37 Lateral Malleolus Ankle Failed Fixation

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History of Previous Primary Failed Treatment

This is the case of a 36-year-old male, with unremarkable past medical history, who sustained an inversion injury of his left ankle whilst playing football. Subsequently, he was unable to bear weight through his left foot and he was taken to the local hospital. On examination, his left lower extremity was neurovascularly intact, but it was severely swollen around the ankle. The radiographic investigation demonstrated a left distal fibula Weber B fracture with a posterior and lateral shift of the talus creating a remarkable medial space opening (Fig. 37.1). He was manipulated under sedation; an acceptable ankle position was achieved, and he was placed in a below the knee backslab (Fig. 37.2).

Two days later, the repeat X-ray showed that the initially acceptable position was lost in the plaster of Paris (Fig. 37.3). A decision was made for provisional closed reduction and stabilisation with an external fixator, considering the severe soft tissue swelling (Fig. 37.4).

Eleven days post-injury, the local soft tissue condition settled, and the patient was taken to the operating room for definite fixation. After administration of prophylactic antibiotics and external fixator removal, the tourniquet was inflated up to 300 mgHg, and open reduction and internal fixation, with one interfragmentary 3.5 mm screw and a 12-hole stainless steel 1/3 tubular plate, was performed (Fig. 37.5). The syndesmosis was checked with the Cotton test [1] under image intensifier and was found stable. Immediately postoperatively, the ankle was immobilised in a below knee backslab.

The patient was discharged home and advised not to weight bear until seen in the outpatient clinic. He was prescribed 4.500 IU of tinzaparin for thromboprophylaxis for a period of 4 weeks.

A week later he was seen in the clinic for a wound check and X-rays of the left ankle which demonstrated failure of fixation with lateral shift of the talus and medial space opening (Fig. 37.6).

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P. V. Giannoudis, P. Tornetta III (eds.), *Failed Fracture Fixation*,
https://doi.org/10.1007/978-3-031-39692-2_37

