

## STUDY OF FUNCTIONAL OUTCOME IN PATIENTS WITH FRACTURE DISLOCATIONS AT PROXIMAL INTERPHALANGEAL JOINTS MANAGED WITH SIMPLE TRACTION DEVICE

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### Abstract

**Background:** A wide spectrum of injuries are included in fractures of the proximal interphalangeal joint ranging from stable avulsion fractures to complex fracture dislocations. Present study was aimed to study of functional outcome in patients with fracture dislocations at proximal interphalangeal joints managed with simple traction device. **Material and Methods:** Present study was hospital based, prospective, observational study, conducted in patients of Closed intra-articular fracture /fracture dislocation at PIP joint of finger, who were managed with traction frame device. The outcome measured categorized according Belsky et al., criteria. **Results:** Among 30 patients, common mode of injury was while playing (80 %), average time between injury and surgery was 9.75 days (range 2 to 14 days) with most of the patients operated in second week (76.67 %). Among majority patients index finger was involved (36.67 %), middle and Ring finger involved in 7 patients (23.33 %) & little finger involved in 5 patients (16.67 %). Majority patients (86.67 %) had fracture of base of middle phalynx. These patients with fracture base of middle phalynx were having dorsal subluxation at PIP joint and remaining 4 patients involving fracture head of proximal phalynx were having volar dislocation at PIP joint (13.33 %). We have treated 26 patients with traction device and in remaining 4 patients involving fracture of head of proximal phalynx additional limited ORIF was done. Complications observed were malunion (20 %), residual pain (16.67 %), pintrack infection (6.67 %) & deformity (6.67 %). According to functional outcome, 5 patients (16.67 %) achieved excellent results, 15 patients (50 %) achieved good results. In remaining patients results were fair (20 %) & poor (13.33 %). **Conclusion:** Simple traction frame device is safe, soft tissue sparing, minimally invasive technique giving excellent functional and cosmetic results with minimal complications.

## INTRODUCTION

A wide spectrum of injuries are included in fractures of the proximal interphalangeal joint ranging from stable avulsion fractures to complex fracture dislocations. Main goal of the treatment is to make the PIP joint painless, stable and mobile at the same time.<sup>[1,2]</sup> Early recognition of these injuries is critical, as untimely management can lead to recurrent subluxation and chronic stiffness, arthrosis, and pain. Unfortunately, initial presentation can be deceptively benign, and the severity of the injury is often underestimated.<sup>[3]</sup>

Ideal treatment should include anatomical fracture alignment along with proper joint congruity as well as early initiation of range of motion. There are numerous variable treatment options for PIP fracture dislocation available in literature such as extension block splinting, extension block pinning, K- wire joint transfixation, external fixation, dynamic traction, open reduction internal fixation, volar plate arthroplasty, and hemi- hamate arthroplasty.<sup>[4]</sup>

Dynamic external fixation of PIP joint fractures acts via indirect fracture reduction, maintenance of fracture alignment and allowing early joint movement ultimately results in excellent functional

outcome.<sup>[5]</sup> Present study was aimed to study of functional outcome in patients with fracture dislocations at proximal interphalangeal joints managed with simple traction device.

## MATERIAL AND METHODS

Present study was hospital based, prospective, observational study, conducted at a tertiary care hospital. Study approval was obtained from institutional ethical committee.

### Inclusion Criteria

- Patients of Closed intra-articular fracture /fracture dislocation at PIP joint of finger, who were managed with traction frame device, willing to participate in present study

### Exclusion Criteria

- Open fractures
- Old fracture more than 2 weeks
- Associated multiple injuries in same hand

Study was explained to patients in local language & written consent was taken for participation & study. A detailed history regarding name, age, sex, date of injury, mode of injury, residential address, occupation was recorded. Patients were examined with emphasis on range of motion across PIP joint measured with goniometer. Patients affected hand was x rayed in both true antero-posterior and true lateral view. After anaesthetic fitness, patients were posted for surgery.

Under digital block anaesthesia, a 1.2-1.4-mm K-wire (K1) was placed transversely through the neck of the proximal phalanx when the fracture involved the base of middle phalanx or more proximally in cases where fracture involved the head of proximal phalanx. A second K-wire (K2) of the same diameter was driven through the base of shaft of the middle phalanx but always away from the fracture site. The first wire (K1) was left long enough on both sides so the ends can be bent in a semicircular fashion. Traction was then applied on the middle phalanx so that it engages in the horns of the proximal phalanx K-wire, achieving the desired skeletal traction.

True antero-posterior and true lateral view X-rays were obtained post operatively. When X-ray showed acceptable reduction of fracture dislocation, mobilisation of PIP joint was started on next day. When reduction was found unacceptable then limited open reduction and internal fixation was tried to achieve an acceptable reduction. Even in these cases the traction frame was left in place to allow external support and early mobilization. In this group of patients who have required additional method for attaining reduction, mobilisation was started after 1week.

