



## Case report

# Conversion of failed ankle arthroplasty to an arthrodesis Technique using an arthrodesis nail and a cage filled with morsellized bone graft<sup>☆</sup>

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## ABSTRACT

Arthrodesis of the ankle joint after a failed ankle prosthesis is most often demanding because of bone loss. The bone loss is also responsible for limb length discrepancy. Intramedullary nail fixation has been described to be successful for arthrodesis of the arthritic ankle joint. We report the use of the nail technique in combination with a morsellized bone graft in and around a cage to convert failed ankle prosthesis with bone loss into an arthrodesis. The advantages which were strived for include developing a more practical operative method with lower morbidity (no autograft), early mobilization and weight-bearing provided by the stability of the internal fixation and restoration of limb length.

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## 1. Introduction

Failed ankle prosthesis is a challenging problem for the orthopaedic surgeon. Indications for revision ankle arthroplasty are limited compared with hip and knee arthroplasty. An ankle arthrodesis is the only treatment alternative in most cases. Standard internal fixation with crossing screws used for primary arthrodesis is often mechanically insufficient after removal of an ankle prosthesis due to tibial and talar bone loss [1]. The bone loss is also responsible for limb length discrepancy. Another treatment option is using external fixation with or without bone grafting. However this method is technically demanding and has a high complication rate such as; pin tract infections, pin loosening, non-union and pain. A second drawback is the duration of treatment with several additional operative procedures, which requires considerable patient compliance [2,3].

An ideal ankle arthrodesis after failed ankle arthroplasty would be stable enough to allow early mobilization and weight-bearing and restore limb length without additional operative procedures. The ankle arthrodesis with an intramedullary arthrodesis nail in

combination with a cage filled with and surrounded by morsellized bone graft appears to meet these requirements. This report illustrates our experience using an arthrodesis nail and morsellized allograft in a cage to perform an ankle arthrodesis for salvage of failed ankle prosthesis.

## 2. Patients and methods

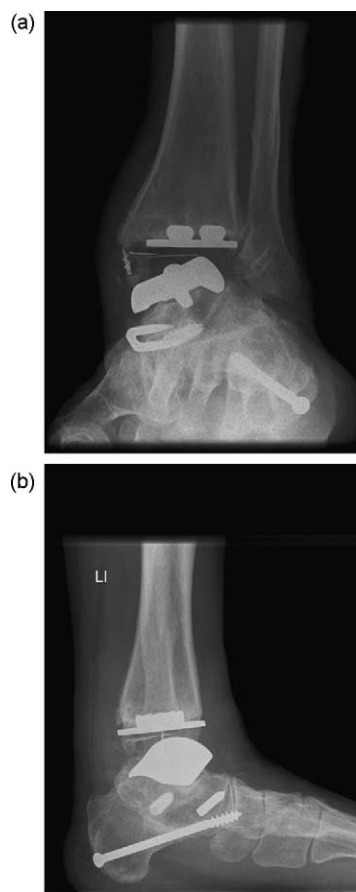
### 2.1. Case 1

A 51-year-old man was treated with a cementless total ankle replacement (STAR; Waldemar Link, Hamburg, Germany) for degenerative osteoarthritis of the left ankle joint. After one year, the patient complained about increasing pain during weight-bearing. A valgus deformity had developed due to instability of the medial supporting structures, which on the hindsight were pre-existent and probably the cause of osteoarthritis. One and a half year after placement of the prosthesis, a medial displacement calcaneal osteotomy was performed in combination with a deltoid repair using a fascia lata strip. There was severe insufficiency of the collateral medial ligaments and absence of the posterior tibial tendon. Two months after the reconstruction during rehabilitation a fracture of the medial malleolus occurred leading to a collapse into valgus (Fig. 1). The fracture of the medial malleolus was provoked by the drill hole in the medial malleolus through which the fascia lata strip was transferred. After this complication it was decided to perform fusion of the ankle.

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**Fig. 1.** (a and b) Plain antero-posterior and lateromedial radiographs of the ankle joint showing the collapse into valgus in case one. The screw used for fixation of the medial displacement osteotomy of the calcaneus, the staple, anchor and interference screw used for the medial collateral ligament reconstruction are visible.

