



ORIGINAL RESEARCH PAPER
 Orthopaedics

FUNCTIONAL OUTCOMES OF PROXIMAL PHALANX FRACTURES BY K-WIRE FIXATION

**KEY WORDS:** Proximal Phalanx fracture, K-wire, early rehabilitation

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| ABSTRACT | Fractures of the proximal phalanx are an extremely common occurrence that are often neglected, receiving delayed treatment and inadequate reduction. These fractures often produce debilitation, pain and deformity attributed to malunion, stiffness, prolonged rehabilitation needed for recovery and functional improvement. This often hampers the quality of life and activities of daily living of patients, thus producing significant distress and dissatisfaction among them. This emphasizes the need for precise surgical techniques and initiating early mobilization to achieve favorable functional outcomes. A retrospective study was performed on the functional outcomes of 13 patients with 17 proximal phalanx fractures, without any associated tendon injuries, treated by K-wire fixation and early active mobilization. These patients were followed up for a minimum duration of 3 months and all patients showed excellent outcomes and achieved full pain-free range of movements within 6 weeks post-operatively. Post-operatively, none of the patients had complications such as rotational mal-union, implant failure, infection, and stiffness. We exhibit promising outcomes for the management of fractures of the proximal phalanx by percutaneous K-wire fixation and immediate meticulous hand therapy. |
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| <b>INTRODUCTION</b><br>The most commonly encountered fractures of the upper extremity are fractures of the phalanges, metacarpals and carpals bones, which account for about 15-19% of fractures in adults, and have a predisposition for occurrence in active young males. <sup>1,2</sup> Most often, these injuries are dismissed as trivial injuries and thus there is a delayed presentation increasing the rate of complications such as the persistence of deformity and substantial loss of function. Treatment is frequently deferred till swelling and persistent pain compel the patients to seek medical care. <sup>3</sup> There are various modalities of treatments available for the management of proximal phalanx fractures, which include mini-plates, screw fixation, and Kirschner wire (K-wire) fixation. Percutaneous K-wire fixation is a well-recognized and widely employed surgical technique for the management of hand fractures owing to its several advantages, such as flexibility, minimal invasiveness, quick application and inexpensiveness as opposed to other methods such as external fixators and plate fixation which provide increased stability but can be more time-consuming, invasive, expensive and technically demanding. <sup>4</sup> The commonly performed surgical technique entails the insertion of one or multiple crossed intramedullary K-wires through the proximal phalanx. <sup>2</sup> The objective of treating these fractures is to obtain optimal bone healing and achieve early functional recovery which is accomplished by a good reduction and stable fixation along with diligent postoperative care and hand therapy to mitigate tendon adhesions and contractures. <sup>5</sup> | above 18 years of age, males and females who had extra-articular fractures of proximal phalanges (single or multiple) without any tendon injuries. The exclusion criteria encompassed skeletally immature individuals, below the age of 18 years, patients with associated tendon injuries, severely comminuted fractures, intra-articular fractures and associated soft tissue loss or bone loss. The post-operative follow-up period was for a minimum of 3 months. All patients underwent pre-operative medical assessments and appropriate radiographs were taken [Figure 1]. All patients received one intraoperative dose of antibiotic. All surgeries were performed by a single surgeon under WALANT(Wide Awake, Local Anaesthesia, No Tourniquet), regional or general anaesthesia. The fracture reduction and fixation were performed under the guidance of a C-arm mobile X-ray imaging system. Adequate precautions were taken to prevent the entrapment of extensor tendons during the procedure. The fixation of the fractures was done using 2 K-wires, the size of which varied from 1 mm to 1.25 mm [Figure 2]. The proximal ends were bent such that it did not impinge the skin. The K-wires were either buried through a 0.5cm longitudinal incision or if kept outside the skin were dressed with pieces of povidone-iodine soaked gauze. Post-operatively, all patients received a single dose of antibiotic, and regular wound or pin tract care was done. All patients were started on early active mobilization by the 3 <sup>rd</sup> postoperative day. The weekly assessment of the post-operative outcome included the range of movements (ROM) of the Metacarpophalangeal Joint (MCPJ), Proximal Interphalangeal Joint (PIPJ), Distal Interphalangeal Joint (DIPJ), and the Digo-Palmar Distance (DPD) of the injured digits. After 4 weeks, the wires were removed and the quick DASH scoring was used to monitor the final functional outcome [Figure 3]. They were further reviewed at 6 weeks, 8 weeks, and 3 months after the surgery [Figure 4]. All of our patients came for follow-up for a minimum of 3 months post-operatively. |
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We present a case series of 17 proximal phalanx fractures without any tendon injuries treated with K-wire fixation and early active mobilization of the digits.

