

## ORIGINAL ARTICLE

## Treatment of Comminuted Intra-articular Fractures of Distal Radius by External Fixator

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### Abstract

**Background:** Treatment of comminuted intra-articular fractures of distal radius by external fixator is an important. **Objective:** The aim of study was to investigate the usefulness of external fixator as a treatment option for displaced comminuted intra-articular fractures of distal radius. **Methodology:** This case series was conducted in the Department of orthopaedic Surgery at Shaheed Suhrawardy Medical College & Hospital, Dhaka during the period of November 2011 to July 2013. All the patients having comminuted intra-articular distal radial fractures were being treated with mini uniaxial external fixator under brachial plexus block. The average follow up was performed in about 6 month. **Result:** A total number of fifteen patients were enrolled for this study. The mean age with SD was  $50.21 \pm 9.473$ . Patient outcomes were measured by modified Knirk and Jupiter score and were categorized as satisfactory and unsatisfactory groups. In this study satisfactory outcome was found in 86.0%. All fractures (100.0%) were united nicely. Few complications were encountered. Postoperative osteoarthritis was not found during follow up. **Conclusion:** The use of external fixator for treating the comminuted intra-articular distal radial fractures produces satisfactory result.

**Keywords:** External fixator, internal fixation, plating, reduction, fracture

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## Introduction

The distal radius fracture has been an orthopaedic conundrum since its description by Colles' in 1814. The standard treatment of this fracture still remains controversial<sup>1-8</sup>. Specific problems in term of stability and immobilization due to combination of dorsal cortex and the intra-articular involvement itself are encounter<sup>2-13</sup>. There are many treatment options like closed reduction, casting, cast- immobilization, external fixation with or without percutaneous pin and open reduction internal fixation with plate screws and intramedullary devices. Each fracture requires individual treatment customized to deal with specific characteristics of fracture<sup>14</sup>. Single frame external fixation devices with or without pins or in combination of plaster become a popular method of treatment for distal radial fractures. Roger Anderson device is the early external fixation device used to treat distal radius fractures. Many authors recommended external fixation for intra-articular comminuted distal radius fractures although it has high complication rate and these are pin related<sup>2-21</sup>. For intra-articular fractures restoration of articular congruity seems to be more important and critical than restoration of radial length and reduction of dorsal tilt of articular surface radius<sup>18</sup>. Improved joint congruity would provide protection against the future degenerative changes<sup>1,11,18</sup>. The aim of study was to investigate the usefulness of external fixator as a treatment option for displaced comminuted intra-articular fractures of distal radius.

## Methodology

This case series was carried out at Shaheed Suhrawardy Medical College Hospital Dhaka, during the period of November 2011 to July 2013. During this period all the patients with comminuted intra-articular distal radius fracture admitted in this hospital were treated with small external fixator. Patients with Barton or Smith fractures were excluded from this study.

**Operative technique:** A frank discussion with patient was held about the option of treatment and its recovery. Accordingly all implants were kept ready. Patient's consent was taken for operation. The injured upper limb was kept elevated to reduce swelling. External fixator was applied in a standard procedure involving second metacarpal and radius in their lateral borders through small stab incision. Operation is usually carried out under brachial plexus block and tourniquet. The injured limb was placed on the side table. Closed reduction was done by longitudinal traction and gentle manipulation before applying frame. Reduction was checked with c-arm or per operative x-ray. Distraction was stopped after satisfactory reduction. A light dressing applied and forearm was kept elevated. Patient was discharged next day after having an anterior-posterior and lateral views x-ray of wrist. During the first 3 weeks patient were evaluated weekly with anterior-posterior and lateral X-rays of wrist. External fixator was removed after 6 weeks. Active and passive mobilization of wrist, metacarpophalangeal and interphalangeal joints are encouraged.

**Table 1: showing the grade of articular incongruity**

Grade	Step off(mm)
0	0-1 mm
1	1-2 mm
2	2-3 mm
3	>3 mm

**Evaluation criteria:** All the patients had anterior –posterior and lateral X-rays of wrists at preoperative, postoperative and follow up period. Immediate postoperative X-ray of injured wrist was taken after reduction and assembling of external fixator to grade articular incongruity according to Kirkland Jupiter<sup>18</sup>. Functional results and radiographic results were evaluated. The follow up was continued for 1 year after the fracture united. Wrist function was evaluated at 6<sup>th</sup> month and 1 year using Solgaard's modification<sup>22</sup> of scoring system described by Gartland and Werley<sup>23</sup>. The scoring system based on clinical and radiological data. Radiological deformity

accounts for 0-3 points, subjective complaints such as pain, limitation of motion and disability are rated as 0-6 points. Objective evaluation which accounts for 0-5 points includes loss of different range of movement of wrist, presence of pain into distal radioulnar joint and evaluation of grip strength. Another 5 points were given for complication such as nerve problems, radiographic arthritic changes and poor function of fingers. Scores are graded, 0-2 points excellent, 3-8 good, 9-20 fair and more than 21 poor. Osteoarthritis is also graded according to Knirk and Jupiter<sup>18</sup>.

