Finger pulp reconstruction with thenar flap: Aesthetic and functional outcome

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ABSTRACT

Purpose: Fingertip injuries are common in industrial production activities as well as in domestic work. Loss of pulp hampers daily life activities. Functional and aesthetic aspects are important in fingertip reconstruction. The bone is usually exposed along with soft tissue loss. Therefore to reconstruct the pulp flap with adequate bulk is required.

Methods: We reported a case series of 12 patients with the injury over the volar aspect of distal phalanx of the index or middle finger. In all cases, laterally based thenar flap was chosen. The flap donor site was closed primarily in most of cases, while 4 patients required skin graft. The flap was detached between 2–3 weeks. Functional assessment was done using static and dynamic 2-point discrimination and range of motion at each joint. The aesthetic outcome was assessed through questionnaire. The results were analyzed using the unpaired t-test (SPSS version 21).

Results: Partial necrosis occurred in 2 cases while rest of flaps survived successfully. Static 2-point discrimination ranged from 6–10 mm, mean 8.6 mm; and dynamic 2-point discrimination ranged from 8–10 mm, mean 8.9 mm. The mean satisfaction score was (4.0 ± 0.55).

Conclusion: Thenar flap is a good choice for reconstruction of the finger pulp as it provides the bulk with good functional and aesthetic outcome.

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Introduction

Fingertip injuries are highly predominant in industrial production activities as well as in domestic work. A fingertip can be divided into pulp, nail and the distal phalanx. Patients who lost a significant amount of pulp tissue face trouble in their daily life, such as pinching, picking up small objects, buttoning and unbuttoning their shirts, the “pill-rolling” movements of the fingers and thumb, etc. In short, the dexterity is lost while performing the skilled tasks. The bone is often exposed in these cases, because a bulk of pulp defected.

Multiple flaps have been described in the literature for fingertip reconstruction. Choosing a suitable flap counts upon various factors which including size, shape, location and availability of the flaps. Cross-finger flaps, thenar flaps, reverse metacarpalartery flaps and homodigital flaps are the most frequently used local flaps for reconstruction of the pulp.1,2,3 The advanced microsurgical technique— toe pulp transfer is another alternative, although it has a steep learning curve, requires supermicrosurgical skills and equipment.

Finger pulp reconstruction with cross-finger flap is commonly performed; however it has certain disadvantages, such as conspicuous donor site at the dorsum of finger along with stiffness of interphalangeal joints (IPJs). Furthermore, cross-finger flaps do not provide adequate bulk and are practically not enough for a multi-finger injury.

Thenar flap was first described by Gatewood 4 in 1926, and was supported by Meals et al.5 It provided adequate glabrous and durable soft tissue to restore pulp. A few limitations on this flap have been described in the literature, such as unsightly donor scars and flexibility contracture of IPJ. In a study of 150 patients, Melone et al6 described that modified thenar flap based laterally have shown excellent results. In 2006, Rinker7 published a study of 19 patients that he used the lateral thenar flap for fingertip reconstruction and reported good functional and aesthetic recovery with minimal complications.

The present study was carried out to assess functional and aesthetic outcome of thenar flap, used for finger pulp reconstruction.

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Methods

Patients with fingertip injuries involving index or middle finger were included in this prospective study irrespective of age and sex. Local flaps could not be used because of the volar oblique amputations with soft tissue loss at the pulp. The fingertip injuries involving the ring and little finger were excluded from the study. The patients with injuries over the thenar eminence, pre-existing joint injury, arthritis, joint stiffness and Dupuytren's contracture were also excluded from the study. The results were analyzed using the unpaired t-test (SSPS version 21).

Totally 12 fingertips were reconstructed with laterally based thenar flap (Table 1). All the patients in our study were males. The age of the patients ranged from 20–54 years (mean 35 years). Among them, 6 patients were older than 30 years. Most injuries were occurred at their workplace and the hospital reaching time varied from 2 h to 10 days.

Operative procedure

The procedure was performed under regional anaesthesia. Laterally based thenar flap was raised using the standard technique (Fig. 1A). While designing the flap, the lateral margin of the flap was placed along the metacarpophalangeal (MCP) crease of the thumb to avoid the palm. The width of the flap was kept 1.5 times to the width of the defect to reconstitute the contour.6 The base of the flap located at the junction of dorsal and volar skin, the thumb was kept in the palmar-abducted position so that the injured finger was fully flexed at the metacarpophalangeal joint (MCP) which brought to the thenar eminence (Fig. 1B).

The flap was raised at the fascia level with utmost care to protect the motor branch of the median nerve. The donor site was closed primarily or skin grafted. The two-thirds of the flap was insetted. The extension blocking splint was given on the dorsum of the hand to keep the hand immobilized for 2–3 weeks.

The flap was detached under local anaesthesia between 2–3 weeks. All the patients underwent physiotherapy in the supervision of the occupational therapist. The patients were then kept in a one year follow-up (Figs. 1C, 1D).

Assessment parameters

Patients were assessed for functional and aesthetic outcome. The functional assessment included static and dynamic 2-point discrimination (2-PD) along with the active range of motion at the MCPJ and IPJ.

Patients were given a questionnaire concerning their post reconstructive aesthetic appearance and were asked about their appearance satisfaction on 4-point Likert scale which ranged from very unsatisfied to very satisfied. Above parameters were assessed at 3, 6, 9 and 12 months. Data analysis was conducted by using the unpaired t-test.

