plan showing coronal (3A), sagittal (3B) and axial (3C) views of the implant fit and alignment.

Surgery

The patient underwent explantation of the existing Agility replacement and installation of a new INBONE tibia and INVISION talus implant.

First, the PROPHECY Tibial Alignment Guide was used to place pins to align the cut block in order to make the predetermined tibial cut after implant removal (FIGURES 4A, B, and C). Additional pins were placed prophylactically in each malleolus to aid in fracture prevention, as the malleoli were thin due to resection at the time of implanting the Agility and vulnerable upon its removal.

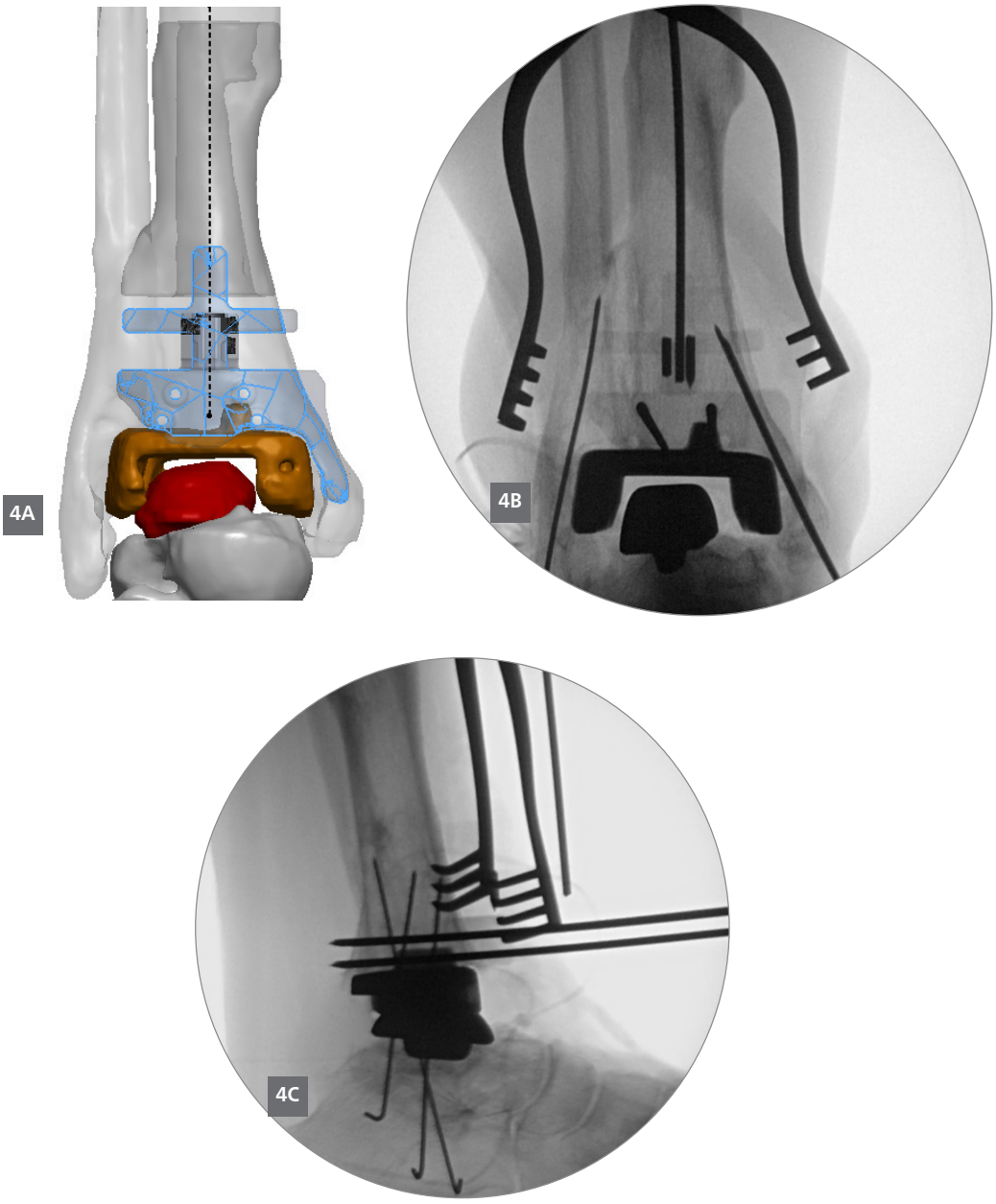


FIGURE 4. Model of the tibia alignment guide on the distal tibia (4A). Intraoperative fluoroscopy showing the AP (4B), and lateral (4C) views of pin placement prior to explant of the failed Agility implant.

