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Technical Tips

# Tibiotalocalcaneal arthrodesis with femoral head allograft, external fixator provisional compression, and locking plate fixation after failed total ankle arthroplasty

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## Abstract

The number of total ankle arthroplasties has increased in recent years with the improvement of implants and advanced attempts to maintain ankle movement. However, this technique presents complications, such as aseptic loosening and infection, requiring revision surgery. In this scenario, conversion by tibiotalar or tibiotalocalcaneal arthrodesis is highly accepted and can be performed with external fixators, intramedullary rods, screws, or locking plates. This article shows the resolution of a case of aseptic loosening tibiotalocalcaneal arthrodesis fixed with a locking plate associated with bone allograft.

**Level of Evidence V; Therapeutic Studies; Expert Opinion.**

**Keywords:** Ankle joint; Arthrodesis; Arthroplasty, replacement, ankle; Femur head.

## Introduction

Advanced osteoarthrosis is a common cause of pain in the ankle, often due to sequelae of trauma. Arthrodesis is the most established and performed treatment for this pathology, but improving techniques and implants, in addition to the greater concern for maintaining ankle movement, have made total ankle arthroplasty (TAA) a useful choice in treating ankle arthrosis[1-8]. The success of this procedure depends on selecting adequate patients with good soft tissue conditions and mild or moderate deformities[2,4,5].

However, the failure rate of this technique remains high compared to tibiotalar arthrodesis (TA) and arthroplasties of other joints[8,9]. The main causes of failure are aseptic loosening, infection, and misalignment[2-4,6,7,9-11]. In such cases, the physician has three options: revision to implant another prosthesis, conversion to arthrodesis, and, in extreme cases, amputation[2,3,6,10,12]. This decision considers the possibility of infection and bone loss in removing components, so many physicians prefer to convert the procedure to arthrodesis[1,3,4,6,9].

When opting for an arthrodesis, ideally should go for TA, keeping intact the subtalar complex. However, in some cases, a great bone defect in the talus leads to unstable fixation. In these cases, a tibiotalocalcaneal arthrodesis (TTC) might present some advantages, helping to promote a more stable arthrodesis with a better chance of consolidation[1,2,6,8]. Literature shows several techniques for this conversion using

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external fixators, screws, intramedullary nails, or plates[1,3,6,9]. In addition, to compensate for the bone loss, many authors recommend using iliac autograft or bone allograft, usually the femur head[1,3,4,9].

This article presents a technical tip for converting from TAA with aseptic loosening and severe bone loss at the talus to a TTC using an external fixation compression fixed with a locking plate associated with bone allograft.

## Technical tip description

The studied patient is a 68-year-old male professional soccer player between the 1970s and 1980s in Brazil. During this time, he has presented a history of repetitive right ankle sprains. He was diagnosed with chronic instability and ankle osteoarthritis, complaining of pain for ten years (Figure 1A-C).

The patient had been attended by several foot and ankle specialists who tried conservative treatment options (physiotherapy, change of footwear, and visco-supplementation) without success. Then, the patient opted for surgical treatment with TAA of the right ankle with the Zennith implant (Corin Group, United Kingdom) performed by another surgical team (Figure 2A-B).

However, after a postoperative period of four months, the patient's ankle region pain persisted and worsened over time. The pain location was the lateral part of the ankle, and 26 months after TAA, a toilet procedure on the lateral part was performed to improve pain (Figure 2C-D).

In the following months, the patient presented with pain in the medial side of the ankle, being submitted to a medial toilet procedure 38 months after the first surgery. Nevertheless, he was still in pain (Figure 2E-F).

After all these procedures, the patient presented good alignment of the ankle but a high level of pain with mobilization, which is why he sought our care. Radiographs were performed and showed aseptic loosening of the tibial component (Figure 2G-H). He also underwent a computed tomography scan (CT) of the affected limb (right ankle) of both tibial and talar components associated with bone stock loss in the talus near the posterior subtalar joint. A PET/CT and SPECT/CT confirmed the loosening and local overload (Figure 3A-H).