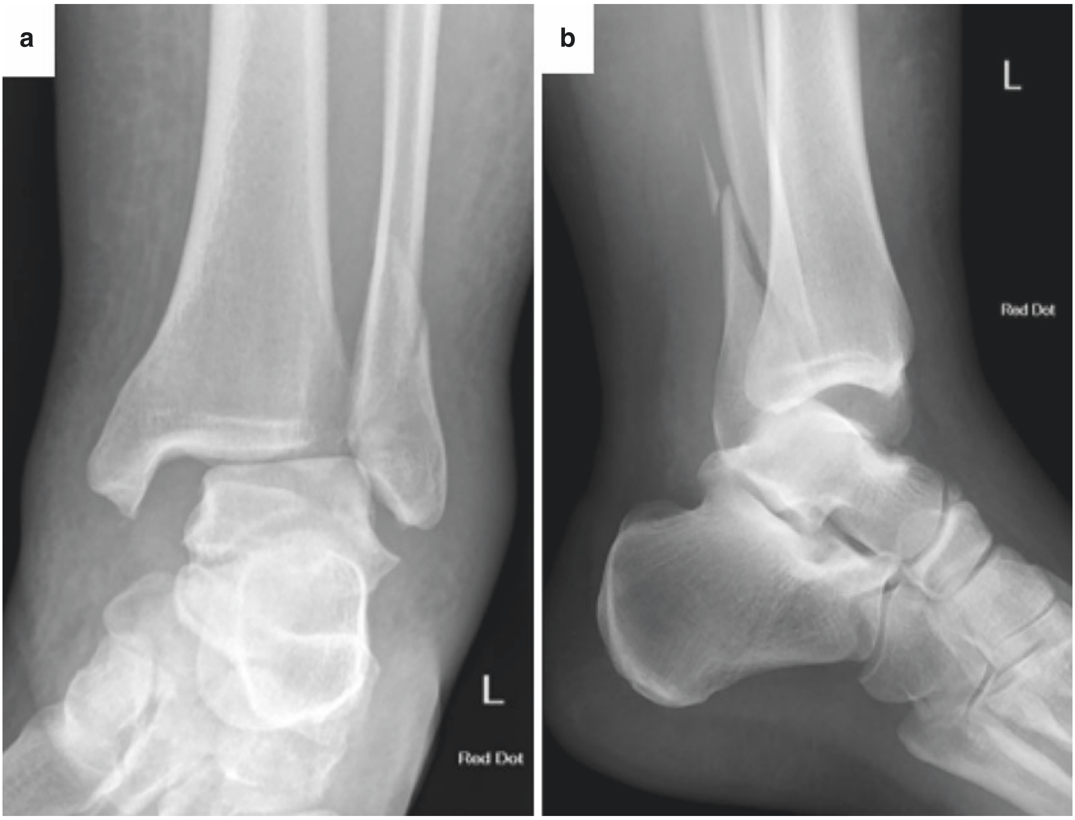

Fig. 37.1 (**a**) Anteroposterior (AP) and (**b**): lateral left ankle radiographs, demonstrating the fracture pattern and the subluxation of the ankle joint laterally and posteriorly. The significant soft tissue swelling should be noted

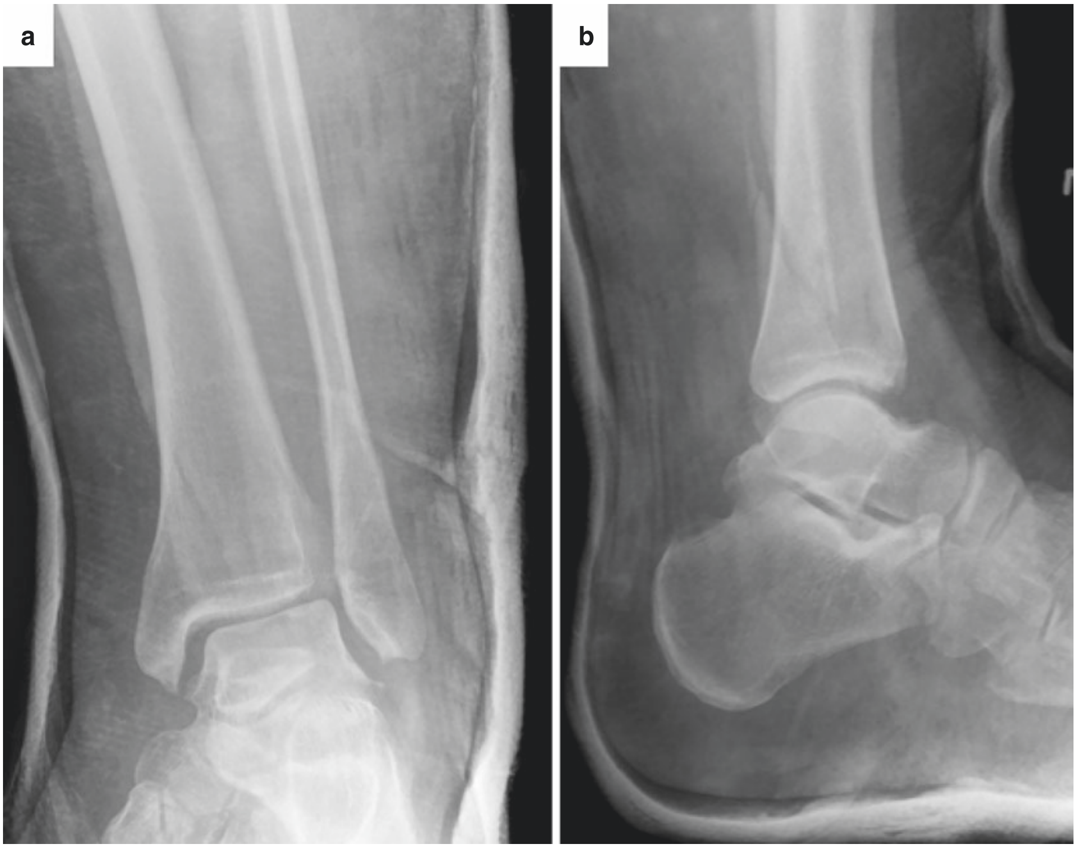

Fig. 37.2 (**a**): AP and (**b**): lateral radiographs of the left ankle after closed reduction attempt. This position was accepted to give time to the soft tissues to settle in a plaster of Paris (back slab)

