

Removal of Metal Work

[Removing IM nail](#)

[Broken + bent locking bolt shaft](#)

[Broken locking bolt shaft](#)

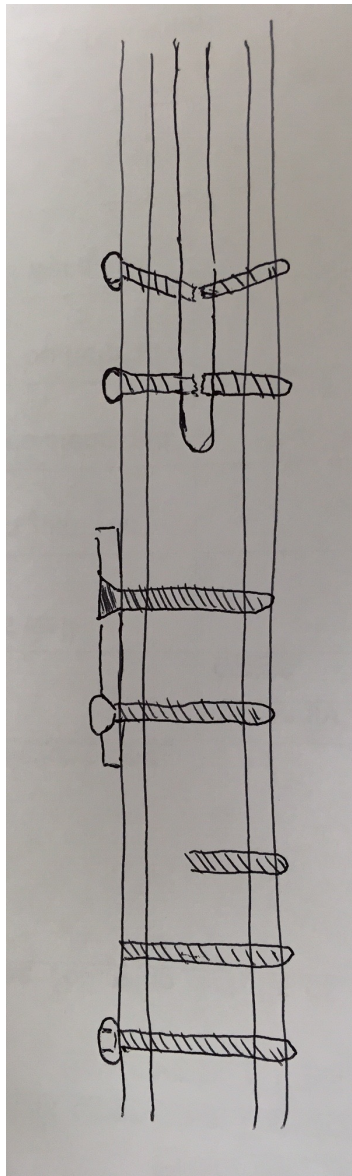
[Stripped locking head in plate](#)

[Stripped non locking head in plate](#)

[Broken shaft](#)

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Broken Screw Set](#)

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Learning Points

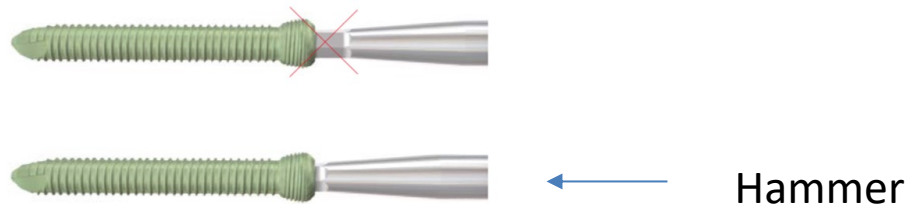
- ROMW can turn into a nightmare if you do not pre-op plan
- Strategy for different ROMW scenarios
- Familiarity with broken screw set
- Familiarity with nail extraction set

Pre-Op Planning

- Is the fracture sufficiently healed, do you need CT?
- Have you up to date x-rays ?
- Have you read the previous op note?
 - Implant
 - Relevant anatomy eg position of radial nerve
 - Problems
- Is extra equipment necessary?
- Ensure a detailed neurologic and vascular exam has been performed and documented.
- [Danger areas](#)
- Detailed consent.

Operative Tips for ROMW

- Ensure all equipment, that might be necessary, is available BEFORE the patient is anaesthetised.
- Mark incisions BEFORE placing Incision Drapes eg Ioban
- It is rare to be able to remove metalwork through a smaller incision
- Ensure your screwdrivers do not have a worn head and are engaged fully by tapping with hammer.



- Release some of the initial friction
 - Shock loading
 - Initial turn clockwise
- Once the blade has been used on metal, it will be blunt, and should not be used further for soft tissues.
- Find all metalwork before removing any. This will help with orientation and reduce use of II.
- Use II
 - Position of incisions
 - Minimally invasive removal
 - Confirmation of removal, without causing fracture
 - Do not miss opportunity for **EUA** eg syndesmosis

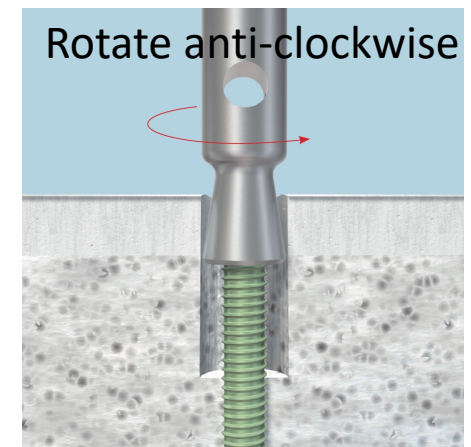
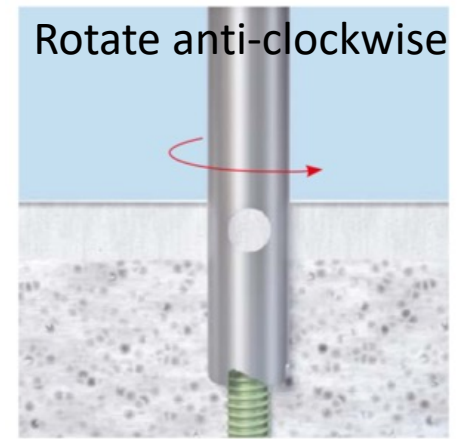
Removing Plate