A TAA revision to TTC using a femoral head allograft was performed in common agreement. The previous anterior ankle 12 cm incision was used to access the tibiotalar joint and verify the loosening of the tibial component with metallosis in the region (Figure 4A-B). Debridement of metal debris was performed, and devitalized bone parts were removed (Figure 4C-F). Then, the femur head allograft was cut, modeled, and perforated to fill the tibiotalar joint failure gap (Figure 5A-E). Subsequently, we performed a lateral 3 cm incision to access the subtalar joint and prepare the joint for fusion.

Provisional positioning and compression of the joints were performed with a modular external fixator type AO, then the alignment was checked clinically and radioscopically. Once the allograft position and the ankle and hindfoot alignment were correct, we performed a definitive fixation with an


**Figure 1.** Initial ankle radiograph before total ankle arthroplasty. A) Anteroposterior (AP) view. B) Lateral view. C) Salzmann view.

anterior locking dynamic compression plate and screws (Wright Medical Group N.V. or its affiliates, Memphis, TE, USA).

The plate was positioned in the anterior ankle face, with neutralizing function, as the external fixator assured the compression. The posterior subtalar arthrodesis was additionally compressed with two traction screws, and the external fixator was removed (Figure 6A-E).

After subcutaneous and skin closure, the patient's ankle was immobilized in a below-knee splint. Solid clinical and radiographic signs of consolidation could be seen within 12 weeks of the procedure.

## Discussion

Increased use of TAA will lead to an increase in cases requiring revisions. For this reason, several techniques and flowcharts have been described to deal with these issues[1-4,7-9].

The diagnosis of loosening ankle arthroplasty is associated with persistent pain complaints after surgery. The investigation begins with laboratory infection tests and ankle radiographs in anteroposterior incidences, mortise, and lateral view, being supplemented by CT[4,9,11]. With these tests, it can be defined whether the patient presents an aseptic loosening or an infection, besides allowing prediction of the patient's bone loss.

Most of the literature indicates the TAA revision to arthrodesis when significant bone loosening is associated with a bad outcome predictor. When the bone loosening is related to severely compromised talus, the literature suggests TTC arthrodesis since it will not have enough bone to stabilize only with the TA[1]. Egglestone et al.[2] showed a better rate of a union in TTC and TC than in TA, and some TA needed to be converted to TTC revision, with all the patient that underwent conversion to TTC leading to a symptom-free

