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Research Paper

Evaluation of Modified Midpalmar Flap for Coverage of Middle and Ring Fingertips Amputation

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ABSTRACT

BACKGROUND:

fingertip is the most injured part of the hand. There are many methods used to cover soft-tissue defects of the fingertip. The primary goal of digital reconstruction is to preserve digital length and maintain full mobility of the digit while providing adequate protective cover of the deeper vital structures with skin and soft tissue of good quality.

OBJECTIVE:

This study to evaluate the use of a modified mid palmar flap for coverage of ring and middle fingertip amputations with an exposed bone to assess functional and aesthetic results regarding the length preservation of digit, overcome joint contracture, and return of sensation.

PATIENTS AND METHODS:

Between January 2020 and June 2021, we used a modified mid palmar flap for 11 ring and middle fingertip amputations for patients, average age 27.7 years, whose fingertip amputations in different planes and zones. Follow- up period at least 4-12 months.

RESULTS:

All flaps are viable, with no partial or total flap necrosis. The patient had neither cold intolerance nor scar tenderness and no joint contracture. With the return of sensation to the reconstructed area. No donor site infection or wound dehiscence.

CONCLUSION:

Modified mid palmar flap is two stages procedure, short time technique provides durable coverage with good color and texture match of the fingertip, without joint stiffness, and can be used for any plane of fingertip injury.

KEYWORDS: Fingertip amputation, mid palmar flap, joint contracture

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INTRODUCTION:

The hand can justly be called the most important extension of the intellect. It is far more than just a tool with prehensile capacities, as it is complemented with a rich collection of sensory receptors [1] .Injuries of the fingertip are very common occurrences secondary to both domestic and industrial accidents and are among the most common hand injuries encountered in the emergency room and the hand practice [2]. The approach that is used to cover soft-tissue defects of fingertip should be carefully selected and based on the following criteria: the topography of the defect, the affected finger, and the associated injuries of the injured finger and neighboring fingers [3]. The long finger is the most commonly injured, followed by the ring, index, and small fingers and, the thumb with equal frequency bilaterally [4] . The majority of injuries of the fingertips occur between the ages of 4 and 30 years, 75% occur in males. Fractures of the distal phalanx are present in 50% of nail bed injuries, the most injuries occur to the middle or distal third of the nail bed [4] . Injuries to the fingertip can be transverse or oblique. If oblique injuries present, they can be dorsal oblique or volar oblique [5].

One of the important staged flaps used to manage fingertips injuries is the thenar flap, an excellent and reliable choice for the reconstruction of distal phalanx soft tissue defects and amputation. Thenar flap is popular and should only be used in children and young adults with injuries to the fingertip of the index, long, or ring finger [6].

AIM OF THE STUDY:

To evaluate the use of a modified mid palmar flap for middle and ring fingertip injuries,to assess functional and aesthetic results regarding the length preservation of digit, overcome joint contracture, and return of sensation.

PATIENTS AND METHODS:

A prospective study was conducted in AL-Wasity teaching hospital and AL-Shaheed Ghazi Al-Hareeri teaching hospital, between January 2020 to June 2021.table 2 demonstrate the patient's data.

Inclusion criteria:

1. All patients with fingertip injuries that involved the middle and ring finger.
2. Any age of patients, even elderly people.
3. Those patients who were accepted to immobilized their digit for at least 10 days.
4. Flap used in all planes of fingertip amputations (volar oblique, dorsal oblique, and transverse).

Table 1: Patient's data:

No.	Age (yrs)	Gender	Involved digit	Amputation zone (Ishikawa)	Mechanism of injury	Amputation plane	Follow up (months)
1.	19	male	LT middle	4	Sharp Cut	Volar oblique	12
2.	20	male	RT middle	3	Sharp Cut	Volar oblique	14
3.	11	male	RT ring	3	Crush	Volar oblique	12
4.	52	male	RT middle	2	Crush	Volar oblique	8
5.	25	male	RT ring	2	Sharp	Transverse	16
6.	30	male	LT middle	2	Sharp	Transverse	12
7.	40	male	LT middle	3	Crush	Dorsal oblique	10
8.	22	female	LT middle	4	Crush	Dorsal oblique	14
9.	23	male	RT middle	2	Sharp	Transverse	8
10.	9	female	RT middle	2	Sharp	Transverse	6
11.	54	male	RT ring	3	Crush	Transverse	4

Exclusion criteria:

1. Patients with digital injury other than middle and ring fingertip
2. Patients who were not accepted to immobilized their finger for at least 2 weeks.
3. Patients who already had contracture or stiffness in involved digit
4. Patients with history of arthritis.
5. Patients with previous history of mid palmar injury or new scar.
6. Patients with concomitant hand injury.
7. Bulk hand of workers.

