

RESULTS OF MINI EXTERNAL FIXATOR IN METACARPAL AND PHALANGEAL FRACTURES

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ABSTRACT

Objective: To evaluate the role of external fixator to treat the soft tissue condition along with metacarpal and phalangeal fracture in terms of fracture union and active range of motion.

Study Design: Descriptive, case series.

Place and Duration of Study: Department of Orthopedics, Bahawal Victoria Hospital, Bahawalpur from Jun 2011 to May 2013.

Subjects and Methods: Total 56 patients of 20-60 years age of both genders with comminuted and open fractures of metacarpal or phalanges bone of the hand, Swanson's Type-I were included by non-probability, consecutive sampling. Patients with Swanson's type-2, associated neurovascular injury, intra-articular fractures and fractures with tendon injuries were excluded. In all patients, mini-external fixators were applied and fracture was assessed for union and functional assessment on basis of active range of movement (Excellent, Good, Fair, Poor) at 6th and 12th weeks and 6th month.

Results: Mean age was 36.31 ± 8.79 years. Males were 73.21% and remaining 26.79% were females. The most common etiology of fracture was road traffic accident (64.29%) and 69.64% had phalangeal bone fractures. In 76.79% patients, only one digit was fractured while fracture of two and three digits was seen in 16.07% and 7.14% patients respectively. Functional results were excellent in 66.07%, good in 16.07%, fair in 10.71% and poor in 0.11% of cases. Fracture union was seen in 91.07% at the end of 6 months.

Conclusion: This study concluded that mini external fixators are an effective treatment of open fractures of metacarpal or phalanges bone of the hand with high functional outcome and union rates.

Keywords: External fixation, Functional outcome, Small bones, Union.

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INTRODUCTION

Hand injury is extremely common and accounts for about 15% of the attendance at accidents and emergency departments¹. Fractures of metacarpals and phalanges are probably the most common fractures in the skeletal system and are often neglected as minor injuries². Diagnosis of phalangeal and metacarpal fractures can be made after careful clinical assessment and radiological examination. Radiological examination should include standard antero-posterior and lateral views of the injured bone³. Most of the fractures are treated conservatively but some form of fixation is often indicated in unstable fractures, intra-articular fractures, open

fractures and multiple fractures². Various implants ranging from K-wires, mini-plates to mini external fixators are used to treat these fractures⁴.

Mini external fixator can be used in open metacarpal and phalangeal fractures⁴. External fixation allows fracture reduction to normal bony length via a rigid external support. Mobilization at joints proximal and distal to the fracture can be achieved across the external apparatus⁵. External fixation can be used as an alternative to internal fixation. In the hand, however, it is more commonly used when a fracture is not amenable to internal fixation⁶. External fixation has advantages in highly comminuted fractures or complex intra-articular fractures. It often simplifies surgery, being both quick and easy to apply. Bony length can be maintained. It avoids

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internal dissection, yet provides fracture stability allowing early movement and easier soft tissue access^{7,8}.

In Pakistan, little work has been done on treating the open metacarpal and phalangeal fracture with external fixator, so this study was conducted to evaluate the role of external fixator to treat the soft tissue condition along with metacarpal and phalangeal fracture so that based on this evidence it may be advocated as the treatment of choice.

SUBJECTS AND METHODS

This descriptive case series was conducted at the Department of Orthopedics, Bahawal Victoria Hospital /Quaid-e-Azam Medical College,

no systemic illness) < 3 days were included in study by non-probability consecutive sampling technique and Swanson Type-II open fractures (contaminated wound (dirt, debris), bites, river/lake injuries, barnyard injuries, systemic illness), open fractures with associated neurovascular injury, fractures with tendon injury, and intra articular fractures were excluded from the study.

Total number of 56 patients who fulfilled the inclusion/exclusion criteria were selected. Detailed history and physical examination of every patient was done. The investigations done before the procedure were blood complete examination, urine routine examination, serum

Table-I: Functional assessment based on total active range of movement (TAM).

Fingers	Thumb	Results
220 to 2600	119 to 1400	Excellent
180 to 2190	98 to 1180	Good
130 to 1790	70 to 970	Fair
<1300	<700	Poor

Table-II: Percentage of patients according to characteristics and presentation.

