

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

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ABSTRACT

Objective: To compare the functional outcomes of K-wire versus mini plate fixation for the treatment of fractures shaft of metacarpal.

Study Design: Randomized controlled trial

Place and Duration of Study: Department of Orthopaedic, Sahara Medical College, Narowal from 1st August 2020 to 31st January 2021.

Methodology: Fifty six patients of both genders presented with fractures shaft of metacarpal were included. Patient's ages were ranging between 15 to 60 years. Radiographic assessment was done to all the patients. Patients were categorized in to two equal groups. 28 patients treated with mini plates (group A) and 28 patients treated with K-wire fixation (group B). Post-operative complications were examined and compare between both groups. DASH scoring system was used for analyzing functional outcomes.

Results: Mean age in group A was 34.57 ± 7.84 years and in group B it was 34.95 ± 7.76 years. Majority of patients 18 (64.29%) and 17 (60.71%) were males in group A and B. Mean time of union in group A was 9.58 ± 2.24 weeks while in group B it was 12.33 ± 2.85 weeks, the difference was statistically significant (p -value < 0.05). As per DASH criteria, 15 (57.14%), 11 (39.29%) and 2 (7.14%) patients had excellent, good and fair functional outcomes who treated with mini plates internal fixation, while in group B 12 (42.86%), 13 (46.43%), 2 (7.14%) and 1 (3.57%) patients had excellent, good, fair and poor functional outcomes. Postoperative complications were more in group B as compared to group A but the difference was not statistically significant (p -value > 0.05).

Conclusion: Both procedures mini-plate internal fixation and K-wire fixation are effective for fractures shaft of metacarpal. However, mini-plates showed better functional outcomes with fewer rate of postoperative complications and earlier union as compared to K-wire internal fixation.

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

INTRODUCTION

Metacarpal bone fractures are one of the most common orthopaedic injuries, accounting for around 10% of the total fractures and the most common hand fractures up to 40%.¹⁻

³ The metacarpals are long tiny, slightly arched bones on the longitudinal axis and concave on the flying surface. Only behind the skull is the weakest region.^{4,5}

Metacarpal fractures may be worsened by therapeutic neglect, over-training rigidity and maltreatment deformity and rigidity.⁶ The goals of treatment include early diagnosis, reduction of rotational anatomy and deformities, soft-tissue preservation, preservation of the longitudinal and transversal arches and maintenance of metacarpus length as a result of shortening by more than 3 mm the external and intrinsically handled muscles are imbalanced.⁷

Hand fractures have been improved because to better materials, implant design, instruments, a better understanding of the biomechanics of internal fixation, the availability of hand surgeon subspecialists, ease of anaesthetic, and the enhancement of hand-physiotherapy methods.^{8,9}

The treatment of metacarpal fractures has expanded considerably over the last 25 years. Closed reduction and splinting can be handled, which is disadvantageous since it is difficult to keep joint motion to prevent stiffness.¹⁰ The fixation of the Kirschner wires, the intraosseous wiring and the fixation of the screw by or without the plate benefit from

early active motion but from the disadvantage of large surgical exposure and soft tissue damage.¹¹

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 Orthopaedic, Sahara Medical College, Narowal from 1st August 2020 to 31st January 2021. A total of 56 patients of both genders presented with fractures shaft of metacarpal were included in this study. Patient's detailed demographics including age, sex, type of fracture, and side of fracture were recorded after taking informed written consent. Comminuted shaft and condylar fractures, metacarpal fractures in children < 18 years old, old Metacarpal fractures, and patients with open fractures were excluded.

Pre and postoperatively complete radiological assessment was done. Patients were categorized in to two equal groups. Twenty patients treated with mini plates (group A) and 28 patients treated with K-wire fixation (group B). Post-operative complications such as superficial infection, delayed union, and finger stiffness were examined. Post-operative complications were examined and compare between both groups. DASH scoring system

was used for analyzing functional outcomes. Patients were followed for 12 weeks.

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

RESULTS

Mean age in group A was 34.57 ± 7.84 years and in group B it was 34.95 ± 7.76 years. Majority of patients 18 (64.29%) and 17 (60.71%) were males in group A and B while 10 (35.71%) and 11 (39.29%) patients were females in group A and B. In group A and B 16 (57.14%) and 15 (53.57%) patients had right side fractures while 12 (42.86%) and 13 (46.43%) patients had left side fractures. 19 (67.86%), 6 (21.43%) and 3 (10.71%) patients in group A had transverse, oblique and spiral fracture shape while in group B 20 (71.43%) patients had transverse, 5 (17.86%) had oblique and 3 (10.71%) had spiral fractures (Table 1).

Mean time of union in group A was 9.58 ± 2.24 weeks while in group B it was 12.33 ± 2.85 weeks, the difference was statistically significant (p-value <0.05). In group B 1 (3.57%) patient had non union while in group B none of patient had non-union of bone (Table 2).

