3D PRINTED TITANIUM EQUINE IMPLANT

Accessory carpal bone plate

Surgical technique

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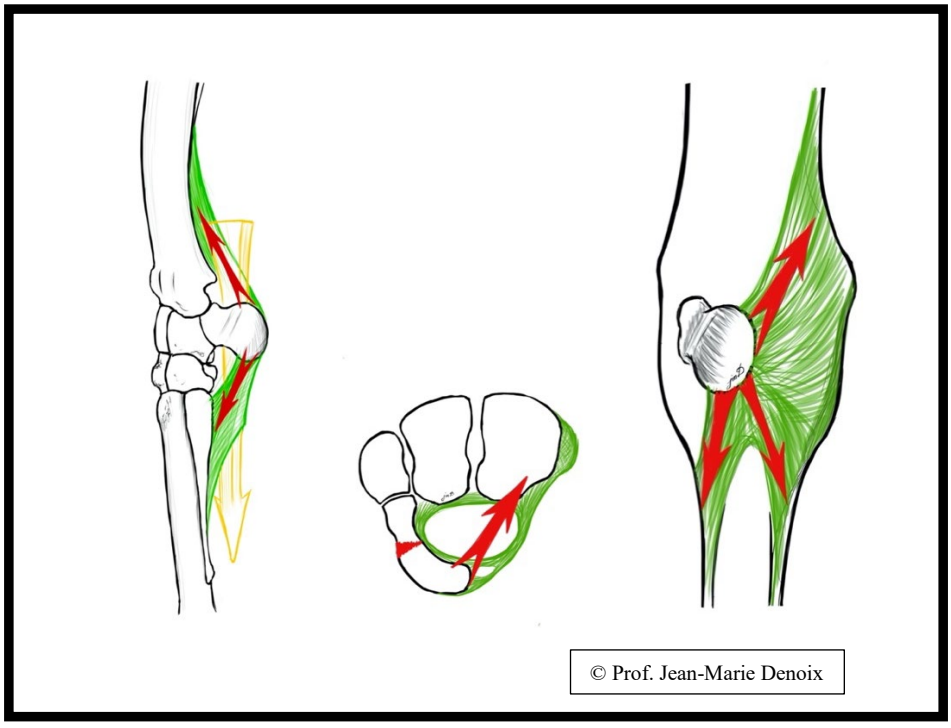
Indication

Because of its location on the palmar aspect of the carpus and its multiple ligamentous attachments, the accessory carpal bone undergoes intense loading during full extension of the carpus.

Frontal fractures occurring through the mid-portion of the bone (ulnaris lateralis tendon groove) are the most common configuration. These fractures may be moderately comminuted.

Although the aetiology of the fracture needs to be demonstrated, accessory carpal bone fractures are likely caused by excessive stress of its palmar attachments, particularly the flexor retinaculum, during overextension of the carpus (see diagram).



Biomechanical tensions placed by the flexor retinaculum on the accessory carpal bone during overextension

Introduction

Accessory carpal bone (ACB) plate

This implant's design is based on 3D anatomical data of the accessory carpal bone obtained by CT imaging.

The plate is shaped to fit the lateral, tension side of the bone.

This innovative design enables to place the plate above the ulnaris lateralis tendon and avoid performing desmotomy.

The degree of angulation of the screws was chosen to maximize bone purchase and avoid accessory-ulnar joint penetration.

Positioning of the accessory carpal bone plate on the bone

Introduction

Screws

The screws have a locking design and are self-tapping.

The outer diameter is 3.5mm and the inner diameter 2.5mm.

The screws are available in three different sizes: 15, 18 and 21mm (size length includes screw head) and have a Torx 10 drive.

21mm is the recommended screw length for adult warmblood, thoroughbred and standardbred horses.

Drill guides

Two long 2.5mm threaded drill guides are provided with the kit.

These are used as plate holders during the procedure.

