Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2023.205812.2790 Volume 29, Issue 6, November 2023
**Manuscript ID ZUMJ-2304-2790**
**DOI 10.21608/ZUMJ.2023.205812.2790**

**ORIGINAL ARTICLE**

# K-Wires Versus Mini-Plates Fixation in Closed Diaphysal Metacarpal Fractures

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**Submit Date 13-04-2023**
**Accept Date 2023-04-26**

## ABSTRACT

**Background:** Closed reduction and percutaneous fixation with K-wires is one of the therapeutic choices for these unstable fractures, although they provide a less firm fixation and are rotationally unstable, as well as a higher risk of pin tract infection and problems from the protruding ends of the wires, despite offering functional results that are comparable to those of plate and screw fixation. This study aimed to compare the outcomes in terms of radiology, function, and postoperative complications for both of these surgical procedures used to repair closed metacarpal shaft fractures. **Methods:** The current study is prospective cohort study included 36 patients suffering from metacarpal fracture. Patients were allocated randomly into 2 groups according to fixation methods; Group (I) 18 patients: were fixed with closed reduction and percutaneous intramedullary K-wires, Group (II) 18 patients: were fixed with mini-plates and screws. The times of (operation, union and the immobilization after surgery) were assessed. All the fractures were evaluated both clinically using the American Society for Surgery of the Hand (ASSH) (Total Active Motion (TAM), Total Active Flexion (TAF) and the quick DASH scores, and radio logically using three views of the hand (antero-posterior, oblique, and lateral) at each visit. The follow up period 3 months. **Results:** Comparison of time till union, total- active motion, total active flexion and quick DASH score revealed no statistically significant difference between the 2 techniques. **Conclusions:** Treatment options for unstable metacarpal fractures that offer reduction and fixation include percutaneous intramedullary K-wires and open reduction internal fixation with mini-plates and screws.

**Keywords:** K-wire; Mini-plates; metacarpal fractures.

## INTRODUCTION

Metacarpal and phalangeal fractures that make approximately 10% of all upper limb fractures are the most common upper limb skeletal injuries. Treatment of hand and metacarpal fractures must take into account both soft tissue healing and fracture healing, since optimal results demand the restoration of functional integrity to both tissues [1]. Stable hand fractures include those that have no displacement, impact, rotation, or angulation at the fracture site. On the other side, unstable fractures are those that cannot be maintained in place by a cast or splint and cannot be precisely aligned by manipulation [2].

Long bone fracture fixation has changed to the point that early use that isn't restricted by an external cast is prioritized along with stiff fixation. A analogous change occurred in the way tiny hand bone fractures were treated [3]. The major goal of treatment is to reduce any anomalies and reestablish the anatomical links between the metacarpal bones when the fracture is displaced and unstable. Treatment for metacarpal fractures that achieves stable fixation, permits rapid function recovery, and reduces the possibility of soft tissue damage and scarring is optimal. It should also be dependable, uncomplicated, and straightforward to use. Despite the fact that plates can strongly fix

anatomical alignment, they can also cause extensor tendon adhesion and significant cosmetic deformity because to the surrounding new bone growth on the rear of the metacarpal [4]. The stability and personality of the fracture have a significant role in the primary management of metacarpal shaft fractures. A slab or splint can immobilize the wrist in extension and the metacarpophalangeal joint in flexion greater than 70 degrees for non-displaced fractures of any form, allowing early interphalangeal mobilization and reducing hand stiffness [5].

The surgical options for treating unstable and displaced metacarpal shaft fractures are numerous. Options include external fixators, tension band sutures, Cerclage wiring, Kirsches (K-wire) internal fixation (with a number of stated methods), and open reduction internal fixation. The described procedures for percutaneous pinning (PCP) using K-wires include transverse pinning to nearby metacarpals, antegrade and retrograde intramedullary implantation, locking techniques, the bouquet osteosynthesis (multiple intramedullary pinning), and more [6].

Closed reduction and per-cutaneous fixation with K- wires is one of the treatment options for these unstable fractures, but they provide functional results that are comparable to those of plate and screw fixation despite having less rigid fixation, rotational instability, a higher association with pin tract infection, and issues caused by protruding ends of k wires [7,8].

