



# International Journal of Orthopaedics Sciences

ISSN: 2395-1958  
IJOS 2017; 3(3): 227-229  
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www.orthopaper.com  
Received: 12-05-2017  
Accepted: 13-06-2017

**Dr. Radhey Sham Garg**  
Professor, Department of  
Orthopaedics, GGS Medical  
College and Hospital, Faridkot,  
Punjab, India

**Mohammed Sagy**  
Resident, Department of  
Orthopaedics, GGS Medical  
College and Hospital, Faridkot,  
Punjab, India

**Gursagar Deep Singh**  
Resident, Department of  
Orthopaedics, GGS Medical  
College and Hospital, Faridkot,  
Punjab, India

**Deepak Garg**  
Resident, Department of  
Orthopaedics, GGS Medical  
College and Hospital, Faridkot,  
Punjab, India

**Arpandee Brar**  
Resident, Department of  
Orthopaedics, GGS medical  
college and hospital, Faridkot,  
Punjab, India

**Correspondence**  
**Dr. Radhey Sham Garg**  
Professor, Department of  
Orthopaedics, GGS medical  
college and hospital, Faridkot,  
Punjab, India

## Functional outcome in metacarpal fractures treated with Minifragment plating

**Dr. Radhey Sham Garg, Mohammed Sagy, Gursagar Deep Singh and  
Deepak Garg**

DOI: <http://dx.doi.org/10.22271/ortho.2017.v3.i3d.45>

### Abstract

There is trend on rise to use miniplates over the kirschner's wire for treating the fractures of hand. The improved system of internal fixation by miniplates has many advantages. The aim of the study was to evaluate whether the newer stable fixation method i.e plating has any significant advantage. The study included a total of 20 cases with individuals ageing greater than 18 years. The patients excluded from the study were who had compound injury, severe osteoporosis and severe comorbid conditions in whom risk of anaesthetic complications were high. The average time for radiological union was 8.7 weeks. Stiffness was the most common associated complication in this study. 8 patients (40%) had shown excellent results; 9 patients (45%) had shown good results; 3 patients had shown fair results and none reported poor result. Plating is an excellent method of fixation in metacarpal fractures.

**Keywords:** miniplate, metacarpal, functional outcome, hand

### Introduction

Hand is an important body part in terms of varied specialized work it does. It is both offensive and defensive in protecting the body and an adjuvant to speech in making it affirmative, impressive and emphatic. Accidental fracture of metacarpals are like fracture anywhere else in the body. Fractures of metacarpals constitute between 14-28% of all visits to the emergency department [1]. The goal of treatment remains primarily to return the person so affected to his or her original field of work whether manual, professional or specialized at the earliest possible with no sequel or disability what so ever.

The fundamental principle of fracture management is same as elsewhere in the body, apart from the fact that fracture of the metacarpal and phalanx needs to be urgently and accurately reduced to restore full function in hand. Any untoward delay or sub-optimal treatment is fraught with the danger of permanent residual disability.

There are various methods of treatment ranging from cast, kirschner's wire application, plating, external fixator, etc. there has been surge in use of plating over the other techniques to treat the fractures of hand. The present study focuses on the treatment of metacarpal fractures with Minifragment plating.

### Material and methods

This prospective study was performed at a teaching hospital in India. The study consisted of a total of 20 cases. A case of either sex  $\geq 18$  years old with fracture of metacarpal were included into the study. An informed written consent of the patient was obtained before inclusion in the study. The ethical clearance from the ethics committee of the institute was obtained before the start of study. The patients excluded from the study were who had compound injury, severe osteoporosis and severe comorbid conditions in whom risk of anesthetic complications were high. The fractures were classified as per OTA (orthopaedic trauma association). The patients were given general or regional anesthesia and all the operative procedures were performed under tourniquet control. Preoperative antibiotics (first- generation cephalosporin) were administered 30 minutes before the operation.

### Surgical technique

The affected limb was scrubbed and prepared with savlon. Painting and draping was done under aseptic and antiseptic condition. Skin incision was given over the dorsal aspect centering over the fracture site. Skin and subcutaneous tissue were reflected to either side. The extensor tendon was retracted to one side and the fracture site was exposed. Anatomical reduction was achieved. Reduction was held by an assistant and the chosen plate was contoured to metacarpal dorsally. The appropriate sized mini plate was centered over the fracture site and secured by insertion of mini screws on either end of the mini plate across the fracture site. The wound was stitched in layers, tourniquet was released and antiseptic dressing was done over the wound.

The operated limb was kept elevated for 48 hours. Anti-inflammatory and analgesics were given. Radiological examination was done on the next day of the operation to document the reduction. The first postoperative dressing was done on the fifth day. Active finger movements were commenced on the 1st postoperative day itself. Alternate stitches were removed on 10th and all remaining on 12th postoperative day.

The patients were examined every three weekly till radiological union. Union was defined as complete obliteration of fracture gap on two perpendicular views. Nonunion was considered when gap was present or no callus was seen on serial radiographs for six months. Delayed union was defined as when callus was not seen on serial radiographs at twelve weeks. On every visit patient were examined clinically and X-rays of the hand were taken. Radiological sign of union, displacement, implant failure or any angulation were recorded. Clinically, patients were examined for any tenderness, infection or pain. The active assisted ranges of movements were started after three weeks. During the period of follow up, only active exercises in physiotherapy center or at home were advocated. The movements of distal interphalangeal, proximal interphalangeal and metacarpophalangeal joints were recorded at one year following operative intervention.

