



Research Article

EVALUATION OF FUNCTIONAL OUTCOME OF TWO K WIRE FIXATION AND EARLY MOBILIZATION IN PROXIMAL PHALANX FRACTURES OF HAND

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ABSTRACT

Purpose: Proximal Phalanx fractures are the most common injuries of hand. Most of them are stable and can be managed conservatively. Fractures with displacement, angulation, rotational deformity and intra articular fractures with joint incongruity need surgical intervention. It has been seen that early mobilization and two k wire fixation brings good functional outcomes thereby we performed this study to evaluate functional outcome of two k wire fixation and early mobilization in proximal phalanx fractures of hand. **Methods:** A prospective interventional study was performed with a total of 30 patients included in this study who underwent two k wire fixation for proximal phalanx fractures of hand. Patients were followed periodically till 3 months and evaluated for active range of motion by using Belsky's Criteria. **Results:** The patients were followed up for three months and assessment was done clinically and radiologically. Clinical assessment was based on Total Active Range of Motion TAM (Fig-1). Out of thirty patients, excellent result was found in seventeen patients, in ten patients results were good using Belsky's Criteria (Table-1). Wire back out was seen in one patient. Infection at pin tract site occurred in one patient. Joint stiffness was seen in one patient. **Conclusion:** Two k wire fixation of proximal phalanx fractures of hand is safe, low cost and effective treatment. It facilitates early mobilization and restoration of function with low complication rate.

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INTRODUCTION

Fractures of the proximal phalanges of hand are one of the most commonly encountered orthopedic hand injuries constituting 10% of all fractures.^{1,2} These fractures are too often considered as minor injuries and may result into deformities, if not properly addressed in the early stage.³ Fracture type, fracture stability and maintaining stability of the fracture are main determinants in treatment.⁴

In proximal phalangeal fractures, the fracture pattern depends on the deforming effect of interosseous muscles, flexor and extensor muscle tendons. The interosseous muscles insert onto the base of the proximal phalanx and flex the proximal fracture fragment, leading to an apex volar deformity.⁵ The flexor and extensor tendons impart a longitudinal compression force that shortens the phalanx and extends the distal fragment. Stability of fractures depends on the deforming forces on the fracture line.

The goal of proximal phalangeal fracture management is to allow for fracture healing to occur in acceptable alignment while maintaining gliding motion of the extensor and flexor tendons.⁶ The most common method of management in stable fractures of proximal phalanx is usually conservative with the help of traction and support. Whereas in unstable fractures, the

aim is to obtain anatomic reduction and maintain stability. Early intervention, Stable fixation and early mobilization provides better functional outcomes.

Kirschner wire (K-wire) fixation helps in better stability and is usually associated with Indirect bone healing producing excellent clinical results as long as early range of motion is ensured. The goal of K-wire fixation is to create a biomechanical environment that is stable enough to allow early postoperative mobilization. Relative stability encourages abundant callus formation. A diameter of at least 1.0 mm is generally recommended for the proximal phalanx.⁷ K-wires are versatile, cost-effective and surgeon friendly that can be used percutaneously or by open methods.⁸

The intramedullary wire enables 3-point fixation and allows early mobilization to prevent stiffness that is, fractures with displacement, rotational deformities, shortening and angulation have been associated with significant morbidity.

In advent of same, we designed and undertook the present study to evaluate functional outcome of two K wire fixation and early mobilization in proximal phalanx fracture of hand. Further, the complications related to the procedure were also assessed.