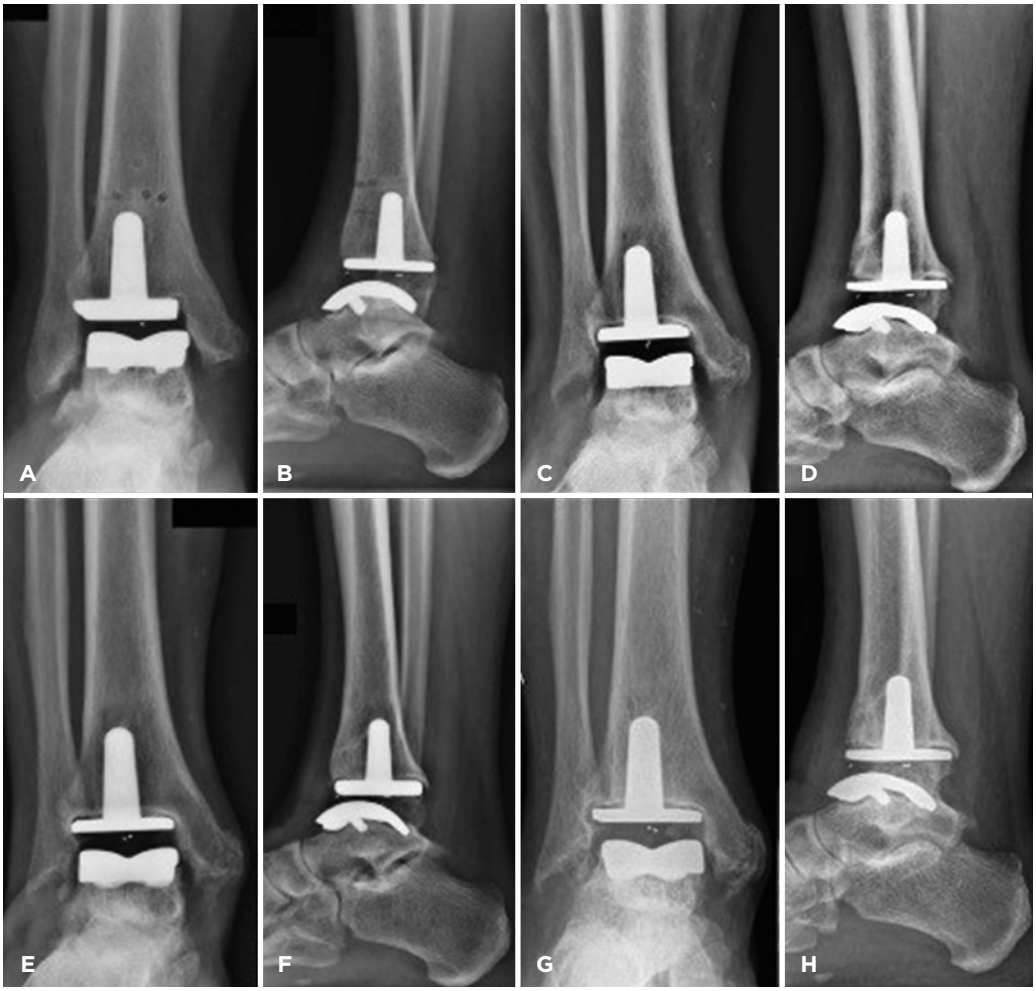


**Figure 2.** A) Immediate (i) postoperative (PO) AP radiograph of the ankle. B) iPO lateral radiograph of the ankle. C) PO ankle radiograph at 26 months, after medial procedure, AP view. D) PO ankle radiograph at 26 months, after medial procedure, lateral view. E) PO ankle radiograph at 38 months, after lateral procedure, AP view. F) PO ankle radiograph at 38 months, after lateral procedure, lateral view. G) Ankle AP radiograph with loosening. H) Ankle lateral radiograph with loosening.

