Operative Technique: Use of a Volar Plate for Restoration of Volar Tilt Intra-operatively

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Introduction

Use of volar locking plates has improved surgical fixation of distal radius fractures, allowing for anatomic reduction and early rehabilitations. AAOS recommends surgical fixation of distal radius fractures when post reduction radial shortening is > 3mm, dorsal tilt > 10 degrees, and intra-articular displacement/step off is > 2mm, particularly in patients > 55 years of age.[1] One of the more difficult aspects of anatomic alignment to achieve is volar tilt. This technique involves utilization of initial distal fixation of the volar plate to achieve an intraoperative correction of volar tilt and improve anatomic alignment.

Background

It is well accepted that the restoration of joint anatomy in distal radius fractures is important for better outcomes, and optimal kinematics through the wrist joints.[1,2] With newer implants such as volar locking plates, we have an ability to achieve better reduction of distal radius fractures intraoperatively, and secure the reduction with increased stability across the wrist joint.[3] We also have the ability to use bridging to overcome comminution.[4] Correction to a volar tilt of 11 +/− 5 degrees has been shown to restore biomechanical function of the wrist.[5] Prior to the use of volar locking plates, in order to restore volar tilt it would be necessary to use a dorsal approach, bone graft, and a dorsal plate. In the case discussed in this paper osteotomy and bone graft was used due to delay in presentation, but this technique can be extrapolated to fractures in which osteotomies are not needed but volar tilt needs to be restored.

Preoperative Evaluation

This operative technique is useful in patients who present with distal radius fractures in which restoration of volar tilt is necessary. In this case, a 36 year old male presents to clinic with left wrist pain and deformity 5 weeks after falling off a skateboard. He had initially been seen at an outside hospital, but was lost to orthopaedic follow up in the interim. Preoperative X-rays at the time of presentation showed a hyperextension deformity of the wrist (Figure 1). Decision was made to take the patient for open reduction and internal fixation of the left distal radius.

Figure 1. Preoperative radiographs showing loss of radial height, and loss of volar tilt.

Procedure

The patient was placed supine with the arm on a radiolucent hand table. A standard volar approach to the distal radius was performed through the FCR sheath, retracting the FPL and exposing pronator quadratus, which was then released from its radial and distal attachments. Subperiosteal dissection was performed allowing for exposure of the fracture site.

The fracture site was probed, and was healed with no micromotion. Because of the unacceptable alignment, it was decided that an osteotomy would be performed. A guidewire was placed as a provisional guide for the osteotomy and then confirmed via fluoroscopy (Figure 2). The osteotomy was then performed using a sagittal saw and completed with an osteotome. The distal fragment was mobilized with a laminar spreader to ensure that the dorsal callous was freed.

Reduction was then attempted by hyperflexing the wrist, but this only achieved neutral volar tilt and was deemed unsatisfactory (Figure 3). Thus, it was elected to attempt reduction using the volar plate. An appropriately sized volar locking plate was fixed to the distal fragment, and adjusted using fluoroscopy. The plate was first fixed provisionally with K wires, and then with locking screws. (Figure 4) To account for the correction desired, the plate was fixed distally while protruding out of the wound. Then, using the volar locking plate as leverage, the distal fragment was reduced to the shaft using a lobster claw. Reduction was checked via fluoroscopy (Figure 5). This reduction maneuver recreated near anatomic volar tilt. At this point, the reduction was found to be appropriate and the sliding hole in the volar locking plate was

Figure 3. Hyperflexion of the wrist during initial attempted reduction of the fracture only produced neutral volar tilt.

Figure 2. Guidewire placed to assess location for osteotomy.

Figure 4.

Figure 5. Lobster claw used to reduce the proximal aspect of the plate to the radial shaft. Volar tilt is restored.

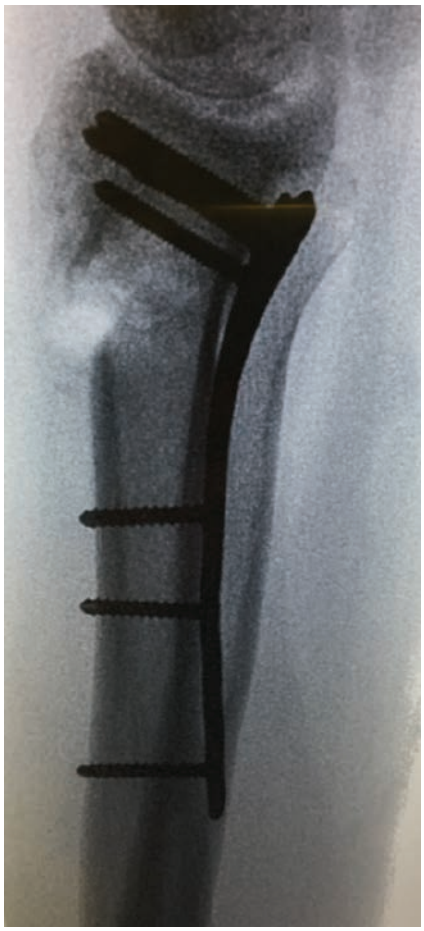

Figure 6. Volar tilt is restored, articular surface is reduced, plate affixed to bone.

filled with a non-locking screw. The fracture was then further reduced to the plate to ensure appropriate alignment of articular components, and distal locking screws were placed subchondrally to support the articular surface. Additional screws were also placed in the shaft of the plate. (Figure 6) The defect from the osteotomy was then filled with allograft.

Postoperative Protocol

Immediately following surgery, the patient was placed into a short arm cast, allowed to start digit range of motion exercises, and was seen 1 week postoperatively for cast change. Two weeks postoperatively, the patient was given a 2 pound lifting restriction, sutures were removed, and the cast was changed. 6 weeks postoperatively, the patient was seen in clinic, cast was removed, and he was placed into a cock up wrist splint. Patient will remain nonweightbearing until the osteotomy site shows full healing on imaging.

Discussion

Restoration of volar tilt has been shown to restore biomechanical function of the wrist. Although this has not been shown to lead to better long term outcomes,[6,7] anecdotally we believe that restoration of near anatomical alignment can only lead to better outcomes. This paper discusses a technique used to restore volar tilt using distal fixation of the locking plate to leaver the reduction. This is a technique that can be used to achieve reduction when an osteotomy is performed on a malunion, as well as in hyperextension type distal radius fractures.

References

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