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Case Report

Primary thumb reconstruction using parts salvaged from other digits: a case report

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Abstract: One-stage thumb reconstruction can be challenging for orthopedic surgeons because the soft tissue conditions are poor, and the requirement for excellent microsurgical capabilities is high. In this case, we used a vascularized flap together with the middle phalanx of the injured index finger to reconstruct the thumb. At the 11-month follow-up evaluation, the patient exhibited a satisfactory aesthetic appearance and a good functional outcome. Using parts salvaged from other fingers can be considered the treatment of choice in one-stage thumb reconstruction instead of second-stage microsurgical reconstruction.

Keywords: Thumb reconstruction, spare parts, one-stage

Introduction

The thumb is critical to the human hand, as it alone accounts for 40-60% of overall hand function [1]. As it results in deprivation of grip and pinch capabilities, thumb amputation is a serious disability. A variety of thumb reconstruction techniques have been developed, aimed at functional restoration and aesthetic satisfaction with minimal secondary iatrogenic harm. Primary thumb reconstruction using spare parts from other mutilated fingers, for example, the adjacent index finger, could result in a good functionally reconstructed thumb, which should be performed as an emergency operation.

Case report

A 49-year-old right-handed man was admitted to our department with a crush injury caused by an industrial machine after an accident at a construction site, which resulted in multiple injuries to his left hand (**Figure 1A**). There was obvious damage to the dorsal skin while radiography revealed that the middle third of the thumb had suffered a comminuted fracture (**Figure 1B**). The index finger was badly crushed and incompletely amputated near the proximal interphalangeal (PIP) joint; moreover, the proximal phalangeal bone had suffered a comminuted fracture. Incomplete amputation of the middle finger had also occurred near the PIP joint.

This patient suffered no systemic diseases, but was a smoker who had smoked cigarettes for twenty years. The patient was extremely keen to avoid amputation of his injured fingers.

One-stage emergency reconstruction was performed on the complicated thumb injury. After radical debridement, replantation of the left middle finger distal to the insertion of the flexor digitorum superficialis tendon was successfully performed first. During the following operation, we found the volar ulnar artery, the concomitant vein and middle phalanx of the index finger remained intact. By blunt dissection to the proximal part of the index finger, a vascularized flap with the middle phalanx of the index finger was formed, which was transferred to the middle third of the thumb through an incision in the first web space (**Figure 2A**). Tendon repair of the extensor digitorum indicis sutured to the extensor pollicis longus was performed without vascular anastomosis. Bone fixation was performed using Kirschner wires. Postoperative X-ray films are shown in **Figure 2B**.

Postoperative follow-up showed a satisfactory aesthetic appearance and a good functional