- DO NOT cut down the centre of the plate, over the screw heads.
- Expose full length of capsule overlying the metal and then incise to the side of the screw heads. The periosteal elevator will then lift the soft tissue plugs out in one piece.



Broken Screw Head

- If necessary use a gouge / chisel to clear bone around the residual shaft
- Choose appropriate sized crown reamer, based on size of residual screw shaft
- Then use appropriate sized extraction bolt. Rotate anti-clockwise and this will cross thread the shaft and bolt threads.



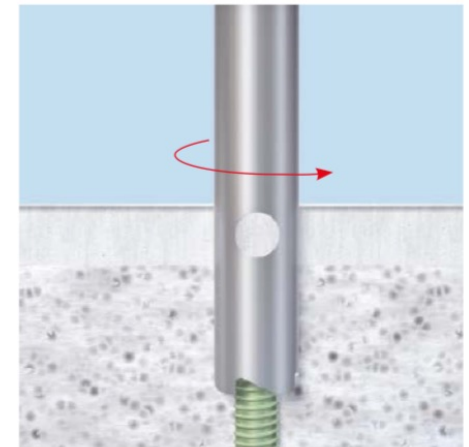
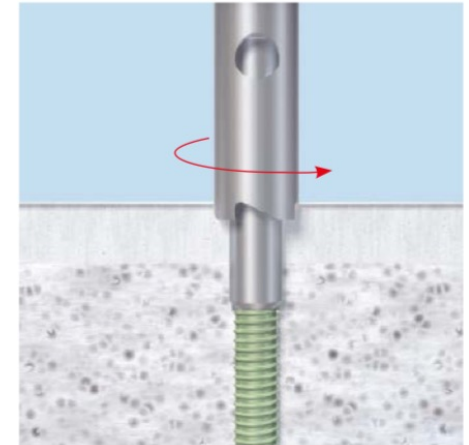
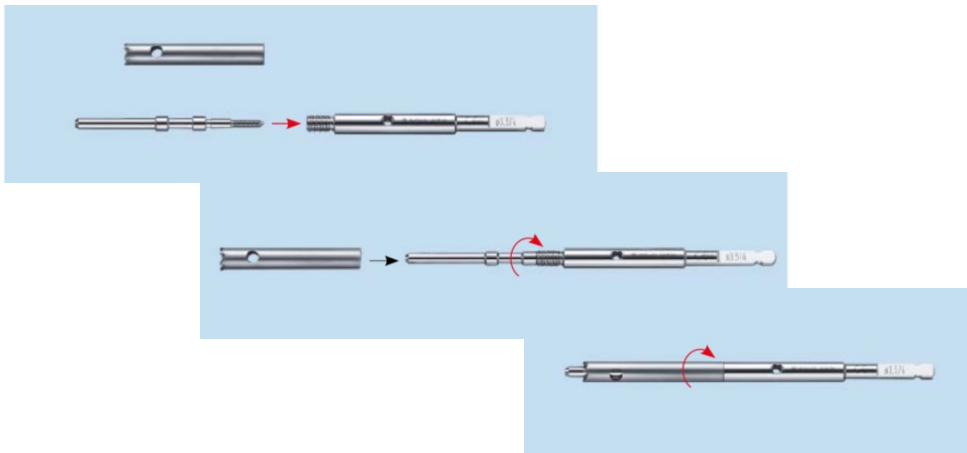
Stripped Head

- Choose appropriate size conical bolt and insert into stripped head. The conical bolt is harder than the stripped screw head so will cut a thread when turned anti-clockwise. Once engaged the screw will back out.
- If you cannot get a grip, deepen the recess with an HSS drill bit – see [Drilling Technique](#).



