

PURPOSE – METHODOLOGY – LITERATURE REVIEW

Ankle fusion procedures are performed to correct severe foot deformity and relieve patient pain, often as a final measure prior to amputation. However, obtaining successful outcomes for diabetic patients can be particularly challenging, as they frequently display poor bone quality and are at increased risk of bone resorption, especially when additional patient co-morbidities are present¹⁻³. In particular, patients with end stage renal disease (ESRD) experience extremely low fusion rates while simultaneously having very high rates of complications in open surgery². Therefore, an alternative treatment option to below knee amputation is needed, as those with ESRD that undergo below knee amputation experience high perioperative mortality, limited restoration of function, and shortened lifespans⁴. Treatments including sustained joint compression are desirable, as compression can promote bone formation and healing⁵⁻⁷. This case study presents a protocol for less invasive percutaneous intramedullary (IM) nailing for diabetic patients with renal co-morbidity utilizing an IM nail providing post-operative sustained compression at the joint (Figure 1).

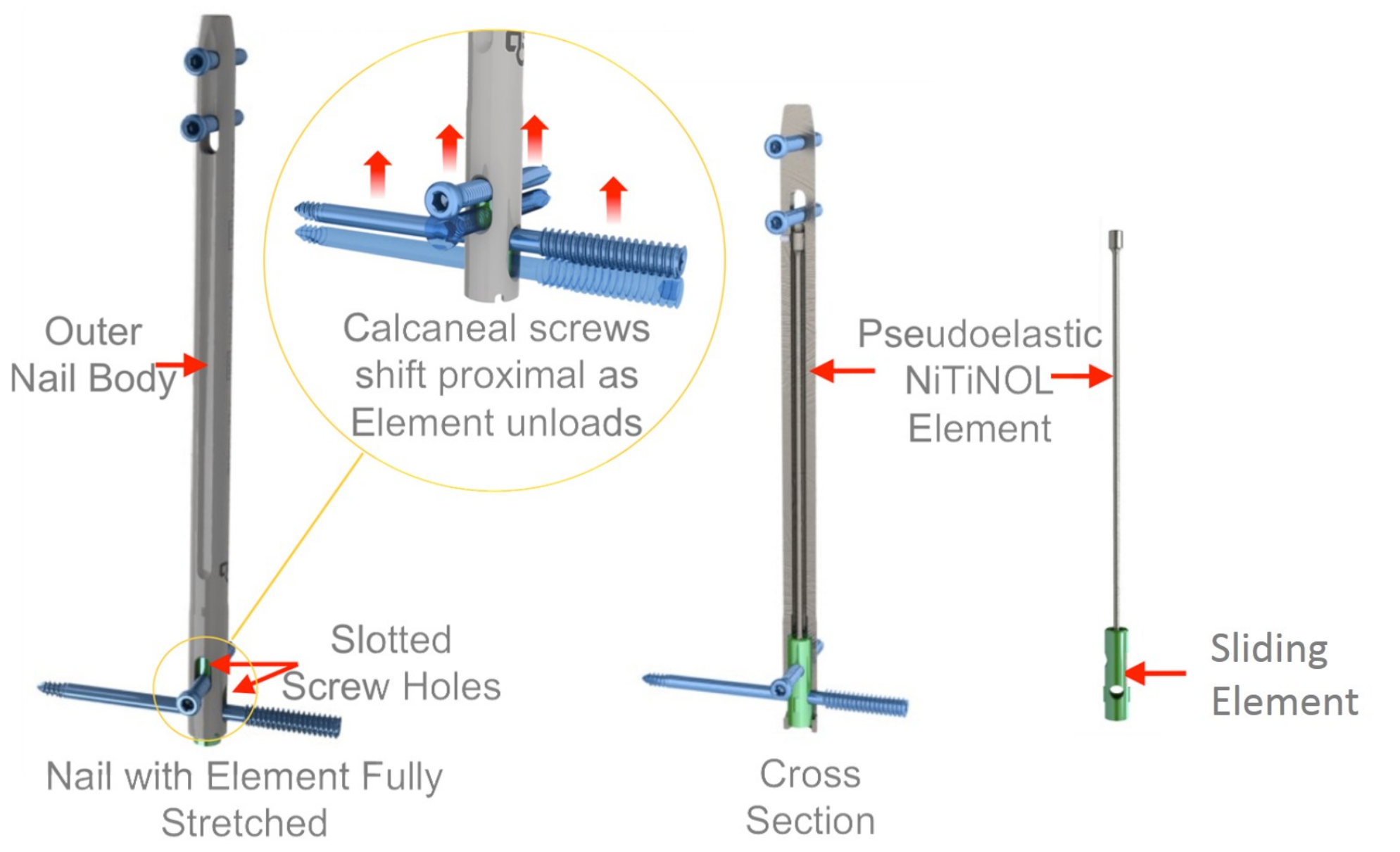


Figure 1. Intramedullary nail featuring internal NiTiNOL compression element

CASE STUDY - PROCEDURE

A case is presented of a diabetic 65-year-old female that experienced a severe right ankle tri-malleolar insufficiency fracture with Pilon features (Figure 2). The case was particularly challenging given that the patient's conditions included status post-renal transplant following end stage renal disease with ten years of hemodialysis, pulmonary artery disease, severe neuropathy, narcotic dependency, and osteopenia secondary to chronic steroid use. The patient underwent a percutaneous ankle IM nailing procedure with no joint preparation, which lasted 42 minutes, and bone quality was noted as poor. The subject 10 mm diameter nail's pseudoelastic internal NiTiNOL compressive element was stretched 3 mm during the procedure. The subject nail has been shown to sustain post-operative compression while also allowing for post-operative quantitative assessment of bone resorption inherent in the healing process^{5,7,8}. A popliteal block with minimal sedation was used, but no tourniquet was utilized nor were graft materials or biologics. No complications were noted.