ORIF by min-plates and screws Also take into account one crucial modality of therapy for these unstable fractures for a number of reasons; they provide stable fixation in all metacarpal fractures that are unstable, enabling early finger deployment. The interossei muscle shortens as a result of plating several metacarpal fractures, although the hand's grip strength is kept. Severe soft tissue damage is frequently present in multiple metacarpal fractures. In these unstable metacarpal fractures, plate osteosynthesis treatment leads to anatomical reduction of the fracture with rigid stabilization, allowing early mobilization of joints without losing reduction, preventing stiffness, and producing positive functional outcomes [9, 10]. To compare the radiological, functional outcome, and postoperative complications of open reduction and internal fixation using mini-plates with closed reduction and percutaneous intramedullary K-wire fixation in the management of closed metacarpal shaft fractures.

## METHODS

During the period of study, 36 patients (28 males and 8 females) with an average age of 35 years, 24 patients who presented at Orthopedic Surgery Department of Zagazig University Hospitals and 12 patients in Sabha medical center - Libya. Suffering from metacarpal fractures between August 2022 to May 2023. Patients were allocated randomly into 2 groups according to fixation methods; Group (I) 18 patients: were fixed with closed reduction and percutaneous intramedullary K-wires, Group (II) 18 patients: were fixed with mini-plates and screws.

The inclusion criteria skeletal maturity. Closed metacarpal fracture according to AO/OTA classification 77. Multiple metacarpal fractures in the same hand considered as single case. Recent metacarpal fracture less than 2 weeks. Simple fracture type A2 in AO classification. and we excluded infection at site of operation. Pathological fracture. Intra articular fracture. Open fracture. Metacarpal fractures below skeletal maturity < 18 years old. Old metacarpal fractures more than 2 weeks.

***Pre-operative:***

The patient's name, age, sex, address, phone number, occupation, dominant hand, medical history, and medical habits were collected as part of the clinical examination. Fracture information includes the type of trauma, time since the accident, the presence of wounds and any accompanying injuries, as well as any first aid and medication given. The patient's injuries and other conditions were thoroughly investigated. An in-depth evaluation of the injured hand was conducted locally while paying special attention to any open wounds. It was done to document sensory affection using the pin prick test and the vascularity refill test. Laboratory investigations including Complete blood count (CBC). liver function tests. Renal function tests. Viral screen. pro-thrombin time (PT), pro-thrombin concentration (PC), INR. Radiological data X rays of the hand AP, lateral and oblique views were done for all metacarpal fractures.

***Surgical technique:***

The operations were carried out on patients under general anesthesia, wrist block and Supra-clavicular block. All patients received a single shot of a 3rd generation cephalosporin (Ceftriaxone 1 gm. I.ve) during induction of anesthesia before application of the tourniquet. The wounded upper limb was put on a side operating table perpendicular to the patient's body while all patients were lying supine during surgery.

***Surgical technique for ORIF by plates and screws:***

A dorso-lateral incision was made to reveal the fracture after sterilizing and pneumonic tourniquet

inflating (figure 1). Second and fifth metacarpals were broken, and a dorso-radial and dorso-ulnar longitudinal incision with a bend at the proximal or distal end, respectively, Third and fourth metacarpal fractures were treated with a longitudinal incision as well as to fix the metacarpals together when multiple bones were broken. Incision that extends distally or proximally in a Y-shape between the metacarpal rays.

In order to reduce contact between the extensor tendons and the periosteum was placed over the implant as much as feasible. An inter-tendinous connection that has been severed needs to be fixed. Layers were used to seal wounds. For subcutaneous tissues, Vicryl 2/0 was employed. For skin closure, prolene or monocryl 2/0 were employed. Figure 2: With the adequate hemostasis for bleeding sites, the tourniquet was deflated.

***Surgical technique for closed reduction and percutaneous intramedullary K-wires fixation:***

The entry location for the fifth metacarpal is dorso-ulnar at the metacarpal head, protecting the extensor carpi ulnaris tendon's insertion without harming the carpometacarpal joint. At the base of the other metacarpals, dorsally, is where the entry site is placed. The dorsal cortex was punctured with a 2 mm drill bit. To prevent the drill from unintentionally slipping off the bone, drilling was first performed perpendicular to the surface of the bone (figure 3). The extensor tendons, or the dorsal sensory branch of the ulnar nerve, were shielded by a drill sleeve. To lessen the chance of damaging the delicate cortex of the metacarpal head, one K-wire was placed blunt tip first. Without ever reaching the fracture zone, two wires were manually introduced into the medullary canal and advanced into the diaphysis. By extending 90 degrees at the MP and PIP joints and pushing up the metacarpal head with the proximal phalanx (Jahss technique), the fracture was minimized under fluoroscopic supervision.

