

*J Med Sci*  
Volume 43, No. 2, June 2011: 145-149

# Micro-vascular surgery in fingertip injury treatment: Case report

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## ABSTRACT

A high priority for fingertip injury reconstruction is the restoration of skin cover to protect underlying bone, tendon, and nerve structures. Other priorities are to maintain or maximize sensibility, preserve digit length, and minimize cosmetic deformity. Because it is so highly visible, though, the appearance of the reconstructed digit should be as normal as possible. Therefore, microvascular surgery has an important role in management of fingertip injuries to give a normal shape of the digit. In this case, a clinical experience using microvascular surgery in the treatment of fingertip injury was reported. In early 2007, there were two fingertip injury cases which were reconstructed using microvascular surgery modality. The first case was a 34 years old male who had defect in soft tissue of the fourth finger in his right hand caused by pressed machine. We performed elective wound reconstruction by transferring the skin and soft tissue freely (free pulp transfer) along with the vasculatures taken from fibular side of great toe in the right foot. Revascularization was performed by connecting deep plantar artery/vein with common digital artery/vein at the injured digit. The second case, was a 29 years old female with clean-cut amputation of the distal part of the third finger in the right hand (Allen's type IV). We performed replantation in the first 16 hours after injury. We reanastomosed the ulnar side of digital artery only without vein and nerve reanastomosis. To avoid the distal edema, we did not perform any skin suture and let the oozing from the vein backflow. In both cases, we have excellent appearance result, moderate usefulness of the finger, but still poor in sensibility.

**Key words:** clinical experiences - fingertip injury - soft tissue defect - clean cut amputation - microvascular surgery - free pulp transfer - replantation.

## ABSTRAK

Prioritas utama untuk rekonstruksi trauma ujung jari adalah pengembalian jaringan lunak dan kulit untuk menutup struktur tulang, tendon dan saraf di bawahnya. Prioritas lainnya adalah mempertahankan sensibilitas, panjang jari, dan meminimalkan deformitas kosmetik. Oleh karena ujung jari sangat mudah terlihat, maka, penampilan dari rekonstruksi jari harus mendekati penampilan normalnya. Bedah mikrovaskular mempunyai peran penting dalam penanganan trauma ujung jari untuk memberikan bentuk jari yang normal. Dalam kasus ini dilaporkan pengalaman klinis menggunakan modalitas bedah mikrovaskular dalam penanganan trauma ujung jari. Pada awal tahun 2007, terdapat dua kasus trauma ujung jari yang direkonstruksi menggunakan modalitas bedah mikrovaskular. Kasus pertama, laki-laki 34 tahun dengan defek jaringan lunak pada ujung jari ke-empat tangan kanan akibat mesin tekan. Pada pasien ini, rekonstruksi penutupan luka dilakukan secara elektif dengan memindahkan kulit dan jaringan lunak secara bebas beserta pembuluh darahnya yang diambil dari ibu jari kaki kanan sisi fibular. Revaskularisasi dilakukan dengan menyambung pembuluh darah arteri/vena plantar profunda dengan arteri/vena digitalis komunis pada jari yang terluka. Kasus kedua, wanita 29 tahun dengan amputasi tajam bagian distal dari ujung jari ketiga tangan kanan (Tipe Allen IV). Replantasi ujung jari yang teramputasi dilakukan pada 16 jam setelah kejadian. Revaskularisasi hanya dilakukan pada arteri digitalis tanpa anastomosis vena dan saraf. Edema bagian distal dicegah dengan cara membiarkan tepi luka tidak dijahit rapat dan perdarahan dibiarkan merembes keluar dari aliran balik vena. Pada kedua kasus, kami mendapatkan hasil tampilan yang sangat baik, hasil yang cukup baik untuk fungsi jari, tetapi kurang baik untuk sensibilitas.

**Kata Kunci:** pengalaman klinis - trauma ujung jari - kerusakan jaringan lunak - amputasi tajam - bedah mikrovaskuler - free pulp transfer - replantasi

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## INTRODUCTION

The fingertip is highly specialized, indispensable part of the normal digit. Fingertip injuries constitute a significant percentage of surgical visits to the emergency room. Fingertip and nail bed injuries are the most common hand injuries. Although a fingertip loss may seem to be a minor injury, an inordinately long period of incapacity with a surprisingly significant disability frequently results.<sup>1,2</sup>

The general principles that are involved in all reconstructive procedures for the hand also applied to fingertip injuries. High priority is the restoration of skin cover to protect underlying bone, tendon, and nerve structures. Other priorities are to maintain or maximize sensibility, preserve digit length, and minimize cosmetic deformity.<sup>2</sup> The primary goal of treatment of an injury to the fingertip is a painless fingertip with durable and sensitive skin.<sup>3</sup>

Because hand is so highly visible, the appearance of the reconstructed finger should be as normal as possible. Therefore, microvascular surgery has an important role in management of fingertip injuries to give a normal shape of the finger.