MATERIALS AND METHODS

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This study was done at one of the biggest tertiary care hospital in central India. All the patient who came to Outpatient department and emergency, who were diagnosed with diaphysealproximal phalanx fracture were considered to be a part of our study after taking proper informed consent. All the patients diagnosed with fracture proximal phalanx were given primary splintage by below elbow cock up slab. The inclusion criteria of study includes patients with proximal phalanx fracture of hand, age more than 18 years, diaphyseal fractures of 2nd to 5th proximal phalanx of hand. All the patients with phalangeal fractures of thumb were excluded from the study. All the patients who fulfilled the inclusion criteria were taken to surgery after proper clinical evaluation. All the patients were operated under local anaesthesia by wrist block. The entry for K-wire insertion was made on dorsolateral and dorsomedial aspect of base of proximal phalanx using a slightly thicker 2 mm K wire under fluoroscopy guidance. After confirming the entry point, these 2 mm wires were removed, followed by two 1 mm K wires insertion through the same entry point. The wires were passed through the fracture site and fracture reduction was confirmed. After confirmation of reduction, the outer ends of K wires were bent and cut using Harrington cutter. Pin tract dressing was done. Buddy strapping was applied using icecream wooden stick for 7 days. All patients were given one shot of IV antibiotic and 2 doses of oral antibiotics for 3 days. Analgesics were given as per pain relief. After 7 days, strapping was removed and gradual mobilization was started at PIP joint. The movement were increased gradually as per pain tolerance.

All the patients were analysed by Belsky's Criteria (Table-1) and VAS Scoring to assess the efficacy of conservative and surgical modalities for closed proximal phalangeal fractures of the hand at interval of 1 week, 2 week, 3 week and 4 week, 8 week and 12 week and were graded as Excellent- pain-free union/no deformity/total active motion TAM (Fig-1)>215°, PIP motion>100°; Good - pain-free union/ minimal deformity/TAM> 180°, PIP motion> 80°; Poor- pain or non-union/ deformity affecting function or cosmesis/TAM<180°, PIP motion<80°. All the data was stratified using Stastical package for social sciences 21.0 software. Institutional Ethical Committee clearance was taken prior to start of the study.

RESULTS

The patients were regularly followed up for three months and assessment was done clinically and radiologically. Clinical assessment was based on Total Active Range of Motion TAM (Fig-1). Out of 30 patients, excellent result was found in 17 patients, in 10 patients results were good, 3 patients were poor results using Belsky's Criteria (Table-1). Wire back out was seen in 1 patient. Infection at pin tract site occurred in 1 patient. Joint stiffness was seen in 1 patient. Out of 30 patients, majority of patients i.e., 11 out of 30 (36.7%) belonged to <25 years age group followed by 8 patients (26.7%) who belonged to 25-34 years age groups, 6 out of 30 patients (20%) belong to 35-45 age group while minimum patients i.e., 5 out of 30 (16.7%) belonged to >=45 years age group. Male

Table 1 Belsky's Criteria for Assessment of Finger Injuries

Belsky's Criteria for Assessment of Finger Injuries. Total Active Movement (TAM) Is a Summation of Total Active Flexion Range of the MCP and IP Joints.		
Excellent	Good	Poor
Pain-free union, and No deformity, and TAM > 215°, and PIP motion > 100°	Pain-free union, and Minimal deformity and TAM ≥ 180°, and PIP motion ≥ 80°	Pain or non-union, or Deformity affecting function/cosmesis, or TAM < 180°, or PIP motion < 80°

preponderance was observed with 21 male patients and 9 female patients.(Table-2) Male: Females ratio was 2.3:1. 15 patients reported on the same day of injury, 4 patients on 2nd day followed by 9 patients who reported on 3rd day and 2 patients on 5th day . (Table-5) Out of 30 patients, 17 patients (57%) had PIP joint motion >100° i.e. Excellent results, 11 patients (37%) had PIP joint motion >80° i.e. Good results and only 2 had Poor results (6%). Out of 30 cases, 3 cases had complications with 1 each of Wire backout, Infection and Stiffness. (Table-3)

Table 2 Sex Distribution

Sex	Frequency	Percent
Female	9	30.0
Male	21	70.0
Total	30	100.0

Table 3 Total PIP Motion at 12th week

Total PIP motion at 12th week	Frequency	Percent
<80	2	6.6
>80	11	36.7
>100	17	56.7
Total	30	100

Table 4 Total active motion at 12th week

Total active motion at 12th week	Frequency	Percent
<180	2	6.6
>180	11	36.7
>215	17	56.7
Total	30	100

Table 5 Reporting Day after injury

Reporting day After injury	Frequency	Percent
Same day	15	50
2 nd day	4	13.3
3 rd day	9	30
5 th day	2	6.7
Total	30	100