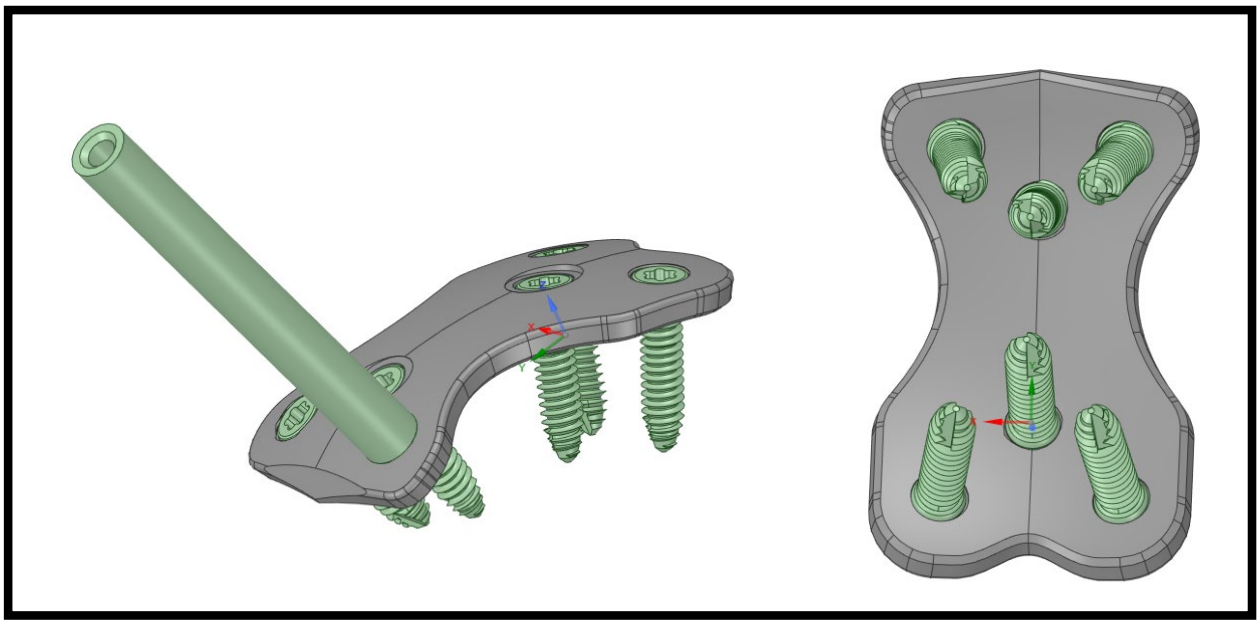
All implants in this kit are made of 3D-printed titanium and are HIP processed (Hot isostatic pressing).

Introduction

Principle

The ACB plate aims to provide stable fixation for frontal accessory carpal bone fractures after adequate anatomical reduction.

This internal fixator aims to create adequate stability to promote primary bone healing, prevent exuberant callus formation, irritation, and injury to the flexor tendons within the carpal sheath and avoid unstable fibrous union between the fragments.



Computerized model for accessory carpal bone implants

Surgical technique

Additional instruments required

- 2.5mm drill bit
- 2 x 2.5mm Steinmann pins
- 3.5 LCP Push-pull reduction device
- Torx 10 Screwdriver
- Weitlaner retractor
- Bone clamp

Preparation

The patient is positioned in lateral recumbency with the limb blocked in extension at the level of the foot.

A fluoroscope is positioned for intraprocedural imaging of the carpus in the lateromedial axis of the accessory bone. Alternatively, intraprocedural radiographs will be taken.

Skyline radiographs of the accessory carpal bone are particularly relevant to evaluate fracture displacement and appropriate reduction

Preoperative radiographs: lateromedial and skyline view

Surgical technique

Surgical procedure

Make a curved incision palmar to the ulnaris lateralis muscle, 1cm dorsal to the palmar edge of the accessory carpal bone.

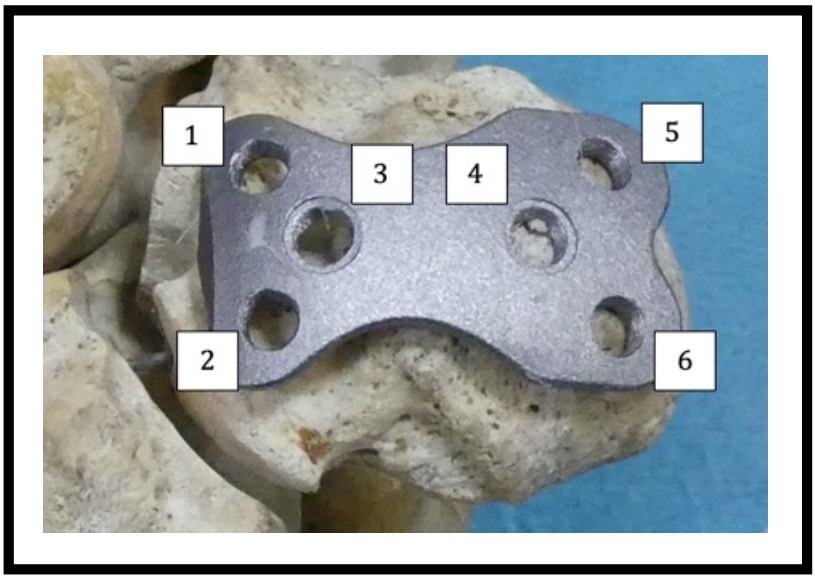
Incise the antebrachial fascia and continue the dissection down to the bone. Beware of the palmar radiocarpal joint bursa (at the level of the dorsal accessory carpal bone margin) and the ulnaris lateralis tendon.