## CASES REPORT

Two cases experience using microvascular surgery to treat fingertip injury in two different levels of injury and two different modalities (free pulp transfer and replantation) have been obtained. The microvascular surgery process and management of both cases were described in Case 1 and Case 2.

### Case 1

A 34 year old male with palmar side skin and soft-tissue of fourth finger of the right hand was crushed caused by pressed machine. We performed delayed reconstruction after the demarcation of necrotized tissue was clear with free pulp transfer from fibular side of great toe of the right foot. At the beginning we planned to perform revascularization between branch of deep plantar vessels and common digital vessels and connect the sensible nerve between free pulp and cutaneous branch of median nerve. Intra-operatively, we had difficulties to lay the neurovascular pedicle bundle below the tunnel skin because of their bulkiness. Due to that

problem, we decided to lay the pedicle over the skin temporarily until the free pulp already had vascular connection with the bed, and then we cut off the pedicle over the skin. Therefore, we did not connect the sensible nerve. Four month after surgery, the outcome was excellent in terms of appearance and the distal phalanx could flex fully, but the sensibility was still poor (FIGURE 1).

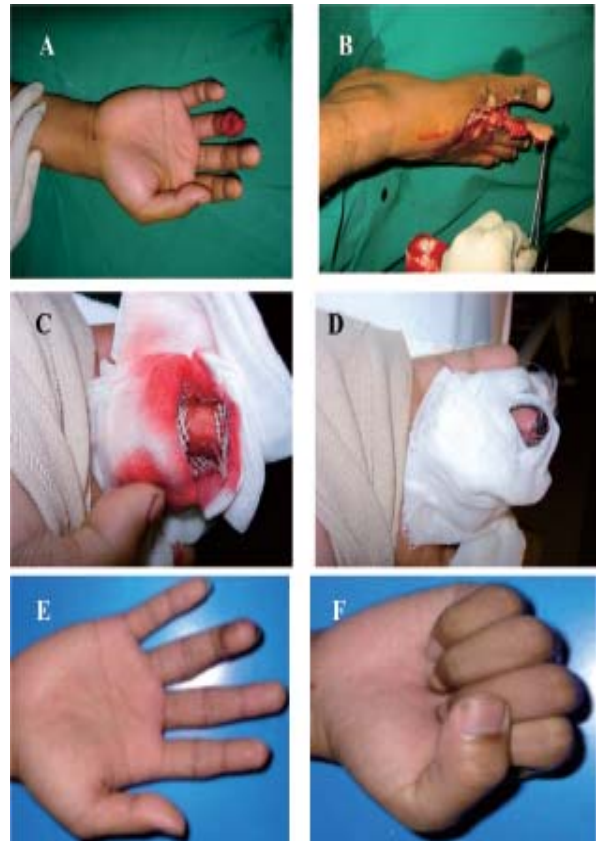


FIGURE 1. Case 1, the crushed palmar side skin and soft-tissue of fourth finger of the right hand (A), free pulp transfer from fibular side of great toe of the right foot (B), appearance in the first week (C and D), and 4 month after surgery (E and F). Courtesy: Teddy OH

### Case 2

A 29 years old female with clean cut amputation at the distal part of distal interphalangeal joint. According to Allen's classification, the injury is type IV. The amputee was preserved in moist gauze and plastic bag inserted in ice pack (cold ischemic about 8 hours). We already performed replantation in the first 16 hours after injury. We reanastomosed the ulnar side of digital artery only without vein

reanastomosis and nerve repair regarding the difficulty in technical matter. To avoid the vein congestion in the distal part, we did not performed any skin suture. In the first 48 hours, oozing from the vein backflow was still going on and the hemoglobin level decreased below 9 g%. After the oozing was stop, fortunately there was no vein

congestion and we expected vein anastomosis has already happened. Three month after surgery follow up, because of the injury level at the distal from deep flexor tendon insertion, the patient could flex her distal phalanx fully. Patient was satisfied, and she started to feel paraesthesia at the tip (FIGURE 2).

