

Surgical correction of distal radius malunions using an anatomic radial locking plate

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Abstract

Background Correction of a distal radius fracture malunion is challenging technically. These malunions most classically deform dorsally, but often the deformity involves three planes.

Methods Using an anatomically designed radial plate that takes into consideration the three planes, correction of the deformity can be obtained. In this video we see a patient with a classic dinner fork deformity that is associated with a dorsal malunion involving the distal radius. Correction of a distal radius malunion can be performed using a radial approach and an anatomic radial plate.

Results The authors have used this technique for difficult distal radius fracture malunions and have achieved superb

correction, returning patients to early range of motion and an active lifestyle.

Conclusions Careful mobilization of the branches of the lateral antebrachial cutaneous nerve and the superficial branch of the radial nerve is required. This technique affords the surgeon excellent access to three sides of the radius to help perform this complex surgery.

Keywords Malunion · Distal radius · Radial locking plate · Radial approach

Introduction

Correction of a distal radius malunion can be difficult. The malunion usually involves a deformity in the X, Y, and Z planes. Traditional X-rays, which are bi-planar, have their limitations for addressing these complex deformities. Using an anatomically designed radial plate that takes into consideration the three planes can be very helpful in addressing these deformities. In this video, the authors demonstrate a simple technique for correcting a typical malunion involving the distal radius. Here, we see a patient with a classic dinner fork deformity that is associated with a dorsal malunion involving the distal radius.

Radial Incision

A radial approach to the distal radius is utilized. The advantage of this approach is that it allows the surgeon to visualize three sides of the distal radius in helping to make the correction, which is a distinct advantage over the volar approach.

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Dissection of the SBRN

Careful dissection is performed to identify the branches of the lateral antebrachial cutaneous nerve and the superficial branch of the radial nerve. These structures are then mobilized carefully out of harms way and protected.

Release of the First Dorsal Compartment

Release of the tendons of the first dorsal extensor compartment is performed. Careful inspection is performed for an accessory compartment housing the abductor pollicis brevis tendon. These structures are then retracted dorsally.

Excision of the BR Tendon

The terminal insertion of the brachioradialis tendon is excised off of the radial styloid process. This helps by removing a major deforming force of the malunion and helps to facilitate the exposure of the distal radius. Lastly, removing this structure allows for better placement of the radial plate and provides a low profile of the implant on the wrist.

Exposure of Shaft and Styloid

At this time, the surgeon should be cognizant of the radial artery. Subperiosteal dissection can be performed to expose the radial shaft, detaching the pronator quadratus and the flexor pollicis longus muscles. The radial styloid process also needs to be carefully outlined because it follows the displacement of the articular surface. Moreover, the surgeon can take advantage of the orientation of the styloid to correct the palmar tilt of the distal radius. The styloid also dictates the placement of the plate for the internal fixation.

Preparation of the Styloid

After the radial styloid process is outlined, it is then prepared for placement of the radial plate. The vertical septa that contain the extensor tendons of the first dorsal compartment are removed so that flat, unobstructed placement of the plate can be performed.

Placement of Radial Plate

The radial plate is now placed on the styloid process. The correct position is approximately 1 cm proximal to the tip of the styloid. It should also be halfway between the dorsal and palmar sides of the styloid process. Incorrect positioning of the plate can lead to suboptimal fixation. Therefore, it is

critical that the plate is positioned correctly. Smooth K-wire fixation allows for provisional fixation and easy radiograph confirmation of the position of the plate before definitive screw placement occurs.

Drill Guide Insertion

The locking drill guides are now placed in the three distal holes so that the correct trajectory for the drilling can be performed.

Distal Fixation

Three locking screws are now inserted into their respective holes, with the correct orientation. The smooth K-wires provide an additional cue to define the correct orientation of the screws.

Checking Plate Positioning

After the distal fixation is applied, radiographic assessment is performed to check the location of the plate and the screw length.

Removal of Plate

With the plate in position, the osteotomy site is marked at a location that will provide stable fixation for the distal fragment. The plate can now be removed so that the osteotomy can be performed.

Partial Plate Removal

A partial plate removal technique is demonstrated in another patient, with the hand facing in the opposite direction.

Osteotomy

The osteotomy is now performed with an oscillating saw. Copious irrigation is applied. Hohmann retractors are useful for protecting the surrounding soft tissues.

Distraction of Osteotomy

After the osteotomy is performed, distraction is required to regain the appropriate length of the radius. A bone clamp and a laminar spreader are useful instruments for this portion of the procedure. At this point, the tourniquet can be deflated and a tri-cortical iliac bone graft can be obtained.

Plate Is Reapplied and Correction Is Performed

The plate is now fixed to the shaft, correcting the deformity. Proximal fixation of the plate to the radial shaft is performed using locking screws.

X-Ray to Check Position of Plate and Correction

Another X-ray check should be performed at this time to assess the correction of the deformity and the internal fixation.

Bone Graft Insertion

Impacting the iliac bone graft into position can now be performed. Care should be taken not to disrupt the internal fixation that has been obtained.

Additional Packing of Bone Graft

Supplemental bone graft can also be applied after the bone graft is positioned to help fill any gaps that may be present.

Pronator Muscle Reattachment

Copious irrigation is performed before closure. The pronator muscle can now be tacked back into position by either going through the empty holes on the plate or around the plate itself, whichever method is easier.

Skin Closure

Routine skin closure can now occur. A volar splint that allows for early range of motion of the fingers is applied.

Summary

In summary, correction of a distal radius malunion can be performed using a radial approach and an anatomic

radial plate. The advantage of this method is that the plate acts as a template for the correction of the malunion and minimizes intraoperative guess-work in performing the correction. The major disadvantage is that the surgery requires careful mobilization of the branches of the lateral antebrachial cutaneous nerve and the superficial branch of the radial nerve. With careful mobilization of these structures, the surgeon has access to three sides of the radius to help perform this complex surgery.

Bulleted List

- We present a simple technique for correcting a typical malunion involving the distal radius.
- Correction of a distal radius malunion can be performed using a radial approach and anatomic radial plate.
- The lateral antebrachial cutaneous nerve and the superficial branch of the radial nerve are carefully dissected, the first dorsal compartment is released, and the brachioradialis is released.
- The plate is applied and the osteotomy is made.
- The osteotomy is distracted and the bone graft is applied and fixed in place.
- The advantage of this method is that the plate acts as a template for the correction of the malunion, and minimizes intraoperative guess-work in performing the correction.
- The major disadvantage is that the lateral antebrachial cutaneous nerve and the superficial branch of the radial nerve are at risk.
- With careful dissection and visualization of these nerves, the surgeon has access to three sides of the radius to help perform this complex surgery.

Conflict of Interest Miguel A. Pirela-Cruz is a paid consultant for AccuMed, and an unpaid consultant for BME, and Trimed.

Alexander J. Hutchinson declares that he has no conflict of interest.

John C. Dunn declares that he has no conflict of interest.

Statement of Informed Consent This article does not contain any studies with human or animal subjects. No identifying data or materials that would require informed consent were used in this study.