

Cross-Finger Flaps Outcome and Modification

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ABSTRACT

Background: Injuries to fingers are frequently encountered since these are the most exposed parts of the body and are in contact with devices and tools so are exposed to a multitude of risks. Various surgical methods such as skin grafting, stump closure, and microvascular reconstruction are in the armamentarium of the plastic surgeon. The cross-finger flap was described originally in 1950 and is one of the workhorse flaps for finger reconstruction and can be done as described originally or as a modification in multiple scenarios of finger trauma.

Methods: This is a prospective single-centre multi-surgeon study carried out on 35 patients from 2018 to 2021 on patients undergoing cross-finger flap. All cross-finger flaps or any modification such as reverse cross-finger flap, or cross-finger flap on graft reposition were included. Each patient was analysed as per the aetiology, the treatment received, the reconstructive procedures done, the functional and aesthetic outcome, and any postoperative complications and their management.

Results: The average follow-up of patients was two years. 22 out of 35 patients were male, and in 28 patients the injury had occurred in the right hand. The average age of patients was 34.5 years.

Conclusion: Cross-finger flap is a simple and reliable flap among the various reconstructive options available for finger injuries. The modifications such as reverse cross-finger and graft reposition flap increase its application. The cosmetic outcome is usually satisfactory and the return of protective sensations is seen in most cases. At times it is a trade-off between extensive microvascular procedure and a marginally short finger with or without nails.

Keywords: Cross-finger flap; Finger reconstruction; Graft reposition flap.

INTRODUCTION

Injuries to fingers are frequently encountered since these are the most exposed parts of the body and are in contact with devices and tools so are exposed to a multitude of risks. It is no surprise that their trauma is frequently encountered by any trauma or plastic surgeon in all emergency settings. Various surgical methods such as skin grafting, stump closure, and microvascular reconstruction are in the armamentarium of the plastic surgeon. The method chosen depends on the type of injury, level of amputation, other patient factors, and the center. (1)

The goals of the treatment include restoration of length, appearance, sensation, and function of the finger. Although protecting the nail bed and providing length at times comes at the cost of having a painful finger. (2, 3) Reimplantation although has the potential to satisfy all possible expectations of an amputated part, (4) but can be applied only to selected patients and at times resources and manpower may be limiting factors.

The cross-finger flap was originally described in 1950 (5,6,7) and is one of the workhorse flaps for finger reconstruction and can be used as originally described or as a modification in multiple scenarios of finger trauma.

In the present study, we aimed to evaluate the effectiveness of using cross-finger flaps in the reconstruction of finger injuries, and distal finger amputations with or without the graft reposition method.

METHODS

This is a prospective single-center multi-surgeon study carried out on 35 patients from 2018 to 2021 on patients undergoing cross-finger flap. All cross-finger flaps or any modification such as reverse cross-finger flap, or cross-finger flap on graft reposition were included. Each patient was analyzed as per the etiology, the treatment received, the reconstructive procedures done, the functional and aesthetic outcome, and any postoperative complications and their management. All patients with trauma hands who reported to Accident and Emergency Department, undergoing cross-finger flap, and having given consent were included in the study.

Technique:

The patient's candidates for cross-finger flap were either operated under the digital, wrist, or supraclavicular block. Either arm or finger tourniquet was applied, after the debridement planning of the flap was done. The flap is usually harvested from the adjacent finger. The middle finger is the donor for the index finger, ring finger, and thumb. The donor finger is chosen based on the site of trauma and the post-operative position of immobilization. The donor may vary especially when one adjacent finger is injured. We at our center prefer the middle finger for thumb defects for ease of position. (Figure 2) The flap is usually harvested from the middle phalanx of the donor finger. (Figure 3b, 3c) Transverse skin incisions are made along the dorsal folds on proximal and distal interphalangeal joints and the longitudinal incision is made along the volar/dorsal skin junction on the side of the finger opposite to the recipient's finger. (Figure 3c) A dorsopalmar hinge is preserved on the interdigital side to preserve

vascularity. The flap is raised on the plane above the epitenon, (Figure 3c) dorsal veins are coagulated. The flap inset is made either in the usual pattern or sometimes above a nail bed or bone graft (graft reposition flap). (Figure 2e) The donor site is grafted with a full-thickness skin graft. (Figure 1c) The de-epithelialized flap is harvested when the defect is on the dorsum (reverse cross-finger flap). (Figure 2a) In such case donor site as well as the flap needs to be grafted. (Figure 2e) After the inset dressing and splintage are done, hand elevation is advised and the patient followed regularly. The flap is divided between the second and third week after the digital block of the donor finger. Post-procedure patients were kept on close follow-up and complications if found noted and managed. Flaps were observed for any necrosis, infection, or neuromas. The return of sensation was checked by microfilaments as described by Semmes and Weinstein

