

Comparative Study Between First Dorsal Metacarpal Artery Flap And Hetero digital Island Flap for Coverage of Thumb Defect

Thesis

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Abstract

Only two surgical approaches are discussed in this study for reconstruction of thumb defects which are first dorsal metacarpal artery flap versus hetero-digital island flap.

The FDMCA flap is a first treatment of choice for defects of the proximal phalanx and proximal part of the distal phalanx of the thumb zone 4. Contraindications of the FDMCA flap are circular defects at the proximal or distal phalanx and previous injury at the second metacarpal level.

Key word: FDMCA- flap –hetero-metacarpal-dorsal

Dedication

To my Wife, my Parents and
my Little Daughter

SONDOS

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Introduction

Traumatic thumb injury presents a much more significant influence on daily living than do injuries to the other digits. Various surgical techniques contribute to repair distal defects of the fingers, especially thumb as traumatic loss diminishes or eliminates the thumb prehensile abilities and may affect overall hand function. (*Lai et al., 2010*)

The goal of reconstruction should be maximum restoration of hand function. Being the only opposing digit against the others, when thumb is involved, functional loss maybe more severe than anticipated. Because of its major contribution to overall hand function, correction of deformities involving the thumb is crucial. Adequate length, mobility, stability and sensation are the goals of a functional thumb reconstruction, moreover selecting the most appropriate technique for thumb reconstruction depends on multiple factors, including the level of injury, status of the remaining hand, presence or absence of the thenar musculature, age, occupation, overall health, and functional demands of the patient. (*Teoh et al., 2003*)

The skin overlying the dorsal aspect of the proximal phalanx of index finger can be raised either as an island flap based on the first dorsal metacarpal artery (FDMA) or as a neurovascular island flap with inclusion of terminal dorsal sensory branches of radial nerve and can be transferred to reach and cover the defects of both volar and dorsal aspects of the thumb and first web space. (*Eski et al., 2007*)

It appears that the “Kite-Flap” is the best solution for cover of simple or complex skin loss of the thumb. Its technical performance is easy, and it gives durable, sensate and stable skin cover. (*El Andalousse and Finni, 2007*)

However, the Hetero digital arterialized flap is a single-stage, thin, fairly mobile flap that produces an excellent cosmetic result, restores sensibility, and enables early mobilization of the hand. Morbidity in the donor finger is within acceptable limits and its usefulness in the reconstruction of thumb pulp defects is well documented. (*Xarchas et al., 2008*)

The Aim of Work

To review the literature concerning the different surgical modalities for reconstruction of the thumb and the choice of suitable approach for each defect accordingly through either first dorsal metacarpal artery flap (FDMA) or Hetero-digital island flap.

Chapter 1

Anatomy and physiology of the hand and thumb

Anatomical consideration of hand and thumb

The bones and joints of the human thumb are a mosaic of primitive and unique features, reflecting stages in the evolution of the hand from a support element on the ground to a grasping structure in the trees and eventually to an organ dedicated entirely to manipulation. The trapeziometacarpal saddle joint configuration and associated musculature are shared with most nonhuman primate species, whereas the broad distal phalanx with its specialized palmar pad is unique to humans. Most of the distinctive features of the modern human thumb can be explained by the requirements for a firm grip and tolerance of large stresses associated with the use and manufacture of stone tools, which contributed for several million years to the survival of human ancestors after they returned to the ground. Fossil remains indicate that early members of the human family, Hominidae, had short thumbs relative to the length of the fingers, which were not subject to the large stresses associated with modern human manipulative behavior. Later hominids had very flat trapeziometacarpal joints and large distal phalanges, indicating a capacity for opposition of the thumb to all four fingertips and for tolerance of large stresses. Pathologies involving thumb joints contribute to the understanding of the sequence of changes in thumb morphology in the fossil record. (*Marzke, 1992*)



Figure 1: Muscles of thumb (*Young, 2003*)

Skin of the hand

The skin consists of 2 layers, the epidermis and dermis. The epidermis, the more external of the 2 layers, is stratified squamous epithelium consisting primarily of keratinocytes in progressive stages of differentiation from deeper to more superficial layers. The epidermis has no blood vessels, so it must receive nutrients by diffusion from the underlying dermis through the basement membrane, which separates the layers.

The dermis is a more complex structure and is composed of 2 layers, the more superficial papillary dermis and the deeper reticular dermis. The papillary dermis is thinner, consisting of loose connective tissue containing capillaries, elastic fibers, reticular fibers, and some collagen. The reticular dermis consists of a thicker layer of dense connective tissue containing larger blood vessels, closely interlaced elastic fibers, and coarse branching collagen fibers arranged in layers parallel to the surface. The reticular layer also contains fibroblasts, mast cells, nerve endings, lymphatics, and epidermal appendages. Surrounding the components of the dermis is the gel-like ground substance, composed of mucopolysaccharides (primarily hyaluronic acid), chondroitin sulfates, and glycoproteins. (***Donohue et al., 2005***)

Hand creases

The distal and middle digital creases were found to be consistently proximal to associated interphalangeal joints by 7 to 8 mm and 2 to 3 mm, respectively. Proximal digital creases were consistently distal to associated metacarpophalangeal (MCP) joints by 14 to

20 mm. Distances between the distal transverse palmar crease and associated MCP joints were 6.8 to 10.3 mm. Distances between the proximal palmar crease and the associated MCP joints were 9.1 to 22.1 mm. Mean perpendicular distances between the distal wrist crease and center of selected carpal structures or joints were as follows: scaphoid, 0.7 mm; pisiform, 3.4 mm; lunate, 9.2 mm; hamate hook, 12.6 mm; ulnar styloid, 11.7 mm; trapeziometacarpal joint, 19.4 mm; radioscapholunate joint, 13.5 mm; and distal radioulnar joint, 21.1 mm. Quantification of these relationships should assist in hand examination and placement of surgical incisions and provide further insight into anatomic and functional relationships of the hand. (***William and Michael, 1993***).

Anatomy of the thumb

Embryology

Most creases, that is, the regular, extra, and oblique creases, were found to develop concurrently with the appearance of the fetal volar pads, apparently independently of the thumb flexion movements. Although the regular creases usually appear to be simple, single creases, they seem to be formed by the radial and ulnar lateral crease segments that develop inwards from each lateral side. The oblique and extra creases on the proximal phalanx of the thumb should be considered as common or “regular” creases, rather than anomalies, because of their high frequency in fetuses and in normal healthy adults. (***Kimura and Schaumann, 1988***)

Skin of thumb and sex difference

Male skin is characteristically thicker than female skin in all anatomic locations. Children have relatively thin skin that progressively thickens until the fourth or fifth decade of life when it begins to thin. This thinning is primarily a dermal change, with loss of elastic fibers, epithelial appendages, and ground substance. (***Donohue et al., 2005***)

Muscles of thumb

The muscles that are used with texting are the ones that flex the thumb, or bend the tip of the thumb inward toward the palm. The long flexor in the forearm bends the end joint of the thumb first, next the middle joint, third the joint at the base of the thumb and finally the