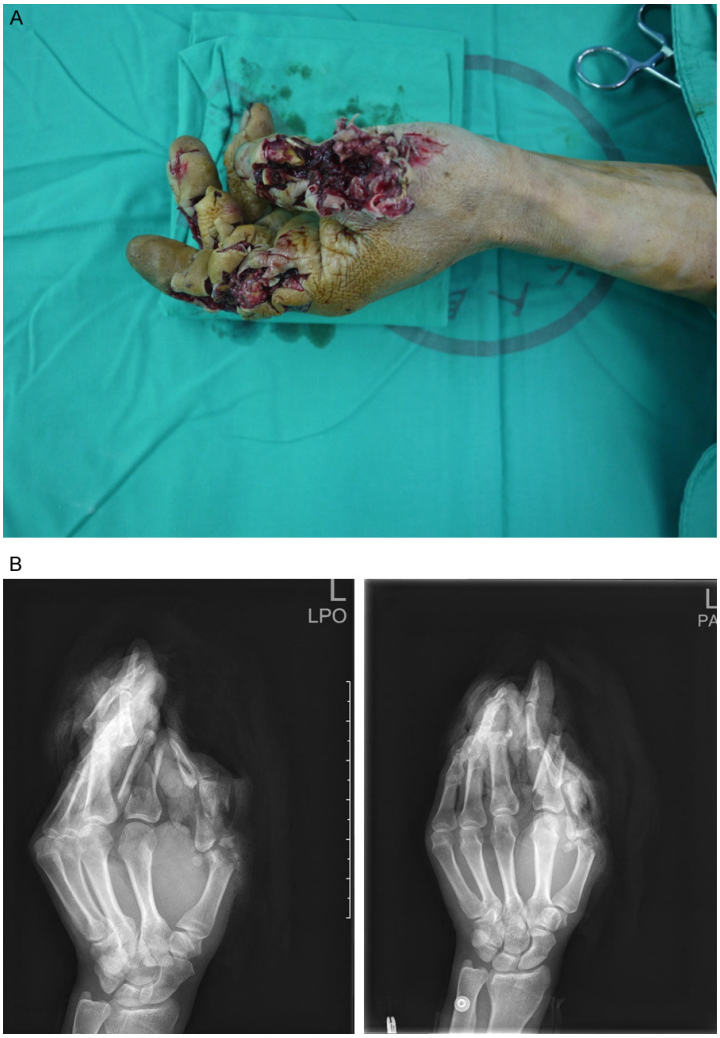

Figure 1. A. Multiple crush injuries of the left hand caused by an industrial machine after irrigation. B. X-ray shows a comminuted fracture in the middle third of the left thumb, combined with fractures of the left index finger and middle finger.

outcome of the reconstructed thumb (**Figure 3**). At follow-up after 11 months, the patient exhibited a two-point discrimination (2 PD) of 4 mm, grip strength of 27 kg (80% of normal side), pulp-to-pulp pinch strength of 5 kg (80% of normal side), good range of movement at the metacarpophalangeal joint and the interphalangeal joint, and a first web angle of 50°.

Informed consent was obtained from the patient and his family for the publication of this case.

Discussion

In 1968, Komatsu and Tamai first reported the successful replantation of an amputated digit employing the microvascular technique [2]. Since then, the development of hand surgery, especially thumb reconstruction, has been boosted and accelerated. Replantation has been demonstrated to be the best method of thumb reconstruction for patients with thumb amputations, with revascularization for those incompletely amputated [3]. When patients are transferred to the ER without their amputated digits or the digits are severely crushed or contaminated, replantation will not be possible and other options for thumb reconstruction become necessary.

Usually, thumb reconstruction is led by the level of thumb amputation combined with patients' individual needs. From simple "Z"-plasty to pollicization or toe transfer with the help of advances in microsurgery, thumb reconstruction has considerably improved the function of the injured hand and allowed creation of a thumb with acceptable cosmetic and functional attributes [4].

In cases of complicated thumb injury, numerous techniques, ranging from simple osteoplastic techniques and distant staged flaps to complex microsurgical procedures, have been described for reconstruction of the injured thumb. Nevertheless primary thumb reconstruction remains a big challenge to microsurgeons.

In cases of non-replantable thumb injuries, delayed reconstruction (weeks to months after the injury) is preferred. However, primary thumb reconstruction, to some extent, is technically more straightforward than a delayed procedure. Fresh tissues, unshortened bones and tendons, and identifiable neurovascular structures free of surrounding scar tissue all make this approach easier. Compared with the toe transfer technique, patients will suffer less by avoiding the experience of being without a thumb, and sacrifice of a healthy toe sometimes comes to nothing when replantation fails [5]. In addition, the potential economic benefits

