Removing Stripped Titanium Screws From Locking Plate: Technique and Case Report

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INTRODUCTION

Following ankle fracture surgery and bone healing, subsequent surgery to remove fixation is common. There are various reasons and indications for the removal. A large, retrospective cohort study reported a 17% incidence of returning to the operating room for fixation removal (1). Fixation removal accounts for 6.3-15% of all orthopedic surgery performed and most of these involve removal of ankle fixation (2).

Removal of fixation can be easy, straight-forward, and fast or it can be very frustrating, require creativity, and take time. Being prepared is critical. Preoperative clinical examination findings help to determine if a single screw is painful or if the entire ankle plate and screw complex must be removed. Preoperative imaging is valuable to understand the number of screws, their position and orientation, and whether they are intact. Obtaining and reviewing the initial operative report can get you started in the right direction. Knowing the fixation manufacturer and screw head pattern allows you to be prepared with the right drivers and instruments for removal.

Despite this preparation, it is a frustrating discovery to find that the appropriate screwdriver cannot engage a screw due to bony overgrowth, because the screw head pattern is stripped, or the screw is cold-welded to the plate. It is important to have access to and familiarity with a universal screw removal set for these situations. Here, we present a case that challenged us. We discuss our thought process, learned-technique, and present considerations that may be useful for other surgeons.

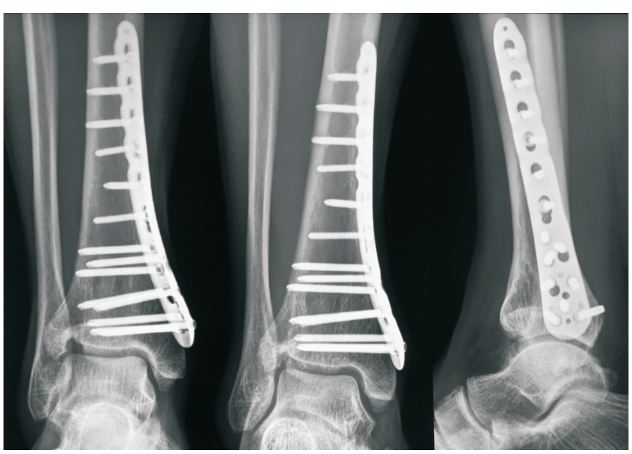

Figure 1. Ankle radiographs demonstrate a long medial tibial pilon plate and 12 screws.

CASE REPORT

A 28-year-old British male presented for evaluation during our surgical mission in Guatemala. The patient's main complaint was painful fixation to his medial ankle. Three years prior, he had sustained a distal medial tibia plafond fracture in South Korea while hiking. He did not sustain a fibular fracture. He had an open reduction and internal fixation procedure in South Korea.

His preoperative clinical examination revealed pain on palpation over the medial malleolus where the plate was palpable. Preoperative radiographs revealed a long medial tibia pilon plate and 12 intact screws (Figure 1). An operative report was not available due to the circumstances. We could not determine, with certainty, the exact diameter and head pattern of the screws. Radiographically, the plate appeared to sit off the bone distally. We anticipated that some of the screws were locked into the plate. We were equipped with an assortment of various sized and shape screwdrivers but we did not have a universal screw removal set. We planned to make an incision over the medial malleolus initially to confirm that we had an appropriate driver and could remove these screws before we made an incision the length of his previous scar for access to the entire plate (Figure 2).

The patient was positioned on the operating room table in the supine position. A short incision was created over

Figure 2. The outline of the prominent plate was traced. We started with a small incision over the distal medial malleolus. We confirmed we were able to remove the screws before expanding the incision the length of the plate.

the medial malleolus and the plate and screws were exposed without difficulty. A 2.7 mm hex screwdriver was used to remove the first screw with ease. Next, we lengthened the skin incision so we could remove the rest of the fixation. We found that 4 of the screws were easy to remove but 8 of the screws appeared to have been power-driven into the plate and their heads were completely stripped. We interposed a piece of Esmarch bandage between the screws and the driver to increase the stability of the driver connection but this did not help. We did not have access to conical extraction screws or carbide burrs. We considered accepting this failed attempt and knew we could come back later with additional equipment if the patient continued to be symptomatic.

Instead, we prevailed with creativity and used the equipment available. We found that the screws were titanium and knew the material would be relatively soft. We questioned whether we could drill through the screw heads. To destroy the 8 titanium screw heads, we necessitated four 4.0 mm stainless steel drill bits. In destroying the locked screw to plate interfaces, we were then able to remove the plate.

TECHNIQUE

To help dissipate the heat generated from this process, we maintained cool saline irrigation to our drill bit. Our suction tip was intimate to the drill bit to remove metal debris from the soft tissues (Figure 3). A significant amount of force was required on the drill during this process and equal counterpressure was necessary. We started with firm pressure, oriented perpendicular to the screw head, centrally. We then worked on a different screw to allow time for cooling. We used the drill on various obliquities to weaken the remaining screw heads. It was not obvious when each screw-plate attachment had been weakened sufficiently. Once all the heads were drilled, we used a small, straight osteotome to get under the plate and we gently tapped an osteotome with a mallet to further weaken the screws to failure. This also helped us to identify where the osteotome could not pass and therefore we learned where more drilling was needed.