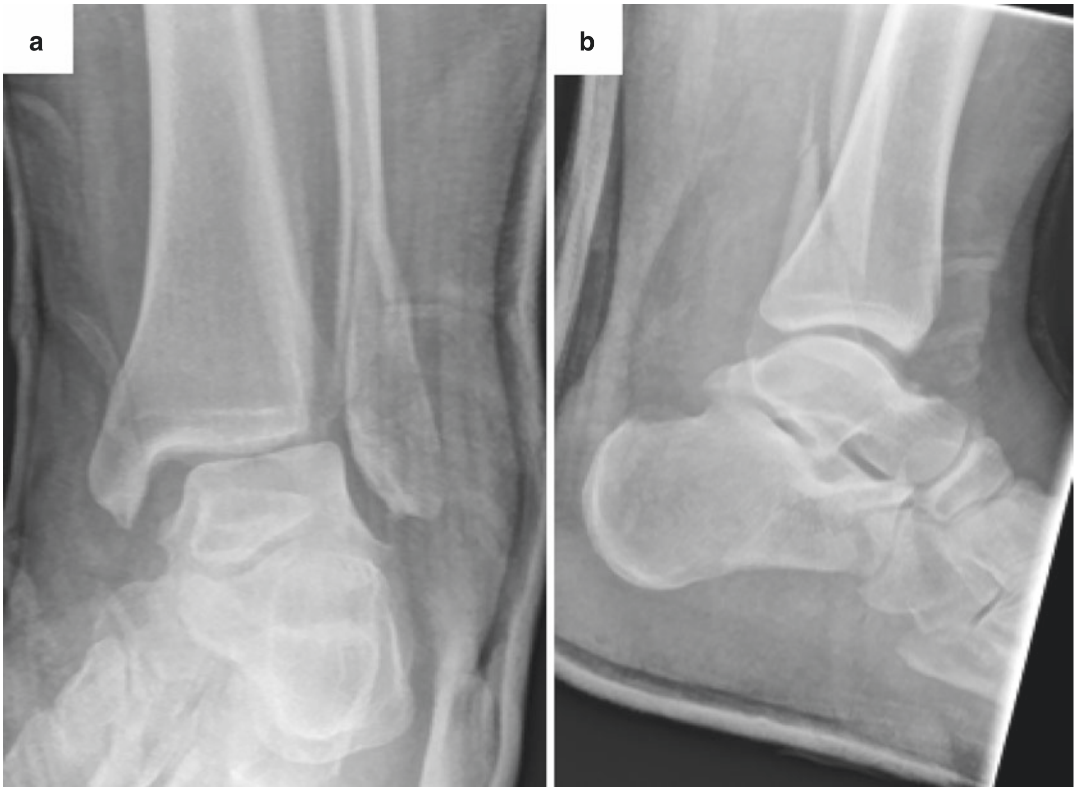

Fig. 37.3 1: AP and 2: lateral radiographs of the left ankle showing the subluxation of the ankle. The talus is shifted laterally