Peri-operative one dose antibiotic prophylaxis with a second-generation cephalosporin was given. The patient was placed into the supine position. A tourniquet was used around the upper leg. The operation was performed through the same anterior incision that was used for the previous ankle arthroplasty. The insert, talar and the tibial component were removed. Removal of the talar component resulted in significant loss of talar bone. Interface specimens were taken for histopathologic investigation. Areas of sclerotic bone at the talus and the tibia were removed using an oscillating saw and thereby creating two new vital horizontal planes. The osteotomy planes of the talus and tibia were additional vitalized with a bone pick. On the tibial site only a few mm of bone was lost. In order to properly fill the gap between tibia and talus a distance of 2.5 cm had to be overcome. A cage (Synmesh, Synthes, Philadelphia, PA, USA) was cut to a 2.5 cm height. The oval cage had a diameter of 22 mm/28 mm. In the cage 2 endorings were mounted. The endorings were mounted with a distance of 3 mm to the end of the cage. This allowed the cage to sink into the host bone till the endorings made contact with host bone. This was done to increase stability and load the bone graft in the cage. The cage was filled with impacted morsellized bone. The morsellized bone was obtained from a femoral head allograft that was undone from cartilage and processed in a bone mill producing chips with a size of 3 mm. With the cage positioned between the two planes the alignment of the foot in relation to the lower leg was checked. Adjustment of the saw cuts was made to secure a correct plantigrade position of the foot. Thereafter, a 2 mm guide wire was drilled from the centre of the cage on the plantar plane in the

distal direction through the hind foot in as much alignment with the future position of the nail as possible. Then the filled cage was interpositioned between talus and tibia and the guide wire was drilled centrally through the cage and into the tibia. A central hole drilled in advance through the morsellized bone in the cage might be helpful. The screws with which the endorings were fixed were found to be too long for the nail to pass through the cage and thus were slightly redrawn. After the correct position of the cage, the guide wire and the alignment were obtained and checked using the image intensifier, a flexible drill was used for over reaming of the guide wire to 12.5-mm. An arthrodesis nail (arthrodesis nail, 5-hole, 12-mm × 18-cm; Biomet, Warsaw, IN, USA) was introduced. Proximal locking was performed with two 30-mm cortical screws using the target device. Compression on the defect site was generated using a compression bold on the plantar site of the calcaneus. The cage sunk into the bone of talus and tibia till the bone made contact to the endorings preventing further migration. Distal locking with one 50-mm screw was performed from posterior into the calcaneus. The defect around the cage was subsequently filled with morsellized graft. Subcutaneous and skin suture were performed using monofilament suture material. Postoperative a short leg plaster was applied. The first 4 weeks weight-bearing was prohibited. Wound healing was uncomplicated. After 4 weeks a walking cast was applied for a following 4 weeks allowing partial weight-bearing on the heel followed by a period of 4 weeks full weight-bearing. After removal of the walking cast the ankle was slightly painful during full weight-bearing and thus a cast was applied for another 4 weeks. The ankle remained painful. CT-scanning demonstrated a non-union and lack of morsellized graft posterior to the cage. Dynamizing the nail by removing the two proximal screws did not result in union, however, the distal locking screw through the calcaneus broke. At 6 months a grafting procedure was performed with additional stabilization using an external frame. After 8 weeks union was achieved and the external fixator was removed (Fig. 2). Although CT-scanning now confirms solid union, unfortunately the patient experiences a continuous (potentially neuropathic) pain in the whole hind foot ever since the last bone grafting procedure. At 12 months clinical follow-up the patient has returned to all-day activities. There is no need for correction of limb length discrepancy.

## 2.2. Case 2

A 75-year-old lady was treated with a cementless Total Ankle Replacement (STAR, Waldemar Link, Hamburg, Germany) for osteoarthritis secondary to rheumatoid arthritis of her left ankle joint. After 2 years a progressive collapse of the talus was observed leading to instability of the prosthesis (Fig. 3). Five years after the index operation and failure of conservative treatment the ankle prosthesis was removed. The body of the talus appeared to be completely necrotic and was resected. The 5 cm bone defect was reconstructed with a cage (Synmesh, Synthes, Philadelphia, PA, USA) with a 22 mm/28 mm diameter and was cut to a 3.5 cm height filled with morsellized allograft. This time shorter screws were used to fix the endorings. The cage rested on the distal tibia plafond, which was vital due to a new horizontal osteotomy plane. The osteotomy plane was additional vitalized with a bone pick. On the tibial side only a few mm of bone was lost. The cartilage of the subtalar joint on the calcaneal site was removed with an osteotome resulting in a horizontal plane with bleeding bone. A 2-mm guide wire was introduced in the same manner as described above (Case 1) through calcaneus, cage and distal tibia. After the correct position central in the cage and ankle was obtained using the image intensifier, a flexible drill was used for over reaming of the guide wire to 12.5-mm. The arthrodesis nail (arthrodesis nail,

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