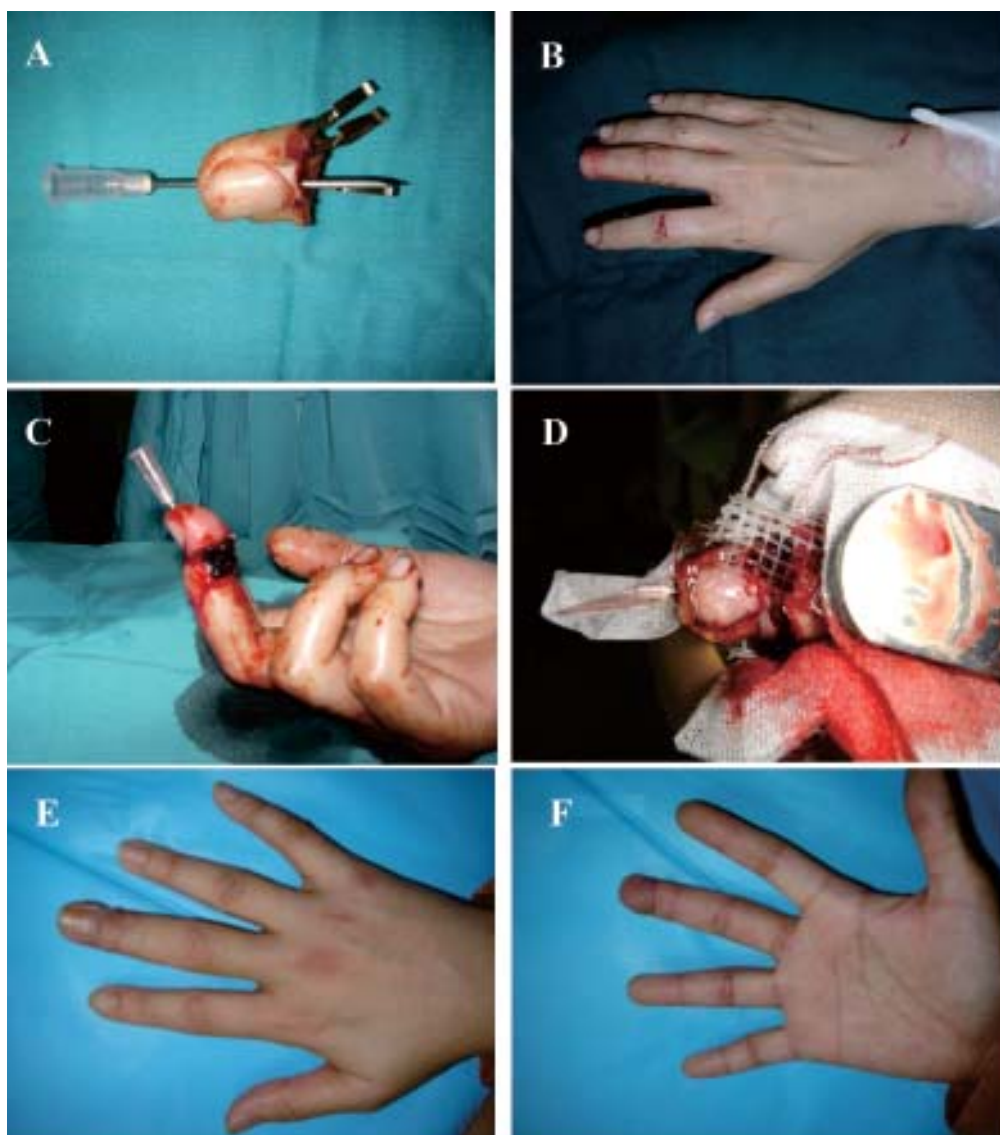


FIGURE 2. Case 2, clean cut amputation at the distal part of distal interphalangeal joint (A and B), replantation in the first 16 hours after injury and oozing from the vein backflow (C and D), appearance after 2 months follow up (E and F).  
Courtesy: Chaula S.

In both cases, good results in appearance and durability, but poor in sensibility have been observed.

The summary of fingertip injury cases managed by microvascular surgery was showed in TABLE 1.

TABLE 1. Summary of fingertip injury cases managed by microvascular surgery

Case	Age (years)	Sex	Injury	Treatment	Follow Up	Appearance	Sensibility	Usefulness
1	34	Male	Ringer Finger volar skin loss	Free fibular side great toe pulp transfer	4 months	excellent	Poor	Moderate
2	29	Female	Middle Finger Tamai class 2	Replantation artery-only anastomosis	3 months	excellent	Moderate	Moderate

**DISCUSSION**

The general principles that are involved in all reconstructive procedures for the hand are applied to fingertip injuries. High priority is the restoration of skin cover to protect underlying bone, tendon, and nerve structures. Other priorities are to maintain or maximize sensibility, preserve digit length, and minimize cosmetic deformity.<sup>2</sup> The primary goal of treatment of an injury to the fingertip is a painless fingertip with durable and sensate skin.<sup>3</sup>

When planning the reconstruction of a fingertip, we have to consider preserving finger length and appearance, including that of the nail, sensory recovery, and providing stable soft-tissue coverage that permits comfortable apprehension. For the treatment of fingertip amputations, various types of local or distant flaps, other than replantation, have been used according to Tamai or Ishikawa classification (FIGURE 3). However, for these procedures, sacrifice of normal local or distant tissue is more or less inevitable. Classical treatment for volar side injury in zone one of Tamai usually uses skin or composite graft, V-Y local flap, thenar flap, or cross finger flap. Moreover, there are still unsolved problems with paresthesia in an advanced or transposed tissue, contracture of the finger joint, and the risk of necrosis in the grafted tissue.<sup>4</sup>