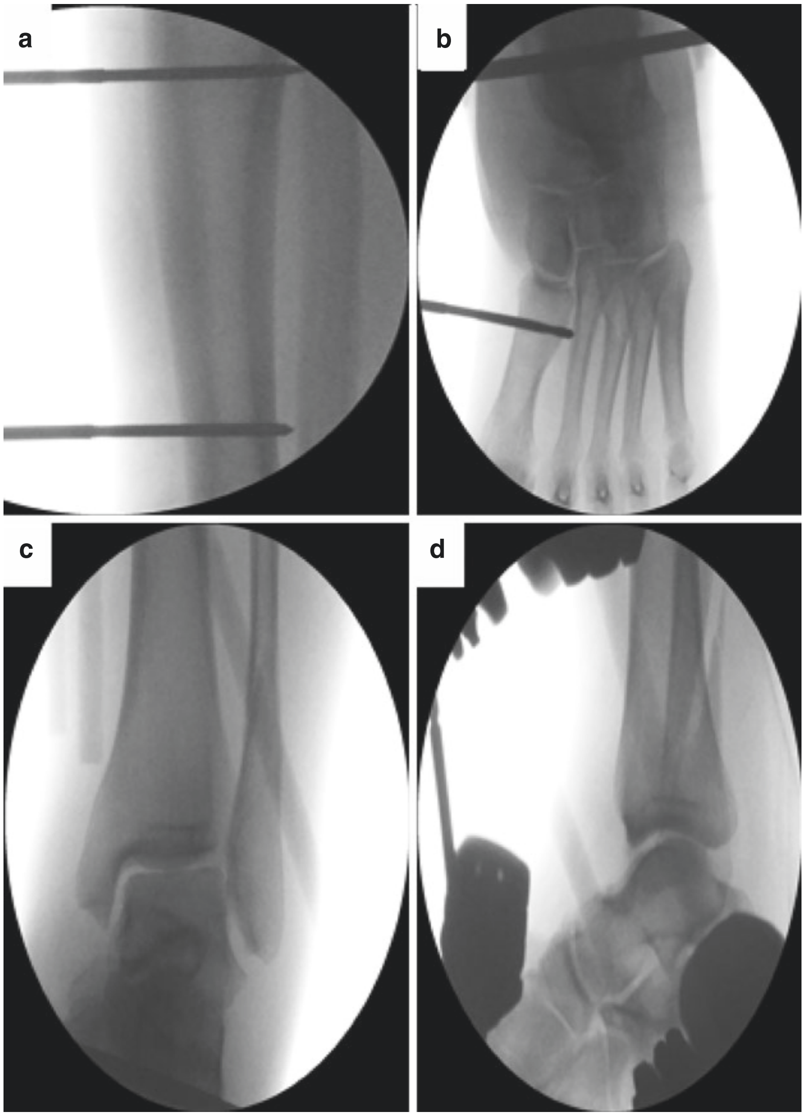

Fig. 37.4 Intraoperative radiographs. (**a**, **b**): Tibial, calcaneal and metatarsal pins positioning is demonstrated. (**c**, **d**): AP and lateral radiographs of the ankle after external fixator application, showing the acceptable joint position

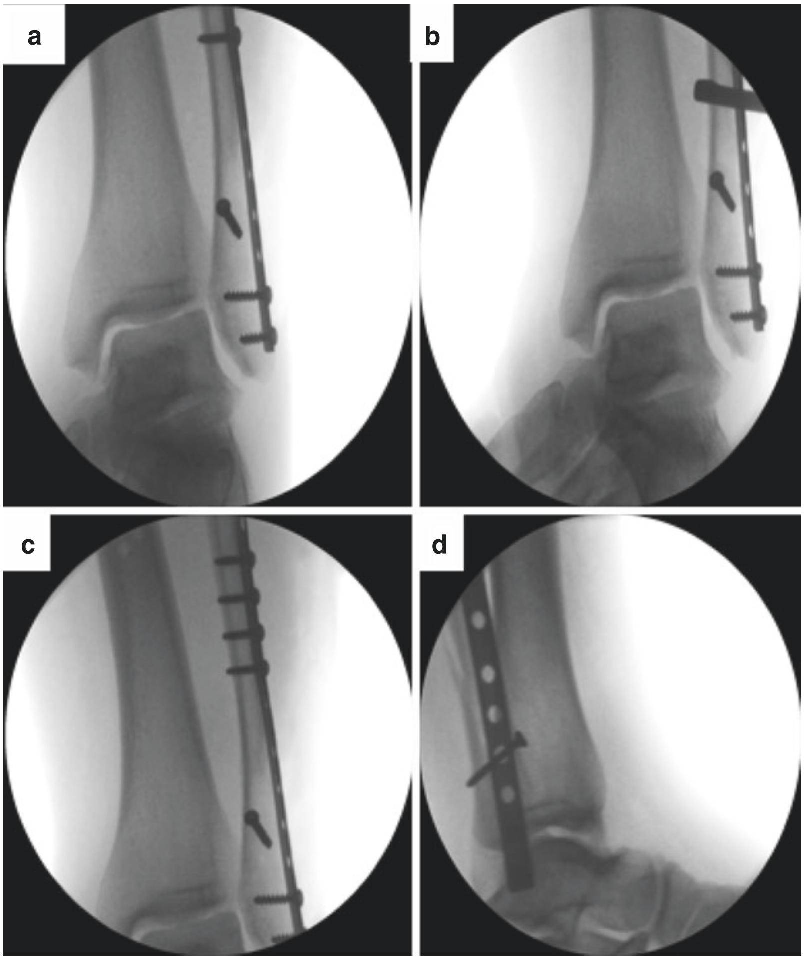

Fig. 37.5 Intraoperative radiographs. (**a**): Mortise views of the ankle under no stress. (**b**): Mortise view of the ankle applying the Cotton test. (**c**, **d**): AP and lateral radiographs of the ankle showing the reduction and stabilisation of the ankle with interfragmentary screw and 1/3 tubular plate

