

## Original Article

# A new external fixation method in Colles' fracture associated with the distal radioulnar joint dislocation in elderly patients

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**Abstract:** Background: Isolated distal radioulnar joint (DRUJ) dislocation is uncommon. It always associated with the radius and ulna fracture (distal radius fracture, Galeazzi, Monteggia fracture or the Essex-Lopresti forearm fracture). Many of DRUJ dislocation associated with distal radius fracture, especially Colles' fracture. Volar locking plate (VLP) must be used to fix the distal fragments and the cast used to keep the correction of the DRUJ necessarily in the traditional methods. The patients may have a lot of long-term complications (Especially forearm rotation disfunction, a high risk of wrist-stiffness and wrist pain). Material and method: We report a 65 year old man who had a Colles' fracture associate with a DRUJ dislocation after a fall to the ground. Results: In this case, we treated him with a new external fixation method and had achieved a satisfactory radiographic and functional outcome after 2 years since the operation. Conclusions: We conceive that this new external fixation method would become an alternative treatment method for such injury as Colles' fracture associated with the dislocation of DRUJ.

**Keywords:** DRUJ dislocation, Colles' fracture, new external fixation method

## Introduction

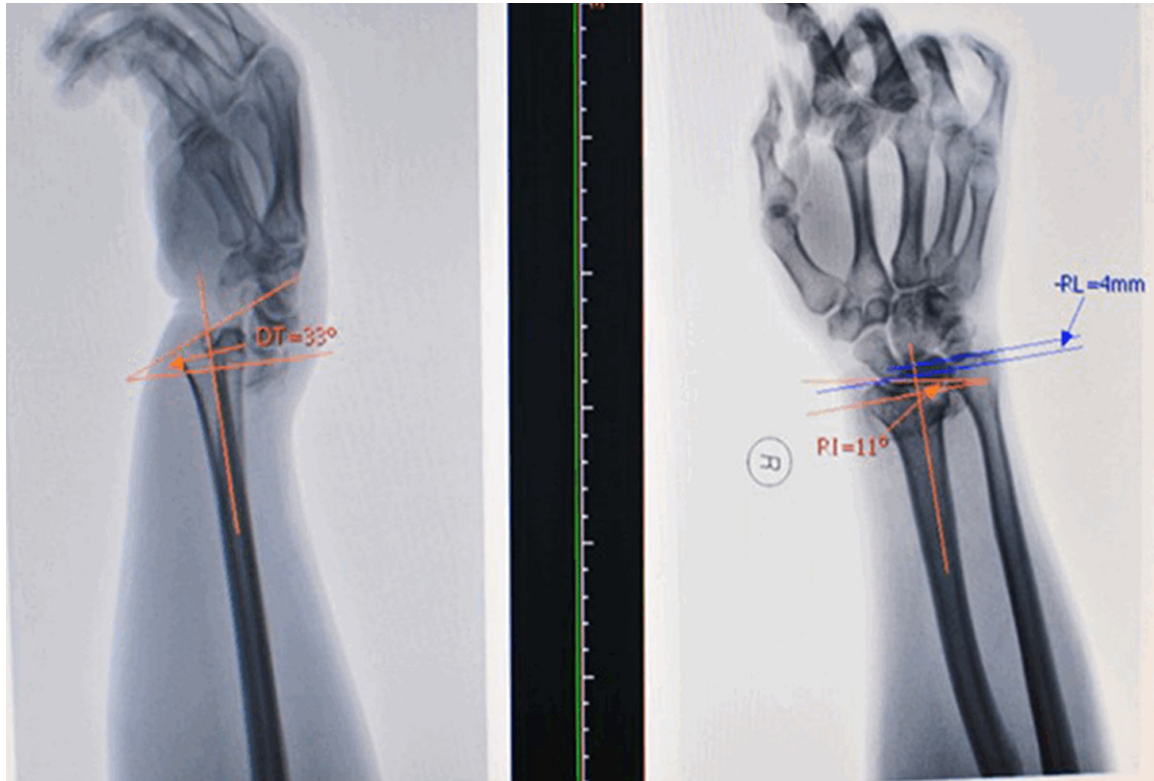
Isolated distal radioulnar joint (DRUJ) dislocation is uncommon [1]. It always associated with the radius and ulna fractures. Such as Colles' fracture, in which there would be a separation between distal radius and ulna because of the radial and dorsal displacement of the radius (combine with the damage of the triangular fibrocartilage complex (TFCC) sometimes) [2]. But orthopedic surgeons always ignore this injury as a result of deficiency of the imaging data and they often neglect the essentiality of the treatment for this injury. So they just reset and fix the distal radius fracture without correcting the dislocation of DRUJ. Therefore, patients may have a series of motorial and sensory dysfunctions of forearm, wrist and hand after a long time post operation. In addition, the traditional treatment to such injury is to use the VLP to fix the fragment of fracture with the plaster to keep the DRUJ immobilization for 4-6 weeks [3]. The most disadvantage of this meth-

