CHAPTER **8**

BIOPRO BREAK-OUT™ CANNULATED SCREW EXTRACTOR

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INTRODUCTION

The difficult problem of retrieving a broken cannulated screw has been typically managed as with other screws, with the use of large trephines or substantial bone resection and exposure. The presence of the hollow cannula has been largely ignored as a means for extraction, but a new device provides some potential help in removing a broken or even stripped cannulated screw. A specific case presentation will also be included to detail some of the advantages and cautions associated with this specific device.

DEVICE

The Biopro Break-Out™ cannulated screw extraction device is part of a simple system that retrieves broken cannulated screws without any further disruption of bone. This is of particular importance when the cannulated screw(s) may be traversing a joint surface or may be lodged deep in the medullary canal of a long bone and difficult to visualize. The basic principal of the device is simple: 2 sharpened, tapered flutes are machined into a "drill bit-like" device, but with a reverse thread angle (Figure 1). As a result, the device will engage into the broken screw when turned counterclockwise. The taper will then "grab" the broken screw and allow it to be unscrewed. Currently, there are 2 sizes of Break-Out™ that will allow for removal of most currently used cannulated screws, a smaller size that will fit cannulated screw sizes 2.7 4.0 mm, and a larger size that accommodates 3.5 7.3 mm cannulated screws. There is a trocar-extended tip that penetrates into the hollow shaft of the cannulated screw cannula and assists in proper alignment. This allows for purchase and eventual tight fitting so that the broken screw can be removed either via manual or power extraction.

TECHNIQUE

Following surgical dissection, allowing the broken hardware to be visualized directly or with use of intra-operative fluoroscopy, the appropriate screw driver is used for retrieval of the proximal screw fragment. This step is optional as the Break-Out™ can be used as an expedient or if the screw head is stripped. It is critical to point out that if the proximal portion of the screw has no threads, it will simply spin even if the device has engaged properly. Simply slide a hemostat under the head of the screw as in other screw removals. Once the proximal portion is removed, a fresh "break-out" extractor is inserted into the bone canal created from extraction of the proximal screw and advanced into the cannula of the distal screw fragment.

Very importantly, the device MUST firmly engage the screw. This is accomplished with a gentle tapping with a mallet. Once firmly seated begin SLOWLY in a counterclockwise direction until the broken screw begins to move. A hand chuck is an option, but if using power, make sure you have good linear speed control, many pneumatic systems accelerate too quickly and can damage the Break-Out™ device, stripping it without retrieval of the screw (Figure 2). Upon retrieval of both proximal and distal screw fragments, the hole that remains is typically the same diameter as the broken screw minimizing bone

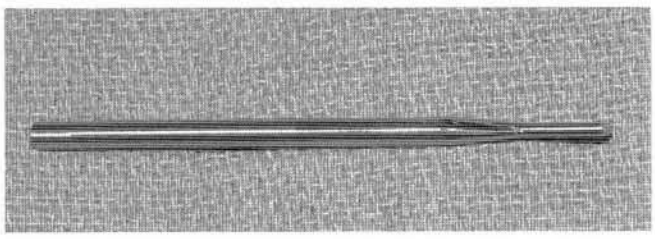


Figure 1. The Biopro Break-Out™ cannulated screw extraction device. Note tapered, reverse cutting flutes.

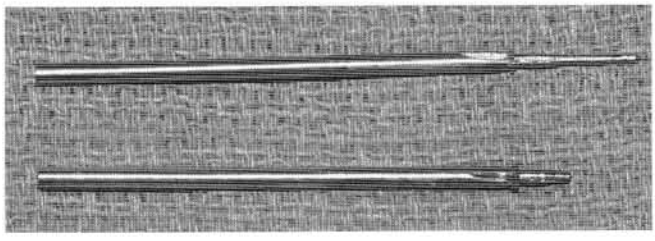


Figure 2. Damaged Break-Out™ devices when a high speed pneumatic drill was used against the hard metal in many cannulated screws. Note the damage and broken tip.

loss and allowing new similarly sized fixation to be replaced. More than one Break-Out™ device may be needed if multiple screws are present and a new device is suggested in difficult locations to minimize the risk of failure. As with all hardware removals, an alternate method should be available in case of complication.

CASE PRESENTATION

A 56-year-old female presented as a direct referral from a local orthopedic surgeon for a third opinion. The patient was experiencing pain after having had a first MTPJ arthrodesis performed for a symptomatic hallux rigidus 6 months prior. Physical exam revealed a well-healed dorsal incision and faintly noticable motion in the direction of dorsiflexion and plantarflexion at non-union site. The patient experienced pain throughout the examination and during ambulation. Radiographic exam revealed 2 broken 3.0 mm cannulated screws traversing the first MTPJ fusion site. The fatigue fracture of both screws appears to be directly at joint level. An apparent non-union was also noted to this joint with no evidence for consolidation (Figures 3, 4).