Place a 2,5mm pin centered on the palmar surface of the accessory carpal bone.

Position and center the plate over the accessory carpal bone: the tip on the beveled edge of the plate is centered between the joint facets of the radius and ulnar carpal bone.

Make a stab incision in the ulnaris lateralis tendon opposite plate hole number 3 (*see below*) to be able to place a second 2mm pin through the plate, the ulnaris lateralis tendon and the bone.

Check the correct positioning of the pins with the fluoroscope (or with radiographs).



Numbered Plate holes (cf. surgical procedure instructions)

Surgical technique

Surgical procedure

Curette the fracture line.

Reduce the fracture using the two pins. This step is crucial! Check reduction with fluoroscopy and radiographs (skyline view). Once reduced, place a bone clamp, or maintain reduction manually.

Place a push pull in plate hole number 4

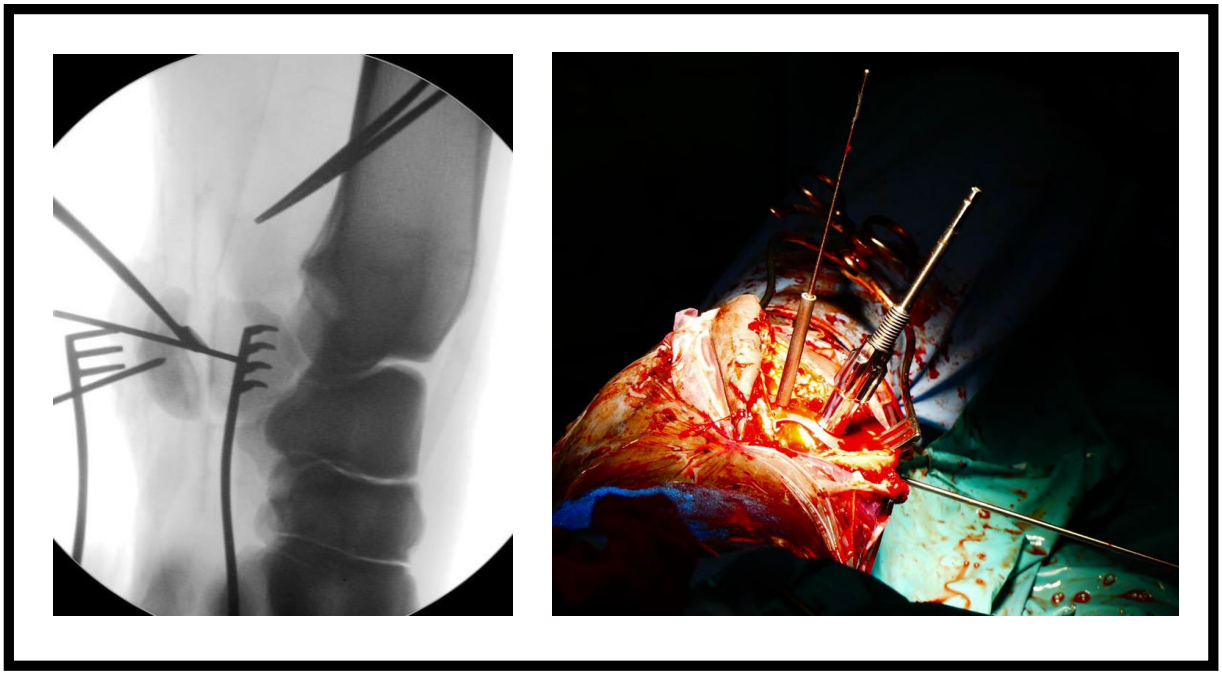
Place the screws in the plate holes in the following order: 1, 6, 2, 5 and 4.

Remove the bone clamp

Suture the antebrachial fascia, the subcutis and skin.

Apply a sleeve cast to the carpus for recovery.