Operative technique:

The operations were done under general anesthesia in 3 patients, and under local anesthesia in 8 patients, Minimal bone debridement was done, a template was made to estimate the defect by using a sterile paper, or sterile ruler to measure them.

The modified mid palmar flap was designed to be located in the mid palmar area more on the thenar side with its ulnar margin located along the oblique palmar crease, the flap was proximally based, with the width of the flap was the same of the width of defect, with an extra 5 mm length was added to its length to allow for some degree of PIP and DIP joints mobilization, like in figure 1 below.

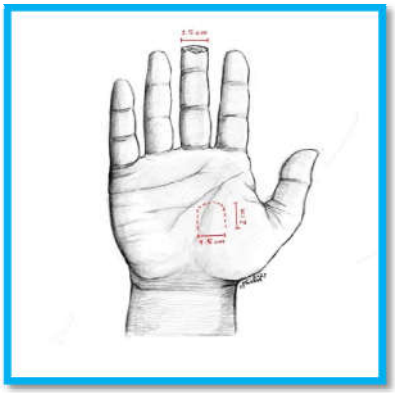

figure : 1

A skin incision is made and gradually deepened. The flap is elevated from distal to proximal in the sub fascial plane incorporating subcutaneous tissue and fascia to preserved vascularity of the flap. After elevation, the flap was inspected to confirm its vascularity and ensure adequate capillary refill. The involved digit {middle or ring finger} was brought to the flap with positioning the MCP in 90-degree flexion, the PIP joint in 90-100 degrees' flexion, and the DIP joint in 5 -10 degrees' flexion. after hemostasis was secured, the donor site was closed without tension, the flap was inset to the fingertip.

After complete inset of the flap, dressing is done by using gauze impregnated with antibiotic ointment, applied along the flap, and then dry gauze was applied. The operated finger is immobilized using a dorsal splint in children for one week that keeps the operated finger in the flexion position. Patients were instructed to keep the hand elevated in the broad arm sling. Patient discharge in the same operative day. 1st change of dressing was done 48 hours after the operation, then on days 5, 8 and 10. Removal of stitches on day 10.

With the second stage of the procedure, the flap was detached under local anesthesia in 8 cases except for 2 cases where children within 10 -14 days. minimal inset was done at the time of flap separation. The PIP joint of the involved finger was put through a passive range of motion at the time of the operation, and started active motion immediately after the operation. The flap was checked postoperatively. Patient was discharged on the same operative day. The Patients were kept on follow-up for 3, 6, and 12 months after the operations.

RESULTS:

Patients were assessed for a functional and aesthetic outcome. All of our patients had viable flaps and we didn't encounter any case of flap necrosis. Only one of our patients who was heavy smoker had venous congestion which was treated by conservative methods. The flap was healed uneventfully.

One of the cases develop wound infection and was treated with topical antibiotics and followed-up for several days for daily dressing. No wound dehiscence was seen in all of our patients.

The modified mid palmar flap provides pliable coverage with adequate bulk that recreates the rounded contour of the normal fingertip. The flap had good color and texture match to the surrounding tissue. No significant joint motion restriction was noted. Only one of the patients who was 52 years old developed slight pain of the PIP joint while the movement of digit which was completely resolved within 2 weeks of surgery by physiotherapy.

The final sensibility discrimination score was obtained after 4 months of surgery. All patients reported no cold intolerance, no pain on tapping. Touch sensation recorded in flaps , and static 2 points were done. The results of S2PD {4-6} mm, compared to {3-5} mm on control fingertip. The patients were subjectively evaluated for their opinion about the aesthetic appearance of their fingertip, 10 of patients were satisfied with their fingertip appearance, and one of them was not satisfied with the result.

The main aesthetic concern was about the appearance of the nail. The final appearance of the nail is determined by the severity of the initial injury to the nail matrix. Two of the patients who was Ishikawa's zone IV had no nails, 8 of them had developed normal nails, one of them was zone III had developed distorted shape of the nail.

Regarding donor site of the flap, we reported no hypertrophic or keloid scar formation, no infection and non-tender scar. The scar is barely visible after 12 months of operations. All patients had return back to their normal life actively after 10 days of separation of the flap.