Case Presentation  
 Study Subjects

A retrospective study was conducted in the Department of Hand Surgery, Sri Ramachandra Medical College and Hospital, Chennai, on 13 patients with a total of 17 proximal phalanx fractures, who presented to the out-patient department and emergency room. This was a study conducted over a period of 2 years between 2022 and 2024. The inclusion criteria included skeletally matured patients

**RESULTS**  
 All patients achieved full ROM and 0cm DPD by the end of 6 weeks

The mean Quick DASH scores at 2 weeks, 4 weeks, 6 weeks, 8 weeks and 3 months were 15.15%, 9.09%, 0%, 0%, and 0% respectively.

None of our patients had any complications of infection, non-union, rotational deformities, extension lag, stiffness, or incomplete ROM by 6 weeks.

## DISCUSSION

Extra-articular proximal phalanx fractures include neck, shaft and epi-basal fractures. Shaft fractures of the proximal phalanx often present with spiral or oblique patterns. The intrinsic muscles exert force vectors that can cause phalanx misalignment. Due to the intrinsic muscle action occurring dorsal to the metacarpophalangeal (MCP) joint's axis, unstable fractures often exhibit dorsal angulation, thus necessitating surgical intervention to restore proper alignment.<sup>6</sup> Although many stable proximal phalanx fractures can be managed without surgery, prolonged immobilization can cause stiffness and tendon adhesions.<sup>7,8</sup> Fracture stability is an important parameter in determining the modality of treatment necessary.

Surgical intervention is recommended to achieve a good reduction and fixation in unstable fractures or when there is a risk of stiffness resulting from prolonged immobilization.<sup>9</sup> There is an abundance of surgical techniques for proximal phalanx fracture fixations. However, the technique of percutaneous K-wire fixation, owing to speed, adaptability, efficiency, and versatility along with its minimally invasive nature and relative inexpensiveness, remains the most preferred modality among hand surgeons for the management of these fractures.<sup>4</sup> A stable fixation supports early mobilization which enhances functional recovery.<sup>8</sup> Moreover, existing literature suggests that a 1mm shortening of the proximal phalanx can lead to approximately a 12° extension lag. Additionally, a 3mm shortening or a 15° angulation may impair the digit's effective flexion-extension arc, as observed in ex-vivo research.<sup>10</sup>

In our study we were able to achieve a good reduction and sturdy fixation by using the 2 K-wires, sparing the MCPJ and PIPJ, which permits early active mobilization. There were no complications of non-union, rotational mal-union, implant failure, loss of reduction, or infections in any of our patients. All patients obtained a full range of movement by 6 weeks post-operatively. Regular hand therapy was provided by our therapists, who are specialized in hand therapy. Active mobilisation was started by day 3, once the swelling subsided. The K-wires were removed at the end of 4 weeks after taking appropriate radiographs prior to the implant removal. All patients were able to do their daily activities comfortably by the 2<sup>nd</sup> month after surgery.

The limitations of our study include the small sample size of our study, the data collection process may have inherent limitations due to the absence of non-randomization, thus influencing the statistical analysis of clinical effectiveness despite no significant differences being observed or recorded in the preoperative variables or demographic characteristics. A larger sample size, randomization, with a multicentre study will overcome these shortcomings and will provide further insight on the management of these fractures.

## CONCLUSION

Our study suggests that this technique of K-wire fixation using 2 crossed K-wires sparing the adjacent joints, improved the stability of fracture fixation while being minimally invasive. This fixation, combined with early range of motion exercises, improved the surgical and functional outcomes of patients, enabling them to return to their regular activity and vocation faster, thus improving patient satisfaction.



**Figure 1-PA And Lateral Radiographs Of Right Hand**

## Showing Comminuted Fracture Of Proximal Phalanx Of Left Little Finger.



**Figure 2- Fracture Reduction And Fixation Using K-wires Under C-arm Guidance.**



**Figure 3- Range Of Movements At The Post-operative 2<sup>nd</sup> And 4<sup>th</sup> Week.**



**Figure 4- Range Of Movements At The Post-operative 6<sup>th</sup> Week.**

**Consent:** Informed consent was obtained from the patients regarding the publication of the article, and all personal information of the patients was kept anonymous.

**Funding Acknowledgment:** This study did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

**Acknowledgments:** Mr. Venu Babu and Ms. Sandhiya Jaichandran, our hand therapists played a pivotal role in providing hand therapy and in rehabilitation of the patients.

**Conflict Of Interest:** The authors declare no conflicts of interest related to the publication of this study.

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