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Original Article

# First Dorsal Metacarpal Artery Flap: A Reliable Choice for Thumb Reconstruction

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## Abstract

**Introduction:** Soft-tissue defects of the thumb are very debilitating and require a good durable coverage to give a functional thumb to the patient. Lots of options are available for thumb reconstruction. In this study, we focused on the first dorsal metacarpal artery (FDMA) flap to cover the defects.

**Materials and Methods:** A prospective study of 7 patients who presented with thumb injury over the period of 2 years is managed with islanded FDMA flap along with treatment for associated injuries and is subsequently evaluated for outcome and followed up to 3 months.

**Results:** We are able to cover the defects easily in all patients without any undue tension. All flap survived, one developed distal margin necrosis and one developed epidermal loss, and both were managed with dressings. Donor site was covered with split-thickness skin graft and wound over the dorsum was closed primarily.

**Conclusion:** With careful dissection, FDMA flap is easy to harvest. It provides reliable, durable, and sensate cover with minimal donor site morbidity.

**Key words:** FDMA flap, Thumb defect, Reconstruction

## INTRODUCTION

During the evolution what humans got is specialized function of the thumb, which aid in grasping and lots of other functions. Soft-tissue defects of the thumb are very debilitating and result in more loss of function than injury to any other finger.[1] Hence, soft-tissue defects of the thumb not only required coverage but also we must ensure that a patient gets a functional thumb.

Lots of options are available to reconstruct the defects such as Moberg's flap, Littler's neurovascular island flap, cross finger flap, pulp tissue transfer of toe, and other small free flaps. In this study, we focused on the first dorsal metacarpal artery (FDMA) flap for thumb reconstruction and its outcomes.

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FDMA flap was first described by Hilgenfeldt in 1961 and Holevich in 1963 as a peninsular flap with preservation of skin over the pedicle.[1] In 1979, Foucher and Braun described it as an island flap.[2,3]

The FDMA is a constant vessel arising from the radial artery. The artery is located deep in the first dorsal web space overlying the ulnar half of the first dorsal interosseous muscle. Venous drainage of the flap is through two venae comitantes that are in connection with large cutaneous superficial veins in the first intermetacarpal space.

## MATERIALS AND METHODS

This prospective study was performed at our institution from January 2021 to April 2023; during this period, 7 patients presented with soft-tissue defect of the thumb. They all are evaluated and planned for FDMA flap.

### Surgical Technique

Out of 7 patients, 6 are done under regional anesthesia and one under general anesthesia. Tourniquet was used in all patients. The first thorough debridement was done.

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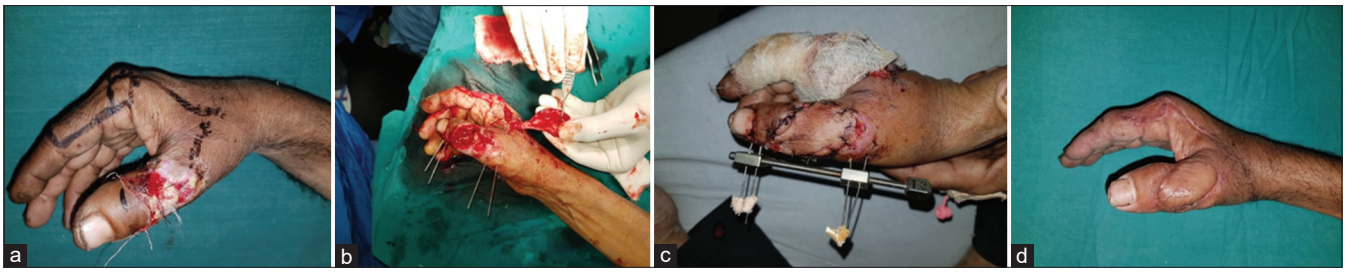



**Figure 1: (a) defect over the dorsum of RT thumb with flap markings, (b) intraoperative bony fixation with flap elevation, (c) after 7th post-OP day, (d) after 3 months with good aesthetically appearing flap**

**Figure 2: (a) RT distal thumb gangrene, (b) after distal amputation and flap elevation, flap easily reached the distal margin and covered the defect, (c) distal margin necrosis, (d) well-healed flap and donor site after 3 months, (e) patient is able to hold glass and do his routine work**

