

Metacarpal-Like and Metacarpal Hand



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KEYWORDS

- Toe-to-hand transfer • Metacarpal hand • Metacarpal-like hand • Second toe transfer
- Combined second and third toe transfer • Trimmed great toe transfer • Whole great toe transfer
- Tripod pinch

KEY POINTS

- Metacarpal-like and metacarpal hand are severe hand injuries that may benefit from microsurgical toe-to-hand transfer.
- The level of thumb and finger amputations, and the residual digits determine the types and subtypes of the metacarpal-like and metacarpal hand.
- The reconstruction of two adjacent fingers and opposable thumb is the core principle in the treatment of metacarpal-like and metacarpal hand injuries.
- In bilateral injuries, donor site selection and management after toe harvest is critical to avoid significant gait disturbances or daily activities restriction.

INTRODUCTION

Metacarpal hand is a severe debilitating hand injury. The term refers to the loss of all fingers proximal to the functional length with or without the thumb.¹ Although a clear consensus on what defines a functional length is lacking, it largely refers to the middle of the proximal phalanx. Given the injury, the hand lacks basic prehensile function, which is the ability to perform adequate opposition of the thumb to fingers.

The metacarpal-like hand, a novel term, refers to the amputation of all digits, fingers and thumb, proximal to the functional length, except in one or two digits, including the thumb. The term summarizes a diverse group of injuries that is in between proximal multiple finger amputation and metacarpal hand. Depending on the spared digits, that still maintain functional length, the hand may or may not still be able to provide proper basic prehensile function. For both injuries, classification

and treatment algorithms are invaluable to guide surgeons in their endeavor to restore or enhance hand function and improve patient's quality of life.

METACARPAL HAND: CLASSIFICATION

In 1997, the senior author (F.-C.W.) proposed a classification for metacarpal hand injuries.¹ The intention was to provide a practical guideline for the classification and treatment of these injuries to achieve optimal function of the reconstructed hand while minimizing morbidity at the donor sites.

The metacarpal hand is divided into type I and type II. Type I includes the hand with amputations of all fingers proximal to the middle level of the proximal phalanx with either a normal thumb or a thumb that has been amputated distal to the interphalangeal joint.

Type II includes the hand with amputations of all fingers proximal to the middle portion of the proximal phalanx with amputation of the thumb

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proximal to the interphalangeal joint. Type II is further subdivided into four subtypes depending on the level of thumb amputation, the presence of thenar musculature function, and the involvement of the basal joint.

METACARPAL-LIKE HAND: CLASSIFICATION

Although the metacarpal-like hand does not result in as much anatomic and functional deficits as the metacarpal hand, it could be similar in its functional impairment if core principles of reconstruction of metacarpal hand are to be adopted.

The metacarpal-like hand can also be divided into type I and type II. In type I, the thumb is either normal or amputated but with adequate length, at the level of interphalangeal joint, and function and one finger is normal or amputated but with adequate length.

In type II, the fingers are like type I, but the thumb is amputated proximal to the interphalangeal joint. Type II can be further subdivided into four subtypes following the same method used for type II metacarpal hand.

SURGICAL TREATMENT

Microsurgical toe-to-hand transfer remains the treatment of choice, although hand allotransplantation could be indicated for reconstruction of type IIb-c in the future when concerns about life-long immunosuppressants side effects are largely resolved.

Toe-to-hand surgery takes into account the adequacy of soft tissue and bony stalk, involved digits, the level of amputation of each finger and thumb, and the presence or absence of thenar musculature. Unilaterality or bilaterality of the injury is also important in deciding on the optimal treatment plan, including donor site selection.² The surgery is done in a staged or one-stage arrangement depending on the level and type of injury.

Metacarpal Hand

A useful rule of thumb for metacarpal hand is to transplant a combined second and third toe (or combined fourth and fifth toe) or bilateral second toe (or bilateral third toe) for the reconstruction of two adjacent fingers in metacarpal hand type I and II, and to transfer a whole great toe, trimmed great toe (superior aesthetic results and equally safe in children),^{3,4} or second toe for additional thumb reconstruction in metacarpal hand type II. When the thenar muscles or/and basal joint function is destroyed, finger reconstruction proceeds first followed by thumb reconstruction (staged reconstruction).

For patients with bilateral metacarpal hands type II, we recommend reconstructing the thumb of the dominant hand with a whole or trimmed left great toe and amputated fingers with either the left third and fourth toes or the right second and third toes or third and fourth toes, aiming at preserving right great toe for car driving. The two adjacent toes can be harvested in tandem or separated depending on the level of amputation (proximal or distal to the web space). The nondominant hand is reconstructed with individual left third and fourth toes or right second and third toes, one used for thumb and the other for one of the fingers.

Metacarpal-like Hand

A useful guideline is to transplant a whole great toe, trimmed great toe, or second toe for thumb reconstruction in type II and to reconstruct the amputated fingers in type I and II as follows. Single toe transfer should be used if the remaining finger is central (long or ring finger) or radial (index or long finger). Combined toe transfer is chosen if the remaining finger has poor function or stiff despite its adequate length. Double lesser toe is chosen to improve the condition of the remaining finger and reconstruct one more adjacent new finger. If the remaining finger is ulnar, basically the fifth finger is left, at least one toe should be transferred to allow hook function, but multiple toe transfer (double lesser toe or combined toe transfer) may grant more stability to hook function. Bilateral metacarpal-like hand type II is reconstructed in a manner similar to bilateral metacarpal hand type II with attention to the location of the remnant digits.

CASE 1

A 50-year-old man was diagnosed with metacarpal hand type I amputation. The patient received a pedicled groin flap with iliac crest bone graft first to replace the missing soft tissue and bony stalk. After uneventful healing of the pedicled flap, a combined second and third toe was transferred. After 25-year follow-up, good results can still be seen (Fig. 1).

CASE 2

A 44-year-old man was diagnosed with metacarpal hand type II amputation. The patient received staged reconstruction. At first, a pedicled groin flap with iliac bone graft was transferred, then a combined second and third toe was transplanted, and after 5 months the patient received second toe transfer for thumb reconstruction. Good results are shown after 24-year follow-up (Fig. 2).

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