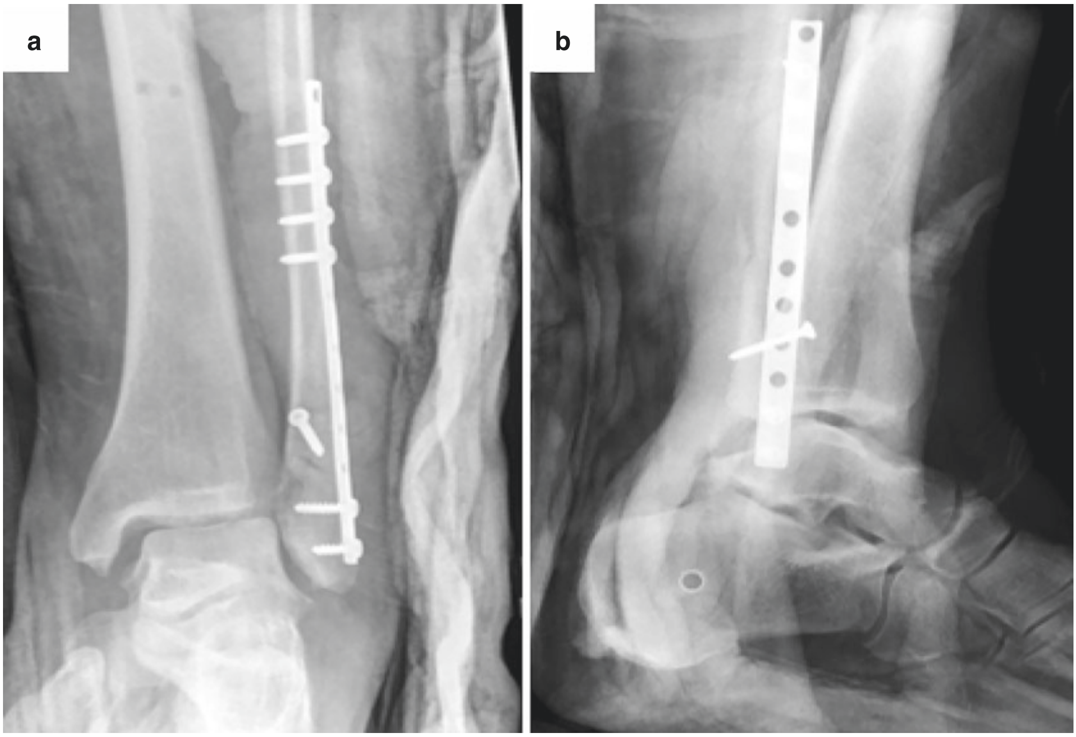

Fig. 37.6 (**a**): AP and (**b**): Lateral weight-bearing left ankle radiographs demonstrating the lateral shift of the talus and the subsequent medial space opening in the backslab

Evaluation of Aetiology of Failure of Fixation

Supination-external rotation ankle fractures are associated with a fibular fracture at the level of the joint and are also classified as Weber B. In such cases, following the biomechanics of the applied forces, significant syndesmotic disruption is not to be expected, based on the presumed integrity of the distal interosseous membrane.

The criteria for acceptable reduction of an ankle fracture on plain radiographs include articular step-off <2 mm, displacement <2 mm, medial clear space <4 mm, ball-shaped dime sign, tibiofibular overlap >5 mm on anteroposterior view, no talar shift and congruency of the ankle mortise [2–5]. These criteria were fulfilled intraoperatively, so no need for further intervention occurred at the first instance. However, plain radiographs have several limitations and lack the desired efficacy to diagnose malreduction of the fracture or malpositioning of the implant. One of these main limitations is the inability to acquire axial views and subsequently investigate any syndesmosis diastasis or subluxation [6]. According to some authors, plain radiography only reliably predicted widening at >4 mm of diastasis [7]. Moreover, measurement of medial clear space may be affected by the degree of axial rotation of the limb, image magnification, and ankle plantar flexion [8–10].

There are many tests and techniques to assess the syndesmosis intraoperatively and postoperatively: squeeze test, Cotton test, stress test, biomechanical criteria (fracture pattern), comparison with contralateral side, CT, MRI and arthroscopy [1, 11–16]. In this case, the Cotton test was utilised. However, the distal fixation of the fibula was deemed to be inadequate as there were only two screws which were rather short in length (suboptimal fixation).

Finally, it should be noted that Nielson et al. [14] found that only 42% of the unstable syndesmoses in their study were recognised intraoperatively.