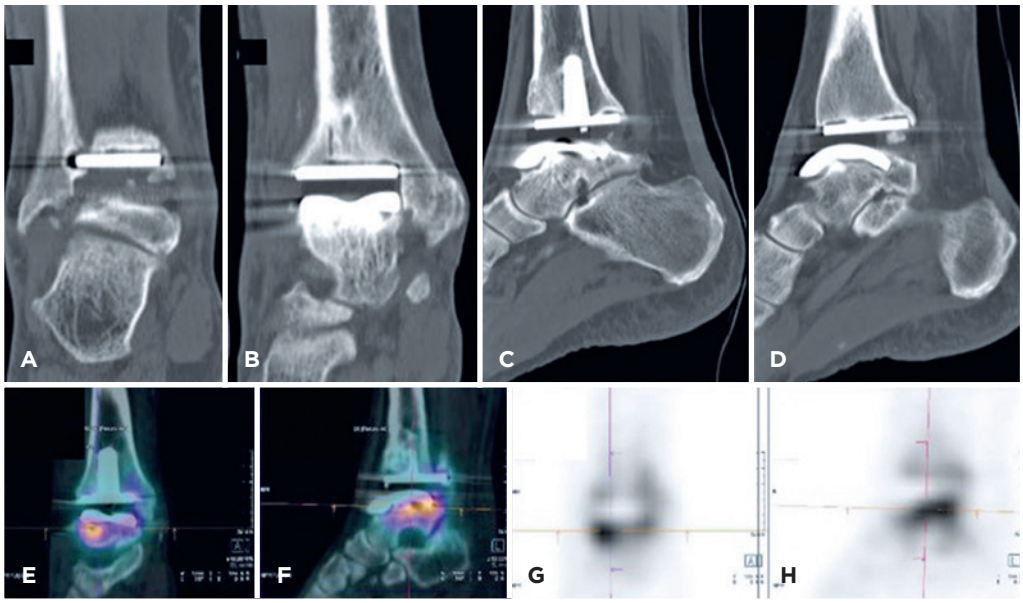


**Figure 3.** Preoperative revision surgery supplementary examinations. A-B) Coronal section CT. C-D) Sagittal section CT. E-F) PET/CT. G-H) SPECT/CT.


**Figure 4.** A) Anterior incision. B) Local tissue with metallosis. C-D) Component loosening. E) Broken prosthesis components. F) Debridement.

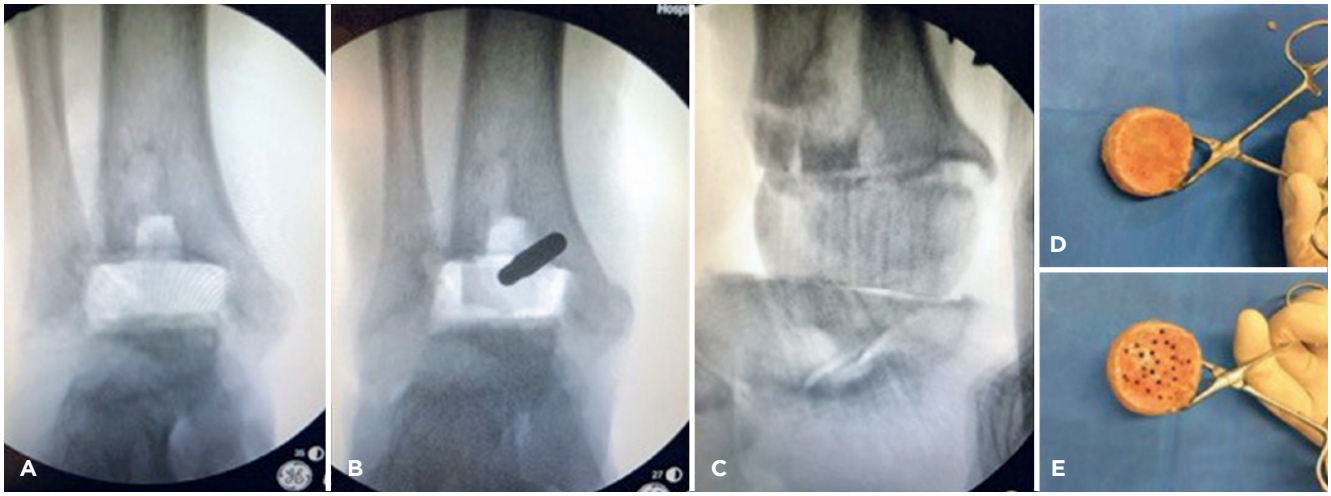


**Figure 5.** A) Fluoroscopy after the debridement. B) Proof test fluoroscopy. C) Femur head allograft fluoroscopy. D) Femur head allograft. E) Femur head allograft after perforation.