od is that it can increase the risk of the stiffness of the wrist as a result of a long-time wrist immobilization. We present a case of Colles' fracture associated with DRUJ dislocation after a new trauma, which treated with a new external fixation to fix the fragment of the fracture as well as correct the DRUJ dislocation at the same time.

## Material and method

A 65-year-old man presented himself to our emergency with a "dinner fork" deformity in his right hand after a fall to the ground because of carelessness 2 years ago. The exact mechanism of this injury is that his palm stayed to the ground at the dorsiextension position. His wrist was in a typical Colles' fracture deformity (dinner fork and bayonet deformity) without any motion at that moment.

A X-ray examination was taken to this patient for his injured wrist [4]. The radiographic out-



**Figure 1.** Radial length (RL) is the distance between the styloid process of the radius and the distal articular surface of the ulna. RL was -4 mm, Dorsal tilt (DT) was 33° and Radial inclination was 11°.

come showed a Colles' fracture with DRUJ dislocation in this case. The anteroposterior (AP) images showed that the gap between distal radius and ulna had increased as the distal radial fragment shifted to radial part. The radial length (RL) was -4 mm and radial inclination (RI) was 11°. Lateral images showed that the distal fragment shifted to dorsal part. The ulna had a radial displacement relative to the radius. The dorsal tilt (DT) was 33° (**Figure 1**).

The AO classification of this case is 23-C3. The Spanning External fixation, Volar Locking Plate and Fragment Specific Fixation were recommend based on the latest AUC of DRF developed by AAOS (**Figure 2**). This patient did not have a desire of an anatomic reposition because he does not need to do subtle work with his hand anymore. And this patient has a limited economic condition. So, we choose the spanning external fixation based on the AUC of DRF and the patient's wish. However, the traditional external fixation just only can fix the fragment of the fracture without correct the dislocation of the DRUJ. Thus, we think up a new external fixation method for this patient.

Reposition of the radial and dorsal deformity of the fragment and the dislocation of DRUJ was attempted under Brachial plexus anesthesia. The patient was made at supine and the arm at the abduction. The forearm was made to supination by ongoing traction confrontation with the assistant and the dislocation of DRUJ was corrected through squeezing this joint. Using the metacarpophalangeal joint and the proximal phalanx of the index finger as a fulcrum to make the fragment to ulnar deviation to correct its radius displacement. Then, using the index fingers of both hands to pull up the distal segment as the index fingers at the semi flexion position, while using the two thumbs to press the proximal segment of the fracture to make the fracture fixed.