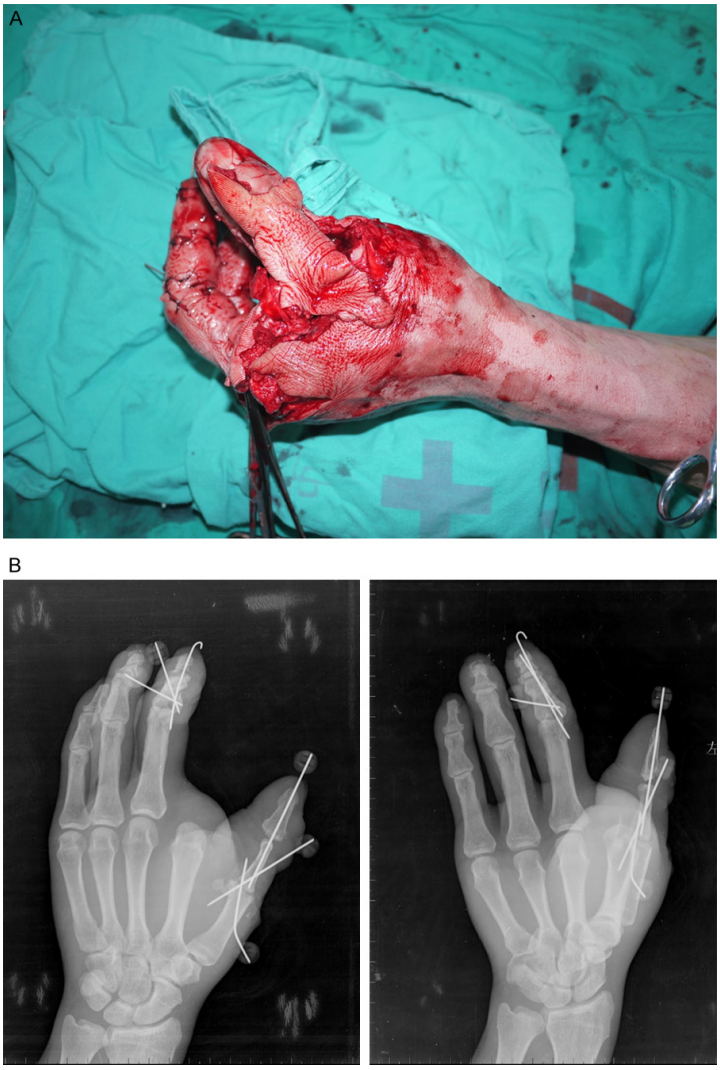

Figure 2. A. A vascularized osteocutaneous flap was formed to cover the defect of the thumb. B. The X-ray of the reconstructed left thumb after operation and the replanted middle finger.

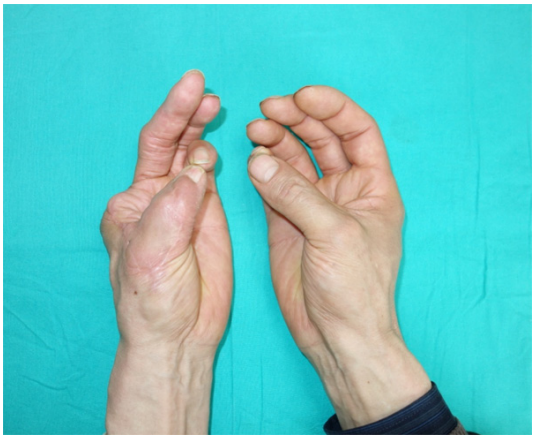

Figure 3. Follow-up at 11 months after operation showed a satisfactory aesthetic appearance and a good functional outcome.

of primary thumb reconstruction should not be overlooked. These include a shorter hospital stay, a faster return to work, and overall decreased morbidity, especially for manual laborers.

Here we report a case involving multiple injuries of the fingers, where we performed one-stage thumb reconstruction using parts salvaged from the injured index finger after considering the patient's strong preferences. This resulted in a good functional outcome of the reconstructed thumb, and even a satisfactory aesthetic appearance. In many situations, pollicization is preferred over microsurgical reconstruction of the injured thumb when there is an associated index finger amputation [6]. We even created a special osteocutaneous flap to cover the defect of the thumb. Without vascular anastomosis, the transplanted part is more likely to survive.

This method has limitations. Successful surgeries may still result in functional limitations and there is the possibility that several release operations may be necessary in future. Rehabilitation also needs to be individualized.

Just as John Napier noted [7], the hand without a thumb is at worst nothing but an animated fish-slice, and at best a pair of forceps whose points do not meet properly. Reconstruction of the injured thumb is vital, and the procedure should take into account patients' requirements, as well as the concrete situations of the injured thumb.

Disclosure of conflict of interest

None.

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