The Patients were reviewed at 1week after starting mobilisation. A note was made of any subjective complaints from patients (pain, pin track infection etc) and encouraged for mobilisation at PIP joint Patient advised for pin track dressing to avoid infection.

The first follow up was taken at 2 weeks followed by 6 weeks, then biweekly & final follow up was taken at 3 months. Traction device was removed at 6 weeks. Patients assessed both clinically and radiologically, noting any symptoms, deformity of finger if any. ROM across PIP joint and total active ROM of finger. The outcome measured categorized according Belsky *et al.*,<sup>6</sup> criteria as-

- Excellent - No symptoms, Pain-free union, No angular/rotational deformity, PIP movement of >100°, total active ROM of >250°
- Good - Minimal angular/rotational deformity, PIP movement of >80°, total active ROM of >180°
- Fair and Poor - Remaining unchanged

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

## RESULTS

In present study, total 30 patients were included. There were 27 (90 %) male and 3 (10 %) female patients in our study. Majority were of less than 24 years age group (76.67 %).

**Table 1: Distribution according to age & sex of the subject**

Age group (in yrs)	Gender		Total
	Male	Female	
≤ 24	21 (70 %)	2 (6.67 %)	23 (76.67 %)
>24	6 (20 %)	1 (3.33 %)	7 (23.33 %)
Total	27 (90 %)	3 (10 %)	30

Common mode of injury was while playing (80 %), average time between injury and surgery was 9.75 days (range 2 to 14 days) with most of the patients operated in second week (76.67 %). Among majority patients index finger was involved (36.67 %), middle and Ring finger involved in 7 patients (23.33 %) & little finger involved in 5 patients (16.67 %).

**Table 2: General characteristics**

Mode of injury	No. of patients	Percentage
Playing	24	80 %
Blunt hit	3	10 %
Fall	3	10 %

Delayed (In days)		
≤ 7 days	7	23.33 %
>7 days	23	76.67 %
Finger involved		
Index	11	36.67 %
Middle	7	23.33 %
Ring	7	23.33 %
Little	5	16.67 %

Out of 30 patients, majority patients (70%) had pre-op range of motion at PIP joint upto 30°.

**Table 3: Pre-op ROM at PIP joint (in degree) of the subject**

Pre-op ROM at PIP joint degree	No. of patients	Percentage
10	8	26.67 %
15	3	10 %
20	5	16.67 %
30	5	16.67 %
40	2	6.67 %
70	7	23.33 %

Majority patients (86.67 %) had fracture of base of middle phalynx. These patients with fracture base of middle phalynx were having dorsal subluxation at PIP joint and remaining 4 patients involving fracture head of proximal phalynx were having volar dislocation at PIP joint (13.33 %). We have treated 26 patients with traction device and in remaining 4 patients involving fracture of head of proximal phalynx additional limited ORIF was done.

**Table 4: Fracture management**

Fracture management	No. of patients	Percentage
Type of fracture		
Head of proximal phalynx	4	13.33 %
Base of middle phalynx	26	86.67 %
Associated Subluxation/dislocation at PIP joint		
Dorsal subluxation at PIP joint	26	86.67 %
Volar dislocation at PIP joint	4	13.33 %
Surgical procedure		
Traction device and ORIF	4	13.33%
Traction device	26	86.67%

There was mean pre-op ROM of  $30.31 \pm 20.95$  degree and mean post-op ROM of  $69.06 \pm 29.27$  degree with mean change of  $38.75 \pm 25.27$  which is highly significant.

**Table 5: Pre-op & post-op ROM**

Mean ± Sd	ROM at PIP joint		Mean change ± Sd	P-value
	Pre-op	Post-op		
	$30.31 \pm 20.95$	$69.06 \pm 29.27$	$38.75 \pm 25.27$	<.001

We were able to achieve complete reduction of the fracture in 50% of the patients with remaining 50% having incomplete reduction. We were able to correct subluxation/dislocation in 16 patients (53.33 %) while in remaining patients subluxation component partially corrected. Complications observed were malunion (20 %), residual pain (16.67 %), pintrack infection (6.67 %) & deformity (6.67 %).

**Table 6: Post-op status & complications**

Post-op status	No. of patients	Percentage
Post-op status of fracture		
Complete reduction	15	50 %
Incomplete reduction	15	50 %
Post-op status of subluxation/dislocation		
Dislocation at PIP joint corrected	4	13.33 %
Subluxation at PIP joint corrected	10	33.33 %
Subluxation at PIP joint present	16	53.33 %
Complications		
Malunion	6	20 %
Residual Pain	5	16.67 %
Pin track Infection	2	6.67 %
Deformity	2	6.67 %

In our study, in 76.67 % of patients we able to achieve movement 60 degree & above comparing with the normal same finger of opposite site.

