

Reconstruction of large area defect of the nail bed by cross finger fascial flap combined with split-thickness toe nail bed graft

A new surgical method

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Abstract

Fingertip injury commonly results in avulsion of the nail bed. For large area defects of the nail bed with distal phalanx exposure, methods for reconstruction of soft tissue defects are scarcely mentioned in the literature.

From May 2014 to January 2016, 6 patients with large area defects of the nail bed with distal phalanx exposure were enrolled. A new surgical method, cross finger fascial flap combined with thin split-thickness toe nail bed graft, was applied in all patients.

All the 6 patients were followed-up at least 3 months. Good blood supply and no infections were observed. The lengths of the thumb or fingers were preserved. Acceptable appearance and nail bed growth were noted. The donor sites showed no dysfunction or deformity.

Cross finger fascial flap combined with thin split-thickness toe nail bed graft is a new and rewarding surgical method to reconstruct large area defect of the nail bed with distal phalanx exposure.

Abbreviations: None.

Keywords: cross finger, defect, flap, graft, nail bed, split-thickness

1. Introduction

Injuries to the fingertip are common and sometimes result in avulsion of the nail bed. Reconstruction of the nail bed is essential for both aesthetic appearance and hand function. For small area defects of the nail bed, nail bed grafts may not be necessary.^[1] For large area defects of the nail bed, primary closure is not feasible without a graft. Many methods have been used. However, for large area defects of the nail bed with distal phalanx exposure, surgical methods with satisfying outcome are rarely mentioned in the literature. In this study, cross finger fascial flaps combined with nail bed grafts were applied in 6 patients who suffered from large area defects of the nail bed with distal phalanx exposure. The detailed surgical procedure, the indications, and the prognosis are described.

2. Methods

2.1. Patients

From May 2014 to January 2016, 6 patients with large area defect of the nail bed and distal phalanx exposure were enrolled.

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The age of the patients ranged from 25 to 52 years. Five patients were male and 1 was female. All the injuries were caused by machines. Digits injured comprised 2 thumbs, 3 index fingers, and 1 middle finger. Five of 6 injuries occurred in the dominant hand. According to Allen type classification, all injuries were of type 3.^[2] Debridement was performed in the emergency department. Infection had been excluded before further treatment was undertaken. Approval was obtained from our institutional review board for the study. Informed consent was obtained from all the patients in this study.

2.2. Indications

The surgical method is applied to reconstruct a large area defect of the nail bed with distal phalanx exposure. The germinal layer of the nail root must be preserved. As long as the germinal layer exists, no matter how large the defect is, this method is applicable. If the germinal layer is intact, the newly growth nail will appear flat and smooth. However, nail deformity will occur inevitably if the germinal layer is injured. For multiple fingertip injuries, this method may not be appropriate.

2.3. Surgical procedure

Surgery was performed under general or regional anesthesia. A tourniquet was applied. A Kirschner wire was inserted through the palmar skin to the distal phalanx to prevent retraction of the skin. The defect of the nail bed and the exposure of the distal phalanx were evaluated (Fig. 1). A rectangular skin flap was designed on the dorsum of the middle segment of the adjacent finger and the pedicle was on the opposite side to the injured finger. An incision was made down to the surface of the deep fascia. A pedicled fascial flap was designed according to the shape of the defect area and the pedicle was located at the opposite side of the skin flap. The fascial flap was dissected superficially to the



Figure 1. (A) A 25-year-old male worker suffered a fingertip injury of the thumb. (B) Postoperative view of the thumb and the donor site 3 months after the operation. The nail bed was successfully restored. (C) A 38-year-old male worker suffered a fingertip injury of the index finger. (D) Postoperative view of the thumb and the donor site 6 months after the operation. The nail bed was successfully restored and there was no deformity at the donor site.

paratenon and raised (Fig. 2). The fascial flap was transferred to cover the defect of the nail bed and was sutured with 6-0 Prolene stitches (Fig. 3). The wound of the donor finger was covered by the original skin flap. A 0.3-mm-thick nail bed from the great toe was harvested. The shape of the nail bed graft was determined by the defect area. The free nail bed graft was sutured on the fascial flap with 6-0 Prolene stitches (Fig. 4). A plaster cast was used for immobilization. The pedicle of the cross finger fascial flap was divided 3 weeks after the operation.

3. Results

All the 6 patients were followed-up at least 3 months (Fig. 1). Good blood supply of the grafted nail bed and the donor site skin were observed. No infection occurred. The lengths of the digits were similar to the contralateral side. The nail beds were successfully reconstructed in all the 6 patients. The nails of 2 patients were slightly deformed due to a germinal layer injury. All the patients were satisfied with the preservation of the length of



Figure 3. The fascial flap is flipped over to cover the defect of the nail bed.

the digit and nails. The donor sites showed no dysfunction or deformity.

4. Discussion

The fingertip injury frequently results in avulsion of the nail bed. Many methods have been used to reconstruct the defect of the nail bed. Amputation, flap coverage, and replantation were the most widely applied methods.

Raja Sabapathy et al^[3] reconstructed fingertip amputations by using volar advancement flaps and free nail bed grafts. Hatoko et al^[4] used hard palate mucosal grafts to reconstruct the defect of the nail bed after resecting subungual exostoses. Hwang et al^[5] employed volar V-Y advancement flaps for transverse or dorsal oblique fingertip injuries and generally used abdominal flaps for volar oblique fingertip injuries, which enabled nail bed grafts available. However, all these methods cannot be used in the cases with distal phalanx exposure. Menéndez-Cardo et al^[6] used 2 rotation nail bed flaps from the remaining nail bed to cover the defects, which could only be used in small area defects of the nail bed.