Broken screw shaft

- Use of 'nipple' with crown reamer helps to centralise when broken shaft is greater than 5mm from surface
- Remove nipple
- Crown reamer passed over residual shaft to sufficient depth for capture with extraction bolt
- Pass extraction bolt and remove anti-clockwise



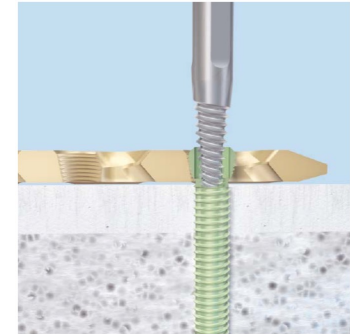
NB all instruments assemble by rotating anti-clockwise

Stripped non locking head in plate

- Use the same technique as for an isolated screw – [Stripped Head](#)

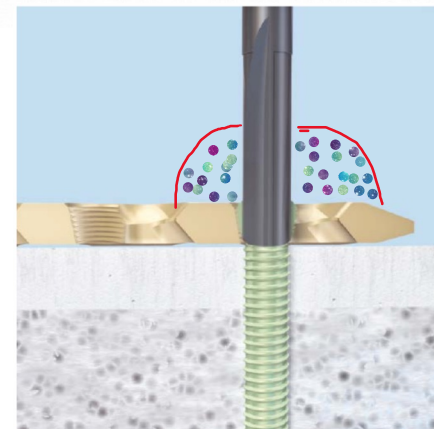
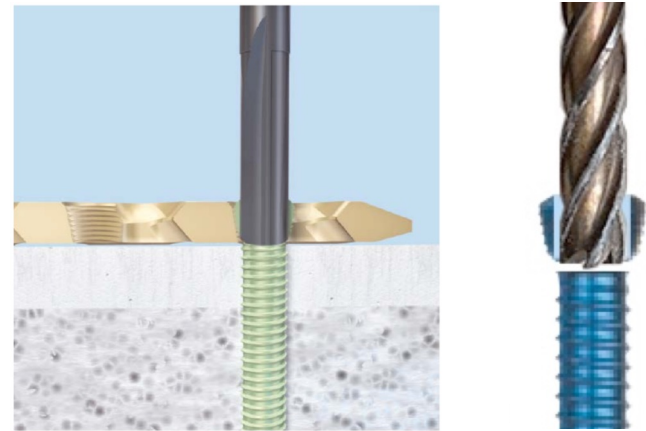
Stripped Locking Head in Plate

- The conical extraction bolt (as per [Stripped head](#)) can be used, however it will be unsuccessful if the head is jammed / 'cold welded'.
- A better technique involves drilling into the recess and removing enough head to disconnect the head from the shaft (see [Drilling Technique](#) and [HSS + Carbide Sizes](#)). Then proceed with removing plate and [shaft](#).



Drilling Technique

- Choose correct type and size of drill
- Drill through a blob of 'Instiligel'. This will capture the metal fillings.
- Deepen recess and then widen as required until the shaft and head have been disconnected.
- Proceed with removal of plate and shaft.



Carbide + HSS Drill Sizes

Screw sizes	Drill bits			Drill bits suitable for		
		Drill diameter	Drill type	Titanium*	Implant steel	Instrument steel
3.5 mm, 4.0 mm	309.503S	2.5 mm	High speed	++	++	–
3.5 mm, 4.0 mm, 4.5 mm, 5.0 mm	309.504S	3.5 mm	High speed	++	++	–
3.5 mm, 4.0 mm, 4.5 mm, 5.0 mm	309.004S	4.0 mm	Carbide	++	+	+
5.0 mm, 6.5 mm, 7.0 mm, 7.3 mm	309.506S	4.8 mm	High speed	++	++	–
5.0 mm, 6.5 mm, 7.0 mm, 7.3 mm	309.006S	6.0 mm	Carbide	++	+	+

