Comparison of Functional Outcome Between Trans– 2nd Metacarpal Fixation and Trans-Trapezius Fixation with K-Wire for Bennett Fracture

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Abstract

Introduction: An articular fracture of the base of the thumb metacarpal consisting of a single, variable-sized, volar-ulnar fracture fragment is termed Bennett fracture. In the studies conducted so far there has been paucity in the knowledge about the methods of k wire fixation for the Bennett fracture and hence the purpose of this study is to compare functional outcome between the trans– 2nd metacarpal fixation and trans - trapezius fixation with K wire for Bennett fracture.

Methods: Patients were 18 years and above with no previous injury on the 1st metacarpal . Final assessment was performed from six months to nine months after the treatment with the DASH Score, VAS scale for pain, Hand Grip strength by Dynamometer. Radiographic images were taken at 6 months post-op in two separate views to evaluate post-traumatic arthritis of the first CMC joint.

Results: Statistical analysis showed a correlation between Pain and DASH score to be 0.946 in TTZ group and 0.966 in T2MC group and hence signifies that patients in T2MC group had a better functional outcome with lower DASH score and lower pain score.

Significant correlation was seen between Pain and Grip strength, with -0.587 in TTZ group and -0.482 in T2MC group. Higher pain score correlated with higher DASH score and lower Grip strength and hence we can conclude that T2MC had a better functional outcome post-surgery than TTZ technique of fixation. Post op radiographs showed that T2MC group of patients had a better outcome with less arthritic complications and less pain and better grip strength .

Conclusion: This study gives us the overview about the two fixation methods of Bennett fracture , and that when trans 2nd metacarpal fixation is done , there are less chances of arthritis of the CMC joint as well as better functional outcomes post operatively as compared to trans trapezial fixation and hence guides a surgeon to make a decision about the technique of fixation to be employed during fixing such fracture.

Keywords: Bennett fracture , Trans-trapezial , Trans- 2nd metacarpal , Functional outcome

Introduction

An articular fracture of the base of the thumb metacarpal consisting of a single, variable-sized, volar-ulnar fracture fragment is termed Bennett fracture. It is reported that Bennett fracture accounts for around 12% of metacarpal fractures and 2% of all hand fractures [1]. Many methods of treatment have been advocated, with no consensus on the best technique [2].

Bennett fractures with less than 2 mm of disruption of articular congruity and minimal displacement may be treated by closed reduction [3]. However, most patients require surgical intervention [4]. Post-traumatic arthritis of the trapezio metacarpal joint of the thumb is a frequent sequel to a Bennett type fracture-dislocation of the thumb metacarpal. The investigations of Gedda and Moberg have shown that after open reduction and pin fixation better results are expected than after conservative treatment [5]. Since then, several surgical procedures have been used of Bennett fracture dislocation.

Usually these fractures are treated with closed reduction and percutaneous fixation with K-wires. Open Reduction Internal Fixation (ORIF) is indicated for fractures which are not reducible by closed technique. ORIF is also indicated in high-demand patients and those who need immediate restoration of a full range of motion. However, ORIF is possible only if the anterior marginal fragment is large enough for internal fixation (>20% of the articular surface) [6].

AO principles of fracture management suggests two methods of fixation of Bennett fracture via K-wire fixation and Lag screw fixation if the medial fracture fragment is large and in K-wire technique, two methods of fixation have been described i.e. transfixion of the base of the first metacarpal to the trapezium and transfixion of the thumb base to the second metacarpal [7], and these two techniques of k wire fixation has been compared in this study.

A study conducted in the year 2019 on comparison between open reduction and closed reduction of Bennett fracture concluded that both methods had good functional outcome and the ORIF method for anatomical reduction seems to be less important in preventing post-traumatic arthritis [8].