The cross finger skin flap, which was first reported by Gurdin and Pangman,^[7] is a classical surgical method to reconstruct soft

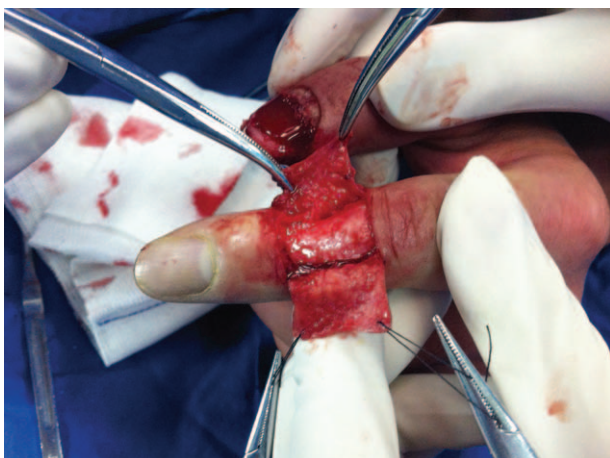


Figure 2. The fascial flap is lifted.



Figure 4. A 0.3-mm-thick nail bed graft harvested from the great toe was grafted on the fascial flap.

tissue defects on the thumb or fingers. Spokevicius and Gupta^[8] described a modification of the cross finger skin flap procedure to enhance the amount of soft tissue under the volar flap, permitting reconstruction of the nail bed. However, this surgical method could not be used for distal phalanx exposure. El-Khatib^[9] used cross finger adipofascial flaps to provide a versatile and reliable covering for exposed tendons or bones. We were inspired by this method and applied it in our patients. According to our follow-up results, the blood supply to both the nail bed and donor finger skin flap in all the 6 cases were good. The original skin flap was used to cover the donor site, which was durable.

Hsieh et al^[10] used thin split-thickness great toe nail bed grafts to reconstruct defects of the nail bed. Although this method itself alone is not suitable for large area defect reconstruction of the nail bed with distal phalanx exposure, it could be used to acquire the nail bed grafts in our study. This technique allows access to abundant nail bed tissue in the great toe without producing deformities at the donor site. None of the donor great toes showed deformity according to our follow-up.

Reconstruction of large area defect of the nail bed with distal phalanx exposure by cross finger fascial flap combined with thin split-thickness toe nail bed grafts has several advantages. First, the problem of blood supply for nail bed graft with distal phalanx exposure is resolved. Second, the length of digit is preserved when compared to amputation. Third, the nail is preserved compared with other flaps. Fourth, this surgical technique is suitable for any of the 5 digits as long as the germinal layer exists. Fifth, compared with other surgical methods, the trauma to the donor site is minimal. Sixth, this surgical procedure is easy to handle.

However, disadvantages of the described methods should not be ignored. First, a second-stage operation is needed to divide the

fascial flap. Second, for multiple fingertip injuries, this method may not be appropriate. Third, the appearance of nail is not normal in patients with germinal layer injury. We want to point out that any suture tension on the nail bed grafts may result in nail deformity. Further investigations are required to conform our findings.

In conclusion, cross finger fascial flap combined with thin split-thickness toe nail bed grafts is a new and reliable surgical method to reconstruct large area defect of the nail bed with distal phalanx exposure. According to our results, this surgical method should be more widely used.

References

- [1] Ogunro O, Ogunro S. Avulsion injuries of the nail bed do not need nail bed graft. *Tech Hand Up Extrem Surg* 2007;11:135–8.
- [2] Allen MJ. Conservative management of finger tip injuries in adults. *Hand* 1980;12:257–65.
- [3] Raja Sabapathy S, Venkatramani H, Bharathi R, et al. Reconstruction of finger tip amputations with advancement flap and free nail bed graft. *J Hand Surg Br* 2002;27:134–8.
- [4] Hatoko M, Tanaka A, Kuwahara M, et al. Hard palate mucosal grafts for defect of the nail bed. *Ann Plast Surg* 2002;49:424–9.
- [5] Hwang E, Park BH, Song SY, et al. Fingertip reconstruction with simultaneous flaps and nail bed grafts following amputation. *J Hand Surg Am* 2013;38:1307–14.
- [6] Menéndez-Cardo A, Marre D. Nail bed reconstruction with local flaps after full-thickness chemical burn. *Dermatol Surg* 2015;41:985–7.
- [7] Gurdin M, Pangman WJ. The repair of surface defect of fingers by transdigital flaps. *Plast Reconstr Surg* (1946) 1950;5:368–71.
- [8] Spokevicius S, Gupta A. The modified cross finger flap for finger pulp and nail bed reconstruction. *J Hand Surg Br* 1997;22:745–9.
- [9] El-Khatib H. Fascial axial pattern cross-finger flap. *Plast Reconstr Surg* 1996;97:850–3.
- [10] Hsieh SC, Chen SL, Chen TM, et al. Thin split-thickness toenail bed grafts for avulsed nail bed defect. *Ann Plast Surg* 2004;52:375–9.