All the procedure were under the C-arm fluoroscopy. The C-arm showed that the position of radius and ulna resumed to normal. Keeping the injured wrist in volar flexion with the forearm supination. A traditional external fixation device with two 1.6 mm diameter K-wires (just like the original external fixation method) was used to fix the distal radius fracture and keep

## New external fixation for Colles' fracture with DRUJ

Indication Profile	Treatment Recommendations
<b>AO/OTA Fracture Type</b> <span>i</span> <input type="radio"/> Type A AO/OTA Fracture <input type="radio"/> Type B AO/OTA Fracture <input checked="" type="radio"/> Type C AO/OTA Fracture	Click Treatment of Interest to View Interactive Literature Review
<b>Mechanism of Injury</b> <input checked="" type="radio"/> High-energy Fracture <input type="radio"/> Low-energy Fracture	<input checked="" type="checkbox"/> <b>Spanning External Fixation</b> + 7
<b>Activity Level of Patient</b> <input checked="" type="radio"/> Normal Activity Level <input type="radio"/> High Functional Demands <input type="radio"/> Independent <input type="radio"/> Home-bound	<input checked="" type="checkbox"/> <b>Volar Locking Plate</b> + 8
<b>Patient Health</b> <input checked="" type="radio"/> ASA 1-2-3 <input type="radio"/> ASA 4	<input checked="" type="checkbox"/> <b>Fragment Specific Fixation</b> 8
<b>Other Injuries (in addition to distal radius fracture)</b> <input type="radio"/> Median nerve injury <input type="radio"/> Gustilo Grade I or II Open Fracture <input type="radio"/> Gustilo Grade III Open Fracture <input checked="" type="radio"/> Other Ipsilateral Injury <input type="radio"/> No associated injuries	<input type="checkbox"/> <b>Percutaneous Pinning</b> ! 6
	<input type="checkbox"/> <b>Distraction Plate</b> ! 6
	<input type="checkbox"/> <b>Dorsal Plate</b> ! 6
	<input checked="" type="checkbox"/> <b>Immobilization without reduction</b> x + 1
	<input checked="" type="checkbox"/> <b>Reduction and Immobilization</b> x 3
	<input checked="" type="checkbox"/> <b>Non-spanning External Fixation</b> x 3

**Figure 2.** The treatment recommendations based on AUC of DRF developed by AAOS in 2013.

the correction of the DRUJ at the same time under the C-arm fluoroscopy. The first k-wire pierced from the distal radius (0.5 cm under the styloid process of radius) to ulnar malleolus as the K-wire pieced through the distal fragment and in parallel with the radiocarpal joint. The significance of this k-wire is to immobilize the distal radius fragment by fixing them to ulnar, sustain the smooth of the articular facet of wrist as well as to keep the correction of DRUJ. The other k-wire pieced from the basis of radius head to the basis of the ulnar malleolus to fix the DRUJ. Then, installed the external fixation just like the traditional one (**Figure 3**). Made the K-wires just exit from ulna and keep them reserve in radius after 3 weeks when the DRUJ had fastness to guarantee the wrist joint can do the forearm rotation exercise. Then removed the k-wires from radius after 6 weeks as the distal radius fragment had stabilized. Finally, removed the all external fixation device after 10 weeks since the time of the operation. The patient was to instructe to move his fingers

