

Original Article

FIRST DORSAL METACARPAL ARTERY FLAP FOR SOFT TISSUE DEFECTS OF HAND

Saeed Ashraf Cheema

Objective: To highlight the various uses of flap based on first dorsal metacarpal artery in various soft tissue defects of hand.

Material and Methods: Twelve cases of various soft tissue defects of hand, of various etiologies, falling within the arc of rotation of the first dorsal metacarpal artery were selected to be covered by the flap based on this artery.

Results: This flap provided cover for soft tissue defects of thumb in seven cases. Three of these cases had defects on dorsal aspect of thumb, three on the volar aspect and in one case it provided the pulp of the distal phalanx. It covered defects at palm, thenar eminence and dorsum of hand in one patient each. Soft defect at first web space were covered in two cases.

Conclusion: This local flap is a good option for the smaller soft tissue defects at the base of index finger, palm, and various aspects of thumb which are within the arc of rotation of the first dorsal metacarpal artery.

Key Words: Reconstruction, First metacarpal artery, Flaps.

Introduction

Hand trauma is quite common and may arise from a number of etiologies including mechanical injuries, fireworks trauma, burn injuries and road traffic accidents. Variety of local flaps is utilized to cover the soft tissue defects of smaller scale. These include cross finger, reverse digital, thenar, hypothenar, metacarpal artery and variety of other flaps.¹⁻⁴ The first dorsal metacarpal artery flap was first described by Colema and Holevich.⁵ However, this flap was popularized by Lie and Posch and later modified by Foucher.⁶ He incorporated the neural structures into the composite flap tissue and termed it as the Kite flap.

This flap is raised from the dorsal aspect of the proximal phalanx of the index finger. It is based on the first dorsal metacarpal artery which is a constant branch of the radial artery. On the dorsum of the hand, radial artery first gives a branch to the dorsal carpal arch and then sends another branch, first dorsal metacarpal artery, before diving between the two heads of the first dorsal interosseous muscle to reach the palm. Second, third and fourth dorsal metacarpal arteries are branches of dorsal arch while fifth metacarpal artery is branch of the dorsal carpal branch of ulnar artery. Flaps raised on this artery have great significance due the anatomic location of the flap and hence utilized to cover the defects on the volar and dorsal aspects of the thumb, tip of the thumb, first web space, metacarpophalangeal joints

of the fingers and defects at wrist and carpal joints.⁷⁻¹⁰ Present series of cases describes the utilization of this flap for defects of various regions.

Material and Methods

This study was carried out at the department of Plastic Surgery, Services Hospital Lahore. Study period was from January 2004 to June 2008. Various cases of hand trauma or soft tissue defects as a result of release of contractures where soft tissue cover was provided with flap based on first metacarpal artery were considered for this study. (Fig1-4).



Fig-1: Severe post burn flexion contracture involving index finger, palm at the base of the index finger and second web space.



Fig-2: Contracture at base of the finger released and z plasty marked to release the contracture of finger and web.



Fig-5-6: Four months postoperative results at the donor and recipient sites showing acceptable appearance



Fig-3: First dorsal metacarpal artery flap has been raised



Fig-4: First dorsal metacarpal artery flap has been inset and z plasty flaps also can be seen.

Study included patients of all ages and both sex. Bio-data of the patients including their name, age, sex, etiology of the soft tissue defect, area and extent of the defect and the flap utilized was recorded. Choice of the reconstructive option depended on the site and size of the defect. Flap was tunneled to the defect site in all the cases. Flap donor site was covered with split thickness skin graft and tie over dressing was done in all cases routinely. No occlusive dressing was done on the flap. Sutures were removed on 7th or 8th post operative day. Patients were advised regular massage of the grafted area on dorsum of the index finger to get good cosmetic results (**Fig.5**).

Discussion

Hand is actively involved in almost every physical activity and as a result is quite commonly involved in traumatic incidences as well. Variety of local and regional flaps is available for reconstruction of the soft tissue defects of the hand. It is a fact that a flap with long arc of rotation would be quite helpful in

Table-1: Etiologies of the defects, age of the patients, and various areas of hand covered by the first dorsal metacarpal artery flap.

Age / Sex	Etiology	Location of defect	Area
23 M	RSA	Dorsum hand - base of thumb at 1st metacarpal	Dorsum
19 M	M tr	Palm - Base of index finger	Index finger
25 M	FWT	1st web space	1st web
48 M	B	1st web space	1st web
22 M	Eb	Thumb - Dorsal aspect of MCP joint	Thumb
33 M	Eb	Thumb - Dorsum of thumb	Thumb
50 M	Eb	Thenar eminence	Palm
27 M	M tr	Thumb - Dorsum thumb	Thumb
28 M	Br	Thumb - Volar thumb	Thumb
08 M		Thumb - Pulp thumb	Thumb
17 F		Thumb - Nail area	Thumb

providing cover to all the areas within the arc of rotation. Similarly it is also quite evident that a flap with a longer arc of rotation would be better able to reach the areas wide apart.

First dorsal metacarpal artery is a branch of the radial artery which arises just before this vessel dips into the two heads of the first interosseous muscle. The pedicle of the flap can be mobilized to the point before radial artery leaves the dorsum. It provides the flap with an arc which reaches both the ulnar and radial borders of the dorsum of hand on a line across the metacarpophalangeal joints of the fingers. This arc would also cover the volar and dorsal areas of the thumb. It also means that soft defects of dorsum lying in vicinity of the metacarpophalangeal joints, along the ulnar and radial borders of the dorsum, and those on the volar and dorsal surfaces of the thumbs may be covered with this flap.^{6,11,12}

The results achieved in this study show that flap effectively covered various defects of hand which are otherwise situated wide apart. This included defects at first web space, defects on thumb, both on volar and dorsal aspects, base of the index finger, thenar eminence and dorsum of hand.

