

# New Technique for Dorsal Fragment Reduction in Distal Radius Fractures by Using Volar Bone Fenestration

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## What to Learn from this Article?

*A new technique for reduction of displaced dorsal fragment in distal radius fracture through volar bone fenestration?  
Result of two such cases done by the same technique?*

### Abstract

**Introduction:** For intra-articular distal radius fractures (AO Classification, type B2) with a displaced dorsal fragment, there remains much discussion on the fixation method for the dorsal fragment. To reduce the displaced dorsal fragment, we developed a new technique consisting of fenestration of the volar bone cortex, reduction using an intramedullary procedure, and fixation using a volar plate. This avoids necessity of dorsal approach.

**Technical Note:** We performed this surgical technique in 2 patients and achieved a good reduced position without much injury to the bone cortex at the site of volar plate placement. This surgical technique allows reduction of the dorsal fragment using an intramedullary procedure by only a volar approach, and, therefore, does not affect the dorsal soft tissue (extensor tendon). For intra-articular distal radius fractures, complete reduction of the articular surface is extremely difficult, and, in patients with a remaining gap on the articular surface, a variable angle locking screw system may be useful. In the 2 patients, the angle of the locking screw was adjusted to catch the displaced dorsal fragment, and adequate reduction and fixation could be achieved.

**Conclusion:** This technique using fenestration of the volar bone cortex allows reduction and fixation of the displaced dorsal fragment in distal radius fractures and thus avoids the necessity of a dorsal approach.

**Keywords:** volar plate, distal radius fracture, dorsal fragment, intramedullary reduction procedure

### Introduction

In treatment for distal radius fractures showing displacement, plate fixation is generally selected. For intra-articular fractures with a dorsal bone fragment (AO classification, type B2), there still remains much discussion on the fixation method for the dorsal fragment. Many authors have reported favorable results using a volar plate alone [1-4], while some have suggested the necessity

of exposure of the fracture area using a dorsal approach, followed by anatomical reduction of the bone fragment and fixation using a dorsal plate [5, 6].

However, the dorsal approach presents problems such as the development of extensor tendon impairment and evaluation of filling materials [5, 7, 8]. Therefore, to reduce the bone fragment of intra-articular distal radius fracture with a displaced dorsal fragment, we developed a

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### Author's Photo Gallery



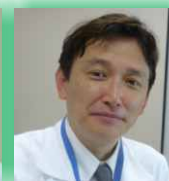
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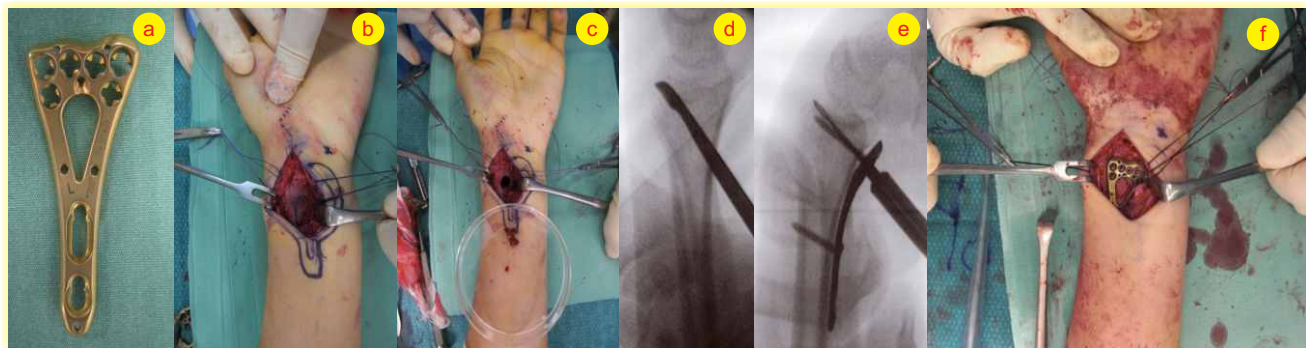


Figure 1 - a: Variable angle two-column plate (Synthes) This plate has a locking screw system allowing up to 15 off-axis angulation in all directions and an open space between the radial and intermediate columns. b: The plate was placed at the optimal site, and the place of the open space was marked. c: Fenestration of the volar bone cortex was performed using a bone chisel. d: A levator was inserted through the fenestration area, and the dorsal fragment was reduced. e: The reduced position was maintained, and plate fixation was performed. f: The suspending bone due to fenestration was returned to its original position.

new surgical technique consisting of fenestration of the bone cortex utilizing the open space of the volar plate, reduction using an intramedullary procedure, and fixation with a volar plate.

**Technical Note**

This operation technique is indicated for intra-articular distal end fractures (AO classification, type B2) with a displaced dorsal distal fragment with joint surface gap in lunate facet of radius and with relatively intact volar cortex. In AO type B2 fractures, since this dorsal fragment tends to dislocate to dorsal side, closed reduction or closed surgical technique such as Kapandji's are not enough to obtain good reduction.

According to Henry's approach, a volar approach to the distal radius area was used. We used a variable angle two-column plate (VA TCP, Synthes, Tokyo, Japan) in 2 patients. This plate is characterized by a locking screw system allowing up to 15° off-axis angulation in all directions and an open space between the radial and intermediate columns (Fig. 1a).

After exposure of the volar side of the radius, the plate was

placed at the optimal site under fluoroscopy, and the open space area was marked (Fig. 1b). After fenestration of this area using a bone chisel (Fig. 1c), an elevator was inserted to reduce the dorsal bone fragment (Fig. 1d). The dorsal fragment can be manipulated through the fenestration and up to distal by an elevator, joint surface will get good reduction. The reduced position was maintained with the wrist in volar flexion, and plate fixation was performed (Fig. 1e). Finally, the suspending bone due to fenestration was returned to the original position (Fig. 1f).