	No. of Patients	% age
Gender		
Male	41	73.21
Female	15	26.79
Cause of fracture		
Road side accident	36	64.29
Blunt trauma	13	23.21
fall	07	12.50
Side affected		
Right	33	58.93
Left	23	41.07
Number of digits fractured		
One	43	76.79
Two	09	16.07
Three	04	7.14
Site of fracture		
Phalangeal bone	39	69.64
Metacarpal bone	17	30.36

Bahawalpur from June 2011 to May 2013. Total 56 patients of age 20 to 60 years of both genders with multiple, comminuted and open fractures of metacarpal or phalanges bone of the hand, Swanson's Type-I (clean wound, no significant contamination, no significant delay in treatment,

creatinine level, x-ray chest, screening for hepatitis B & C and lateral and AP radiograph of the fractured site.

After proper wound wash and wound debridement, the fracture to be treated was reduced and the length of crossbar required

measured. A customised external fixator consisting of k-wires connected by syringe cap/insulin syringe barrel was used. Fixator was applied on metacarpal/phalanges in bridging mode. The pin sites were marked on the skin. This was done under direct vision or with an image intensifier. Pin placement was planned to avoid piercing the extensor mechanism. This

proforma was be filled at time of presentation and second part (follow up) was filled at 2nd 6th, 12th week and at 6th month. Data was analyzed using SPSS version 20. Mean and standard deviation was used for quantitative variables while frequency and percentage was used for qualitative variables. Chi-square and Fisher's exact test was applied and p -value ≤ 0.05 was

Table-III: Functional outcome.

	Phalangeal (n=39)	Metacarpal (n=17)	Total (n=56)
Functional outcome			
Excellent	27 (69.23%)	10 (58.82%)	37 (66.07%)
Good	07 (17.95%)	02 (17.65%)	09 (16.07%)
Fair	02 (5.13%)	04 (23.53%)	06 (10.71%)
Poor	03 (7.69%)	01 (5.88%)	04 (7.14%)
p -value	0.234		
Fracture Union			
Yes	36 (92.31%)	15 (88.24%)	51 (91.07%)
No	03 (7.69%)	02 (11.76%)	05 (8.93%)
p -value	0.4832		

position varied depending on the bone being treated, but always avoids the midline. It is important to ensure that bi-cortical bites were taken. The fracture was then reduced to the appropriate length and to the correct angulations, and then proximal and distal pins were passed across fracture and connected with appropriate size bar and anti septic dressing splint was given for one week and stitches were removed at 2nd week at 1st follow up. Fracture was assessed for union by the presence of trabecular continuation across the fracture line on lateral and AP radiograph at 6th, 12th weeks and final outcome at 6th month. External fixator was removed at 6th to 12th week depending on union. Nonunion was declared at 6th month (ex-fix not in place at that time). Later further treatment of non-union including bone grafting was done. Range of motion was assessed by functional results based on active range of movement in degrees (Excellent, Good, fair, Poor) at 2nd, 6th, 12th weeks and the final outcome was documented at 6th month as shown in table-I. First part of the

taken as significant.

RESULTS

Age range was from 20 to 60 years with mean (SD) age of 36.31 ± 8.79 years. Out of 56, males were 41 (73.21%) and remaining 15 (26.79%) were females with male to female ratio of 2.73:1. The most common etiology of fracture was road traffic accident 36 (64.29%) followed by blunt trauma and fall. In 43 (76.79%) patients, only one digit was fractured while two and three digits fracture was seen in 9 (16.07%) and 4 (7.14%) patients respectively. Fracture of phalangeal bones was found in 39 (69.64%) patients while in remaining patients metacarpal bones were fractured (table-II).

Functional results based on total active range of motion (TAM) as found in metacarpal versus phalangeal bone fractures are shown in table-III. The overall results were excellent in 66.07%, good in 16.07%, fair in 10.71% and poor in 7.14% of cases. A higher TAM was observed with single digit involvement (n=43) as compared to

fractures that involved more than one digit (n=13). Fracture union was seen in 51 (91.07%) and in only 05 (8.93%) patients, non-union was seen at the end of 6 months.

