

# Compare the Outcomes of Mini-Plate versus K-Wire Fixation in Patients with Shaft of Metacarpal Fractures

Mini-Plate versus  
K-Wire Fixation  
for Fractures  
Shaft of  
Metacarpal

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## ABSTRACT

**Objective:** To compare the outcomes of mini plate versus K-wire fixation in patients undergoing surgical treatment for fractures shaft of metacarpal.

**Study Design:** Randomized controlled trial study.

**Place and Duration of Study:** This study was conducted at the Department of Orthopaedics, Nishtar Hospital Multan from January 2019 to June 2020.

**Materials and Methods:** Forty patients of both genders presented with fractures shaft of metacarpal were enrolled. All the patients were divided equally in to two groups. Group I with 20 patients received mini plate internal fixation and group II with 20 patients received K-wire fixation. Functional outcomes were analyzed by DASH scoring system. Post-operative complications were examined.

**Results:** In group I, 12 (60%) patients were male and 8 (40%) were females with mean age  $32.22 \pm 8.96$  years and in group II 13 (65%) were male and 7 (35%) were females with mean age  $33.86 \pm 7.48$  years. In group I, 13 (65%) patients had excellent, 4 (20%) had good, 2 (10%) had fair and 1 (5%) had poor functional outcomes, in group II 7 (35%) patients had excellent, 7 (35%) had good 4 (20%) had fair and 2 (10%) had poor functional outcomes as per DASH criteria. In group I, 2 (10%) patients and in group II 4 (20%) patients had developed postoperative complications.

**Conclusion:** Internal fixation with miniplate for shaft of metacarpal fractures showed better functional outcomes with fewer rate of postoperative complications and earlier union as compared to K-wire internal fixation.

**Key Words:** Shaft of metacarpal fracture, Internal fixation, Mini-plate, K-wire, DASH scoring system

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## INTRODUCTION

Metacarpal fractures represent 18-44% of all fractures in the hands.<sup>1-3</sup> The active and working population, particularly adolescents and young adults, has the most metacarpal fractures. The occurrence of hand trauma has evolved over the years, sometimes leading to metacarpal, fractures and dislodes.<sup>3,4</sup>

The metacarpal bone of the hand is one of the most common orthopaedic wounds, accounting for 14-28 percent of all hospital visits followed by trauma by various means such as auto fall, attack, road accidents, industrial accidents, and farm accidents.<sup>5</sup>

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Metacarpal fractures are frequently disregarded or treated as minor injuries, which lead to major impairment and distortions with the constant paralysis of fine hand movements. The deformity due to non-treatment, stiffness due to over-treatment and malformance and steepness due to poor treatment can complicate metacarpal fractures.<sup>6</sup>

Many factors, such as responsive handling of the tissues, protection of gliding tendon planes, infection prevention and early and suitable physiotherapy, apart from precise reduction and fixation, affect good mobility recovery. The lack of radiological or clinical recovery after four months of fixation determines the non-union of the metacarpal fracture.<sup>7</sup> For metacarpal fracture patients the rate of union or delayed union may be up to 6%.<sup>8</sup>

We conducted present study with aimed to compare the functional outcomes of mini-plate versus K-wire for shaft of metacarpal fractures.

## MATERIALS AND METHODS

This randomized controlled trial was conducted at Department of Orthopedics Nishtar Hospital Multan from 1<sup>st</sup> January 2019 to 30<sup>th</sup> June 2020. A total of 40

patients of both genders presented with fractures shaft of metacarpal were enrolled. Patient's detailed demographics including age, sex, and side of fracture were recorded. Patients with osteoporosis, fractures with bone loss, comminution to the extent that accurate reconstruction with firm cortical apposition is impossible and refractures were excluded. Pre- and postoperatively complete radiological assessment was done. All the patients were divided equally in to two groups. Group I with 20 patients received mini plate internal fixation and group II with 20 patients received K-wire fixation. Post-operative complications such as superficial infection, delayed union, and finger stiffness were examined. Functional outcomes were analyzed by DASH scoring system. Patients were followed for 3 months.

All the data was analyzed by SPSS 24.0. Chi-square test was done to compare the outcomes and postoperative complications between both groups. P-value <0.05 was taken as significant.

## RESULTS

In group I, 12 (60%) patients were male and 8 (40%) were females with mean age  $32.22 \pm 8.96$  years and in group II 13 (65%) were male and 7 (35%) were females with mean age  $33.86 \pm 7.48$  years. 11 (55%) patients had right side fracture and 9 (45%) had left side involvement in group I and in group II 10 (50%) patients had right side and 10 (50%) had left side fracture. No significant difference was observed between both groups regarding age, gender and side of fracture (p-value >0.05) [Table 1]. At 4<sup>th</sup> postoperative week union was achieved in 4 (20%) and 2 (10%) patients in group I and II, at 8<sup>th</sup> postoperative week in group I 16 (80%) patients achieved union of bone while in group II 12 (60%) patients had union, at 12<sup>th</sup> postoperative week 20 (100%) patients in group I and 19 (95%) patients in group II had union of bone. None of patient had non-union of bone at final follow-up (Table 2)

In group I, 13 (65%) patients had excellent, 5 (25%) had good, 2 (10%) had fair and none of patient had poor functional outcomes, in group II 7 (35%) patients had excellent, 7 (35%) had good 4 (20%) had fair and 2 (10%) had poor functional outcomes as per DASH criteria. A significant difference was observed between both groups with p-value 0.036 (Table3). In group I, 2 (10%) patients in which 1 (5%) had superficial infection and 1 (5%) had stiffness and in group II 4 (20%) patients had developed postoperative complications in which 2 (10%) patients had finger stiffness, 1 (5%) patient had superficial infection and 1 (5%) patient had delayed union. No significant difference was observed between both groups with p-value >0.05 (Table 4).