RESULTS

The average follow-up of patients was 2 years. 22 out of 35 patients were male, and in 28 patients injury had occurred in the right hand. The average age of patients was 34.5 years ranging from 13 to 58 years. The middle finger was the donor finger in 18 cases. In 3 cases graft repositioning was done and in one case the post-operative infection was followed by graft loss. None of the cases had flap loss. Out of 35 flaps, 12 were planned in reverse fashion. De-epithelisation was done before the elevation of the flap using a grafting blade and the same sheet of the graft was applied to the donor area and flap. At follow-up 8 patients complained of cold intolerance, and 15 patients had joint stiffness, 18 patients have a poor color match at secondary defect usually hyperpigmentation. None of the patients complained of neuropathic pain and neuroma. It was noted that one person had documented a mallet finger post-op in the donor's finger. (Figure 4b) Although this complication is rarely documented.



Figure 1: Classic cross-finger flap (a) Compound defect volar aspect right little finger; (b) Cross-finger flap from ring finger; (C) Donor site grafted.



Figure 2: Graft reposition with cross-finger flap (a) Amputated distal half of distal phalanx right thumb; (b) Injured hand; (c) Separation of bone and nail bed from soft tissue; (d) Fixation of bone and nail bed to stump; (e) Reverse cross-finger flap and grafting done; (f) Excellent pulp thickness; (g) Nail with satisfactory outcome.



Figure 3: Technique (a) De-epithelization of flap before harvest; (b) Raising a reverse cross-finger flap; (c) Conventional flap; (d) Nail bed over nail plate graft in graft reposition flap to act as a scaffold.



Figure 4: Complications (a) Infection of graft in graft reposition flap; (b) Mallet finger post flap harvest; (c) Donor site poor cosmetic outcome; (d) Flap hyperpigmentation; (e) Post infective loss of graft in reposition cross finger flap, thumb length salvaged by dorsoulnar flap thumb.

DISCUSSION

Cross-finger flap is a robust reliable flap that can be applied to several finger defects and fingertip amputations. (8) Our study just confirms the reliability of cross-finger flaps with none of the patients having loss of the flap and presents the additional application of utility as graft reposition flap.

The technique of graft reposition flap was described by Foucher (9) in 1992. In this technique, soft tissue is removed from the amputated fingertips bone and the nail bed is fixed to the stump (Figure 2c) and covered with a flap. The reposition-flap method is a treatment that can provide near-normal anatomy and finger length in patients with distal tip amputations that cannot be replanted. (10) (Figure 2a) Various flaps have been used in the literature for the reposition-flap method. Cross-finger or thenar flaps are more easily applicable and do not require microsurgery experience. (11) In our study very few patients were candidates for graft reposition flap as some injuries were proximal and thus good candidates for reimplantation, some were too distal with only soft tissue loss, and some with completely crushed and dirty amputated parts when using a graft from the amputated part was not found worthwhile. In our series, we used this technique in three patients with one patient having post-infection loss of the graft. The repositioned graft in that case was removed and the thumb length was salvaged by the dorsoradial flap thumb. The patient had a near-normal thumb length without a nail bed. Rest two patients have excellent outcomes. (Figure 2g, 2f)

Some authors have criticized cross-finger flaps for poor quality pulp and donor site sequelae (12, 13). In our study, the pulp quality was mostly good (Figure 2f) but donor site sequelae were present as stiffness and donor site graft hyperpigmentation. (Figure 4c) Studies were thin skin graft was used to cover donor site defect had more unsatisfactory harvest site outcome (14) we have preferred thick grafts in our study

CONCLUSION

Cross-finger flap is a simple and reliable flap among the various reconstructive options available for finger injuries. The modifications such as reverse cross-finger and graft reposition flap increase its spectrum. The cosmetic outcome is usually satisfactory and the return of protective sensations is seen in most cases. At times it is a trade-off between extensive microvascular procedure and a marginally short finger with or without nails.

Declaration by Authors

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