All patients had postoperative x-rays taken. Plain radiographs of the afflicted hand's postero-anterior, oblique, and lateral views. All patients received thorough education regarding the processes and significance of the rehabilitation program, as well as information about the times of follow-up visits, prior to discharge.

***Follow-up:***

The patients were followed up at Orthopedic Surgery Department of Zagazig University Hospitals outpatient clinic and in Orthopedic Surgery Department of Sabha medical center at 2, 4, 6,8,10 and 12weeks, postoperative for Clinical evaluation, Radiological evaluation and Functional evaluation.

***Ethical approval:***

All participants provided their written informed consent, and the study was authorized by the Zagazig University Faculty of Medicine's research ethical council (ZU-IRB #9862). The work has been done in compliance with the Declaration of Helsinki, which is The Code of Ethics of the World Medical Association for studies involving humans.

***Statistical Analysis***

The data were imported into the statistical analysis application Statistical Package for the Social Sciences (SPSS version 20.0). The significance of differences was determined using the subsequent tests. Using the Chi square test (X2), compare and correlate qualitative variables. Quantitative continuing group is shown by mean SD, whereas qualitative express as number and percentage. quantitative comparisons between separate groups using the t test, with a P value cutoff of 0.05 used to denote statistically significant results.

## RESULTS

The demographic data of the two studied groups. It demonstrates that, in group (I), age ranged between 20-57 with a mean of 33.75±10.92 years old, while in group (II) it ranged between 22-55 with a mean of 36.85±10.28 years old. Age differences between the two study groups are not statistically significant. Display 3 patients (16.7%) and 15 patients (83.3%) who are men females in group (I) and 13 patients (72.2%) males and 5 patients (27.8%) females in group (II). Regarding gender, there is no statistically significant difference between the two groups that were examined that Among the studied group of patients, heavy workers were 10 patients (55.6%) in group (I), 11 patients (61.1%) in group (II), light workers were 6 patients (33.3%) in group (I), 2 patients (11.1%) in group (II), house wives were 2 patients (11.1%) in group (I), 5 patients (27.8%) in group (II). Between the two study groups, there is no statistically significant difference in terms of occupation. 16 of the patients (88.9%) in group (I) had their right hand as their dominant hand and Left side in 2 patients (11.1%), in group (II) the dominant hand was right in 17 patients (94.4%) and Left side in one patient (5.6%). There is no statistical significant difference between the two studied groups regarding dominant hand. in group (I) the Rt. side was affected in 8 patients (44.4%) and the Lt. Side in 10 patients (55.6%), in group (II) the Rt. side was affected in 9 patients (50.0%) and the Lt. Side in 9 patients (50.0%). There is no statistical significant difference between the two studied groups regarding affected side. that mode of trauma was direct in 7 patients (38.9%) were in

group (I), 6 patients (33.3%) were in group (II), indirect in 8 patient (44.4%) were in group I, 10 patient (55.6%) were in group (II), road traffic accidents (RTA) in 3 patients (16.7%) were in group I, 2 patients (11.1%) were in group (II). There was no statistical significant difference between the two studied groups regarding mode of trauma. Transverse fracture occurred in 8 patients (44.4%) in group (I), 4 patients (22.2%) in group (II), oblique fracture occurred in 7 patients (38.9%) in group (I) and 5 patients in group (II) (27.8%), spiral fracture occurred in 3 patients (16.7%) in group I and 9 patients (50%) in group (II). Table (1) there was no statistical significant difference between the two studied groups regarding shape of fracture. Two patients (11.1%) in group (I), two patients (11.1%) in group (II) sustained injuries other than the metacarpal shaft fracture. The type and distribution of associated injuries are described in **(Table 1)** there is no statistical significant difference between the two studied groups regarding associated injury.