**Table No.1: Demographics of included patients**

Variable	Group I	Group II	P-value
Age (years)	32.22±8.9	33.86±7.48	0.086
<b>Gender</b>			
Male	12 (60)	11 (55)	>0.05
Female	8 (40)	9 (45)	
<b>Fracture side</b>			
Left	9 (45)	10 (50)	>0.05
Right	11 (55)	10 (50)	

**Table No.2: Union of bone at postoperative follow-up**

Variables	Group I	Group II	P-value
At 4th week	4 (20)	2 (10)	>0.05
At 8th week	16 (80)	12 (60)	>0.05
At 12th week	20 (100)	19 (95)	>0.05

**Table No.3: Functional Outcomes as per DASH scoring System**

Variables	Group I	Group II
Excellent	13 (65%)	7 (35%)
Good	5 (25%)	7 (35%)
Fair	2 (10%)	4 (20%)
Poor	-	2 (10%)

P-value 0.036

**Table No.4: Comparison of Postoperative complications between both groups**

Variables	Group I	Group II
No complication	18 (90%)	16 (80%)
Superficial infection	1 (5%)	1 (5%)
Finger stiffness	1 (5%)	2 (10%)
Delayed union	-	1 (5%)

P-value >0.05

## DISCUSSION

Fractures shaft of metacarpal bone are commonly encountered fractures in orthopedic settings. Many of surgical modalities have been applied for the treatment of these fractures but mini-plate fixation and internal fixation with K-wire are the most performing procedures due to high rate of excellent functional outcomes and fewer rate of complications.<sup>9,10</sup> Majority of patients were male in both groups and overall accounted 57.5% while females were 42.5%. Majority of patients were ages between 25 to 45 years. These results were comparable to many of previous studies in which male patients population was high 60% to 70% and average age of patients was 30 years.<sup>11,12</sup>

In present study, we found that at 4<sup>th</sup> postoperative week union was achieved in 4 (20%) and 2 (10%) patients in group I (mini plate) and II (k-wire), at 8<sup>th</sup> postoperative week in group I 16 (80%) patients achieved union of bone while in group II 12 (60%) patients had union, at 12<sup>th</sup> postoperative week 20 (100%) patients in group I and 19 (95%) patients in group II had union of bone. We found no significant

difference between both groups. But patients received mini plate fixation had earlier union of bone as compared to k-wire fixation. None of patient had non-union of bone at final follow-up. A study conducted by Agarwal et al<sup>13</sup> reported that time of union was better in patients received mini plate as compared to patients with k-wire fixation but the results were statistically insignificant. Another study by Ali et al<sup>14</sup> reported that Fifteen patients showed union after six post-op weeks, out of these 1 (4%) cases, K-wires were handled and fourteen (56%) were treated with miniplate. After 8 weeks of surgical treatment, 27 patients showed union, 7 cases (28%) with k-wires and 20 (80%) with miniplates were treated. During the 10th post-op week, 43 cases existed with Union, of which 18 (72%) with K-wires were treated and 25 (100%) with Miniplate were treated. On the 3rd and 4th months of post-operative procedures, 49 cases showed an X-ray union, of which 24(96%) cases were handled with K-wires and 25(100%) with a miniplate. There was a statistically insignificant gap between the postoperative unions.

In our study we found that among patients who received mini plate fixation, 13 (65%) patients had excellent, 5 (25%) had good, 2 (10%) had fair and none of patient had poor functional outcomes, in group II (K-wire) 7 (35%) patients had excellent, 7 (35%) had good 4 (20%) had fair and 2 (10%) had poor functional outcomes as per DASH criteria. A significant difference was observed between both groups with p-value 0.036. Agarwal et al<sup>13</sup> reported that patients received mini plate fixation had better functional outcomes as compared to k-wire fixation.

A research by Zhang et al<sup>15</sup> found that 21 excellent and 46 good results have been achieved in the bone cement group k-wire fitting; and 9 very good, 50 good and 5 fair plate and screw group results. The functions of the fingers were significantly different ( $p < 0.05$ ).

We found that 2 (10%) patients had postoperative complications in mini plate group while 4 (20%) patients had developed postoperative complications in K-wire group, no significant difference was observed between both groups however, 1 (5%) patient had delayed union in k-wire group. These results showed similarity to some previous studies.<sup>16,17</sup>

## CONCLUSION

Internal fixation with miniplate for shaft of metacarpal fractures showed better functional outcomes with fewer rate of postoperative complications and earlier union as compared to K-wire internal fixation.

### Author's Contribution:

Concept & Design of Study: Azhar Rashid  
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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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