Clinical Examination

Following the diagnosis of failed fixation, the patient was referred to our reconstruction unit for further management. On examination 10 days following initial fixation, the lateral malleolar wound was found to be clean, with no evidence of erythema or discharge.

There was some residual swelling over the medial malleolus. There was no distal neurovascular deficit. The function of the common and superficial peroneal nerve was intact.

Ankle movements of plantar flexion and dorsiflexion were associated with marked irritability and expressed discomfort.

Diagnostic-Biomechanical and Radiological Investigations

In this case, postoperative weight-bearing radiographs in the backslab indicated incomplete fracture fixation with syndesmosis diastasis, lateral shift of the talus and subsequent medial space opening, as shown in Fig. 37.6. Despite the clinical picture of an almost healed wound, performing baseline biochemical investigations to screen for infection is good practice (FBC, CRP, ESR). The results obtained can be considered as baseline results in case there will be issues with infection at a later stage.

The degree of malreduction and extent of syndesmosis injury can be further evaluated by the acquisition of a CT scan.

Preoperative Planning

The steps of the revision surgery consist of:

(a) Removal of the previous implant and insertion of a new implant for fixation.
(b) Confirmation of accurate distal fibula reduction.
(c) Investigation of gripping strength of the distal fragment screws.
(d) Supplementary syndesmotic screw fixation.

Implants Required:
- Small fragment set.
- ALPS distal fibula anatomical plate (Zimmer Biomet).

Revision Surgery

The previous incision was utilised, and the implant was approached through careful dissection. The reduction of the fracture with the interfragmentary screw was not anatomical as it was fixed in external rotation (fibular length was not accurate); moreover, one of the distal screws was loose with inadequate bone purchase (screw length was inaccurate). The plate and the lag screw were removed. The fibula fracture was reduced anatomically, and a lag screw was inserted (Fig. 37.7).

The fibula fracture was then stabilised with an anatomical distal fibula locking plate (Zimmer Biomet) which provided more options for distal locking screw fixation (Fig. 37.8).

After the plate application, the syndesmosis was reduced under direct visualisation, held with a reduction clamp and a four-cortices transyndesmotic screw was inserted (Fig. 37.9).

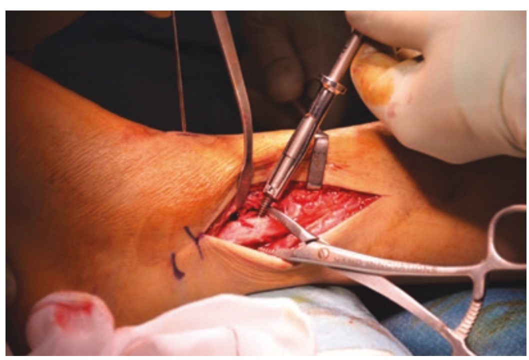

Fig. 37.7 Intraoperative picture showing insertion of lag screw

Fig. 37.8 Intraoperative picture showing insertion of proximal screws in the distal fibula anatomical locking plate

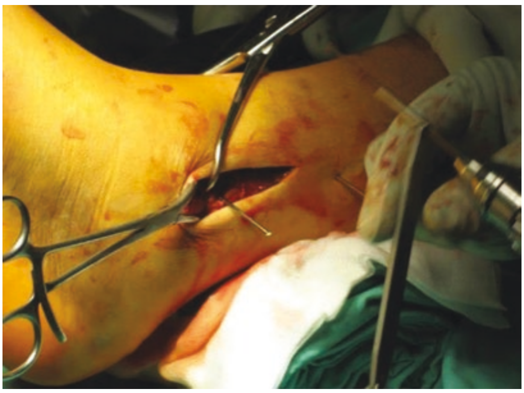

Fig. 37.9 Intraoperative image showing maintenance of syndesmosis reduction with reduction clamp