**Table 2;** showed that in group (I), trauma surgery time interval ranged between 1-6 days with a mean of 3.00±2.05 days, while in group (II) it ranged between 2-7 days with a mean of 3.85±2.16. There was no statistical significant difference between the two studied groups regarding trauma surgery time interval. in group (I), operative time ranged between 30-60 minutes with a mean of 40.25±7.52 m., while in group (II) it ranged between 40-80 minutes with a mean of 60.00±9.73 m. There was statistical significant difference between the two studied groups regarding operative time K-wires group show significant decrease in operative time. **Table (2)** shows that in group (I), number of C-arm images ranged between 15-25 with a mean of 18.30±13 images, while in group (II) it ranged between 7-20 with a mean of 11.00±3.01 images. Between the two study groups, there is no statistically significant difference in terms of occupation. 16 of the patients (88.9%) in group (I) had their right hand as their dominant hand Table (2) shows that in group (I), time of union ranged between 6-8 with a mean of 6.85 weeks, while in group (II) it ranged between 4-10 with a mean of 5.42 weeks. There was statistical significant difference between the two studied groups regarding time of union. K-wires group show significant increase in time of union

**Table (3)** showed that complication occurred in 3 patients (16.7%) in group (I), 5 patients (27.8%) in group (II). There was no statistical significant difference between the two studied groups regarding complication.

**Table (4)** showed that TAF was excellent in 13 patients (72.2%) were in group I, 15 patients (83.3%) were in group II, good in 5 patient (27.8%) were in group I, 3 patient (16.7%) were in group II, no poor patient (0.0%) in group I, and no patient (0.00%) in group II. There was no statistical significant difference between the two studied groups regarding TAF (measured at 3 month post-operatively).

Quick DASH Score 3 month mean was 9.4 in group (I) and 8.5 in group group (II) **table 5**, there was no statistical significant difference between the two studied groups regarding Quick DASH Score 3 month (measured at 3 month post-operatively).

**Table (1):** Baseline data of studied groups.

| | Groups | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | K-wires | | | | | mini plates | | | | | P value |
| | Mean | SD | Median | Minimum | Maximum | Mean | SD | Median | Minimum | Maximum | |
| **Age** | 33.75 | 10.92 | 33.00 | 20.00 | 57.00 | 36.85 | 10.28 | 35.00 | 22.00 | 55.00 | > 0.05 |
| | **Count** | | **%** | | | **Count** | | **%** | | | |
| **Gender** | | | | | | | | | | | |
| **Male** | 15 | | 83.3% | | | 13 | | 72.2% | | | > 0.05 |
| **Female** | 3 | | 16.7% | | | 5 | | 27.8% | | | |
| **Occupation** | | | | | | | | | | | |
| **Heavy workers Light workers** | 10 | | 55.6% | | | 11 | | 6.11% | | | > 0.05 |
| **Housewives** | 6 | | 33.3% | | | 2 | | 11.1% | | | |
| | 2 | | 11.1% | | | 5 | | 27.8% | | | |
| **Dominant hand** | | | | | | | | | | | |
| **Left** | 2 | | 11.1% | | | 1 | | 5.6% | | | |
| **Right** | 16 | | 88.9% | | | 17 | | 94.4% | | | > 0.05 |
| **Side affected** | | | | | | | | | | | |
| **Lt** | 10 | | 55.6% | | | 9 | | 50.0% | | | > 0.05 |
| **Rt** | 8 | | 44.4% | | | 9 | | 50.0% | | | |
| **Side affected details** | | | | | | | | | | | |
| **Lt 2nd** | 0 | | 0.0% | | | 1 | | 5.55% | | | 0 |
| **Lt 3rd** | 3 | | 16.7% | | | 2 | | 11.1% | | | 3 |
| **Lt 3rd, 4th** | 0 | | 0.0% | | | 1 | | 5.55% | | | 0 |
| **Lt 4th** | 3 | | 16.7% | | | 2 | | 11.1% | | | 3 |
| **Lt 4th &5th** | 1 | | 5.5% | | | 0 | | 0.0% | | | 1 |
| **Lt 5th** | 3 | | 16.7% | | | 3 | | 16.7% | | | 3 |
| **Rt 1st** | 0 | | 0.0% | | | 1 | | 5.55% | | | 0 |
| **Rt 2nd** | 1 | | 5.5% | | | 1 | | 5.55% | | | 1 |
| **Rt 3rd** | 2 | | 11.1% | | | 0 | | 0.0% | | | 2 |
| **Rt 3rd, 4$^{th}$&5th** | 0 | | 0.0% | | | 1 | | 5.55% | | | 0 |
| **RT 4th** | 2 | | 11.1% | | | 1 | | 5.55% | | | 2 |
| **Rt 5th** | 3 | | 16.7% | | | 5 | | 27.8% | | | 3 |
| **Mode of trauma** | | | | | | | | | | | |
| **Direct** | 7 | | 38.9% | | | 6 | | 33.3% | | | > 0.05 |
| **Indirect** | 8 | | 44.4% | | | 10 | | 55.6% | | | |
| **RTA** | 3 | | 16.7% | | | 2 | | 11.1% | | | |
| Pattern of fracture | | | | | | | | | | | |
| **transverse** | 8 | | 44.4% | | | 4 | | 22.2% | | | > 0.05 |
| oblique | 7 | | 38.9% | | | 5 | | 27.8% | | | |
| **Spiral** | 3 | | 16.7% | | | 9 | | 50% | | | |
| **Associated injuries** | | | | | | | | | | | |
| **Yes** | 2 | | 11.1% | | | 2 | | 11.1% | | | > 0.05 |
| **Non** | 16 | | 88.9% | | | 16 | | 88.9% | | | |

