Acta Orthopaedica et Traumatologica Turcica xxx (2016) 1–5

Contents lists available at ScienceDirect

Acta Orthopaedica et Traumatologica Turcica

journal homepage: https://www.elsevier.com/locate/aott

Flexor tendon complications in comminuted distal radius fractures treated with anatomic volar rim locking plates

Adnan Kara [a], Haluk Celik [b, *], Yunus Oc [c], Metin Uzun [d], Mehmet Erdil [a], Cihangir Tetik [d]

[a] Department of Orthopaedics and Traumatology, Faculty of Medicine, Istanbul Medipol University, Istanbul, Turkey
[b] Department of Orthopaedics and Traumatology, Zonguldak Ataturk State Hospital, Zonguldak, Turkey
[c] Department of Orthopaedics and Traumatology, Sisli Etfal Training and Research Hospital, Istanbul, Turkey
[d] Department of Orthopaedics and Traumatology, Acibadem Maslak Hospital, Istanbul, Turkey

ARTICLE INFO

Article history:
Received 7 December 2015
Received in revised form
2 March 2016
Accepted 20 April 2016
Available online xxx

Keywords:
Distal radius fracture
Flexor tendon complications
Intraarticular fracture
Volar plating

ABSTRACT

Objective: Anatomic volar rim locking plates are designed with the aim of treating intraarticular distal radius fractures. When used to treat comminuted distal radius fractures, these plates can damage the flexor tendons.
In this study, we sought to determine the radiological and functional results and rate of complications of these plates.
Methods: We retrospectively reviewed the records of 36 patients (28 males, 8 females; mean age: 46.4 years) with AO/OTA Type C2-C3 distal radius fractures treated with anatomic volar rim distal radius plates between January 2011 and December 2014. Radial length, radial inclination and palmar tilt were compared with the intact wrist. Results were evaluated with the Mayo wrist and Lidstrom scores. Complications were documented throughout the follow-up period of 23.8 (range: 12 to 48) months.
Results: Postoperative measurements of the radial length, inclination and palmar tilt did not differ significantly. Mayo wrist and Lidstrom scores were good and excellent in 27 and 32 patients, respectively. Flexor tenosynovitis was symptomatic in 15 patients and asymptomatic (localized swelling only) in 21. Plates were removed from 15 patients due to symptomatic tenosynovitis and from six patients due to partial rupture of the flexor pollicis longus tendon. The flexor digitorum profundus tendon of the second finger was also partially ruptured in three patients.
Conclusion: Anatomic volar rim locking plates provide satisfying radiological and functional results in treating AO/OTA Type C2-C3 comminuted distal radius fractures. However, if these plates interfere with the union of the fracture, they should be removed to avoid potential tendon problems caused by their placement in the rim region.
Level of Evidence: Level IV, Therapeutic study

Intra-articular fractures of the distal radius generally have a worse prognosis than unstable extra-articular fractures.[1] Due to the anterior tilt of the lunate facet, distal radial fractures involving the watershed line and the volar rim, and the coronal type of lunate facet fractures are hard to support and stabilize against shearing forces after fixation of distal fragments. In these types of fractures, conventional locked plates cannot provide butress effect. Fragment-specific plates and wire loop fixation techniques are used for fixation of small intraarticular fragments.[2,3] Anatomic volar rim plates (2.4-mm, variable angle LCP volar rim distal radius plate; Synthes Inc., Oberdorf, Switzerland) are designed to provide butress effect over the anatomical volar rim as an alternative to these methods.

In addition to providing a stable fixation, volar locking plates may compress and damage the flexor tendons.[4–6] To avoid flexor tendon problems, some surgeons recommend keeping the plates proximal to the volar rim.[7] However, this practice may not always be possible in comminuted fractures with multiple intraarticular fragments in the distal bone.[8–10]

We retrospectively assessed the radiological and functional results of patients with comminuted AO/OTA Type C2-C3 distal radius fractures treated with anatomic volar rim locking plates in order to determine the rate and nature of complications.

* Corresponding author.
E-mail address: drhalukcelik@gmail.com (H. Celik).

http://dx.doi.org/10.1016/j.aott.2016.04.001

Please cite this article in press as: Kara A, et al., Flexor tendon complications in comminuted distal radius fractures treated with anatomic volar rim locking plates, Acta Orthop Traumatol Turc (2016), http://dx.doi.org/10.1016/j.aott.2016.04.001

Patients and methods

We reviewed the records of all patients with comminuted AO/OTA Type C2-C3,[11] intraarticular, segmental, distal radius fractures treated with open reduction and internal fixation using an anatomic volar rim distal radius plate (2.4-mm, variable angle LCP volar rim distal radius plate) between January 2011 and December 2014.

Of the 55 patients meeting the eligibility criteria, 10 with volar and dorsal plating, two with bilateral distal radius fractures, one with a contralateral forearm fracture, two with ipsilateral radioulnar instability, and four patients lost to follow-up were excluded from the analysis. The 36 evaluable patients (28 males, 8 females) had a mean age of 46.4 (range: 22–69) years.

Informed consent was taken from each patient before enrollment. Standard anteroposterior and lateral radiographs were obtained for both wrists before, immediately after, and at least 12 months after surgery (Fig. 1).

Surgical indications were an intraarticular step-off of more than 1 mm, a dorsal tilt more than 10°, and a radius more than 2 mm shorter than the contralateral one on the radiographs obtained after closed repositioning performed in the emergency department.[12] All patients underwent three-dimensional computed tomography (CT) to guide surgical planning. Fracture involving the volar rim and the lunate facet was confirmed by CT imaging.