**Table 7: Distribution according to % of movement attained compared to the normal finger**

% of movement attained compared to normal finger	No. of patients	Percentage
10%	2	6.67 %
20%	3	10 %
45%	2	6.67 %
60%	5	16.67 %
80%	7	23.33 %
90%	4	13.33 %
100%	7	23.33 %

Majority patients were satisfied with treatment given (83.33 %).

**Table 8: Patient satisfaction**

Patient satisfaction	No. of patients	Percentage
Satisfied	25	83.33 %
Unsatisfied	5	16.67 %

In our study, according to functional outcome, 5 patients (16.67 %) achieved excellent results, 15 patients (50 %) achieved good results. In remaining patients results were fair (20 %) & poor (13.33 %).

**Table 9: Functional outcome**

	No. of patients	Percentage
Excellent	5	16.67 %
Good	15	50 %
Fair	6	20 %
Poor	4	13.33 %

## DISCUSSION

Intra-articular fractures at proximal interphalangeal joint are common, and owing to their structural complexity, they carry the risk of numerous complications other than nonunion. A forward angulation or lateral angulation as small as 5° may interfere with flexion and cause overlapping of the digits. Moreover, finger joints are prone to contractures, and therefore, stiffness, deformity (swan neck, Boutonnière), persistent subluxation, and loss of full ROM are common.<sup>[7]</sup>

Fracture dislocations of PIP joints are prone to cause a stiff painful finger if concentric movements of joints are not restored. One stiff finger can impair the function of the entire hand and jeopardize a patient's career.<sup>[8]</sup> The goals of treatment are—to obtain a concentric reduction of PIP joint, to maintain joint stability, to re-establish gliding motion, and to allow early motion. Treatment by traction devices is based on two principles—ligamentotaxis through traction restores joint and fracture alignment; early mobilization promotes joint healing and restores function.<sup>[9]</sup>

Ginakos *et al.*,<sup>[10]</sup> studied total of 37 studies including 471 patients and 480 fingers were reviewed. PIP joint range of motion (ROM) was greatest postoperatively in patients who underwent volar plate arthroplasty at 90.6 degrees. Dynamic external fixation resulted in the lowest PIP joint ROM with an average of 79.7 degrees. Recurrent pain and osteoarthritis were most often reported in extension block pinning at 38.5 and 46.2%, respectively. Open reduction and internal fixation

had the highest rate of revision at 19.7%. Overall, the outcomes of PIP fractures and fracture-dislocations are based on the severity of injury, and the necessary treatment required. Closed reduction with percutaneous pinning and volar plate arthroplasty had good clinical and functional outcomes, with the lowest complication rates.

Shah *J et al.*,<sup>[11]</sup> studied 43 patients with proximal phalangeal fractures were treated by nail traction, post-reduction X-ray evaluation showed good reduction in 33 cases, fair reduction in 8 and poor reduction in 2 cases. At final assessment, 35 patients had good total active motion (TAM) score, six had fair and two had poor TAM score. Complications were noted in two patients and these included pressure necrosis in palm and stiffness in proximal interphalangeal joint. With careful selection of patients, nail traction seems to be simple, safe and effective technique for managing proximal phalangeal fractures.

Chatterjee *B et al.*,<sup>[12]</sup> studied 25 cases of PIP joint fractures treated with Suzuki frame. Of 25 cases, radiological union was achieved in 23 cases. Remaining 2 were lost to follow up. Good to excellent result was achieved in 91% cases. None of the patients suffered any sort of infection and were discharged on a single antibiotic (co-amoxiclav). Even the pain score was zero in 21 cases which accounts for 91%. So this procedure gives good results in term of pain and functionality both.

The optimal outcome from surgical treatment demands an appropriate surgical plan, atraumatic soft tissue handling, and stable fixation to facilitate early motion; however, complications such as non-

union, malunion, infection, and stiffness can occur even in the setting of appropriate treatment.<sup>[13]</sup>

Because open reduction and fixation is difficult and may lead to fragment necrosis, closed reduction including traction systems is favored. These systems allow early mobilization, whereas the immobilization of the PIP joint results in stiffness with a reduced range of motion due to periarticular scarring.<sup>[14]</sup>

## CONCLUSION

The primary results of management of closed intra-articular fracture/fracture dislocations at proximal interphalangeal joint of fingers using simple traction frame device, shows that it restores joint alignment and stability in PIP joint fracture dislocation.. Simple traction frame device is safe, soft tissue sparing, minimally invasive technique giving excellent functional and cosmetic results with minimal complications.

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