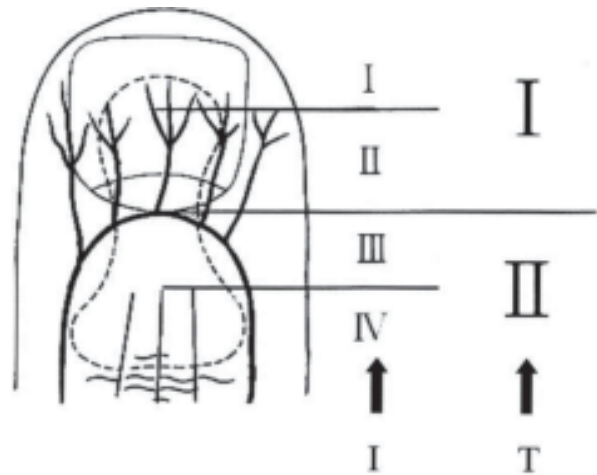


FIGURE 3. The levels of replantation determined by the level of arterial anastomosis. I, the Ishikawa classification of the subzone and T, the Tamai classification of the zone.

The primary goal of treatment of an injury on the fingertip is a painless fingertip with durable and sensate skin.<sup>4</sup> Level or type of finger tip injury regarding to vascular anatomy determines whether we can perform replantation or not (FIGURE 3). If level of injury is included in class two of Tamai classification, the replantation can be performed, but it is difficult if the level of injury is more distal or the injury only involves the volar skin loss.

Since the advent of the first successful finger replantation in 1968 by Komatsu and Tamai, there has been much progress in microsurgery leading to many reports of high success rates. However, for fingertip amputations [i.e., amputations at or distal to the distal interphalangeal (DIP) joint], replantation is still difficult because of the small-size vessels.

Yet, despite the difficulty in microsurgical anastomosis of distal vessels, the functional results obtained with fingertip replantations are often much superior compared to those more proximal replantations. Furthermore, considering the aesthetic results of the various alternative techniques of fingertip reconstruction that are often displeasing and leave conspicuous donor defects, the importance of a successful fingertip replantation becomes obvious.<sup>4,5</sup>

If level of injury is included to class I of Tamai classification which is difficult to be replanted, the most ideal innervated flap used in hand/finger reconstruction should have similar thickness as the hand and also appropriate vessels for anastomosis. In addition, it should have nerve fascicles responsible for the sensation with similar number and quality as that of the recipient site, and the nerve should run parallel to the vascular pedicle. After the harvest of the flap, it should leave a minimal and acceptable disfigurement and dysfunction at the donor site. Considering these major factors makes the first web space of the foot one of the best donor sites for the soft-tissue reconstruction of the hand/finger.<sup>6</sup> However, we can also perform modification of the homodigital lateral V-Y advancement flaps described by Segmuller.<sup>7</sup> In the other case, Kimura and Saitoh explained the use of toe hemi-pulp free flap to give a good result in sensibility and usefulness of the finger.<sup>8</sup>

We had two cases of fingertip injury. On both cases we used microvascular surgery in reconstructing the injury. In Case 1, for ideal result, we should perform nerve sutured,<sup>8</sup> but intra-operatively, we have difficulty with the neurovascular bundles bulkiness of the donor flap necessitating us to lay the bundle lay over the skin to avoid anything that will jeopardize the viability of the flap.

In Case 2, ideally we should perform vein reanastomosis to avoid the distal edema and blood loss, but we have difficulty to find any vein in the distal part, therefore we anticipated the vein congestion with let blood from the distal part. Kamei *et al.*<sup>9</sup> described venocutaneous fistula for reducing vein congestion in the finger tip replantation. Furthermore, nerve was also important to repair. In other cases, Mustafa *et al.*<sup>5</sup> and Matzuzaki *et al.*<sup>4</sup> reported arterial anastomosis would give a good result in appearance and sensory.

## CONCLUSION

Two cases of microvascular surgery to treat fingertip injury have been reported. The cases had two different levels of injury and two different modalities (free pulp transfer and replantation). A good result in appearance and durability, but poor in sensibility have been observed after surgery. We still observe and hope there would be any improvement of the sensibility.

## ACKNOWLEDGMENT

The authors wish to thank our colleagues from Plastic Surgery Division, Department of Surgery, Faculty of Medicine, University of Indonesia/Dr. Cipto Mangunkusumo General Hospital, Jakarta for assistance in preparation of this manuscript. We would like to thank the editorial board of Journal of the Medical Sciences for review and criticism in improving the manuscript.

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