**Table 2: Showing grading of arthritis**

Grade	Findings
0	None
1	Slight Joint Space Narrowing
2	Marked Joint Space Narrowing, Formation of Osteophytes
3	Bone on Bone, Formation of Osteophytes and Cysts

## Results

A series of 15 patients were operated out of which 10 male and 5 female with an age range of 18-80 years (Mean±SD = 50.21±9.473 years) (Table 3). All fractures united in this series within 2 months, 10 cases were excellent (66.0%), 3 cases were good (20.0%) and 2 cases had pin tract infection treated accordingly (Table 4).

**Table 3: Demographic Characteristics of the Study Population (n=15)**

Variables	Frequency	Percentage
Male	10	66.7
Female	5	33.3
Mean age	50.21±9.473 (years)	

There was radial deviation of wrist in one case but was acceptable and functionally good. Some of the patients had stiffness of fingers and wrist. These patients undergone physiotherapy and had full range of motion. There was no case of neurovascular problem; however, one patient developed transient

median nerve paresthesia involving index finger. There was no redisplacement of fracture fragment in any case. There was one case of fracture radius at the site of Sanz screw placement. That was one case of old neglected open fracture of distal radius and the bone very osteoporotic. However, fortunately fracture was united with cast for another 4 weeks. No one patient needed 2<sup>nd</sup> operation correction of redisplacement of fracture fragment or reapplication of frame.

## Discussion

Comminuted intra-articular fractures of distal radius are commonly observed in orthopaedic practice<sup>19</sup>. The importance of anatomic reduction of wrist fracture has been demonstrated by clinical study as well as laboratory assessment of force and stress loading across the radio-carpal joint<sup>18,24</sup>. In fractures with articular surface displacement more than 2 mm, radial shortening more than 5mm, dorsal angulations more than 20 degree had suboptimal results has been reported in the present studies<sup>18,25</sup>.

**Table 4: Success Rate of Unite of Fractures (n=15)**

Variables	Frequency	Percentage
Excellent	10	66.0
Good	3	20.0
Pin tract infection	2	14.0
Total	15	100.0

The goal of management of these fractures is to achieve anatomic reduction and to maintain it by firm fixation until united<sup>2-5, 9, 11-13, 19-22</sup>. Comminution of the dorsal cortex of radius and intra-articular involvement render these fracture inherently unstable<sup>9-12,18-22</sup>. Even if proper reduction can be achieved, loss of reduction and shortening of radius after a few days or weeks is almost inevitable with conventional cast immobilization<sup>16,19,21-22</sup>. A wide variety of orthopaedic and surgical treatment has been proposed to prevent the loss of reduction and radial shortening like supination cast, above-elbow casts in various

degree of rotation, percutaneous pinning of the distal fragment, percutaneous pinning according to Kapandji, longitudinal pins and even early Darrach resection has been described<sup>12,19,21,22</sup>. Bohler introduced a method with pins incorporated in a plaster cast in order to provide a fixed traction device to maintain length<sup>2,16,19,21,22</sup>. The maintain disadvantages of this technique were inability to restore normal palmar tilt of the distal radial articulation and a high rate of complications, sometimes as high as 50.0%<sup>2, 16, 18-19, 22</sup>. Internal fixation has also been advocated as the method of choice but it can be very hazardous due to poor quality of bone and comminution and sometimes it not attainable<sup>1</sup>.

After Anderson's original description of external fixator, improved anatomical and functional results were reported<sup>2-4,9-10,16-22</sup>. The external fixator is useful particularly in reducing and maintaining intra-articular comminution<sup>2-4,9-12,16-22</sup>. Reduction of intra-articular comminution is based on the principles of ligamentotaxis<sup>11,13,16,19,22</sup>. External fixation has been a popular for treatment of displaced fractures of distal radius, radial length and dorsal tilt have improved significantly with this method<sup>26-28</sup>. Pin in plaster technique is also a good method for treating distal radial fractures but there were some problems of nerve injury and stiffness of wrist and fingers. Moreover there is chance of developing osteoarthritis<sup>29</sup>.

Our study showed 86% satisfactory and 14% unsatisfactory results which are similar to other series<sup>30</sup>. Patients with a satisfactory overall score have a significantly lesser grade of postoperative articular incongruity. The better the articular congruity after reduction and fixation the better the overall score. Joint incongruity seems to lead to developing posttraumatic radio-carpal degenerative changes<sup>2,11,18</sup>. Complications are also similar with other series.

## Conclusion

The use of external fixator for treating the comminuted intra-articular distal radial

fractures produces satisfactory result if an anatomical reduction of distal radial articular surface can be obtained by ligamentotaxis. Moreover it is simple technique, less invasive procedure learning curve is also short and hardware can be removed in outpatient basis.

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