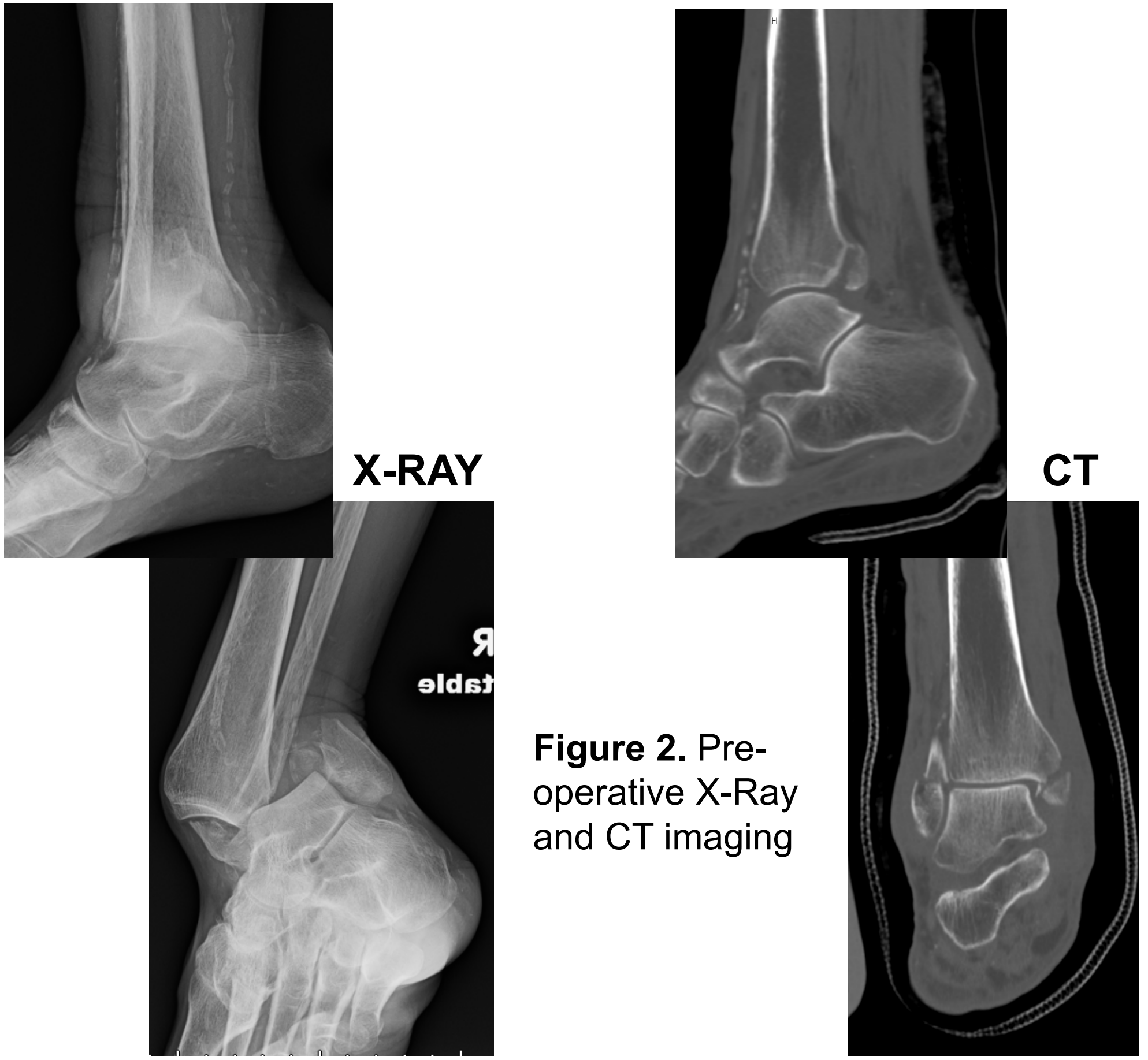


Figure 2. Pre-operative X-Ray and CT imaging

CASE STUDY - RESULTS

The patient utilized minimal pain medications following surgery. Her wounds healed after two weeks, with no swelling. Lateral radiographs were used to track the compressive travel of the nail's pseudoelastic element, and between surgery and six weeks post-op the element recovered 2.9 mm while providing sustained compression (Figure 3A). The patient was weight bearing as tolerated in a CAM boot after eight weeks. The patient then transitioned to diabetic shoes with no brace. Twelve weeks post-op the patient had the medial-lateral screw removed. She experienced bilateral lower extremity revascularization and was off of pain medications and was pain-free at fifteen weeks. The patient resumed weight bearing as tolerated in flats and refuses to wear diabetic shoes, and continues to be seen nearly three years following surgery. She is pleased with her outcome.