In the studies conducted so far there has been paucity in the

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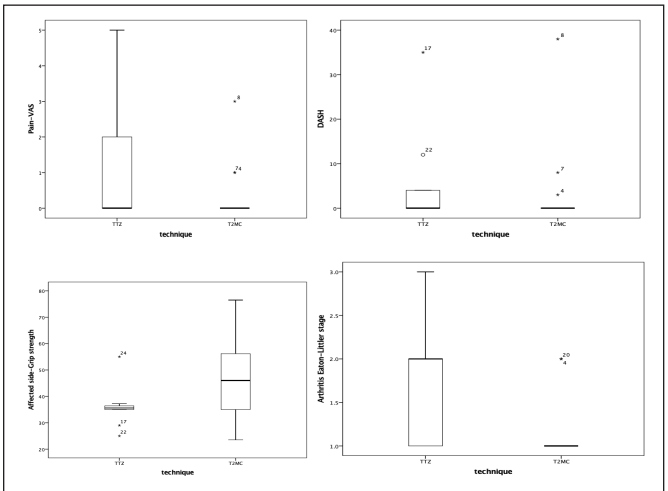

Figure 1: Showing Functional Outcome

knowledge about the methods of k wire fixation for the Bennett fracture and hence the purpose of this study is to compare functional outcome between the trans–2nd metacarpal fixation(T2MC) and trans-trapezius fixation (TTZ) with K-wire for Bennett fracture.

Methodology

This study was conducted on the patients operated between June 2018 to Jan 2021 at Mysore medical college and Research institute. Ethical clearance was obtained since this is a retrospective study. Twenty four Bennett fracture patients were considered for the study. Patients were 18 years and above with no previous injury on the 1st metacarpal. Patients in this study were operated within 7 days of injury and not associated with any other fracture of the hand.

All operations were performed under brachial block anesthesia or wrist block. After operation the hand was immobilized with thumb spica splint for 45 days. Subsequently K-wires were removed after 6weeks and rehabilitation was promptly started. Final assessment was performed from six months to nine months after the treatment with the Disabilities of the Arm, Shoulder and Hand (DASH) Score, VAS (Visual Analogue scale) scale for pain, Hand Grip strength by Dynamometer.

To evaluate pain we used VAS scale ranging from 0 (no pain) to 10 (worst imaginable pain), and Grip-strength of both hands was assessed and was expressed in kilograms using, Baseline Hydraulic Hand Dynamometer. The mean of three separate measurements was recorded for each hand. The difference was calculated to compare the grip-strength between the injured and non-injured hand [9].

Radiographic images were taken at 6 months post-op in two separate views (Anteroposterior and Oblique views) to evaluate post-traumatic arthritis of the first carpometacarpal(CMC) joint using the Van Niekerk and Owens modifications of the Eaton and Littler classification [10].

Results

Table 1 provides the pre-operative data. In this study, 24 patients were included who fulfilled the eligibility criteria and underwent fixation of the Bennett fracture of the thumb and studied. Patients were between the age group of 18 to 50 years with mean age being 33.0 ± 10.82 in TTZ and 30.7 ± 11.48 in T2MC group.

Among 24 patients, 9 patients (2-females, 7-males) underwent trans-traperzial fixation and 15 patients (6-females, 9-males) with trans-2nd metacarpal fixation with K-wire.

In 15 patients who underwent T2MC fixation, 7 patients were operated on left side and 8 on right side, with dominant hand being left side in 4 patients and right side in 11 patients.

Among 9 patients who underwent TTZ fixation, 7 people were operated on right side and 2 on left side, with dominant hand being left side in 2 patients and right side in 7 patients. Two underwent open reduction and 7 closed reduction and percutaneous fixation. Similarly among 15 patients who underwent T2MC fixation 2 underwent open reduction and 13 CRPF.

In 20 patients closed reduction under fluoroscopic guidance and 4 patients open reduction was performed followed by percutaneous fixation with two K-wires either through 2nd metacarpal or through trapezius to achieve articular surface anatomical reduction.

In 15 patients Trans–2nd metacarpal k wiring was performed and in 9 patients Trans- Trapezius fixation was done.