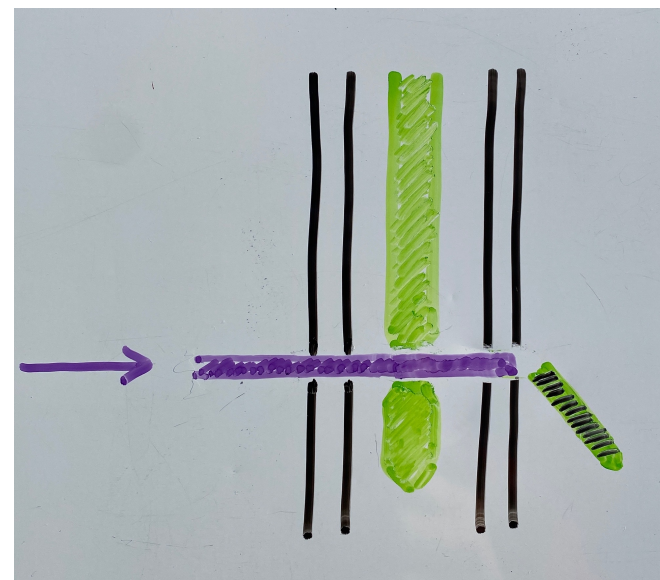
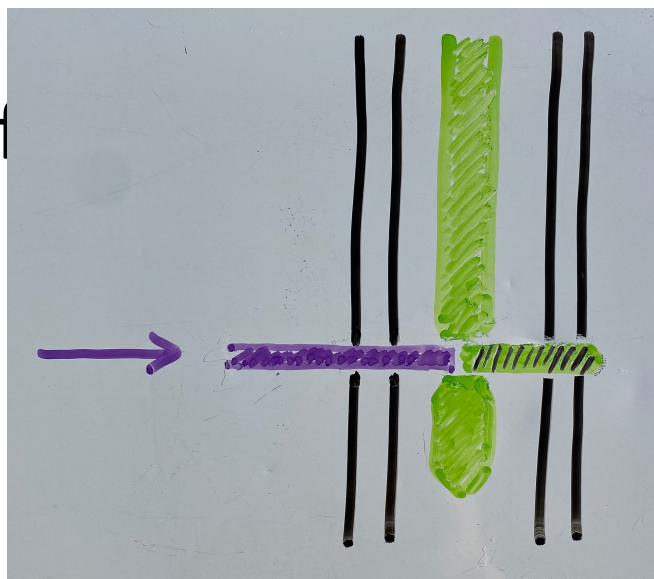
- ++ good drilling properties
- + adequate drilling properties
- not recommended

Danger Areas

- Distal antero-lateral tibial plate
 - Often inserted using minimally invasive technique with proximal and distal wounds
 - The superficial branch of the peroneal nerve always runs obliquely across the distal wound.
 - The proximal part of the plate sits underneath anterior tibial artery
- Anterior approach to hip and pelvis
 - If they do not have a LFCN palsy they will do soon!
- SI screws
 - Superior gluteal artery and branches run very close. Use blunt accurate dissection through previous stab incision
- Distal humeral plates
 - Radial and ulnar nerves are at risk as they may now occupy a non anatomical position. An accurate description should be found in the original operation note.

Broken Locking Bolt

- Remove proximal part of bolt.
- Use smooth pin (1mm smaller than bolt) to knock through. NB works on bolts NOT screws, due to the [cross-section profile](#).

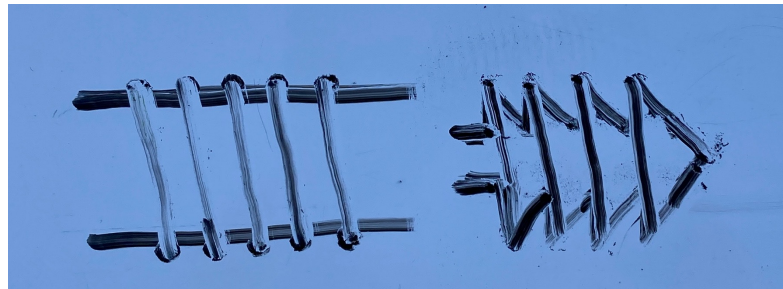


Cross Sections

Bolt vs Screw

- A bolt is designed to resist load perpendicular to the axis. The shaft diameter is large compared to the thread diameter.
- A screw is designed to resist load in the axis. The shaft diameter is small compared to the thread diameter.

Bolt



Screw

Broken + Bent Locking Bolt

- Leave broken bolt pieces in situ and knock back IM nail to re-align.
- Proceed with removal of broken locking bolt.



Removing IM Nail

- Confirm ALL locking bolts have been removed.
- Intact IM nail
 - Use correct extraction bolt and sliding hammer
- Broken IM nail
 - Use correct extraction bolt to remove proximal fragment
 - Retrieve distal fragment using ‘crochet hook’



or

- Retrieve distal fragment using [tubular cutter](#)