DISCUSSION

Fractures involving the tubular bones of the hand are the most common of all skeletal injuries. Although failure to gain union following a metacarpal or phalangeal fracture is rare, concomitant problems present a different story⁹. Most of these fractures can be treated conservatively, but in a relatively small number of patients with unstable fractures operative treatment is indicated. There are two types of fixation: internal according to Arbeitsgemeinschaft fur Osteosynthesefragen (AO) standards, and external for a selected group with open unstable fractures or severe soft-tissue injuries⁶. External fixation allows fracture reduction to normal bony length and can be used as an alternative to internal fixation in highly comminuted fractures or complex intra-articular fractures of hand¹⁰.

In our study, the mean age of patients was 36.31 ± 8.79 years with male predominance. Similarly, Drenth et al¹¹ and Gupta et al¹² in their studies have shown the mean age of 35 and 35.6 years respectively with male predominance. On the other hand, Ma et al¹³ and Wen et al¹⁴ have found much lower mean age (25.5 years) while Soni et al¹⁵ has found much larger mean age (49 years) compared to our study. The most common etiology of fracture was road traffic accident 36 (64.29%) in our study with majority of patients (69.64%) had phalangeal bone fractures. Similar observations were also found in many previously published studies^{11,13,14}.

We have found excellent functional results in 66.07%, good in 16.07%, fair in 10.71% and poor in 7.14% of cases. Also fracture union was seen in 51 (91.07%) and in only 05 (8.93%) patients, non-union was seen at the end of 6 months in this study. In a study by Ma et al¹³, the functional results based on total active range of movements TAM were found to be excellent in 25% cases,

good in 42.86% cases, fair in 17.86% cases, and poor in 14.29% cases. He has found the non-union rate of 6.06%. In another study, excellent functional results were seen in 30.77%, good in 50.0%, fair in 11.54% and poor in 7.69% cases. The overall excellent-good rate of function of total active joint motion was 80.8%¹⁴. He has also concluded that all patients had tolerated the external fixator device well and were satisfied with the functional results.

Gupta et al¹² in his study has found excellent functional results in 45.16%, good in 41.93%, fair in 9.68% and poor in 3.23% patients. In his study, non-union rate was found to be 6.45%. The results of Freeland et al¹⁷ are comparable to those reported by our study (80% excellent to good TAM). However, the results of our study are inferior to the study of Schuind et al¹⁷ who reported 96% excellent to good TAM. This may be due to the inclusion of only closed fractures in his study where as we have included only open fractures in our study and final outcome is definitely expected to be compromised to some extent in open injuries.

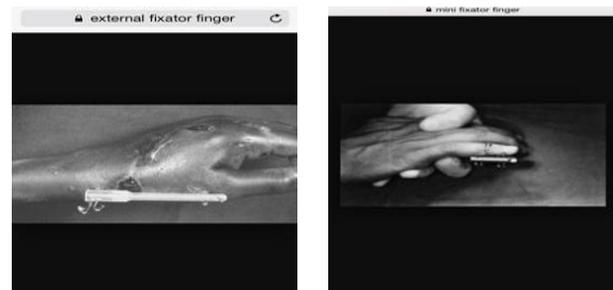


Figure-1: Mini and external fixator finger.

Mcculley et al¹⁸ found non-union in 25% patients and functional results fair to poor in 62.5% patients which is much higher compared to our study and all other previously described studies. The limitation of his study was that of very small sample size which may also be the reason of these higher rates of poor functional results and non-union rates. Dailiana et al⁴ in his series has also demonstrated the higher efficacy of mini external fixators in achieving good union and functional rates in the intra-articular and

comminuted fractures. Thakur et al¹ in his study has achieved union in 98% of the fractures and functional results based on TAM were found excellent in 68%, good in 22%, fair in 8% and poor in 2% of cases. Drenth et al¹¹ reported excellent to good functional results in 69.44% patients.

CONCLUSION

This study concluded that mini external fixators are an effective and durable treatment of comminuted and open fractures of metacarpal or phalanges bone of the hand with high functional outcome and union rates.

We recommend that mini external fixators should be considered in the treatment of comminuted and open fractures of metacarpal or phalanges bone of the hand for achieving high functional outcome and union rates.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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