We then inserted the osteotome under the plate, oriented from proximal to distal, so we could pry the plate off the bone. The patient's bone was strong but we were cautious to not refracture his tibia. The remainder of the screws were maintained within the tibia and were not prominent through the soft tissues (Figure 4). Saline irrigation was used to further remove metal debris and a layered closure was performed. Following surgery, the patient was immediately partial weightbearing and had an uncomplicated recovery (Figure 5).

DISCUSSION

Surgery to remove ankle fixation is common. Patients should be made aware of this possibility at the time of the initial fracture repair. Usually the indication for removal is painful irritation since there is not much soft tissue coverage over the ankle's bony prominences. Fixation removal can provide pain relief for the patient; however, the removal procedure can be an extremely painful experience for the surgeon.

Considerations to prevent the screws from stripping, cross-threading, or cold-welding are considered. Using a lock-guide in the plate when drilling can ensure that the variable angle at which the screw is inserted still allows it to lock into the plate without cross-threading. During screw insertion, surgeons can take care to not strip screws by using

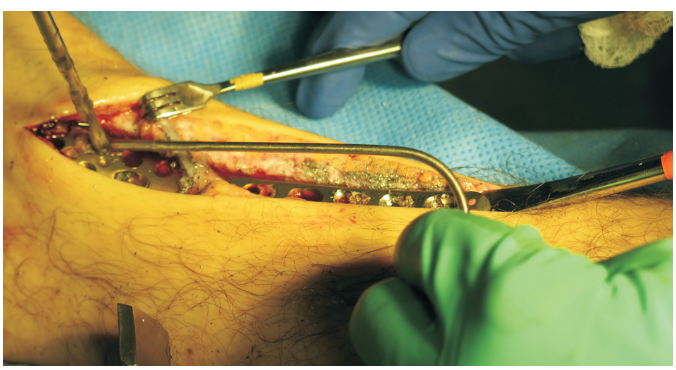

Figure 3. Most (8 of 12) of the titanium screwheads were stripped and the correct driver could not engage the screws; therefore 4.0 mm stainless steel drills were used to drill and destroy the screw heads' interface with the plate. An osteotome was then used to pry the plate off the bone.

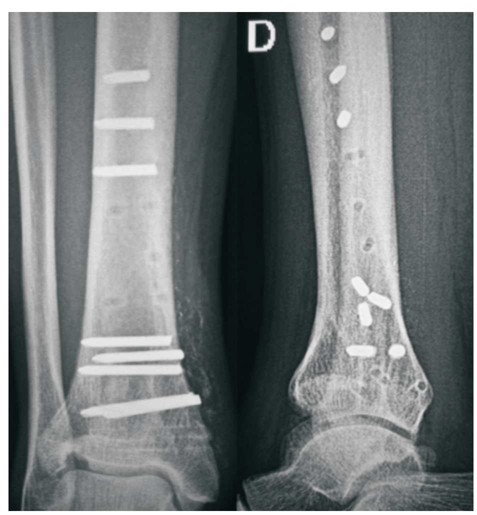

Figure 4. Postoperative radiograph. The prominent plate and screw heads have been removed. Metal debris in the soft tissues is minimal and the screw threads remain within the tibia.

Figure 5. The patient healed uneventfully. He is without pain and is pleased with the results

a torque limiter or performing the final couple screw turns by hand. Fixation biomaterial (titanium, stainless steel, etc.) and locking versus non-locking screw technology should be considered on a patient-specific basis.

It has been said that "Nobody looks good removing fixation." Having the correct instruments and a hardware removal set can make the job possible and straightforward. In this case report, we persevered to help an NGO employee who only gets an opportunity to have such a surgery once per year. This procedure enabled him to maintain his NGO job in a foreign country, without having to return and wait for the National Hospital system of Britain to schedule this surgery. It is the spirit of our mission efforts to do as much as we can with the limited materials available and this is one example of that. This method is not perfect or even preferred when other options are available; however, drill bits are widely available and this may be an option for other surgeons with such limitations.

We found it is possible to "drill out" titanium screw heads using standard drill bits, to the point of destruction of the locking screw-plate interface. In our experience one 4.0 mm stainless steel drill bit allowed for destruction of two 2.7 mm screw heads, on average. Heat and metal debris are generated during this process. We assume this is similar to that of using a carbide-tipped burr. There were not any postoperative complications of thermal bone necrosis or soft tissue inflammation due to metal debris. The force required during this process is likely more than that required with a carbide-tipped burr. Our young patient had good bone stock and did well; however, the prying of the plate would not be indicated in patients with osteoporotic bone. There would be a greater risk for fracturing the bone. The amount of force and counterpressure required an active assistant. If we had been removing fixation from the fibula, a lateral decubitus position on the table would eliminate the need for counterpressure; counterpressure would be provided by the table. We left the remainder of the screws within the bone. Since they were buried in the bone, they should not irritate the patient. When the indication for hardware removal is infection or metal allergy, these screw segments could be trephined out. In leaving the threads in the bone, we did not leave 8 holes in the bone which would weaken it and require additional bone healing processes (presumably resulting in more swelling and pain).

REFERENCES

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2. Bostman O, Pihlajamak H. Routine implant removal after fracture surgery: a potentially reducible consumer of hospital resources in trauma units. J Trauma 1996;42:846-9.