Functional outcome

In this study, we noted that a total of 6 patients noted pain at follow-up, among them 3 patients underwent TTZ and 3 underwent T2MC. The Mean DASH score for TTZ group was found to be 5.7, SD- 11.70 and for the T2MC group found to be 3.3, SD- 9.84.

Statistical analysis showed a correlation between Pain and DASH score to be 0.946 in TTZ group and 0.966 in T2MC group and hence signifies that patients in T2MC group had a better functional outcome with lower DASH score and lower pain score.

Similarly grip strength was calculated for operated side and contralateral side with hydraulic hand dynamometer and it was noted that in TTZ group the mean affected side grip strength of 36, S.D-8.18, with contralateral side grip strength being 52.5, S.D-9.88, and in the T2MC group the mean affected side grip strength being 47.3, SD-15.51 and C/L side grip strength being 55.7, SD-13.12.

Significant correlation was seen between pain and grip strength, with -0.587 in TTZ group and -0.482 in T2MC group. Higher pain score correlated with higher DASH score and lower grip strength and hence we can conclude that T2MC had a better functional outcome post - surgery than TTZ technique of fixation.

Table 1: Baseline variable for two techniques

	TTZ (n = 9) n (%)	T2MC (n =15) n (%)	p value
Age (Mean + SD)	33.0 ± 10.82	30.7 ± 11.48	0.637
Sex			
Male	7 (77.8)	9 (60.0)	0.657
Feale	2 (22.2)	6 (40.0)	
Dominance			
Right	7 (77.8)	11 (73.3)	0.998
Left	2 (22.2)	4 (26.7)	
Fracture Side			
Right	7 (77.8)	8 (53.3)	0.38
Left	2 (22.2)	7 (46.7)	
Mechanism of Injury			
RTA	2 (22.2)	4 (26.7)	0.749
Fall on the outstretched hand	5 (55.6)	9 (60.0)	
Sports Injury	2 (22.2)	2 (13.3)	
Fixation			
CR	7 (77.8)	13 (86.7)	0.615
OR	2 (22.2)	2 (13.3)	

We took post op radiograph at follow-up and classified the 1st Carpometacarpal joint arthritis using Eaton and Littler classification and noted that Median grade of arthritis for TTZ group was 2 and for T2MC group was 1, which signifies that T2MC group of patients had a better outcome with less arthritic complications and less pain and better grip strength.

Discussion

The first important finding in our study is the good correlation between the Grip strength and Pain score as well as DASH score and Pain score, which shows that the patients who underwent Trans 2nd metacarpal fixation had better functional outcome compared to the Trantrapezoidal fixation group. In a study conducted in 2019, to compare open reduction vs closed reduction of Bennett fracture, similar outcome measures were used and concluded that both techniques have good outcomes [11].

Similarly we also noted that there is a less number of patients with post traumatic arthritis in the T2MC group as compared to TTZ group, which again concluded that T2MC is a better fixation method in preventing post traumatic arthritis of the first CMC joint. In a systematic review conducted by Greevan et al, noted that post-traumatic arthrosis as scored using the Eaton Littler score was more common in patients treated with ORIF than in patients treated with CRIF [12].

Fixation failure or requirement of re-surgery was not noted in any patients and post operative pain and reduced grip strength were the only notable complications.

The limitations of this study were the number of cases considered were not more as well as in the each group of surgical technique , also as this was a retrospective study and not randomised control study, the number of patients in each study group were not equally distributed. Hence to get a better results we need a randomised study comparing the two study groups with longer follow-up period. Nevertheless this study provides us a vital information about the surgical technique of K-wire fixation for Bennett fracture and guides the surgeons to make the choice of fixation needed to get better function outcome post surgery.

Conclusion

This study gives us the overview about the two fixation methods of Bennett fracture , and that when trans 2nd metacarpal fixation is done , there are less chances of arthritis of the CMC joint as well as better functional outcomes post operatively as compared to trans trapezial fixation and hence guides a surgeon to make a decision about the technique of fixation to be employed during fixing such fractures.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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