Next, the explantation procedure was performed with the pins in place.

Once the Agility was explanted, the sequence was the same as that for a primary PROPHECY INBONE (FIGURE 5A) except that the talar resection was referenced from the tibial cut (FIGURES 5B, C, and D). Ankle deformity correction was accomplished by a combination of manual positioning of the foot plus the use of assistive, intra-articular, patient-specific spacer blocks to facilitate re-alignment of the talus bone based on the predetermined corrected state from the alignment plan. The final talus resection depth was adjusted manually and determined using lateral fluoroscopy.

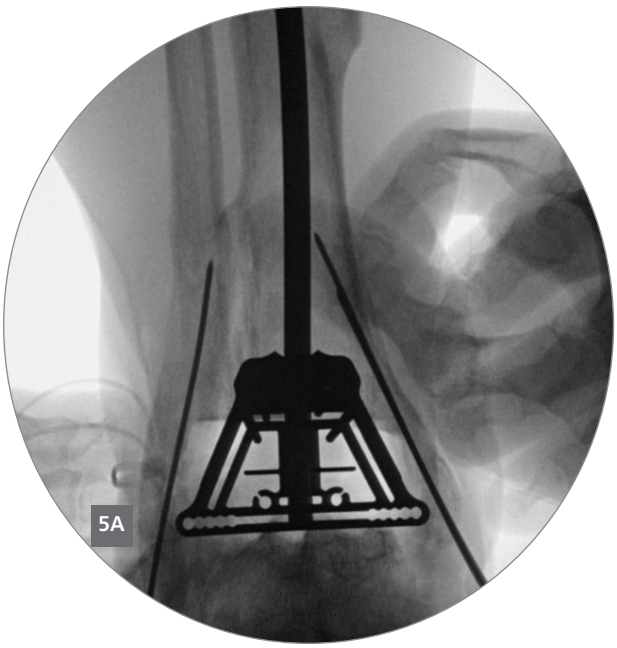


FIGURE 5A. AP view of the tibia cut guide in place.

FIGURE 5B. Lateral view of the PROPHECY spacer guides which facilitate correct positioning of the talus under the tibia.

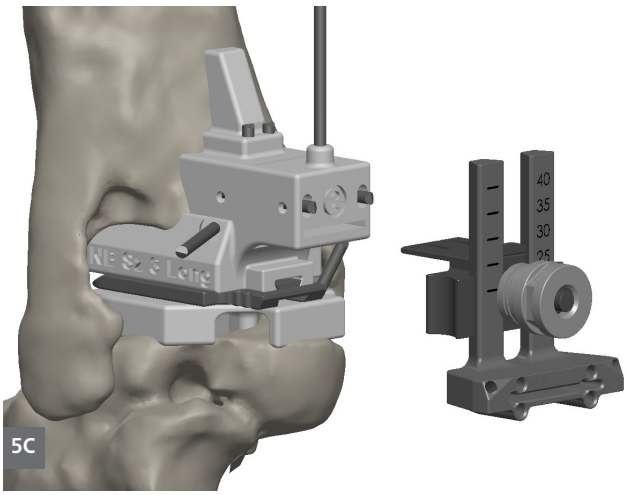


FIGURE 5C. Assembled spacer guides and talus resection guides

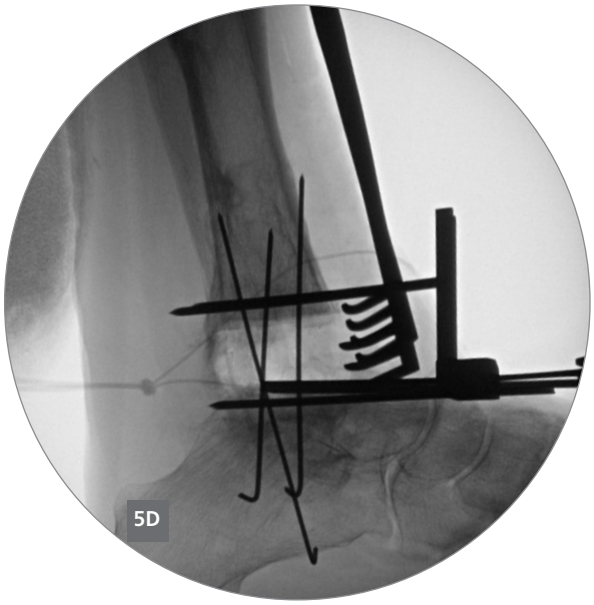


FIGURE 5D. Lateral view after pinning the talus resection guide and removal of the PROPHECY spacer instruments.

The remainder of the case followed the steps of a routine PROPHECY case, but using an INVISION talar construct instead of INBONE (FIGURES 6A-F).