Results

The time of flap detachment extended from 14 to 21 days (mean 17.25 days). Partial necrosis of the flap occurred in 2 patients which were managed conservatively. Flexion contracture of proximal interphalangeal joint (PIPJ) occurred in 2 patients in which 1 was older than 30 years.

The static 2-PD varied from 4–10 mm with mean (6.33 ± 2.21) mm, at the end of one year while dynamic 2-PD was ranged from 2–8 mm with mean (4.41 ± 1.70) mm. The mean range of motion of MCPJ was (99.58 ± 5.93) degrees (ranged, 90–110 degrees).
range of motion for PIPJ was 90–100 degrees with a mean of (92.54 ± 3.22) degrees. The distal interphalangeal joint (DIPJ) motion ranged 45–55 degrees with a mean of (50.41 ± 3.79) degrees. Questionnaires were answered by all the patients on 4-point Likert scale. Mean satisfaction score was (4.0 ± 0.55). Ninety percent of the patients were satisfied or very satisfied with their reconstruction.

**Discussion**

Thenar flap was first described by Gatewood\(^4\) and Meals & Brody,\(^5\) who have long been criticized for complications related to donor site and the flexion contracture in a reconstructed finger. Classically the flap was raised medially which had encroached on the palm. Later, Flatt\(^6\) modified classical thenar flap harvesting technique by basing it proximally. Both proximally or medially based thenar flaps were associated with severe donor site morbidity because of the involvement of the palmar skin.

It has been 40 years since the thenar flap was described by Gatewood\(^4\) when Melone et al.\(^6\) reported laterally based thenar flap in a case series of 150 patients. The distal border was placed at the MCP crease of the thumb which yield excellent results and avoided donor site morbidity by precluding palmar region. Most of the patients in this series had no significant impairment of function and disfigurement at the donor site.

The functional outcome of flap after detachment was assessed by static 2-PD and dynamic 2-PD along with the range of motion at each joints of the operated finger. Dellon\(^\text{7}\) reported static and dynamic 2-PD as 5.6 mm and 3.3 mm respectively in a series of 5 patients. The p values of above-mentioned results were 0.758 and 0.427, respectively. Similarly, a study of Barbato et al.\(^\text{10}\) reported static 2-PD was 6.5 mm in their series of 20 patients. Results in this study were comparable to both the above studies.

The static 2-PD in our patients ranged 4–10 mm with mean (6.33 ± 2.21) mm while dynamic 2-PD had ranged 2–8 mm with mean (4.41 ± 1.70) mm, which is comparable with a report by Dellon\(^\text{7}\) in a series of 5 patients where static 2-PD was 5.6 mm and dynamic 2-PD was 3.3 mm. Similarly, in a study of Barbato et al.\(^\text{10}\) reported static 2-PD was 6.5 mm in their series of 20 patients.
The mean range of motion at the 3 types of joint were assessed for one year and patient was asked to visit regularly at an interval of 2 weeks in which emphasis was given on the physiotherapy at each joint. In our case series of 12 patients, 2 patients have lost follow-up. Joint stiffness after thenar flap has been debated. Range of motion achieved in this study at MCPJ,PIPJ and DIPJ is similar to study by Rinker et al. At the end of one year, the range of motion at the MCPJ was (99.58 ± 5.93) degrees varying between 90–110 degrees. The range of motion for PIPJ was between 90–100 degrees with a mean of (92.54 ± 3.22) degrees. The DIPJ motion ranged between 45–55 degrees with a mean of (50.41 ± 3.79) degrees. The range of motion has always been improved with the time and in the studies where the patient followed up for 2 years showed the improved range of motion. The mean MCPJ motion in the reconstructed finger was (99.58 ± 5.93) degrees, mean PIPJ motion was (89 ± 3.6) degrees and mean DIPJ motion which was 42 degrees. Though p value showed no significant difference in our study in comparison with previous study, nonetheless our duration was lesser than his studies.

Cautions has been advised about the operative procedure of fingertip injury under taken in patients older than 30 years of age due to post operative flexion contracture deformity in these patients. However, in this series we found no significant difference in functional and aesthetic outcome in different age groups. Two patients developed flexion contracture in reconstructed finger were managed conservatively. Out of them, one was 26 years old and the other was 42 years old. The flexion contracture could be easily avoided in a well motivated patient with strict active and passive physiotherapy schedule.

As suggested by Gatewood the flap was detached in 14–21 days. There was only one case who was 42 years old where detachment was done after 21 days because patient could not come earlier for the detachment.

Fingertip reconstruction by thenar flap follows the basic principle of plastic surgery, replacing like with like. It provides durable glabrous skin with sufficient bulk to fingertip. And if properly designed, donor related complications can be avoided. Other flap that can provide like to like replacement is toe to finger pulp transfer without the complication of flexion contracture as joints are not fixed in one position. However, it requires super microsurgical skills and equipment which is not available at every institute. Limitations of this study are small sample size and lack of comparison with other flaps and normal contralateral finger.

Thenar flap is a good choice for reconstruction of the finger pulp as it provides the bulk and colour match. Active physio therapy post-operatively reduces the risk of PIP contracture.

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Ethical Statement
The study approved by an ethical committee with an approve No:AIIMS/IEC/2019/834.

Declaration of Competing Interest
The authors declare no conflicts of interest.

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