**Table (2):** Outcome data of the studied groups.

| | Groups | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | K-wires | | | | | mini plates | | | | | P value |
| | Mean | SD | Median | Minimum | Maximum | Mean | SD | Median | Minimum | Maximum | |
| **Trauma surgery time interval (days)** | 3.00 | 2.05 | 2.00 | 1.00 | 6.00 | 3.85 | 2.16 | 2.50 | 2.00 | 7.00 | > 0.05 |
| **Operative time (m)** | 40.25 | 7.52 | 40.00 | 30.00 | 60.00 | 60.00 | 9.73 | 60.00 | 40.00 | 80.00 | < 0.05 |
| **No. of C-arm images** | 18.30 | 2.13 | 18.00 | 15.00 | 25.00 | 11.00 | 3.01 | 10.00 | 7.00 | 20.00 | < 0.05 |
| **Time of union (weeks)** | 6.85 | 0.81 | 7.00 | 6.00 | 8.00 | 5.42 | 1.57 | 5.00 | 4.00 | 10.00 | < 0.05 |

**Table (3):** Distribution of the patients according to studied complications

| | | Groups | | | | |
|---|---|---|---|---|---|---|
| | | K-wires | | mini plates | | P value |
| | | Count | % | Count | % | |
| **Complication** | **Yes** | 3 | 16.7% | 5 | 27.8% | > 0.05 |
| | **No** | 15 | 83.3% | 13 | 72.2% | |
| **Complication details** | **superficial infection** | 0 | 0.0% | 1 | 5.5% | > 0.05 |
| | **Delayed union** | 0 | 0.0% | 1 | 5.5% | |
| | **Extension lag** | 1 | 5.5% | 0 | 0.0% | |
| | **Non- union & broken plate** | 0 | 0.0% | 1 | 5.5% | |
| | **Pin tract infection** | 1 | 5.5% | 0 | 0.0% | |
| | **Stiffness** | 1 | 5.5% | 2 | 11.1% | |
| | **No** | 15 | 83.5% | 13 | 72.4% | |

**Table (4):** Distribution of patients according to TAF.

| | | Groups | | | | |
|---|---|---|---|---|---|---|
| | | K-wires | | mini plates | | P value |
| | | Count | % | Count | % | |
| **TAF** | **Poor** | 0 | 0.0% | 0 | 0.0% | > 0.05 |
| | **Good** | 5 | 27.8% | 3 | 16.7% | |
| | **Excellent** | 13 | 72.2% | 15 | 83.3% | |

**Table (5):** Distribution of patients according to Quick DASH Score.

| | Groups | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | K-wires | | | | | mini plates | | | | | P value |
| | Mean | SD | Median | Minimum | Maximum | Mean | SD | Median | Minimum | Maximum | |
| **Quick DASH 3 month** | 9.48 | 6.55 | 9.00 | 0.00 | 23.70 | 8.55 | 6.24 | 7.40 | 2.00 | 24.00 | > 0.05 |