A flexor carpi radialis approach was taken in all surgeries. After elevating the pronator quadratus muscle and restoring the articulation, the small and main fragments were fixed temporarily with Kirschner wires. Plates were then positioned distal to the volar rim in order to fix and support the fractured fragments. The distal screws were placed as close as possible to the subchondral bone, and potential articular penetrations were avoided by diverting them 15° proximally. Plate placement was done according to the suggested surgical technique (Fig. 2).[13] The prominence of screws with the articular and dorsal cortex penetrations was evaluated by dorsal horizontal intraoperative fluoroscopy and by tangential imaging at 20 degrees of elevation.

After fixation, we tried to cover the plate with the pronator quadratus muscle. No patient received bone grafts.

The wrist was immobilized postoperatively with a plaster-splint on the volar surface. Splints were removed after the soft tissue healed, and then active finger and wrist exercises were begun. All patients received physiotherapy after discharge from the hospital.

Functional and radiological findings were recorded during follow-up visits on the 3rd, 6th, and 12th weeks and on the 6th, 12th, and 24th months after discharge. Wrist motions were measured with a goniometer. Functional results were evaluated with the Mayo wrist score.[14] Radiological results were evaluated with Lidstrom scores modified by Sarmiento.[15] Radius length and inclination and the palmar tilt were compared with the intact wrist. When diagnosing radiological fracture union, bone bridgings on the radial, ulnar, and dorsal cortices were considered. A fracture union time greater than six months was considered to indicate nonunion.

Grip strength was measured with a dynamometer (Jamar; Therapeutic Equipment Corp., Clifton, NJ, USA). Symptomatic tenosynovitis was diagnosed due to the presence of localized swelling, sensitivity on palpation, crepitation induced by finger movement, loss of active motion, and weakness in the fingers.[16] Patients with only localized swelling were considered to have asymptomatic tenosynovitis. Other complications that developed during follow-up were recorded.

The data were analyzed with the Number Cruncher Statistical System software 2007 (NCSS, LLC, Kaysville, Utah, USA). The data were described with either means and standard deviations or medians and interquartile ranges. The operated and contralateral sides were compared with the Wilcoxon signed-rank test for the non-normally distributed variables.

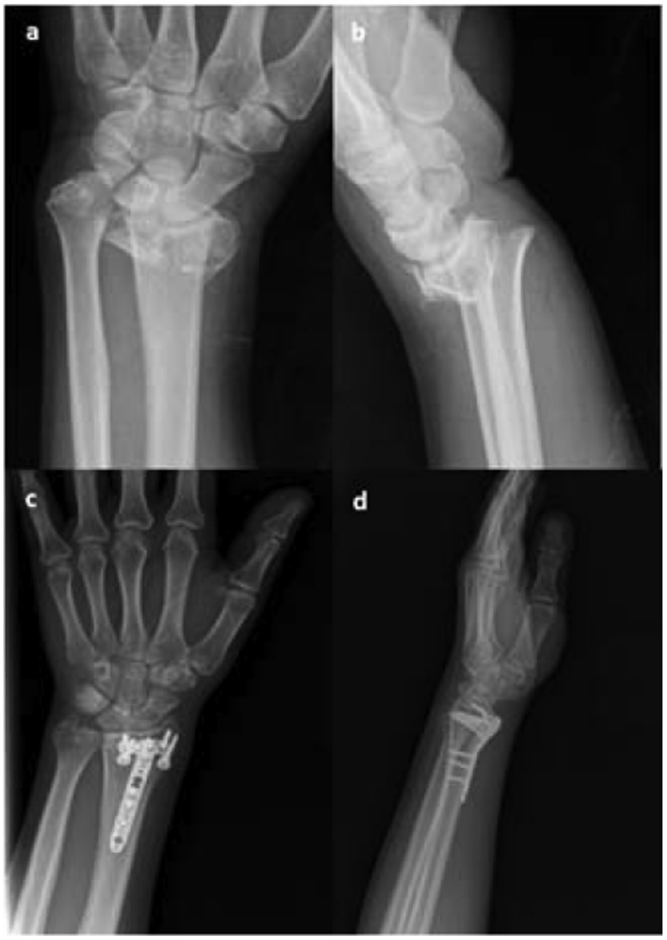

Fig. 1. (a, b) Preoperative and **(c, d)** 14-month postoperative anteroposterior and lateral views of the left wrist of a 39-year-old man treated with a volar locking rim plate.

Results

According to the AO/OTA classification, all fractures were Type C (C3 in 23 and C2 in 13 patients).[11] The cause of the fractures was a simple fall on the hand in 26 cases, traffic accidents in five, and fall from height in five.

According to the Gustilo-Anderson open fracture classification, five patients had a Type 1 open fracture and one had a Type 2 open fracture. The dominant hand was involved in 28 patients. In addition, three patients had a proximal femur fracture, two had a tibial plateau fracture, and one had a tibial shaft fracture. The mean time from hospital admission to surgery was 4.4 (range: 1–8) days.

Mean follow-up period was 23.8 (range: 12–48) months. Mayo wrist scores were excellent in 10 patients (28%), good in 17 (47%), moderate in five (14%) and poor in four (11%).

On the final follow-up visit, the grip strength was 76% of the uninvolved hand.

Radiographs indicated that union occurred in all fractures at a mean of 14 (range: 12–16) weeks. There was no statistically significant difference in terms of radial length, radial inclination or palmar tilt ($p > 0.05$) (Table 1).

Please cite this article in press as: Kara A, et al., Flexor tendon complications in comminuted distal radius fractures treated with anatomic volar rim locking plates, Acta Orthop Traumatol Turc (2016), http://dx.doi.org/10.1016/j.aott.2016.04.001