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Evaluation of functional outcome of immobilisation of extra-articular fractures of distal end of radius in position of dorsiflexion

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Abstract

Background: Cast immobilisation after successful closed reduction is a standard treatment for displaced extra-articular fractures of lower end radius. The position of the wrist during immobilisation is controversial. Immobilisation in dorsiflexion prevents redisplacement after closed reduction. Our aim is to determine the effectiveness of immobilization of wrist in dorsiflexion in such cases and evaluate functional outcome.

Materials and Methods: Study included 56 patients, above 20 years of age with closed extra-articular fractures of lower end radius treated conservatively with below elbow cast application. The wrist was maintained in 15° of dorsiflexion during plaster immobilisation. At 24 weeks, functional results were evaluated with subjective symptoms and objective signs, as per modified Demerit Point Score System.

Results: 79% of our patients had excellent to good result and 21% had fair result; there was no poor functional outcome.

Conclusion: Cast immobilization of extra articular fractures of lower end radius with wrist in dorsiflexion prevents re-displacement of the fragments resulting in satisfactory anatomical & functional outcome.

Keywords: Functional outcome, immobilisation, extra-articular fractures, distal, radius, position, dorsiflexion

1. Introduction

The mainstay of treatment in extra-articular distal end radius fracture, historically has been closed reduction and cast immobilization and still continues to do so in selected cases [1]. Although, above elbow cast is preferred for the treatment of these fractures, a forearm cast is sufficient [2]. Plaster immobilization in slight dorsiflexion of wrist has been found to give better radiological and functional results in such cases [3, 4]. This current study was undertaken to evaluate the functional outcome of immobilisation of extra-articular distal end radius fractures with wrist in slight dorsiflexion after successful closed reduction.

2. Materials and Methods

The study was carried out from August 2018 to August 2019, after obtaining clearance from the Institutional Ethics Committee. Informed consent was taken from each patient prior to inclusion in the study.

100 patients with extra-articular type of distal radius fracture, who underwent conservative treatment with wrist immobilised in dorsiflexion formed the material. Out of 100 patients, 44 patients were excluded from the study due to either drop out or incomplete data. Thus 56 patients were left for final evaluation. The injury was classified according to Fernandez classification [5]. type 1 fractures (Fernandez Bending fractures with posterior displacement), in either sex, of less than 10 days duration were included in the study. Fractures with extension into the joint, associated fractures in the affected limb, gross comminution and open fractures were excluded from the study.

There were 30 male and 36 female patients. The right hand was affected in 34 patients while patients aged 35–55 years showed highest incidence. All the injuries followed fall on outstretched hand. The limb was immobilised initially with a dorsal slab for 4–5 days till the

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swelling reduced along with elevation of the arm with pillow pouch and active finger movements. Closed reduction was done under general anaesthesia and C-arm guidance. After acceptable reduction, a below elbow cast was applied still maintaining the reduction. As the plaster was hardening, the assistant slowly brought the wrist to 15° of dorsiflexion and slight ulnar deviation while maintaining the traction. The plaster was well moulded over the wrist.

The rehabilitation of the patient was started on the same day as the surgery and included active movement of all the fingers as well as active movements at the shoulder and elbow joints.

The first follow up was done at 7th day post-operatively to rule out any redisplacement with the help of wrist antero-posterior and lateral X-rays. The plaster was removed at 4 weeks and active wrist movements were started. Final follow up was done at 6 months interval for Subjective symptoms and Objective signs, all of which were subjected to a Modified Demerit Point Score System to evaluate functional results. The end result was marked as Excellent (0–2 points), Good (3–8 points), Fair (9–20) and Poor (21 or more points).⁶ Goniometer was used for the measurement of range of movement of wrist joint of the healthy and injured hand at 6 months after treatment. Measurement of grip strength was done by inflating a rolled sphygmomanometer cuff to 10 mm of Hg. Thereafter, the patient was asked to squeeze and the pressure achieved was recorded. Readings were taken for both the injured and uninjured hands for comparison.

3. Results

3.1. Subjective evaluation

Subjective evaluation was done on the basis of pain, restriction of movements and disability. At the final follow-up of 6 months, 79% of the patients had Excellent to Good subjective symptoms. Rest 21% cases had slight symptoms with Fair outcome. Weakness of the grip strength was the most frequent complication observed in 28 (50%) out of the total patient of 56 showing this symptom.

3.2. Objective evaluation

- Pain in distal radio-ulnar joint: Pain in distal radio ulnar joint was present in 28 patients (50%).
- Grip strength: At 6 months it was found that 28 (50%) cases had diminished grip strength. It was found that impaired grip strength had a strong correlation with overall functional outcome. 30% of the patients with excellent outcome had impaired grip strength while 75% of the patients with good or fair outcome had impaired grip strength at 6 months.
- Loss of mobility: The most common movement to be lost was loss of radial deviation (42%), followed by loss of circumduction (30%).
- Complications: No complication was seen in any of the patient in our study group like median nerve compression, shoulder-hand syndrome, Sudeck's osteodystrophy.

3.3. Functional end results

79% of our patients had excellent to good result and 21% had fair result; there was no poor functional outcome.

Table 1: Functional end result assessed on the basis of demerit point score system at 6 months

Demerit point score system	No. of patients	Percentage (%)
0–2 (Excellent)	20	35.72
3–8 (Good)	24	42.85
9–20 (Fair)	12	21.43
>20 (Poor)	0	0
Total	56	100

4. Discussion

No clear consensus exists as to the best position for immobilizing the wrist in a cast in extra-articular fracture of lower end radius. Sarmentio *et al* advocated immobilization in the position of supination to decrease the deforming force of the brachioradialis, which may cause loss of reduction^[7]. Wahlstrom recommends immobilization in pronation because he claims that the pronator quadratus causes the deforming force and is responsible for loss of reduction^[8]. According to the John Charnley, Colles' fracture should be treated in palmar flexion and ulnar deviation as dorsal periosteal hinge provides stability^[9]. Extra-articular fractures of the lower end of radius were classically treated by closed reduction, cast immobilization in palmar flexion and ulnar deviation. But this conventional position has higher chance of redisplacement, inhibits hand functions and has greater associated complications like median nerve compression^[10]. Studies done as early as 1910 & 1932 also maintained that dorsiflexion and ulnar deviation to some extent resulted in satisfactory outcome^[5]. Fractures immobilized with the wrist in dorsiflexion showed the lowest incidence of redisplacement, especially of dorsal tilt, and had the best early functional results. In palmar flexion the dorsal carpal ligament is taut, but cannot stabilize the fracture because of its lack of an attachment to distal carpal row. The deforming forces and the potential displacement of the fracture are parallel, in the

same direction. In dorsiflexion, the volar ligaments are taut and tend to pull the fracture fragment anteriorly. The deforming forces act at an angle, which tends to reduce the displacement of the fracture^[4].

In this study we compared the functional outcome of extra articular type of distal radius fractures treated conservatively with wrist immobilized in dorsiflexion. We found that individual movements of supination, pronation, ulnar and radial deviation as well as total range of movements are satisfactory when the wrist is immobilized in dorsiflexion. Recovery of grip strength and subjective assessment of pain, disability and limitation of the movements were also encouraging.

5. Conclusion

Functional results of extra-articular fractures of lower end radius are superior if the fractures after reduction are immobilized in dorsiflexion of wrist rather than in conventional palmar flexion position.

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