**Figure (1):** Skin incision

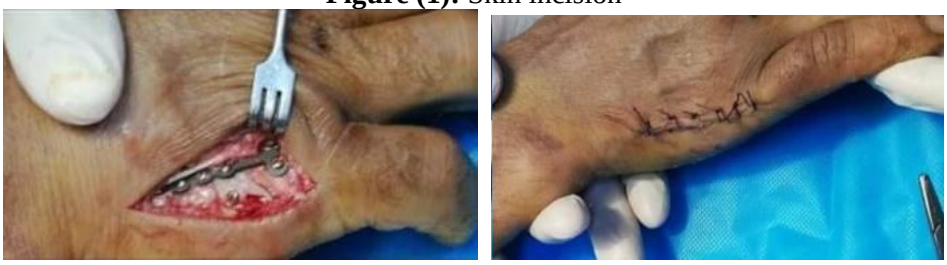

**Figure (2):** Adequate soft tissue coverage was ensured over the plate.

**Figure (3)**: Intra-operative x-rays showing fracture 4th metacarpal

## DISCUSSION

**Venkatesh** [11] conducted a prospective study containing 30(24 males and 6 females) Patients who had the functional outcome as measured by ASSH TAF was excellent after closed metacarpal shaft fractures and screws were treated with open reduction and internal fixation with min-fragment plates. good and fair in 70%, 20% and 10% of the patients respectively. Compared to our study results; TAF was excellent and good in 83.3% and 16.7% of the cases respectively. Aykut [12] studied 29 patients with 37 metacarpal fractures were fixed internally and openly using low profile micro plates. The median fast DASH score ranged from 3.6 to 11.4. The average grip strength measured by the Jamar hand dynamometer was 44.7 (9) kg for normal hands and 41.05 (8.3) kg for broken hands. Duzgun Set al.[45]showed also same results with low profile min- plates. Compared to our- study; the quick DASH score 3 months mean 9.48 and P value >0.05.

Başar et al. [13] conducted a study to assess the results of metacarpal fracture osteosynthesis using mini-plate and screws in terms of radiology and functionality. This study conducted 43 patients (7 females, 36 males) who were operated between 2009 and 2012. The average follow-up period was 19.76months. The patients' average age was 31.11 years. Regarding total joint range of motion, it was determined that 38 patients had outstanding range, 4 patients had acceptable range, and 1 patient had medium range. the results did not reveal any appreciable discrepancies between the fingers of the operated hand and the corresponding digits of the healthy hand. There were no noticeable differences between the analogous finger on the opposite healthy side in terms of grasping strength. Bone union occurred in all patients in a mean time of 6 weeks (range: 5-7 weeks). After the surgical treatment for the fracture, it took people 31.6 days on average to return to work [13].

Compared to our study results; mean age of patients was 36.8 years and mean union time 5.42 weeks TAF which was excellent and good in 83.3% and 16.7% of the cases respectively.

Nalbantoglu et al. [14] conducted a retrospective study containing 50 low-severity metacarpal fractures; excluding the first metacarpal; a total of 43 patients (37 men and 6 women), with a mean

age of 31 years, a range of 17 to 52 years, and all of whom underwent open reduction and low-profile plate fixation, with a mean follow-up of 62.2 years (range, 12 to 96 years), were included in the study. At final evaluation, the mean TARM was220.5±43.9 degrees (range 30°-260°). Results were excellent for 25 patients, good for 12 patients, acceptable for 5 people, and poor for 1 patient. The average grip strength was reduced by 5.2%–7.3%.The mean Quick-DASH score ranged from 0 to 11 and was 2.02.8.All breaks were joined. Extensor tenosynovitis, plate-related discomfort necessitating plate removal in four patients, and less than 180 degrees of TARM in six patients were among the issues that affected ten patients.

Compared to our study results: In every case, there was evidence of bone union. average time was5.42 weeks. TAM excellent in 66.7 %, good in 22.2%, poor in 5.55% and faire in 5.55% of the patients. Total active flexion was excellent 83.3% of cases fixed by plates and screw. Quick DASH 3 month mean was 8.55 point. Aski and Bhatnagar [15] the fourteen unstable metacarpal shaft fracture patients were all fixed using percutaneous intramedullary K wires and closure reduction. The patients' ages ranged from 18 to 46, with a mean age of 27. Eight people had callus formation on X-rays at 4 weeks, and by 8 weeks, all fractures had radiological union. Two patients had pin tract infections. Compared to our study; mean age 33.75 years, Implant union rate was also 100% mean 6.85 weeks, Pin tract infection was observed in 1 patient.