FIGURE 6A. Lateral view after the talus resection.

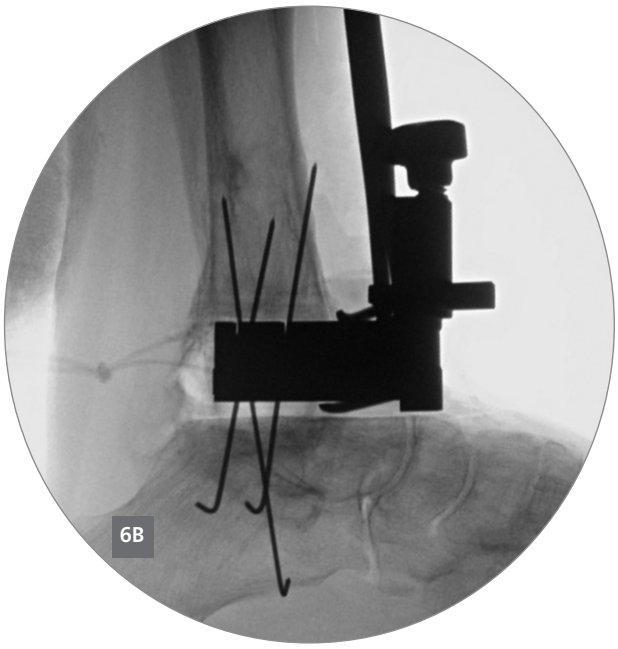


FIGURE 6B. Lateral view of the PROPHECY tibia stem alignment guide in place.

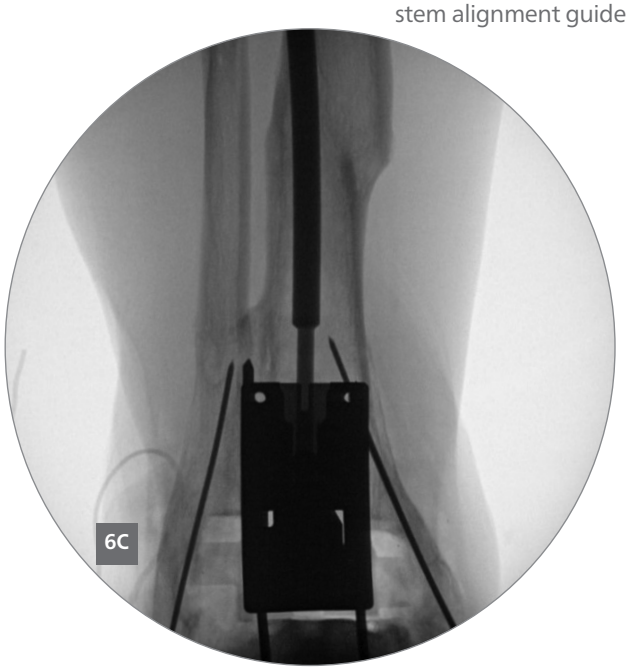


FIGURE 6C. AP view of the PROPHECY tibia stem alignment guide in place.

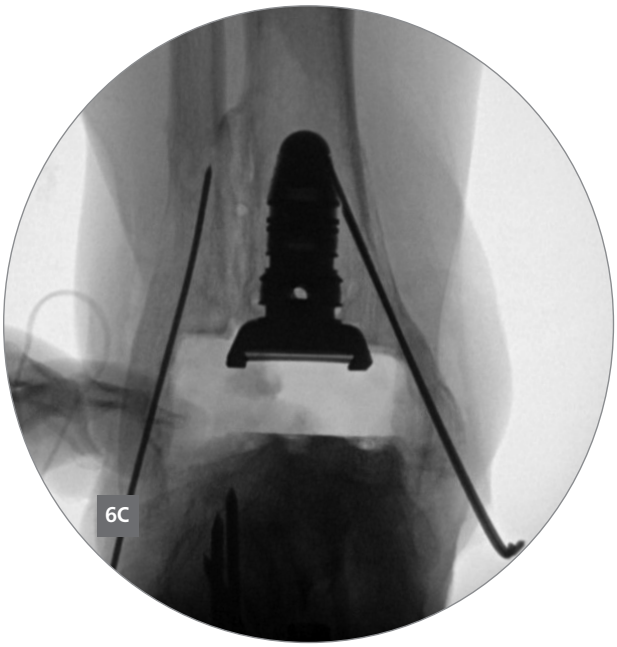


FIGURE 6C. AP view of the revision tibia prosthesis.