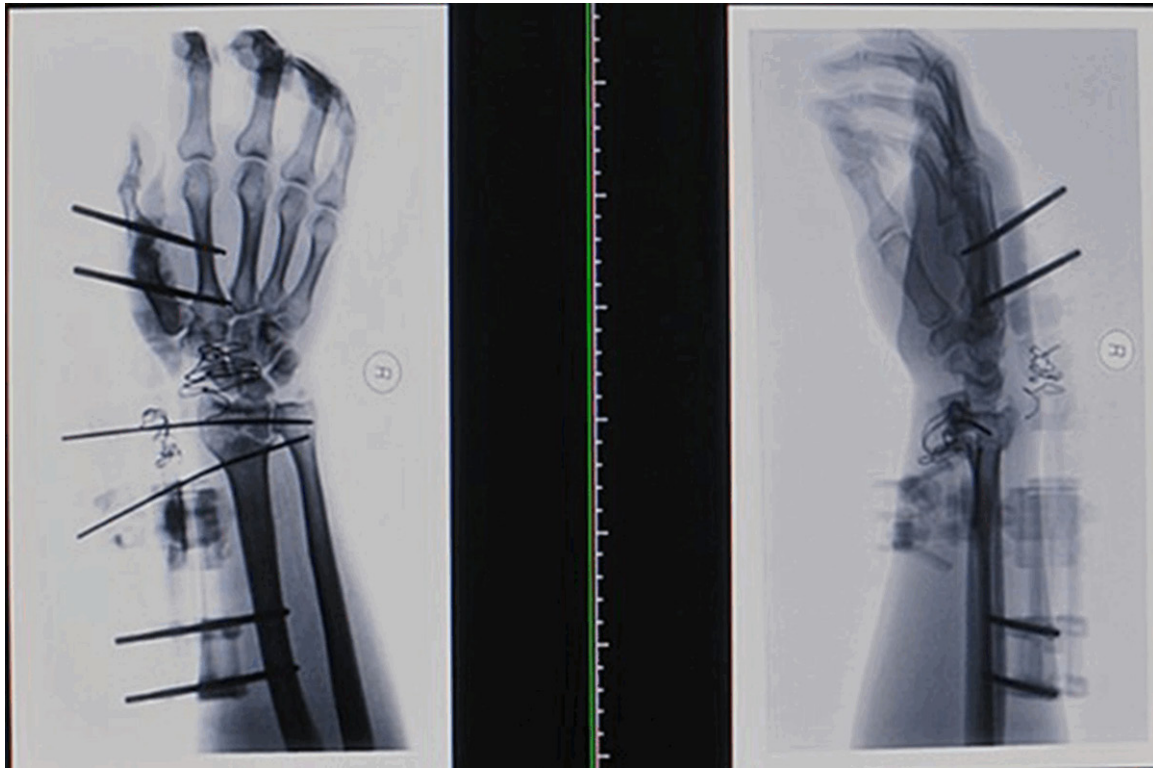
after the surgery and exercise his wrist after 3 weeks as the K-wire was exited from ulna. The only difference is that we pierced the K-wire from radius to ulna to fix the fragment as well as keep the correction of the DRUJ in the new method. In the traditional one, we pierced the k-wires only on radius just to fix the fracture fragment.