Van Bussel [16] retrospectively analyzed 34metacarpal shaft fractures of 27 patients fixed with intramedullary Kirschner-wires, the mean follow-up was 11 weeks. One patient had tenolysis due to prolonged discomfort and decreased function; nonetheless, all fractures went on to union without any signs of secondary fracture dislocation or implant migration. The K-wires were taken out in 26 cases (81%) overall. Functional result was excellent with average DASH scores 5 points. Compared to our study; the quick DASH score 3 months mean 9.48 points and P value >0.05. Extension lag occurred in one patient due to tendon injury.

Xu, and Zhang [17]. conducted ameta-analysis study involving a total of 18 studies and 1,375 patients with metacarpal or phalangeal fractures (709 cases and 666 controls) was conducted to compare the therapeutic effects of mini-plate versus Kirschner wire (K-wire) in the treatment of these fractures in the Chinese Had population. The findings demonstrated that mini-plate internal fixation had advantages over K-wire internal fixation, including quicker healing times, reduced infection rates, and a lower incidence of complications. However, mini-plate requires longer surgery times than K-wire, and there was no discernible difference in hospital stays between the two groups.

Wutphiriy [18] conducted a randomized, controlled experiment to In this study, a total of 112 patients with 122 metacarpal and phalangeal fractures were enrolled. K-wire and mini-plate were compared for the management of these fractures. The patients were assigned at random to receive one of the two techniques for fracture fixation. K-wire fixation was used to treat 63 fractures, and mini-plate fixation was used to treat the remaining fractures. The K-wire group had a significantly shorter operational time (P = 0.01). Postoperative discomfort, rate of union, healing time for successful cases, total active ROM, TAM, and sequelae did not differ.

Kim et al [19] a study was carried out to evaluate the clinical and radiological outcomes of patients with metacarpal mid shaft fractures after surgery using either intra medullary K-wire nailing or internal fixation with plates. 39 patients with metacarpal mid shaft fractures participated in this study between October 2008 and September 2012. Of these 39 patients, 24 received internal fixation using mini-plates, and 15 underwent intramedullary K-wire nailing.

In all cases, bone union was seen, and the two surgical approaches did not significantly differ in the bone union times; for intramedullary K-wire nailing and internal fixation with plates, respectively, the average times were 7.8 and 8 weeks. The final follow-up radiographs revealed statistically significant differences in posterior angulation, with patients who underwent intramedullary K-wire nailing having an average angle of 14° and patients who underwent internal fixation with plates having an average angle of 5°. Between the two groups, there were no appreciable differences in the quick-DASH, power, or range of joint mobility scores.

Pin tract infection founded in 1 patient repaired by k- wires. Treated with powerful antibiotics. Superficial infection occurred in one patient repaired by min- plates and screws and treated by surgical debridement and antibiotics. Delayed union occurred in one case fixed with mini-plates. Non-union and damaged plate occurred in one patient treated using min-plates Planning was to be amended with plating and bone graft but patient declined. Stiffness occurred in one patient fixed by K-wires and two patients fixed by mini-plates treated by mobilization and physiotherapy. Extension lag occurred in one patient fixed by K-

wires. Overall, comparison of time till union, Total active motion Total active flexion and quick DASH score revealed no statistically significant difference between the 2 techniques.

**This study had some limitation as**: Small number of patient, which not represents the community perfectly. And with larger sample sizes, statistical differences might be generated, and good representation of population could be achieved. Lacked of comparative groups; as the patient not included all metacarpal fractures, where it will have more beneficial results. .

## CONCLUSIONS

Both open reduction internal fixation with mini-plates and screws or percutaneous intramedullary K-wires are effective options for treating unstable metacarpal fractures because they offer reduction and fixation that is sufficient to permit mobilization of the adjacent joints, assisting in the achievement of satisfactory functional results. Although K-wires performed better than plates and screws (90% and 85%, respectively), there were no statistically significant changes in the clinical outcomes between the two techniques, with the exception of the length of the procedure. K-wires group exhibit a notable reduction in operative time, No. of C-arm images K-wires group show significant increase in number of C-arm images. And time of union K-wires group show significant increase in time of union.

**Conflict(s) of interest:** None

**Financial Disclosures:** None

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To Cite:

Elmalt, A., El-soufy, M., Shahadah Hekama Abofakher, B., Elaidy, S. K-Wires versus Mini-Plates Fixation in Closed Diaphysal Metacarpal Fractures. *Zagazig University Medical Journal*, 2023; (1551-1559): -. doi: 10.21608/zumj.2023.205812.2790