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Reconstruction of combined thumb amputation at the metacarpal base level and index amputation at the metacarpal level with pollicization and bilateral double toe composite transfer

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KEYWORDS

Toe to thumb transfer;
Thumb amputation;
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Pollicization

Summary *Background:* This study aimed to describe the technique and report our experience with the reconstruction of combined proximal thumb amputations at the metacarpal base level and index finger amputation at the metacarpal level with pollicization and bilateral double toe composite transfer.

Methods: The technique consists of pollicization of the remnant index ray. Then a contralateral composite medial great toe pulp and vascularized second toe proximal interphalangeal joint flap are harvested to reconstruct the metacarpophalangeal joint of the thumb. Subsequently, an ipsilateral composite great toe wrap-around and second toe proximal interphalangeal joint flap are harvested to reconstruct the thumb interphalangeal joint and the distal thumb. A neurotized superthin anterolateral thigh flap is used to reconstruct the ipsilateral toe defect, while the bone defects of the bilateral second toes are reconstructed with

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corticocancellous iliac crest bone grafts. Between 2010 and 2014, eight patients underwent reconstruction. Four patients could be recalled for follow-up, with a mean duration of 22 months.

Results: All flaps survived. The contour and length of the reconstructed thumbs was similar to the contralateral one. The mean Michigan hand outcomes questionnaire score was 80.5. The mean disabilities of the arm, shoulder and hand score was 7.5. The mean foot and ankle disability index score was 94.2.

Conclusions: Reconstruction of thumb amputations at the metacarpal base level with pollicization and double toe composite transfer results in excellent contour and functional outcome, with a natural-appearing thumb. In addition, all toes are preserved.

Level of evidence: Therapeutic, Level IV

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Introduction

Reconstruction of proximal thumb amputations is extremely challenging. Different designs of toe to thumb transfers have been described, inclusive of trimmed toe, wrap-around toe, second toe, and other variations.^{1–3} However, for thumb amputations proximal to the metacarpophalangeal (MCP) joint, none of these work very well. The problem then to be addressed is of length and soft tissue coverage. Several approaches have been used. These include a preliminary groin flap for coverage followed by transfer of the second toe with the metatarsal for length.⁴ Another option is metacarpal distraction lengthening followed by toe transfer.⁵ Osteoplastic reconstruction of the thumb ray with a vascularized or nonvascularized iliac crest bone graft sometimes followed by secondary toe transfer is another effective option for restoration of length and function.^{6,7} Another option for osteoplastic reconstruction is a reverse flow radial forearm osteocutaneous flap.⁸ Pollicization of course is another option,^{9–11} but this requires that the index finger is intact and uninjured.

A limitation of all these techniques is the sometimes limited function obtained and altered appearance of the reconstructed thumb, which may not resemble a natural thumb. In Lin's series of 24 thumb amputations proximal to the MCP joint reconstructed with osteoplastic surgery, for example, only 54% achieved opposition.⁶ For thumbs reconstructed with a pollicized index finger, good function is dependent on the retention of the thenar muscles.⁹ Otherwise, the reconstructed thumb functions as a post only for grasping and pinching.

Unfortunately, with many severe thumb injuries, a concomitant index finger injury is common. In these cases, the index finger stump can be pollicized and used for thumb reconstruction.^{12–14} In the presence of a concomitant index finger amputation, the index metacarpal is then perfused by the first dorsal metacarpal artery and venae comitans.¹⁵ Pollicization of a damaged or shortened index metacarpal cannot, however, restore the full length, function, and appearance of a normal thumb.

In the present study, we describe our technique for the reconstruction of very proximal thumb amputations at the metacarpal base and trapeziometacarpal joint, combined

with index finger amputations at the metacarpal level, with pollicization combined with bilateral composite toe transfer. All toes are preserved with this technique.

Methods

Patients

Between 2010 and 2014, eight patients underwent reconstruction. A retrospective review was performed after institutional review board approval. Four patients could return for follow-up. Demographic data are presented in [Table 1](#). Three patients were male and one was female. The mean age was 24.5 (range 17–29). The mean duration of follow-up was 23.3 months. The right hand was affected in three cases, and the left hand was affected in one case. All cases had sustained traumatic amputation of the thumb at the metacarpal base level together with concomitant index finger amputation at the metacarpal level. In addition, all cases had functional thenar muscles, and three had normal carpometacarpal joints.

Surgical technique

Reconstruction of the thumb is achieved by the pollicization of the remnant index ray. The technique for pollicization is well described.^{9–15} Then a contralateral composite medial great toe pulp and vascularized second toe proximal interphalangeal (IP) joint flap are harvested to reconstruct the MCP joint of the thumb. The toe pulp provides soft tissue coverage over the vascularized toe joint transfer. Subsequently, an ipsilateral composite great toe wrap-around and second toe proximal IP joint flap are harvested to reconstruct the thumb IP joint and the distal thumb. This prevents an overly thick thumb that results when only a great toe transfer is performed. We have previously described our technique of great toe wrap-around flap reconstruction, preserving the weight-bearing plantar skin as a triangular flap.³

In the hand, the pollicized index metacarpal is fused to the trapezium by using a miniplate for stability. Then the contralateral vascularized second toe joint is fixed to the

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