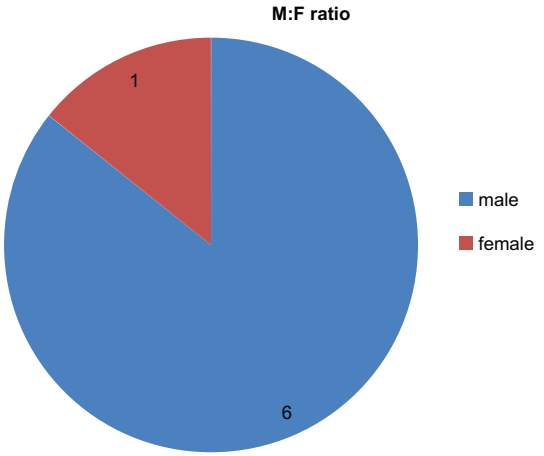
Associated bony injuries are fixed properly. Then, size of defect is measured and extrapolated on the dorsum of the index finger. Planning in reverse was done to ensure the flap reaches and cover whole the defect easily and tension free. Then, incision is placed first over the dorsum of index finger and flap is elevated from distal to proximal and carefully above the paratenon of extensor tendon and dissection continues once we reached the proximal limit, then a lazy S incision is placed over dorsum of the hand. Dermal flap is raised on both the side of the incision. Next flap is lifted and dissection continues proximally carefully dissecting the pedicle. At this stage, one can see the first dorsal interossei muscle and we include some fibers in the muscle to ensure that no damage was done to pedicle. Once flap is elevated, tourniquet was released and flap is check for bleeding. Then, a subcutaneous tunnel was made and flap is transferred to defect site and insetted. Donor site is covered with split-thickness skin graft (STSG) and incision over dorsum is closed primarily. Dressing was done. Post-operatively, hand elevation is done for 48 h. All patients were discharged after graft dressing on the 5th post-operative day. Sutures were removed on 10–14th post-operative day. This was followed by a course of physiotherapy for 6 weeks in all patients. The patients were instructed to come for post-operative follow-up every month for 3 months. All patients were evaluated for the occurrence of early post-operative complications in terms of flap necrosis, hematoma, infection, wound dehiscence, and graft loss.

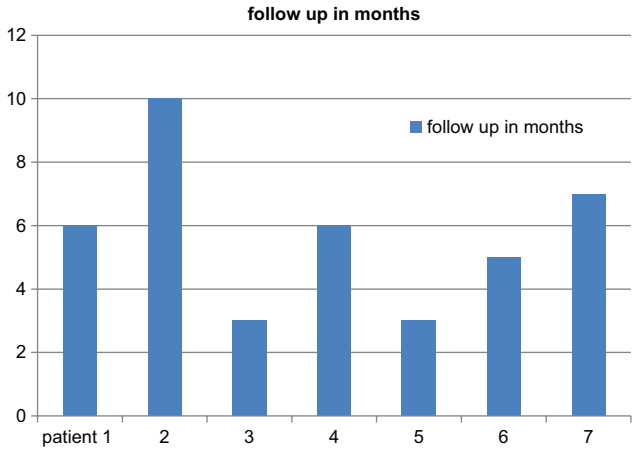
## RESULTS

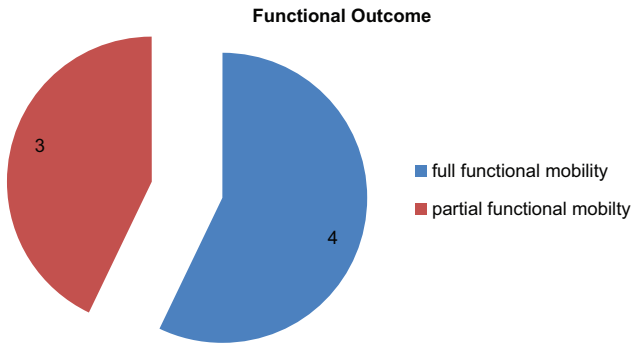
During this period, seven 1st dorsal metacarpal artery island flaps were used for the reconstruction of complex post-traumatic soft-tissue thumb defects in seven cases with an average age of 39.4 years. The subject data and outcomes are summarized in Table 1. The flap sizes ranged from 21 × 13 mm to 31 × 22 mm (mean 25.8 × 17.1 mm). Five flaps survived completely and one had distal flap margin necrosis that was treated conservatively and healed by secondary intention, and one had distal half epidermal loss, which again manages by dressings. All the recipient and donor areas were healed uneventfully. The mean follow-up period was 5.7 months (range 3–10 months). The functional outcome, four had full functional recovery while 3 had partial owing to underlying bony injury. They were pleased with the cosmetic appearance of the flap and donor site.