It is also evident that flap was quite often used to reconstruct the soft tissue defects of the thumb. The armamentarium to reconstruct the soft tissue defects of the thumb is quite a big one^{1-3,13,14} but this flap has its own advantages.

It would be a better choice than Moberg flap for such defects if the thumb tip defect is bigger than 1.5 cm. It may be preferred choice when compared with Littler flap for sensate resurfacing of the thumb as dissection is far more easier in case of first dorsal metacarpal artery flap and also it contains reliable venous drainage. The skin paddle is more reliable and

larger when compared with both the above mentioned flaps. Similarly the donor site has far less morbidity as compared to these flaps.¹³ The sensation of the first dorsal metacarpal artery flap, as assessed by 2PD, rivals other modes of thumb reconstruction.¹³ The skin from the dorsum of the index finger has 3-7 mm 2PD.¹⁵

Although flap has disadvantage of grafted skin on the dorsal aspect of index finger, proper post operative care of the grafted area usually leaves this area supple and soft which is cosmetically acceptable as well. More over studies have described the skin of this flap as wear and tear resistant when transferred to the volar thumb surface.^{16,17} At the same time studies do suggest neuro-vascular flap for larger skin defects of thumb.¹⁸

There was loss of flap in one case where it was used to cover the thumb. Failure might have been due to any inadvertent pressure at the subcutaneous tunnel. Patient was 8 years of age and usually the compliance is poor in this age group.

Although it was a series of limited cases but variety of areas were covered with this flap due to its long arc of rotation. It is easy to raise and grafted index finger is also acceptable in the long run, both functionally and cosmetically. If the sensory supply to the skin is included in the flap it provides a reliable sensory flap. It provides single stage solution as compared to the cross finger flaps and also morbidity is less when compared with Moberg and Littler flaps.

Department of Plastic Surgery
Services Institute of Medical Sciences, Lahore
theesculapio@hotmail.com
www.sims.edu.pm/esculapio.html

References

1. Xarchas KC, Tilkeridis KE, Pelekas SI, Kazakos KJ, Kakagia DD, Verettas DA. Littler's flap revisited: an anatomic study, literature review, and clinical experience in the reconstruction of large thumb pulp defects. *Med Sci Monit* 2008;14: 568-73.
2. Guelmi K, Barbato B, Maladry D, Mitz V, Lemerle JP. Reconstruction of digital pulp by pulp tissue transfer of the toe. Apropos of 15 cases. *Rev Chir Orthop Reparatrice Appar Mot* 1996;82:446-52.
3. Woon CY, Lee JY, Teoh LC. Resurfacing hemipulp losses of the thumb: the cross finger flap revisited: indications, technical refinements, outcomes and long-term neuro-sensory recovery. *Ann Plast Surg* 2008;61:385-91.
4. Smith RJ, Albin R. Thenar "H-flap" for fingertip injuries. *J Trauma* 1976;16(10): 778-81.
5. Holevich J. A new method of restoring sensibility to the thumb. *J Bone Joint Surg* 1963;45B:496502.
6. Foucher G, Braun JB. A new island flap transfer from the dorsum of the index to the thumb. *Plast Reconstr Surg* 1979; 63:344-9.
7. Chang SC, Chen SL, Chen TM, Chuang CJ, Cheng TY, Wang HJ. Sensate first dorsal metacarpal artery flap for resurfacing extensive pulp defects of the thumb. *Ann Plast Surg* 2004; 53: 449-54.
8. Sherif MM. First dorsal metacarpal artery flap in hand reconstruction. Anatomical study. *J Hand Surg Am* 1994;19: 26-31.
9. El-Khatib HA. Clinical experiences with extended first dorsal metacarpal artery island flap for thumb reconstruction. *J Hand Surg Am* 1998;23:647-52.
10. Tränkle M, Sauerbier M, Heitmam C, Germann G. Restoration of thumb sensibility with the innervated first dorsal metacarpal artery island flap. *J Hand Surg* 2003; 28(5):758-66.
11. Earley MJ. The arterial supply of the thumb, first web and index finger and its surgical application. *J Hand Surg* 1986;11B:163-74.
12. Ratcliffe RJ, Regan PJ, Scerri GV. First dorsal metacarpal artery flap cover for extensive pulp defects in the normal length thumb. *Br J Plast Surg* 1992;45:544-6.
13. Henderson HP, Reid DA. Long term follow up of neuro-vascular island flaps. *Hand* 1980; 12(2): 113-22.
14. Littler JW. The neuro-vascular pedicle method of digital transposition for reconstruction of the thumb. *Plast Reconstr Surg* 1953;12:303-19.
15. Gellis M, Pool R. Two-point discrimination distances in the normal hand and forearm. *Plast Reconstr Surg* 1977; 59:57-63.
16. McFarlane RM, Stromberg WB. Resurfacing the thumb following major skin loss. *J Bone Joint Surg* 1962; 44A(7):1365-75.
17. May JW Jr, Chait LA, Cohen BE, et al. Free neurovascular flap from the first web of the foot in hand reconstruction. *J Hand Surg Am* 1977; 2(5): 387-93.
18. Bunnell S. Plastic problems in the hand. *Plast Reconstr Surg* 1946; 1(3): 265-270.