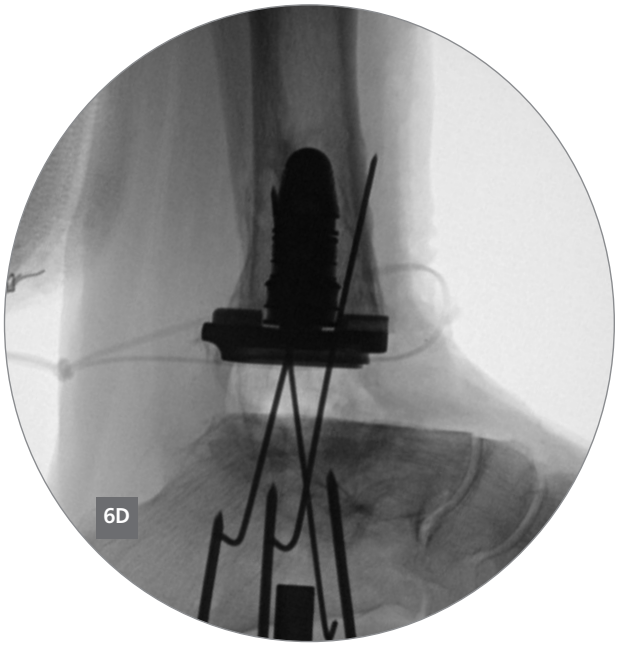


FIGURE 6D. Lateral view of the revision tibial prosthesis (INBONE).

FIGURE 6E. AP view while trialing the INVISION talar plate and dome.

FIGURE 6F. Prepping the talar peg holes through the talar plate trial.

Intraoperative fluoroscopy shows excellent position of the implant with restoration of ankle height and good talar coverage and outstanding range of motion, which was better than preoperative (FIGURES 7A-B). To reduce the risk of postoperative malleolar fracture, cannulated screws were inserted into both malleoli over the existing K-wires (FIGURES 7C-D).

FIGURE 7A. Final INBONE and INVISION components with ankle in dorsiflexion.

FIGURE 7B. Plantarflexion.

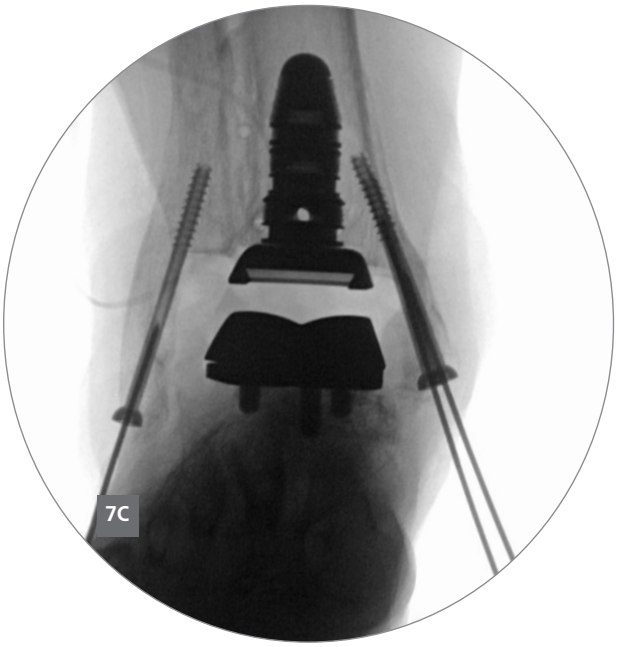


FIGURE 7C. Final intraoperative AP x-ray.

FIGURE 7D. Final lateral intraoperative x-ray.

Postoperative Care* and Follow-up

Immediately postoperative, the patient was placed in a splint and immobilized for the first few days after surgery.

At one week postoperative, the patient began early ROM exercises. Progressive weightbearing was introduced at three weeks postoperative.

At three months postoperative, the implant continues to show good alignment radiographically (FIGURES 8A, B, and C). The patient reports that her pain has improved substantially. She reports that her ankle pain is now less than at any time during the history of the previous implant. Her range of motion has improved to 40° plantarflexion (35° preop) and 10° dorsiflexion (5° preop). She walks without a limp and reports that her life has regained normalcy from pain relief and substantially improved function. To date, her postoperative recovery course has been uneventful.

FIGURE 8. Three month postoperative radiographs: AP (8A), oblique (8B), and lateral (8C). The components continue to show good positioning and maintenance of correction.

** Postoperative care is the responsibility of the individual surgeon.*

Notes

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1023 Cherry Road
Memphis, TN 38117
800 238 7117
901 867 9971
www.wright.com

56 Kingston Road
Staines-upon-Thames
Surrey TW18 4NL
United Kingdom
+44 (0)845 833 4435

161 Rue Lavoisier
38330 Montbonnot Saint Martin
France
+33 (0)4 76 61 35 00

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