Additional step: Place a cannulated screw over the pin centered on the palmar surface of the accessory carpal bone in order to improve the stability in all plans, as well as the tension band effect of the plate.



Intraprocedural fluoroscopic image ***Intraprocedural picture after plate is fixed to the bone***

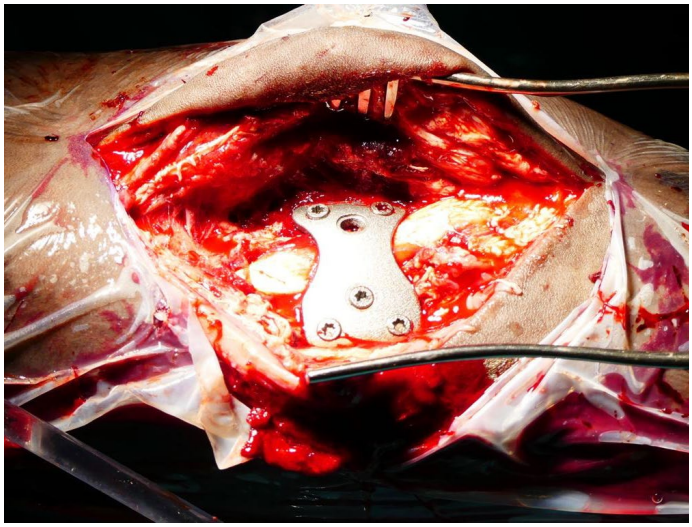
Surgical technique

Postoperative management

After 48h, replace the sleeve cast with a Robert Jones bandage and palmar splint. Change the bandage once a week. A Robert Jones bandage with palmar splint should be kept in place for 1 month.

Box rest for 2 months.

Starting at 6 weeks post operatively, flex the carpus passively 10 times 2 to 3 times daily.



Final image of the plate applied to the bone

Surgical wound at 48h

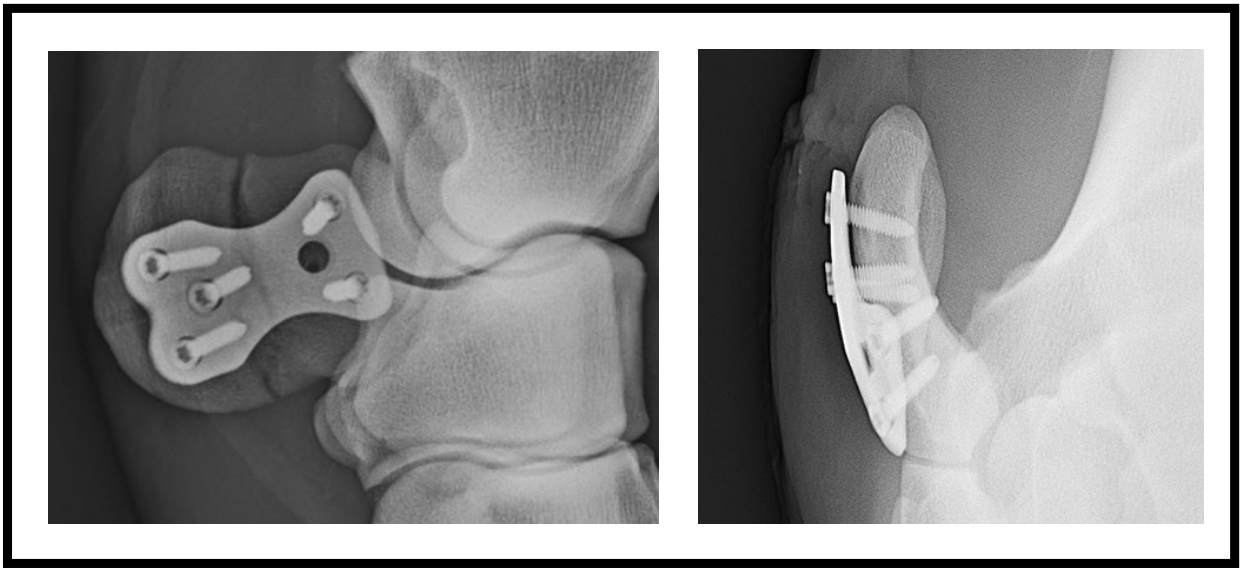
Surgical technique

Postoperative management

After 2 months start hand walking. Increase the hand walking/ walker time gradually until 3,5 months.

The horse can be turned out in the paddock at 2.5 months postoperatively.

Perform check-up radiographs at 2 and 3.5 months postoperatively.



Postoperative radiographs: lateromedial and skyline view