Like in figure 2.

Figure 2: Case no.2: 23 years old male, RT middle fingertip amputation, transverse plane, Ishikawa zone II.
(A)Preoperative volar view. (B)Intraoperative finger positioning with the flap.
(C), (D), (E) 8 Months postoperative volar view.
(F) 8 Months postoperative dorsal view.

DISCUSSION:

Fingertip is a highly sensate structure with very exquisite mobility and stability [7] . The main goal of management of fingertip injury is to provide a durable coverage which is sensate and painless together with a good appearance [8] .Gatewood in 1926 was introduced the thenar flap and has been repeated by many plastic surgeons [9]. originally the thenar flap was medially based and placed high on the thenar eminence [9]. In 1950, Flatt modified thenar flap and he was recommended thenar flap to be placed proximally. Both these flaps whether medially or proximally based were associated with donor site morbidity [9]. According to N.J. Barton, the problem in this thenar flap is that it is taken from the site on which the fingertip converges when flexed down to the palm, this will lead to post-operative tender scar which prevent a firm grip.

Later on, the flap was modified to be laterally based as was suggested by Beasley [9]. In spite of this modification, thenar flap is still associated with complications namely post- operative flexion contracture of the PIP joint of the recipient's finger [9,10,11]. Melon et al in 1971 had used a thenar flap in 150 cases of patients with fingertip injuries (the index and middle were the most injured digit 81%). Although he achieved excellent aesthetic result, their functional result has shown flexion contracture of the PIP joint [12] . In 1983 Delon had used thenar flap for fingertip reconstruction, his result was resemble to Melon et al including a good functional and cosmetic results, but flexion contracture of PIP joint was noted [12]. Barbato et al showed 25% PIP joint contracture when he used distally based thenar flap in 20 patients [13] .

Barclay and Porter had also used thenar flap for fingertip reconstruction, their result showed that seven of 31 patients (33%) were reported donor site tender scar [14].

Another modification in this mid palmar flap is that we added an extra 5 mm to the length of the flap, this allow the finger to be slightly raised with some degree of mobilization of both the PIP joint and DIP joint which reduced the incidence of flexion contracture, and provide easy dressing.

Another compelling factor that plays role in reducing flexor contracture of the involved digit is the early flap separation which is done within 10 -14 days as the flap had a robust blood supply as was mentioned above and also due to immediate physiotherapy after flap separation.

One of the advantages of modified mid palmar flap over a thenar flap is that patient can eat and write during the period of immobilization since the motions of all thumb joints are not restricted.

It is fascinating to know that crucial functional recovery occurs even without neurorrhaphy. This result of neurotization occur because of the proximity of recipient and donor site together with good tissue match and high density of nerve ending receptors at the tip of the finger. This fact makes the surgeons who performed free glabrous skin flap that based on the superficial palmar branch of the radial artery not routinely performed nerve anastomosis, Kleinert et al reported good sensory return with non-innervated flap for coverage of fingertip defect [15,16].

Our study is consistent with Garg et al. in 2019, a review of 12 cases (they used modified mid palmar flap for management of fingertip injury of the middle finger) [17]. Our study included both the middle and ring fingers. Their results showed: there is no case of flap necrosis and the reconstructed pulp had adequate tissue bulk as our flap. No reported case of hypertrophic scar in the donor area as ours. only three of the patients had developed tender scar as compared to our study we reported no scar tenderness. Comparison is shown in table 2 below.

Table2: Comparison of Garg et. al. study results with our study

Parameters	Garg et. Al. study	Our study
Flap necrosis	No	No
Scar tenderness	Three patients	No
Joint stiffness	One patient	One patient
Shape and length satisfaction	all	One
Sensation	Not included	2 points discriminations, and touch

Conclusions and Recommendations

Although this technique was 2 staged surgeries, but

- It's short time procedure, can done under local anesthesia.
- A modified mid palmar flap had offered a good coverage of the middle or ring fingertip injury with good functional and cosmetic results.
- Provide bulky and durable coverage with good color and texture match, and good option for sensation.
- With modification in mid palmar flap the possibility of postoperative contracture and donor site scar tenderness is reduced.
- As a donor tissue in straight axis of the flexed middle finger which could make it a good option for middle fingertip reconstruction.
- We recommend further evaluation in future, and a greater number of patients need to be operated by using this technique for more accurate assessment and results.

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