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Original Research Article

Thenar Flap: A Study of 20 Cases of Industrial Fingertip Injuries, Functional and Aesthetic Outcome

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Abstract

Background: Fingertip injuries are the most common injuries, predominant in the industrial production activities. Treatment of fingertip injuries should be based on specific tissue losses. Thenar flaps provide adequate glabrous and durable soft tissue to restore the pulp.

Aims & Objectives: Present study demonstrates distinct advantages of thenar flap used for finger pulp reconstruction and evaluates functional and aesthetic aspects of thenar flaps.

Materials and Methods: Patients with acute fingertip injuries attending the emergency department of a super speciality hospital which is amidst an industrial zone were included in this prospective study. Thenar flap design was customised according to the defect. Following flap inset, the finger was immobilised in palmar flexion and flap division was performed after 3weeks. Further follow up for assessment of aesthetic (static 2-point discrimination) and functional outcome was done upto six months. The results were analysed by unpaired t-test.

Results: A total of 20 fingertip injuries were reconstructed with thenar flap. The sensory assessment at the thenar flap was 2-8mm with mean 5.6+/-1.2. The range of movement was found to be 95-110, 90-100 degrees with mean 98.5+/-2.1, 92.5+/-3.2 at Metacarpophalangeal (MPJ) and Proximal interphalangeal (PIP) joint respectively. During follow up, temporary joint stiffness occurred in two patients, which recovered with strict physiotherapy. No long-term complications, and good patient satisfaction were observed.

Conclusion: When proper principles of flap design, care of wound and early mobilization are followed, excellent outcomes can be expected with thenar flaps.

Keywords: fingertip defects, thenar flap, finger pulp reconstruction, flap division, aesthetic outcome

Introduction

Fingertip injuries are the most common injuries of the upper extremity. These injuries are predominant in the industrial production activities as well as domestic work or recreational activities.

Treatment of fingertip injuries should be based on specific tissue losses. Patients who lost a significant amount of pulp tissue, the dexterity is lost while performing skilled tasks. Various procedures have been described in the literature for finger pulp reconstruction. Cross finger flaps, thenar flaps, reverse metacarpal artery flaps, neurovascular island flaps, small free flaps and homodigital flaps are the most frequently used local flaps for reconstruction of fingertip loss. [1,2,3] However a basic controversy persists regarding the most suitable type of flap. [4, 5-14]

Thenar flaps was first described by Gatewood [15] in 1926, and was supported by Meals et al., [16] It provided adequate glabrous and durable soft tissue to restore the pulp. It is often used for larger volar defects, especially radial volar defects of index and middle fingers. Thenar flaps not only have an advantage of good soft tissue padding but gives good color and texture match, as well as inconspicuous donor scars that can be closed primarily without skin grafts.

The thenar flap is not easy to design, especially for inexperienced hand surgeons, however it is still useful now a day's whenever there is a need to cover a fingertip defect in emergency operation theatre. Due to a steeper learning curve, thenar flaps have fallen into disrepute.

The thenar flap needs to be customised in order to resurface a wide variety of fingertip defects. The few existing studies vary widely with respect to flap design, the timing of flap division and rehabilitation. [17,18,19] In 1926, Gatewood classical description of thenar flap was placed high on thenar eminence and placed medially. [15] In 1957, Flatt introduced proximally placed thenar flap.[11] In 1969, Beasley described a laterally based thenar flap.[7] In 2006, Rinker [20] published a study in 19 patients showing good recovery with minimal complications by using a lateral thenar flap. Although variation in procedure has been described, [7, 11, 14, 15] the common factor for success is precision in design and technique.

The aim of the study is to demonstrate distinct advantages of thenar flap used for finger pulp reconstruction and to assess the functional and aesthetic outcome of thenar flaps.

Materials and Methods:

Patients with acute fingertip injuries attending the emergency department of our super speciality hospital which is amidst an industrial zone were included in this prospective study. Informed consent was taken from all the patients. Ethical committee approval was taken. Fingertip injury management and follow up by a single surgeon over a period of two years was included to avoid inter surgeon bias.