### Results

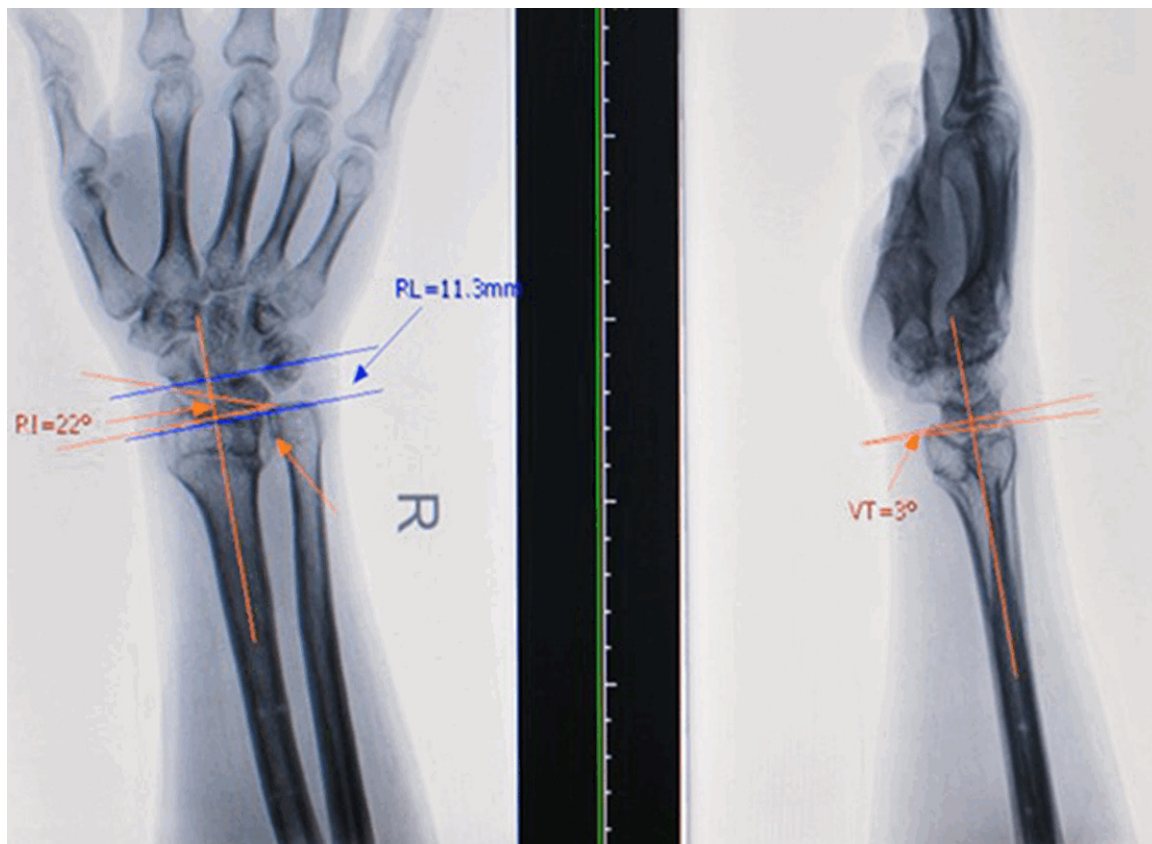
At 2 years follow up, the patient has a satisfactory prognosis of both functional and radiographic outcomes (**Figure 4**). Just as Volar tilt was 3°, Radial length was 11.3 mm and Radial inclination was 22° as well as the Cooney score was 95 point (the wrist pain was completely released, the right hand grip was 30 kg and left hand grip was 30 kg, the injured arm can do normal work without any inconvenience, the range of motion in the right hand compared to the left was 60°/70° of extension, 60°/65° of flexion, 90°/90° of supination, 90°/90° of pronation ) as we can see from the **Table 1**.



## New external fixation for Colles' fracture with DRUJ



**Figure 3.** The only difference between the new external fixation method and the traditional one is the direction of the K-wires pierced as the two K-wires pierced from radius to ulna.



**Figure 4.** The radiograph showed a satisfactory outcome as the RL returned to 11.3 mm, RI 22°, volar tilt (VT) 3° and the gap between radius and ulna had returned to normal.

**Table 1.** The radiographic and functional outcomes of this case after 2 years since the surgery

Outcomes after 2 years (right vs left)	Radiographic outcomes			Functional outcomes (Wrist Cooney score)			
	Volar tilt	Ulnar variance	Radial inclination	Rotation	Flexion/extension: 120°	Pain	Grip strength
	3°/11°	11.3 mm/13 mm	22°/23°	Pronation: 90°/90° Supination: 90°/90°	Flexion: 60°/65° Extension: 60°/70°	No/No	30 kg/30 kg

## Discussion

DRUJ is a synovial joint that consist of caput ulnare, ulnar notch of radius and triangular fibrocartilage complex (TFCC). It has a complex anatomic structure and its radial sigmoid notch is not completely consistent with the articular surface of ulnar head. The contact area of radial sigmoid notch and ulnar head articular surface decreases with the rotation and supination of forearm which always appears in distal radius and ulna fractures. So, The dislocation of DRUJ always accompanied with Colles' fracture and it often can increase the incidence of the complications of the fracture, such as wrist deformity, pain, restricted rotation and severe loss of function [5]. However, the orthopedic surgeons always only focus on the treatment of the fracture but ignore the correction of DRUJ dislocation [6]. It may cause the unstable of the DRUJ which can lead to a bad effect to the efficacy of the fracture [7]. The most common complications are ulnar wrist pain, limited rotation of forearm even the traumatic arthritis. The patients always can't do the functional exercise efficiently just because of the wrist pain due to the luxation of the DRUJ. Therefore, patients may have a series of motorial and sensory disfunctions of forearm, wrist and hand after a long time from the operation.