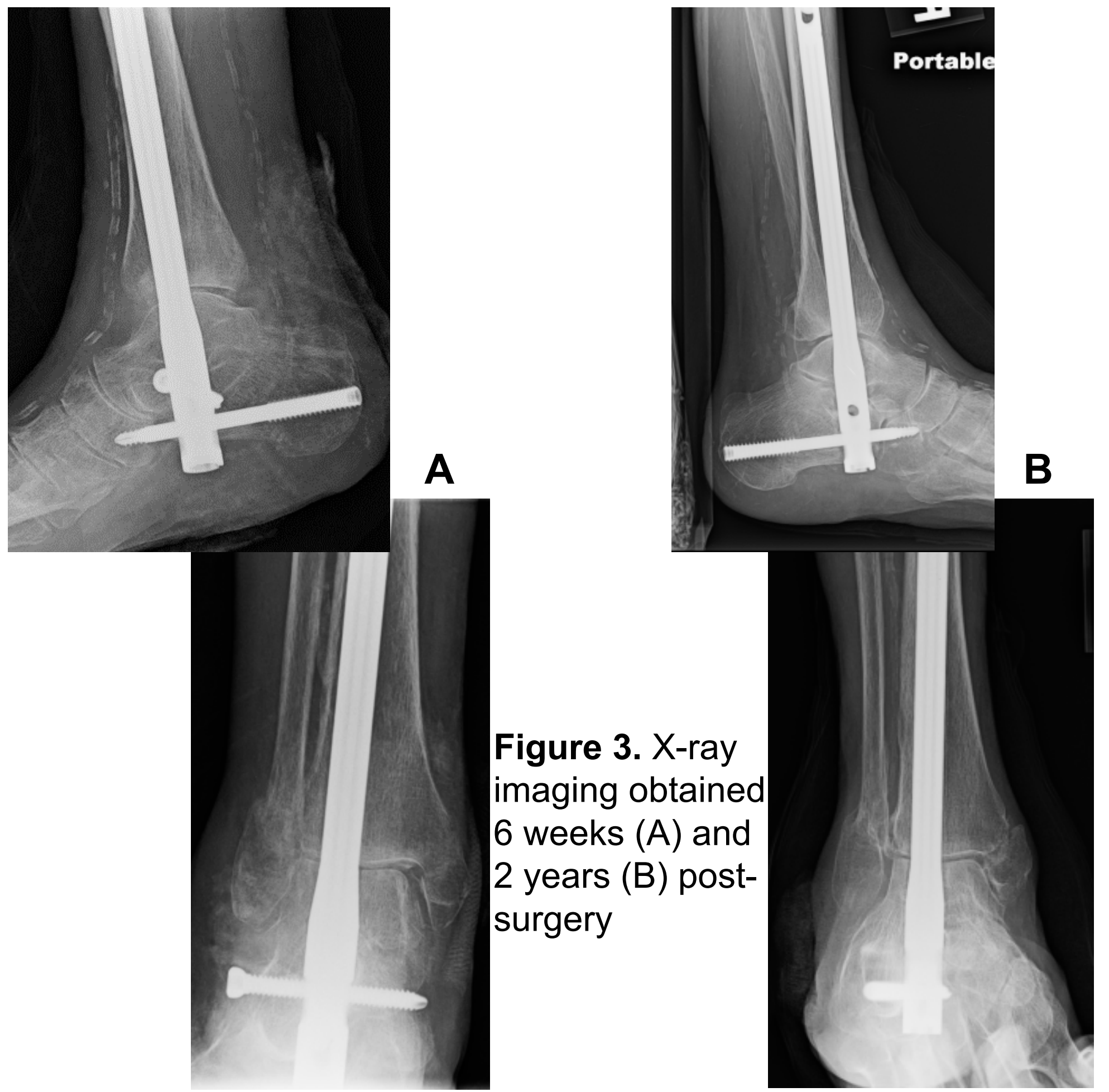


Figure 3. X-ray imaging obtained 6 weeks (A) and 2 years (B) post-surgery

DISCUSSION

Diabetic hindfoot pathology management is challenging given frequent complications and co-morbidities, such as end stage renal disease⁹. In this patient population in particular, below knee amputation or open surgery are not desirable. In parallel, compression has previously been shown to promote the healing response. However, while multiple present-generation IM nails apply internal compression, that compression is not sustained post-operatively, and as such they add limited clinical benefit over previous-generation nails, in particular in the treatment of diabetic patients⁶. In this study, an intramedullary nail providing sustained joint compression, demonstrated as beneficial in diabetic hindfoot procedures, was used^{5,7,8}. The results indicate that use of a pseudoelastic intramedullary nail in high-risk percutaneous ankle procedures in diabetic patients with multiple co-morbidities can result in a successful outcome.

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