Inclusion criteria:

- Fingertip injuries involving index finger and middle finger.
- Acute traumatic fingertip amputations/injuries, with exposed bone or tendon.
- Injuries with transverse defects, volar oblique, dorsal oblique defects (figure - 1) with a paucity of soft tissue precluding a local flap.

Exclusion criteria:

- Patients with injuries over the thenar eminence
- With preexisting joint injuries
- Patients suffering with arthritis, joint stiffness and dupuytren's contracture.

Figure 1: Injuries with transverse defects

Thenar flap design was customised according to the defect and follows the recommendations of Beasley etal[7], Flattetal [11] etc. Thenar flaps were designed as proximally-based flaps (figure- 2) for dorsal oblique and transverse defects and distally based flap for volar oblique defects.

The flap was placed on the glabrous skin of the thenar eminence with the proximal portion of the flap at the level of the most proximal aspect of the metacarpophalangeal joint (MCPJ) crease and positioned with the MCPJ flexed to near 90° and the proximal interphalangeal joint (PIPJ) in limited flexion to prevent a possible future contracture. The flap was designed according to the shape of the defect. The procedure was performed under local anaesthesia. The thenar flap was dissected from distal to proximal, incorporating subcutaneous tissue and fascia. Dissection proceeds in a sub-fascial plane to preserve vascularity of the flap. Care was taken to identify and avoid injury to the radial digital nerve to the thumb. (Figure- 3)

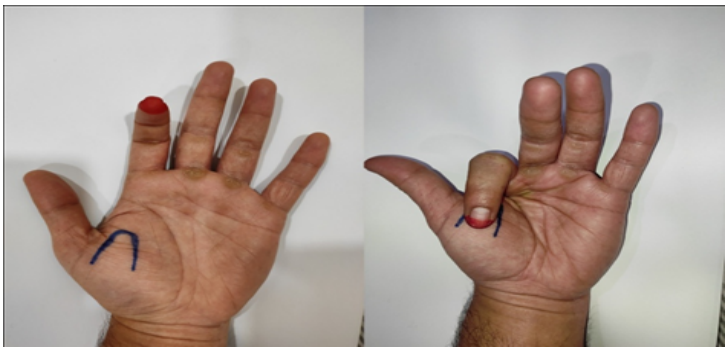

Figure 2: Design of the flap

Figure 3: Dissection of flap

Figure 4: Inset of flap

The flap was inset into the finger with fine Prolene sutures (Figure- 4).

The injured finger was immobilised in palmar flexion using elastic adhesive bandage. The patients were advised follow up twice a week for the first 3 weeks. Flap division was performed after 3 weeks. Proper flap in setting was done at flap division. Donor site was closed primarily. Further follow up was done after one month, three months and six months. All the patients were advised physiotherapy to prevent stiffness of the joints in the injured finger.

During follow up, patients were assessed for aesthetic and functional outcome. Sensory (2-point discrimination) and range of motion (at metacarpophalangeal (MP), and Proximal inter phalangeal (PIP) joints) were tested for functional assessment. Patients had been given a questionnaire that surveyed their opinion in different categories like appearance, sensation in thenar area, function of joints (MP, DIP, PIP) using a five-point likert scale. Patients were also invited to make comments and give suggestions without mentioning their identity. The results were noted and analysed by unpaired t-test.

Results:

A total of 20 fingertip injuries were reconstructed with thenar flap. All the patients in the study were above 25 years of age. Our study included 19 males and 1 female patient. The characteristics of the patients and their injuries are displayed in the fig or table 5. Most of the injuries occurred in workplace and were crush injuries (85%) involving single fingertip. 14(70%) had index finger involved and 6(30%) had middle finger involvement. Most of injuries 15 (75%) treated in this study were volar oblique defects. The reconstructive goals were met in all the patients without revision. Meticulous wound care was given until the wounds were completely healed. There were no tender or hypertrophic donor site scars reported.