Table 6 Comparison of Mean VAS among Different Time Interval

Time Interval	N	Mean VAS
At 1 week	30	5.1
At 12 weeks	30	0.7

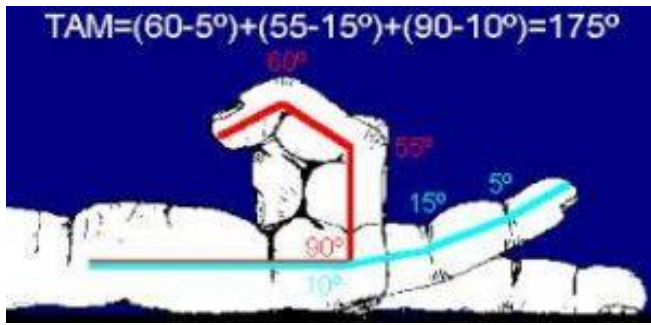


Figure 1 Total Active Motion in Finger - Criteria

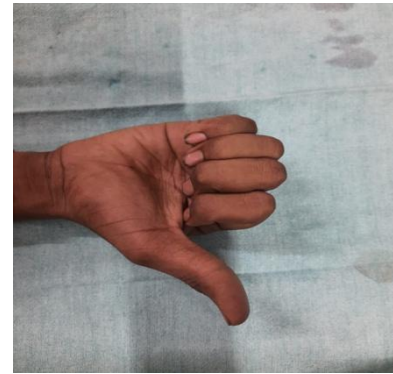


Fig. 2g Clinical Picture showing thumb Movements post operative



Figure 2 Follow up of a patient who underwent the surgical procedure

Fig.2a Antero-posterior Xray view of right Hand
Fig.2b Oblique Xray View of Right hand



Fig. 2c Post op Clinical Photo of right Hand
Fig. 2d Post Op X ray of right Hand

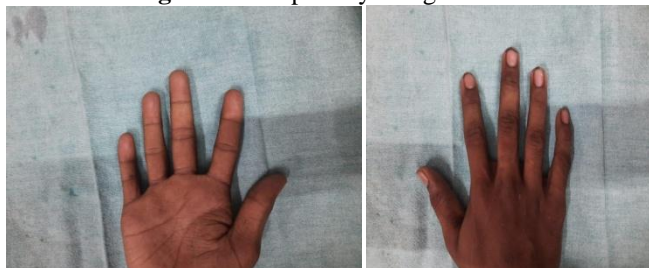


Fig-2e Palmar Aspect of Right Hand
Fig. 2f Dorsal Aspect of Right Hand

DISCUSSION

Kirschner wire (K-wire) fixation techniques is an operative intervention using intramedullary wire fixation primarily associated with indirect bone healing producing excellent clinical results as long as early range of motion is ensured. The goal of K-wire fixation is to create a biomechanical environment that is stable enough to allow early postoperative mobilization.

Amongst the various techniques used, K-wires are versatile, cost-effective and surgeon friendly that can be used percutaneously.⁰⁹ we had compared our technique with other studies on the basis of TAM & Mean PIP joint motion. An improvement was observed in our study in the Total active motion TAM (Fig-1) with follow up appointments at 1 week, 3 weeks, 4 weeks, 8 weeks and 12 weeks respectively. While only 1 patient reported TAM >2150 at 1 week of fixation, proportion of patient increased with each appointment i.e., 7 patients at 2 weeks, 13 patients at 4 weeks and 17 patients at 12 weeks.(Table-4) It is reported in other studies that union is achieved in 4-8 weeks on average. Kose A et al. (2019)¹⁰ & Singh J et al. (2011)¹¹ also used TAM criteria to define the functional outcome in their study. Our study had an average TAM of >2150 at the end of 3 month with 17 patients (56.7%) reporting same which was similar to Rex C et al(2015)¹² who had majority of patients with average TAM 270° and Hornbach et al. (2001)¹³ reported an average TAM of 265°. As the time of follow up appointment increased the degree of TAM also increased suggestive of improvement with time and movement after fixation. Patankar et al (2008)¹⁴ shows excellent result in 100% patients.

