

# Cosmetic Reconstruction of the Digits in the Hand by Composite Tissue Grafting



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## KEYWORDS

- Microsurgery • Digital reconstruction • Cosmetics • Toe • Thumb • Flap • Free tissue transfer
- Hand function

## KEY POINTS

- We present our methods of digital reconstruction using composite tissue transfer.
- Our major aims of surgery are to improve the cosmetic appearance of reconstructed hands and donor feet.
- We describe several methods using modified or novel designs for composite tissue transfer from the foot to improve cosmetic appearance of the reconstructed digits and to improve both the cosmetic appearance and function of donor feet.
- This article provides technical details of the methods we used to move closer to an ideal reconstruction of digits and minimizing donor foot morbidity.

## DIGITAL RECONSTRUCTION: CURRENT STATUS AND CHALLENGES

The loss of a thumb or finger can dramatically affect a person's work and life. Methods for thumb and finger reconstruction, especially microsurgical techniques, have been extensively studied.<sup>1–15</sup> However, toe-to-hand transfer is not a perfect procedure in terms of either functionality or cosmetics.<sup>3,16–24</sup>

The following are the 2 major challenges:

1. Loss of one or multiple toes from the donor foot: during conventional toe-to-hand transfer, a surgeon harvests the toe according to the length of the damaged thumb/finger. This procedure causes significant damage to the foot and toe that sometimes outweighs the benefit of the reconstructed thumb/finger.<sup>25</sup> Such reconstructive procedures sometimes require the sacrifice of multiple toes. Consequently, unacceptable damage to the foot is created when multiple thumb/finger reconstructions are performed.<sup>26–32</sup>

2. Poor cosmetics of the reconstructed digits: despite some similarities between thumb/fingers and toes in appearance and function, there are dramatic differences in the lengths of individual phalanges, joints, diameter, and the lengths of a digit from a toe. The reconstructed digits still look like toes, which is especially noticeable when a long digit is reconstructed.

The hand is not only an indispensable tool but also part of a person's general appearance. Therefore, a digital defect not only impairs a patient's daily living and work activities but also affects the patient's self-image and willingness to socialize. Patients often feel embarrassed about showing the digit reconstructed by traditional toe-to-hand transfer techniques.

The focus of our past work on digital reconstruction has been to produce a thumb/finger that closely resembles a normal digit and has good function. At the same time, we have tried to preserve foot/toe function and appearance as much

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as possible. However, the above-mentioned goals are difficult to achieve through conventional toe-to-hand transfer.<sup>3,12-14,19,25,30,33-40</sup>

### OUR METHODS AND GOALS: IDEAL COSMETIC RECONSTRUCTION

In 1998, we started to modify the toe-to-hand transfer to produce aesthetic reconstruction of a thumb/finger. To improve the cosmetic appearance of a reconstructed digit, we take different types of grafts from various parts of the body to build a thumb/finger that closely resembles a normal digit.<sup>41</sup>

Here, we will discuss the different surgical techniques that we have used and the results of digital reconstruction in our patients with grade I to VI digital defect.

The goals and unique achievements of our procedures for cosmetic reconstruction of the digit in the hand include:

1. The reconstructed digit closely resembles the corresponding contralateral digit in diameter and length.
2. The lengths of different phalanges, the sizes of nails, and the texture of skin of the reconstructed digit closely resemble the corresponding contralateral digit.
3. The surgical produces cause less damage to the donor foot than previous approaches. Digits can be reconstructed by sacrificing only one toe, or without sacrificing even a single toe.

### CLINICAL PATIENT DATA

From December 1998 to December 2012, 646 digits (212 thumbs and 434 fingers) (**Table 1**) were reconstructed with the methods described in this article; 417 digits were on the right hand,

and 229 were on the left hand. To preserve the appearance of donor sites, we repaired or reconstructed them as follows:

1. Five toes in the donor foot were preserved in most of these patients.
2. The great toe was used to supply the nail, skin and part of distal phalanx for the reconstruction. The donor soft tissue wound was covered by a pedicle or free flap, and the bone defect was repaired with an iliac bone graft.
3. The second to fourth toes were used to donate the joint and nail. The donor wound was repaired by a pedicle or free flap, and the iliac bone was grafted to fill the bone and joint defect.

All the 646 reconstructed digits survived completely. The patients were followed up till 2 months after the procedure, at which time the Kirschner (K) wire internal fixation was removed and bone union confirmed. Partial flap necrosis was treated with skin graft and bone graft was performed if non-union of the bone was found. The follow-up 2 months after the procedure varied greatly. Cases involving techniques new to our unit were followed up continuously for 1 to 2 years.

### TECHNICAL DESCRIPTION OF OUR METHODS *Reconstruction for Grade I Defect*

#### *Method 1 - Surgical design: composite tissue transfer from one great toe*

According to the defect on the finger (**Figs. 1** and **2**), a vascularized composite tissue graft including partial nail, dorsal part of the distal phalanx, and a skin flap is taken from the lateral side of the great toe (see **Figs. 1** and **2**). A tongue-shaped flap is left on the medial plantar side of

**Table 1**

**Classification of digital defects used in this article, and number of digits that we reconstructed between 1998 and 2012**

Degree of Defect <sup>a</sup>	Level of Digital Amputation <sup>b</sup>	Number of Digits	Number of Patients
I	Distal phalanx	151	136
II	DIP joint (IP joint)	213	197
III	Middle phalanx (proximal phalanx)	113	95
IV	PIP joint (MCP joint)	93	72
V	Proximal phalanx (first metacarpal bone)	51	33
VI	MCP joint (basal joint)	25	19
Total		646	552

**Abbreviations:** DIP, distal interphalangeal; IP, interphalangeal; MCP, metacarpophalangeal; PIP, proximal interphalangeal.

<sup>a</sup> Wang CQ, Wang JL, Wang ZT, et al. Thumb and finger reconstruction with the pedal digit transplantation: report of 541 cases. *Chin J Repar Reconstr Surg* 1997;11:350-2.

<sup>b</sup> The level of thumb amputation is given in parenthesis if different.

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