Table 1: Characteristics of patients and their injuries

Characteristics	Total
Number of patients	20
No. of males	19 (95%)
No. of females	1 (5%)
Injuries of the right hand	13 (65%)
Crush injuries	17 (85%)
Middle finger defects	6 (30%)
Index finger defects	14 (70%)
Volar oblique injuries	15 (75%)
Transverse injuries	2 (10%)
Dorsal oblique injuries	3 (15%)

Follow up:

All the 20 patients were followed up regularly upto 6 months. The patients were assessed for esthetic and functional outcome.

The sensory assessment at the thenar flap by static 2-point discrimination (2PD) at the thenar flap varied from 2-8mm with mean 5.6+/-1.2, at the end of 6 months in comparison to mean of 2.2+/-1.1mm for the equivalent site in the contra lateral hand. Results summarised in table -2. There was high 2 PD values in older patients.

Table 2: Summary of 2 PD testing

	Mean stat 2PD (mm)
Flap	5.6+/-1.2
contralateral	3.2+/-1.1

The functional assessment was done by testing the range of motion (ROM) at the MPJ and PIP joint. The ROM in this study was found to be 95-110, 90-100 degrees with a mean of 98.5+/-2.1, 92.5+/-3.2 at MPJ and PIP respectively.

Stiffness of the involved finger at PIP joint was observed in 2 patients at 3rd month follow up visit (ROM-45 and 55 degrees) due to noncompliance with physiotherapy but complete recovery was seen at 6 months with strict physiotherapy. There were no functional digital flexion contractures or thumb adduction contractures at 6 months follow up. (Figure-5) Aesthetic outcome was excellent. (Figure-6)

Figure 5: Functional outcome on follow up

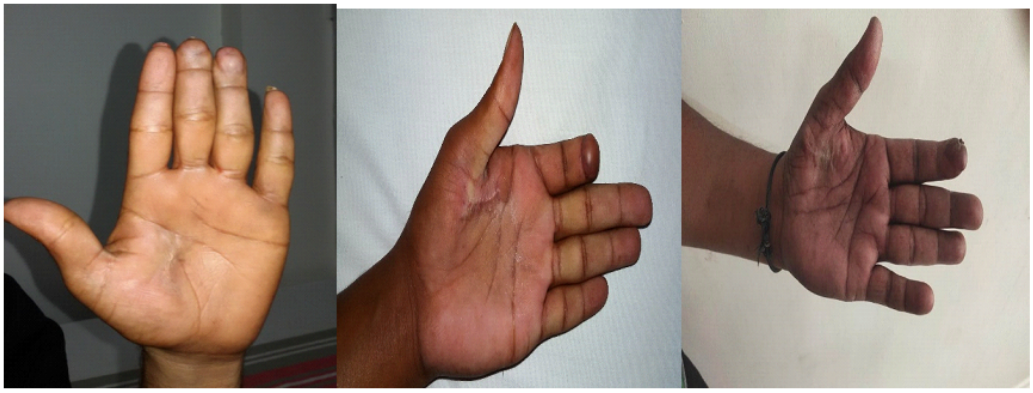

Figure 6: Aesthetic outcome

All the 20 patients have accepted to fill the questionnaire form provided. In the 5-point likert scale, mean satisfaction score was 4.1+/-0.5. Regarding the appearance, 80% of patients responded as very good or excellent with a mean of 3.8+/-0.2. Regarding the movement, 90% of them responded as very good or excellent. For sensation of thenar area, 90% responded as very good or excellent. Overall, no patients gave poor or very poor response for any of the component. (Figure-7) There were no specific comments given by the patients but few suggestions were advised by the patients to reduce the duration of immobilisation for the hand.