Patient A: an 18-year-old male, previously in good health, was admitted to the emergency room after a motorcycle accident. Plain X-ray examination showed a left distal radial fracture (Figs. 2a and b), a volar tilt (VT) of -2, and ulnar tilt (UT) of 15. CT revealed a fracture line from the volar watershed line to the dorsal proximal area and dorsal displacement of the distal fragment (Fig. 2c). One week after injury, osteosynthesis was performed using the above surgical technique, and a good reduced position was achieved (Figs. 2d and e). At present, 1 year after the operation, the range of wrist motion is 90° for flexion, 70°



Figure 2 - a: Plain frontal X-ray image at the time of injury: Ulnar tilt (CT), 15°. b: Plain lateral X-ray image at the time of injury: Volar tilt (VT), -2°. c: CT at the time of injury: A fracture line was present from the volar watershed line to the dorsal proximal area, and the distal fragment was dorsally displaced. d: Postoperative plain frontal X-ray image: UT, 21°. e: Postoperative plain frontal X-ray image: VT, 13°.



Figure 3 - a: Plain frontal X-ray image at the time of injury: Ulnar tilt (CT), 15°. b: Plain lateral X-ray image at the time of injury: Volar tilt (VT), -2°. c: CT at the time of injury: A fracture line was present from the volar watershed line to the dorsal proximal area, and the distal fragment was dorsally displaced. d: Postoperative plain frontal X-ray image: UT, 21°. e: Postoperative plain frontal X-ray image: VT, 13°.

for extension, 90° for supination, and 90° for pronation. Plain X-ray examination shows maintenance of the postoperative reduced position (VT, 13; UT, 21). He could return to his previous work.

Patient B: a 66-year-old male, previously in good health, was admitted to the emergency room after falling off a ladder. Plain X-ray examination showed a right distal radius fracture (Fig. 3a and 3b), a VT of 1, and a UT of 22. Although this displacement is not much, CT revealed intra-articular fracture with displaced dorsal fragment in lunate facet but no injury in the volar bone cortex (Fig. 3c). As described in “Technical Note”, closed reduction and closed surgical technique such as Kapandji's are not enough for these dislocated fragments to obtain good reduction. Five days after injury, osteosynthesis was performed using the above surgical technique, and a good reduced position was achieved (Fig. 3d and 3e). At present, 1 year after the operation, the range of wrist motion is 45° for flexion, 75° for extension, 90° for supination, and 90° for pronation. Plain X-ray examination shows maintenance of the postoperative reduced position (VT, 13; UT, 19), and he can practice karate without pain.

### Discussion

There is no generally accepted opinion on the surgical technique for distal radius fracture with a displaced dorsal fragment. Kim et al. reported good results using only volar plate fixation even for fractures accompanied by a displaced dorsal fragment [1]. In contrast, Jakubietz et al. reported that anatomical reduction using a dorsal approach and dorsal plate fixation should be performed [6]. Lozano-Calderon and Schneeberger et al. reported that dorsal plate or k-wire fixation should be added to reduce the dorsal fragment when its adequate fixation

cannot be achieved using a volar plate alone [5, 9].

However, the dorsal approach for distal radius fracture presents problems such as the development of complications and evaluation of bone filling materials for bone defects after reduction [5, 7, 8]. Therefore, for anatomical reduction and fixation of the dorsal fragment using a volar approach alone, we developed a new technique involving fenestration of the volar bone cortex and reduction using an intramedullary procedure.

The VA TCP used in this study has an open space between the radial and intermediate columns (Fig. 1a). Fenestration of the volar bone cortex in this open space allows a reduction procedure for the dorsal fragment (Fig. 1d). This reduction procedure may not invade the dorsal soft tissue (extensor tendon). Indeed, in both patients, the postoperative VT was 13, showing adequate reduction of the dorsal fragment (Fig. 2e and 3e). In addition, complete extension of the fingers was possible after the operation, and no adverse effects on the dorsal soft tissue (extensor tendon) were observed.

The problem of this surgical technique is the necessity of producing a new bone fracture. However, since the open space of the VA TCP is used for fenestration, the bone resected for fenestration can be returned to the original position after reduction of the dorsal bone fragment followed by plate fixation. In our patients, bone union in the fenestration area could be achieved without problems. A possible complication is inadequate reduction, resulting in a gap. For intra-articular fractures (AO C type), complete reduction of the articular surface is extremely difficult. Schneeberger reported good results despite a remaining step off or gap on the articular surface 2 years after the operation for AO type C3 fractures [9]. In

patients with an AO type C fracture showing a remaining gap on the articular surface, a variable angle locking screw system such as the VA TCP allowing up to 15 off-axis angulation in all directions may be useful. In our patients, the angle of the locking screw could be adjusted to catch the dislocated dorsal fragment, and adequate reduction and fixation could be achieved.

### Conclusion

Fenestration of the volar bone cortex in the open space of the VA TCP (volar plate) allowed a reduction procedure for the dorsal fragment. This operation technique is indicated for displaced dorsal distal fragment with joint surface gap in lunate facet of radius. Closed reduction is not enough to obtain good reduction, because these fragments tend to dislocate to volar side. We got good reduction by pushing these fragments up to distal using intramedullary elevator. In addition, the variable angle locking screw system was useful to catch the displaced dorsal fragment.

### Clinical Message

For intra-articular distal radius fractures with a displaced dorsal fragment, there remains much discussion on the fixation method for the dorsal fragment. We developed an available technique consisting of fenestration of the volar bone cortex, reduction using an intramedullary procedure, and fixation using a volar plate. This technique was useful for the reduction and fixation of the displaced dorsal fragment in distal radius fractures.

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