Motion at PIP joint was analyzed using Belsky's Criteria (Table-1) for assessment of finger injuries. PIP score illustrates the degree of movement at PIP joint. After 12 weeks, 17 had PIP >100, 11 had PIP >80 and only 2 patients had PIP <80. Singh J et al. (2011)¹³ also used Belsky's Criteria (Table-1) for assessment of finger injuries criteria to define the functional outcome in their study. The mean VAS at duration of 1 week was 5.10 which was significantly reduced to mean VAS 0.70 at 12 Weeks. (Table-6).

There are various complications of using K wires for proximal phalanx fractures like soft tissue and tendon irritation, contracture, adhesions, cosmetic issues. Some other major complications of these fractures include malunion, reflex sympathetic dystrophy, infections etc.¹⁰ there were certain limitation to our study like small patient sample, involved

limited group of patients, limited follow up. A further detailed study can be helpful in decreasing these limitations.

CONCLUSION

Two k wire fixation of proximal phalanx fractures is safe, low cost, and effective treatment. It facilitates early mobilization and restoration of function with low complication rate. This technique provides better rotational stability than the conventional single k wire usage.

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References

1. Emmett, J. E., & Breck, L. W. (1958). A review and analysis of 11,000 fractures seen in a private practice of orthopaedic surgery 1937-1956. *JBJS*, 40(5), 1169-1175.
2. Drenth, D. J., & Klasen, H. J. (1998). External fixation for phalangeal and metacarpal fractures. *J Bone Joint Surg Br*, 80(2), 227-230.
3. Tank, P. M., Patel, N. B., Patel, V., & Rana, T. (2018). Simple low cost static external fixators for phalangeal fractures of hand. *Int J OrthopSci*, 4, 714-720.
4. Le Nen, D. (2014). Extra-articular fractures of the digital metacarpals and phalanges of the long fingers. *Chir Main*, 33(1), 1-12.
5. Kurzen, P., Fusetti, C., Bonaccio, M., et al. (2006). Complications after plate fixation of phalangeal fractures. *J Trauma*, 60(4), 841-843.
6. Lögters, T. T., Lee, H. H., Gehrman, S., Windolf, J., & Kaufmann, R. A. (2018). Proximal Phalanx Fracture Management. *Hand (N Y)*, 13(4), 376-383.
7. Belsky, M. R., Eaton, R. G., & Lane, L. B. (1984). Closed reduction and internal fixation of proximal phalangeal fractures. *J Hand Surg Am*, 9(5), 725-729.
8. Kamath, J. B., Harshvardhan, Naik, D. M., & Bansal, A. (2011). Current concepts in managing fractures of metacarpal and phalanges. *Indian J Plast Surg*, 44(2), 203-211.
9. Singh, A. K., Nidhi, N., Arun, G. R., & Rrs, S. (2014). Outcome of Displaced Metacarpal and Proximal Phalangeal Fractures Treated with Intramedullary κ -Wire and Cross κ -wires: A Prospective Study of 105 Patients. *International Journal of Orthopaedics*, 1, 25-30.
10. Köse, A., Engin, M. Ç., Topal, M., Köse, M., & Şencan, A. (2019). Clinical and Radiological Outcomes of Closed Reduction and Kirschner Wire Fixation In Treatment Of Extra-Articular Fractures Of The Proximal Phalanx. *The Medical Journal of Mustafa Kemal University*, 10(37), 30-35.
11. Singh, J., Jain, K., Mruthyunjaya, & Ravishankar, R. (2011). Outcome of closed proximal phalangeal fractures of the hand. *Indian J Orthop*, 45(5), 432-438.
12. Rex, C., Vignesh, R., Javed, M., Balaji, S. C., Premanand, C., & Zakki, S. A. (2015). Safe corridors for K-wiring in phalangeal fractures. *Indian J Orthop*, 49(4), 388-392.
13. Hornbach, E. E., & Cohen, M. S. (2001). Closed reduction and percutaneous pinning of fractures of the proximal phalanx. *J Hand Surg Br*, 26, 45-49.
14. Patankar, H., & Meman, F. W. (2008). Multiple intramedullary nailing of proximal phalangeal fractures of hand. *Indian J Orthop*, 42, 342-346.

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