Up to now, the orthopedic surgeons often use the non-operative methods to treat the Colles' fracture associated with DRUJ dislocation because this injury is easy to be manual and closed replaced. The most commonly method is plaster external fixation. But, this method has a lot of deficiencies such as: it is hard to maintain the forearm at the reset state for a long time, it is difficult to achieve a satisfactory fixation because the loose of the plaster when it become dry, it may compress the capitulum ulnae if the plaster too tight, it always can not restore the smooth of the radiocarpal articular facet, re-dislocation of the DRUJ, the high risk

of the traumatic arthritis and dysfunction of the wrist joint and it can hinder the functional exercise of the wrist joint at the early time.

Currently the orthopedic surgeons use the method of volar locking plate (VLP) with the cast to treat such injury just on the basis of their experiences [3]. They use the volar locking plate (VLP) to fix the fragment of fracture with the cast to keep the DRUJ immobilization for 4-6 weeks as the affected wrist at the position of the volar flexion and the forearm pronation. The most disadvantage of this method is that it can increase the risk of the stiffness of the wrist because of a long-time wrist immobilization. Treatment methods to isolated DRUJ dislocation also include simple K-wire to fix the DRUJ, arthroplasty of ulnae and so on. None of these methods is useful for this case as they can't fix the fragment of the fracture.

So, a new external fixation method was found to use for this case. The only difference between the new and traditional external fixation is the direction of the K-wire pierced. We pierced the K-wire from radius to ulna to fix the fracture fragment as well as kept the correction of the DRUJ while the traditional one pierced the K-wire only on the radius to fix the fragment of the fracture [8]. In this case, we only exited the K-wires from ulna and kept them reserve in radius after 3 weeks when the DRUJ had fastness to guarantee the wrist joint can do the rotation exercise. Then removed the k-wires completely after 6 weeks as the distal radius fragment had stabilized. Finally, removed the all external fixation device after 10 weeks since the time of the operation. Then we instructed this patient to move his fingers after the surgery and exercise his wrist after 3 weeks as the K-wire was exited from ulna. We can immobilize the distal radius fragment, sustain the height and smooth of the articular facet of wrist as well as to keep the correction of DRUJ. The patient achieved a satisfactory prognosis of

both functional and radiographic outcomes [8] as we expected (**Table 1**).

The advantages of the new method compared to the VLP with cast method include: A. a closed reduction method with small skin incision without the exposure of the deep tissue can both reduce the rate of infection and the risk of damages of the circumambient and important tissue (radial artery and median nerve). It also can short the time of healing; B. lower operating time to decrease the risk of the infection; C. preservation of periosteal stripping and Pronator muscle cutting which is helpful for the union of the fracture and the recovery of the pronation and supination of the forearm; D. the possibility of early functional exercise to reduce the risk of the stiffness of wrist. The most disadvantage of this new method compared to the VLP method is the reduction of the fracture fragment. However, we achieved a satisfactory both radiographic and functional outcomes as the Volar tilt is 3°. Radial length is 11.3 mm. Radial inclination is 22° and the Cooney score was 95 point in this case.

### Conclusion

The new external fixation method in this case combined the traditional external fixation method for distal radius fracture with the treatment of the isolate luxation of DRUJ. It can both fix the fragment of distal radius fracture and correct the dislocation of DRUJ at the same time. The patient was freed of wrist pain and the dysfunction of the forearm rotation, which always occur in such injury after a long time. Thus, the new method would become an alternative treatment for Colles' fracture associate with the dislocation of the DRUJ.

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### Disclosure of conflict of interest

None.

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