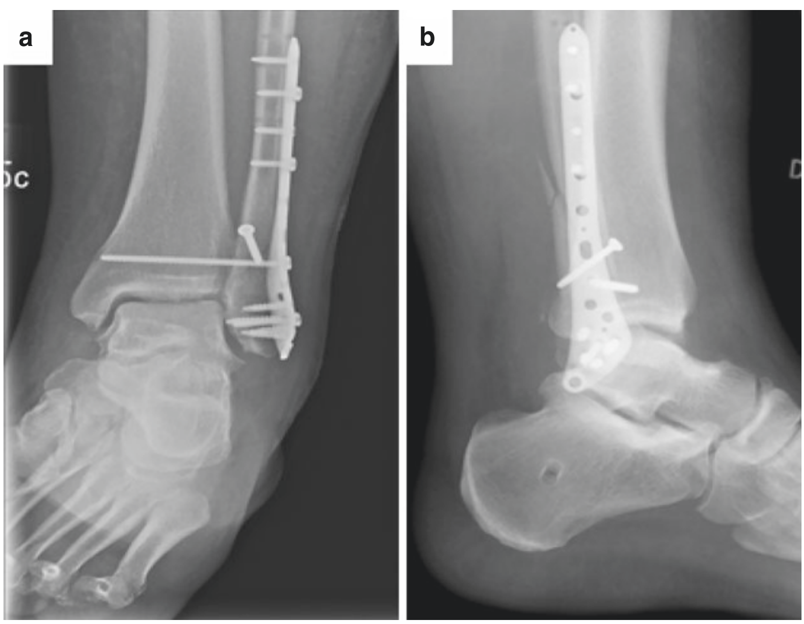

Fig. 37.10 (**a**): AP and (**b**): Lateral radiographs of the left ankle after revision surgery. There is no talar shift or medial space opening. The fracture is anatomically reduced

Radiographic confirmation of acceptable reduction was achieved under a stress test (application of dorsal flexion and external rotation), and the ankle was placed in a below the knee backslab (Fig. 37.10). Postoperative instructions included non-weight bearing for 6 weeks in a walker boot with immediate initiation of mild range of motion exercises. Three months postoperatively, the fracture had healed (Fig. 37.11), but the patient was experiencing some stiffness in dorsal flexion. The patient was referred to physiotherapy and 6 months postoperatively he returned to his pre-injury level of mobilisation.

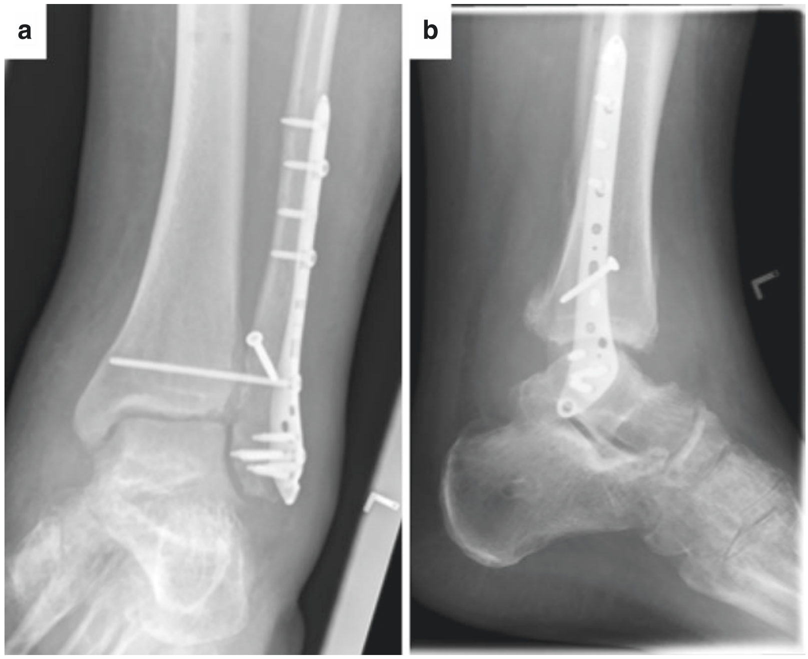

Fig. 37.11 (**a**): AP and (**b**): Lateral left ankle radiographs 3 months postoperatively. On examination, the patient could weight bear pain free, but there was some residual stiffness in dorsiflexion

Summary: Lessons Learned

It can be challenging to confirm an anatomic ankle fracture reduction and to investigate if this needs syndesmotic fixation or not. Intraoperative image intensifier has been a significant weapon in the treatment of ankle fractures, but additional measures should be considered not to miss syndesmotic injuries. Such tips and tricks should be considered in these circumstances by the surgeon as a lateral radiograph of the contralateral uninjured ankle for comparison. This can be easily taken preoperatively in the radiology department or intraoperatively with the image intensifier and used as a reference for the accuracy of fracture's reduction.

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