As per DASH criteria, 15 (57.14%), 11 (39.29%) and 2 (7.14%) patients had excellent, good and fair functional outcomes who treated with mini plates internal fixation, while in group B 12 (42.86%), 13 (46.43%), 2 (7.14%) and 1 (3.57%) patients had excellent, good, fair and poor functional outcomes (Table 3).

Table 1: Demographic information of the participants

Variable	Group I	Group II
Age	34.57 ± 7.84	34.95 ± 7.76
Gender		
Male	18 (64.29%)	17 (60.71%)
Female	10 (35.71%)	11 (39.29%)
Fracture side		
Left	12 (42.86%)	13 (46.43%)
Right	16 (57.14%)	15 (53.57%)
Fracture shape		
Transverse	19 (67.86%)	20 (71.43%)
Oblique	6 (21.43%)	5 (17.86%)
Spiral	3 (10.71%)	3 (10.71%)

Table 2: Union time of bone and non-union

Variable	Group A	Group B	P-value
Union time (weeks)	9.58 ± 2.24	12.33 ± 2.85	0.018
Non-union	-	1 (3.57%)	N/S
Union of Bone	28 (100%)	27 (96.43%)	N/S

Table 3: Functional outcomes as per DASH scoring system

Variable	Group I	Group II
Excellent	15 (57.14%)	12 (42.86%)
Good	11 (39.29%)	13 (46.43%)
Fair	2 (7.14%)	2 (7.14%)
Poor	0 (0)	1 (3.57%)

P-value >0.05

In group A, 3 (10.71%) patients had superficial infection, 2 (7.14%) had stiffness, 1 (3.57%) patient had implant loosening while none of patient had delayed union while in group B 4 (14.29%) patients had superficial infection, 3 (10.71%) had finger stiffness, 2 (7.14%)

patients had implant loosening and 1 (3.57%) patient had delayed union. Postoperative complications were more in group B as compared to group A but the difference was not statistically significant (p-value >0.05) [Table 4].

Table 4: Comparison of postoperative complications between both groups

Variable	Group I	Group II
Superficial infection	3 (10.71%)	4 (14.29%)
Finger stiffness	2 (7.14%)	3 (10.71%)
Implant Loosening	1 (3.57%)	2 (7.14%)
Delayed union	-	1 (3.57%)

P-value >0.05

DISCUSSION

Fractures shaft of metacarpal bone are commonly encountered fractures in orthopaedic 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 rates of complications.^{12,13} Majority of patients were male in both groups and overall accounted 62.5% while 37.5% were females. Overall mean age in our study was 35.46 ± 8.58 years. Studies demonstrated that males patients were more who had fracture shaft of metacarpal and the average age of patients was 30 years.^{14,15}

In present study, we found that Mean time of union in group A (mini-plates) was 9.58 ± 2.24 weeks while in group B (K-wire fixation) it was 12.33 ± 2.85 weeks, the difference was statistically significant (p-value <0.05). In group B 1 (3.57%) patient had non union while in group B none of patient had non-union of bone. A study conducted by Agarwal et al¹⁶ 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.

A study conducted by Ahmad et al¹⁷ reported that patients received mini-plates had shorter time of union of bone as compared to those who received K-wire fixation (11.80 ± 2.38 Vs 12.95 ± 3.38).

Another study by Abdel-hamid et al¹⁸ reported that patients treated with mini-plates the average union time was 6 weeks as compared to K-wire with 8 weeks.

As per DASH criteria, 15 (57.14%), 11 (39.29%) and 2 (7.14%) patients had excellent, good and fair functional outcomes who treated with mini plates internal fixation, while in group B, 12 (42.86%), 13 (46.43%), 2 (7.14%) and 1 (3.57%) patients had excellent, good, fair and poor functional outcomes Agarwal et al¹⁶ reported that patients received mini plate fixation had better functional outcomes as compared to k-wire fixation.

Khaled et al¹⁹ reported that 93.3% patients had satisfactory functional outcomes who received mini-plates while 86.7% patients with K-wire fixation had satisfactory outcomes.

In our study postoperative complications were more in k-wire fixation group as compared to mini-plates group, but the difference was not statistically significant (p>0.05). We found that among group A (mini-plate), 3 (10.71%) patients had superficial infection, 2 (7.14%) had stiffness, 1 (3.57%) patient had implant loosening while none of patient had delayed union while in group B (k-wire fixation) 4 (14.29%) patients had superficial infection, 3 (10.71%) had finger

stiffness, 2 (7.14%) patients had implant loosening and 1 (3.57%) patient had delayed union. These results showed similarity to many of previous studies in which mini-plate fixation were associated with fewer rate of complications as compared to k-wire fixation.^{20,21}

CONCLUSION

Both mini-plate internal fixation and K-wire fixation procedures are effective for fractures shaft of metacarpal. However, mini-plates showed better functional outcomes with fewer rate of postoperative complications and earlier union as compared to K-wire internal fixation.

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