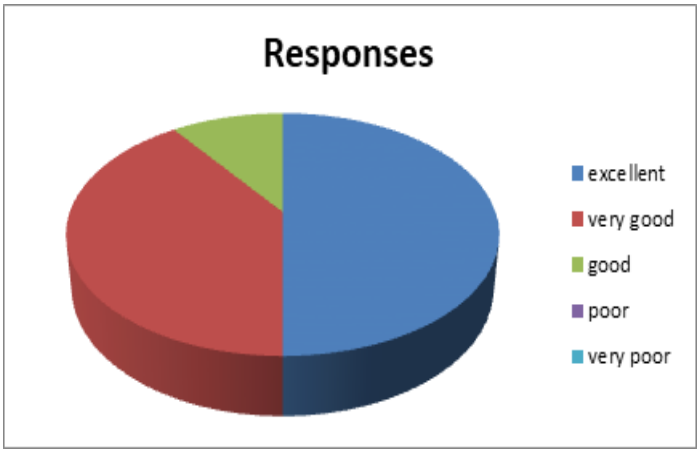

Figure 7: Responses about functional and aesthetic outcome from patients

Discussion:

Severe fingertip injuries with significant pulp loss and exposed bone are difficult to treat and must have a reliable reconstructive option. In these cases, the thenar flap is a local, autogenous tissue source that provides substantial bulk for fingertip reconstruction with minimal donor site morbidity. Thenar flap has been work horse flap for fingertip injuries. [19-23]

Although thenar flaps were criticised for high incidence of complications including flexion contractures, donor site morbidity and cold intolerance (Fitousietal., [24] more recent studies on laterally based thenar flaps by Meloneetal., [26] and proximally based flaps by Jasons Barr etal., [25] Rinker et al.,[20] etc. have contradicted these concerns. Our study confirms that the thenar flap is a highly safe procedure with minimal morbidity and no flexion contracture, by using appropriate techniques. In 2 patients, minimal stiffness was noticed in involved finger at PIP joint at 3rd month follow up visit due to noncompliance with

physiotherapy. Complete recovery from stiffness was observed at 6 months with strict physiotherapy.

Distal fingertip injuries were more common in males. It was observed that right- and left-hand injuries occurred at near equal frequencies despite the majority of the population being right-handed. [27-30] In our study right-handed injuries were more common as it is the dominant hand in majority of our population. Similar observation was noted in the study by RK Sahuetal., in 2019. [31]

The sensory outcome of flap after detachment was assessed by static 2-PD and functional outcome by the range of motion at each joint of the operated finger. Dellon[18] reported static 2-PD as 5.6mm, Barbatoetal., [17] reported static 2-PD as 6.5mm, RK Sahuetal., [31] reported 6.33mm, Jasson Barr etal., [25] reported mean as 5.5mm and the present study reported as 5.6mm, which is similar to other studies.

The functional outcome measured by range of movement at MPJ, PIP joint reported in the present study was 95-110, 90-100 degrees. Range of motion achieved at MCPJ and PIPJ in the study by Rinker et al, [20] was 99.58 ± 5.93 degrees and 90-110 degrees respectively, at the end of one year. Study by Jasson Barr etal., [25] showed that all the patients had a ROM of 85° at MCPJ and the average PIPJ ROM was 103° (95°–110°) in flexion. There is no significant difference in range of motion in our study compared to previous studies; none the less the duration of our study is less than other studies. We found no significant difference in functional and aesthetic outcome in different age groups.[32]

The thenar flap can provide a three-dimensional composite reconstruction that is functionally, aesthetically acceptable and preserves proper sensation over thenar area. This is reflected in the questionnaire results, with 90% of respondents reporting good or excellent results in all three categories. Study by Rinker et al., [20] reported, good or excellent results (75%) from respondents for parameters like function, durability and aesthetic appearance.

The results of the present study showed no significant disadvantages like contractures or disfigurement or loss of sensation etc as reported previously. The thenar flap still stands out as a better option for fingertip injuries. When proper principles of flap design, care of wound and early mobilization are followed, excellent outcomes can be expected. Limitations of this study are small sample size and lack of comparison with other flaps.

Despite limitations, we believe thenar flap as a safe and effective reconstructive option for fingertip injuries occurring in any age group as it provides the bulk and colour match with minimal complications.

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