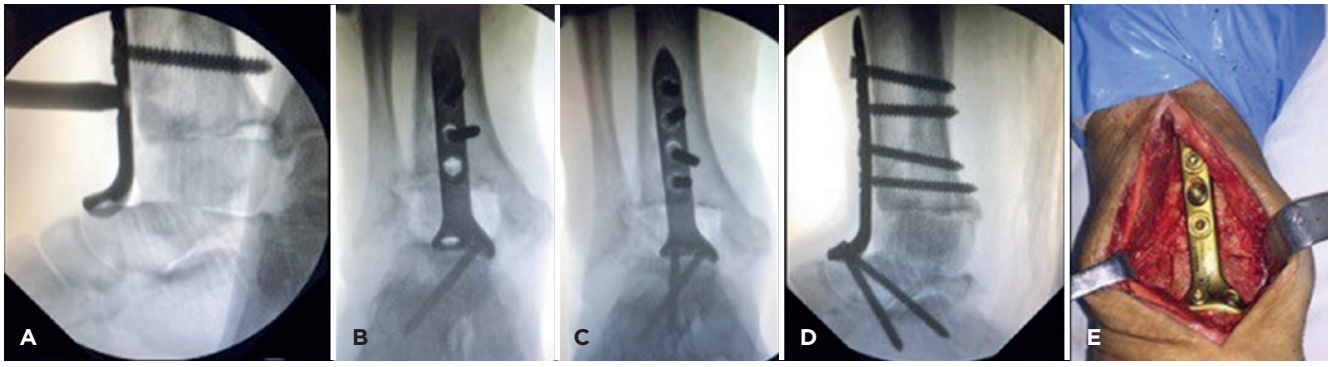


**Figure 6.** A-B) Initial fixation of the arthrodesis fluoroscopy. C-D) Final fixation of the arthrodesis fluoroscopy. E) Final fixation.

clinic union, while 50% of the patients that opted for a TA had a failed arthrodesis.

Wagener et al.[13] described using a custom-made total ankle as a revision instead of a standard one. They showed a case series of 11 patients with 6.9 years of follow-up with a good outcome, improving the AOFAS and VAS scores. However, only this paper discusses this possibility and the high cost of a costume-made device.

It is common to use a femoral head bone allograft to solve the problem of bone failure and the shortening that most of these patients end up presenting[7,8]. This kind of graft offers some advantages because it is spherical, with a great bone volume, allowing good bone contact area and easy foot positioning after modeling with a saw or an osteotomy[3,8]. Allograft use is associated with lower consolidation rates, so it is recommended when more than 2 cm shortening is expected[6,7,9].

In case of revision to arthrodesis, several options for implants, such as external fixators, intramedullary nails, screws, and locking plates, could be used alone or combined. In a systematic review, Gross et al.[6] verified that the best consolidation rate was obtained using plates, while a rod with a metal cage presented the lowest consolidation rate.

This case had a large gap due to the talar body bone loss. We opted to do the compression with an external fixator because it allowed a good compression of the tibia, allograft, talus, and calcaneus extrinsically with a provisional external fixation. Thus, we did not need to pass several screws through the talus and the graft to do the compression, an advantage considering the bone stock loss the patient already had. Also, not all plates can do axial compression through it.

## Conclusion

Ankle arthroplasty failure creates several challenges for the ankle surgeon. One of the main challenges is bone failure due to prosthesis placement. A bone graft can help fill this

defect without major shortening and maintaining good bone contact. In addition, using an external fixator allows for robust compression between the fragments without relying on plates with specific systems. It enables fewer screws for final fixation without compromising the talus, which already has a low bone stock.

**Authors' contributions:** Each author contributed individually and significantly to the development of this article: DLR *(https://orcid.org/0000-0003-0183-8641) Conceived and planned the activities that led to the study, performed the surgeries and bibliographic review.; RM *(https://orcid.org/0000-0002-5025-4338) Statistical analysis, interpreted the results of the studies and data collection; RBS *(https://orcid.org/0000-0003-1085-09117) Performed the surgeries, participated in the review process and formatting of the article; ALGS *(https://orcid.org/0000-0002-6672-1879) Clinical examination, interpreted the results of the study and approved the final version; TDF *(https://orcid.org/0000-0002-9687-7143) Performed the surgeries, clinical examination, and formatting of the article.All authors read and approved the final manuscript.*ORCID (Open Researcher and Contributor ID).

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