The surgical plan was to remove the broken cannulated screws via the Break-Out™ extraction system, obtain calcaneal bone graft and repeat the first MTPJ arthrodesis using interfragmentary compression in addition to plate fixation. Intra-operative fluoroscopy was utilized to identify exact screw locations. The non-union site was explored and the screws identified at the joint level in both the first metatarsal and proximal phalanx. A small-sized Break-Out™ device was inserted into the cannula of the first metatarsal distal screw fragment (from the screw that was placed from the medial proximal phalanx to lateral first metatarsal), firmly seated and rotated in counterclockwise direction allowing removal of the broken screw segment. The head of the distal screw fragment in the proximal phalanx and second screw fragments were retrieved in a similar manner (Figures 5, 6). Following removal of all of the screw fragments (Figure 7), the joint was explored and the fibrous non-union visualized. It was also clear that minimal damage had been casued by the screw removal itself (Figure 8). At this time, the joint surfaces were debrided followed by calcaneal bone grafting, repositioning and final fixation with a 3.5mm screw and 2.4mm T-plate. The patient went on to heal uneventfully in 6 weeks with the aid of a bone stimulator that was dispensed from her initial surgery throughout the course of this second surgery.

SUMMARY

The BioPro Break-Out™ extraction system is an alternative device to simplify the retrieval of broken cannulated screws. The issue with the earlier described device damage (Figure 2) has been discussed with the manufacturer and was likely the result of the lower metal strength when compared with the metals utilized in some stainless steel and excessive speed delivery as with a pneumatic drill. In these situations, a hand-type chuck with a T-handle is preferred as it allows the surgeon to better modulate torque and minimize the risk of failure. The advantages of this technique are decreased operative time and minimal bone damage while retrieving broken cannulated screws.

Figure 3. Failed 1st MTPJ arthrodesis demonstrating fractured cannulated screws.

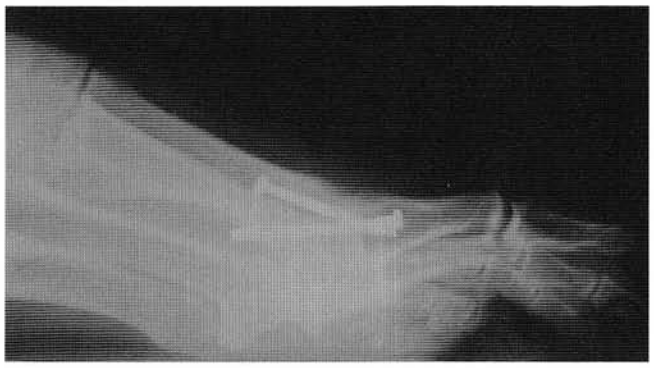
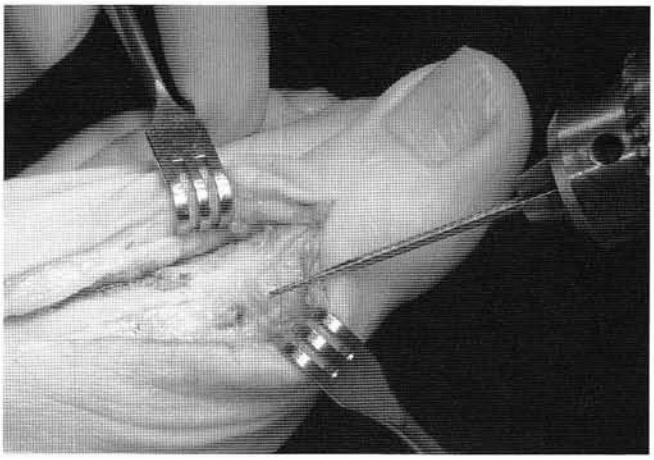
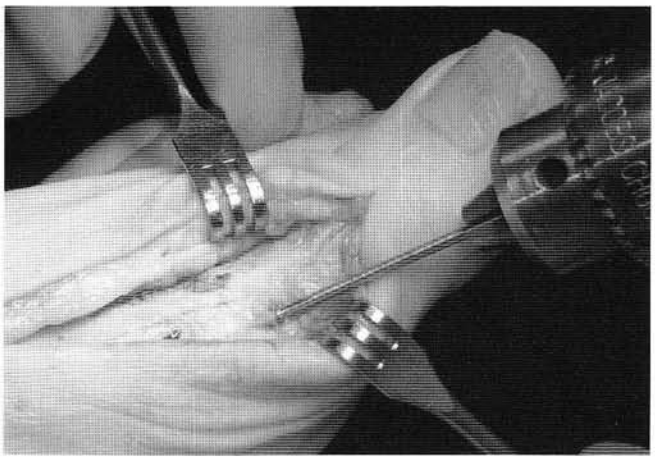


Figure 4. Radiograph of failed 1st MTPJ arthrodesis demonstrating fractured cannulated screws.



Figures 5. Intraoperative photos demonstrating the device engaging the broken screw.



Figures 6.

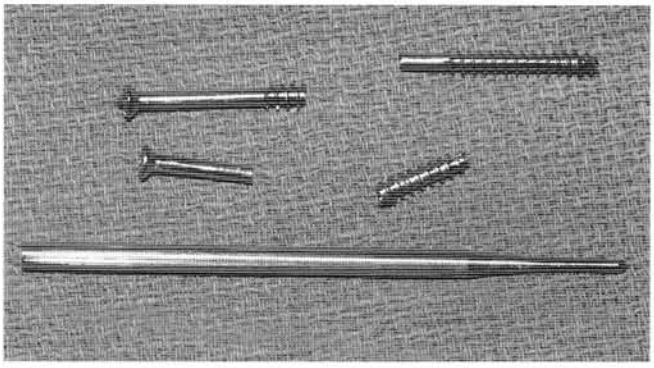


Figure 7. All broken screw fragments successfully removed and a Break-Out™ device.

Figure 8. Appearance of the non-union site demonstrating minimal bone loss following screw extraction.