The functional evaluation was done using total active range of motion (TAM) as suggested by American Society for the Surgery of Hand (ASSH) [2]. It includes summation of active flexion at metacarpophalangeal, proximal interphalangeal and distal interphalangeal joints, after excluding the sum of extension deficits at respective joints. The movement regained was calculated as percent-regained motion compared to normal range of motion at all the three joints (270 degrees). The results were tabulated according to Strickland's original classification [3]. The patients with 85-100% of TAM were described as excellent; 70-84% as good; 50-69% as fair and 0-49% as poor.

### Results

The mean age of the patients was 35.72 years. 52.5% of the fractures occurred between the age group of 31-50 years. Male to female ratio is approximately 10:3. In 12 (62.5%) cases, mode of injury was road traffic accident, being the commonest cause of injury. 7(35%) cases occurred because of assault and in 1(2.5%) case, mode of injury was railway accident. 68% extraarticular diaphyseal non-comminuted fractures, 32% had diaphyseal comminuted fractures. Majority of the patients were operated within one week of the surgery with 13 patients having been operated within 3 days of injury and 7 cases having been operated within 4-7 days of injury. One patient had developed fever (table I). The fever

developed after 24 hrs of operative intervention and lasted for two days. There was associated wound infection in this patient. The discharge was purulent due to pyogenic infection. The patient was given antibiotics for three weeks and daily antiseptic dressings were done. There was complete resolution of discharge following treatment. Four patients had experienced post-operative stiffness. One patient (5%) had shown delayed union (Table I). One patient had reported tendon rupture. The tendon ruptured at the metacarpal shaft level and was primarily repaired; with uneventful recovery. No patient in had shown non-union, mal-union, implant failure.

In our study 12 patients in group A had shown union in 6-9 weeks; 7 patients in 10-12 weeks and 1 patient in >12 weeks with average union time of weeks. The average union to time was 8.7 weeks.

Movement at distal interphalangeal joint (DIP): 14 patients in group B with flexion possible at DIP by more than 59 degree; 2 patients between 49 and 58 degree; 4 patients had less than 48 degree.

Movement at proximal interphalangeal joint (PIP): 6 patients in group B had shown flexion possible by greater than 89 degree at IP joint; 8 patients had flexion between 77 and 92 degree and 5 patients had shown flexion between 55 and 76 degree and one patient had flexion less than 55 degree.

Movement at distal inter phalangeal joint (MCP): 6 patients in group B had shown flexion possible at MCP joint by greater than 76 degree; 10 patients had flexion between 63 and 75 degree and 4 patients had shown flexion between 45 and 62 degree and none had flexion less than 45 degree.

The evaluation of the result was done according to the Strickland's criteria (Table II) as described earlier. In our study 8 patients (40%) had shown excellent results (figure 1a, 1b); 9 patients (45%) had shown good results; 3 patients had shown fair results and none reported poor result.

### Discussion

Fractures of the hand are increasing due to rapid industrialization and rise in automobile accidents. They constitute about 10% of the all the fractures [4] the majority of the fractures can be managed by the non-operative intervention while others require operative intervention. The goal of operative intervention is to provide stable fixation for bony union and allow early range of movements to prevent stiffness.

The miniplate has advantage of providing rotational control and compression at the fracture site in transverse fracture while its pitfalls include fibroplasia at the fracture site due to periosteal stripping which occurs during its application [5-7].

The radiological union was achieved in all the cases in about 12 weeks. The mean time to achieve union in cases treated with metacarpal plating was 8.7 weeks. Omakawa *et al.* [8] reported union in all the cases of fractures of hand treated with miniplates within 10 weeks. The good to excellent results were obtained in 85% of the cases. Nalbungla *et al.* [9] had reported good to excellent in 86% of the cases treated with miniplates in metacarpal and phalangeal fractures.

Stiffness was the most common complication observed. Gupta *et al.* [10] had also reported stiffness as a major complication in their case series. Various other complications like tendon rupture, infection were also noted in isolated cases and were managed appropriately.

The limitations of the study were

1. non randomized groups
2. small number of patients and

## 3. short term follow up.

Thus we concluded that there is trend towards use of miniplates in the treatment of fractures of hand. Patients treated with mini plating had good results in metacarpal fracture.

**Table 1:** Immediate, early and late postoperative complications

| complication        | Group B      |                     |
|---------------------|--------------|---------------------|
|                     | No. of cases | Percentage of cases |
| Fever               | 1            | 5                   |
| Swelling            | 2            | 10                  |
| Discharge           | 1            | 5                   |
| Stiffness at joints | 4            | 20                  |
| Delayed union       | 2            | 10                  |
| Malunion            | 1            | 5                   |
| Tendon rupture      | 1            | 5                   |

**Table 2:** Showing grading of results according to the Strickland's classification

| Grade     | Number of cases | Percentage |
|-----------|-----------------|------------|
| Excellent | 8               | 40         |
| Good      | 9               | 45         |
| Fair      | 3               | 15         |
| Poor      | 0               | 0          |
| Total     | 20              | 100        |

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