**Table 1: Clinical data**

| Age/sex | Flap Size(mm) | Flap site | Associated injury | complication | Functional recovery | Follow-up (months) |
|---|---|---|---|---|---|---|
| 45 y/M | 26×13 | Rt dorsal | Nil | Nil | Full | 6 |
| 50 y/M | 24×14 | Lt dorsal | Nil | Nil | Full | 10 |
| 26 y/M | 29×18 | Rt dorsal | NIL | Nil | Full | 3 |
| 55 y/M | 31×22 | Rt dorsal | IP Jt disruption and tendon injury | Nil | Partial | 6 |
| 7 y/F | 21×13 | Rt dorsal | IP Jt disruption | Distal half epidermal loss | Partial | 3 |
| 45 y/M | 29×21 | Rt volar | Distal amputation | Distal margin necrosis | Partial | 5 |
| 48 y/M | 21×19 | Rt volar | Nil | Nil | Full | 7 |



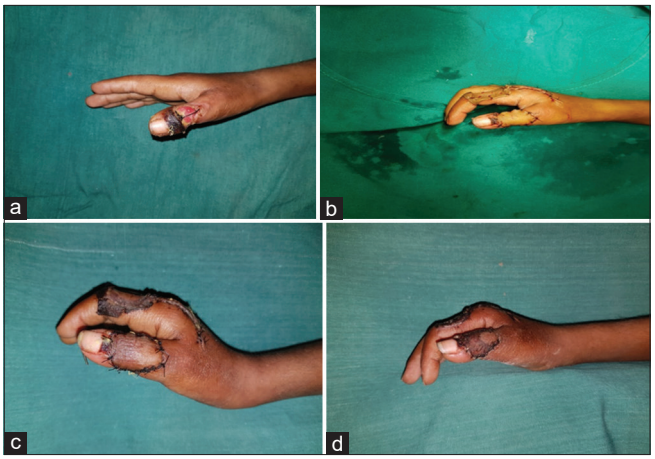




**Figure 3: (a) right thumb dorsal defect, (b) immediate post-OP after flap inset, (c) 7th post-OP day, (d) after 3 weeks**

### Case 1

A 55-years-old male presented with a history of road traffic accident, resulting in defect over the dorsum of right thumb with IP Jt disruption, he was managed with distraction and FDMA flap, and has good post-operative recovery with partial functional outcome owing to joint injury, and nonetheless, he was able to do his routine work.

### Case 2

A 45-years-old male presented with partial amputation of RT thumb at IP Jt, initially managed with replantation, which eventually fail. Later on, distal amputation of RT thumb and coverage with FDMA flap was done. He has good recovery and able to do his routine work.

### Case 3

A 7-years-old female presented with defect over the dorsum of the right thumb along with thumb IP Jt disruption, and the patient was treated with FDMA flap and K-wire fixation of IP Jt was done [Figures 1-3].

## DISCUSSION

Lots of options are available to reconstruct the thumb defects such as Moberg's flap, Littler's neurovascular island

flap, cross finger flap, pulp tissue transfer of toe and other small free flaps and groin flap, abdominal and other distant flaps. All the above-mentioned options have their merits and demerits. Local flaps offer superior esthetic results due to the replacement "like with like" tissue.[4]

In this study, we focused on FDMA flap and its outcomes. We were able to cover the defect in all the patients, without any undue tension. Five out of seven flaps survived completely. One developed distal margin necrosis, which was managed with dressing and other developed loss of epidermal tissue over distal half of the flap, which was again managed with dressing.

Ghoraba and Mahmoud,[5] in their study of 15 flaps, 14 flaps survived completely while one developed distal necrosis and they also managed it with dressings. Satish and Nema[6] used 9 FDMA flaps to cover post-traumatic thumb defects and found that the mean flap size was 33.3 × 19.4 mm and only one flap had partial necrosis that healed without secondary procedure.

As compared to groin and abdominal flap, FDMA flap has many advantages as it is a single-stage procedure with minimal donor site morbidity and also we need not to immobilize the hand in awkward position and also stiffness of joints occurring as a result can be avoided.

Donor site is covered with STSG, which heals without any complication and there is no morbidity related to donor site. Ratcliffe *et al.*[7] and Cil *et al.*,[8] in their respective studies also, have no morbidity related to donor site.

As the thumb is major factor in hand function, any repair of the thumb defect must also restore functional integrity. In our study, four patients attained full functional range of motion of their thumb and are able to do their work while three patients had partial recovery owing to underlying bony and tendon injuries although they are able to do their work. In literature, there are no much studies evaluating functional outcomes after FDMA flap and comparing it with other options available.

## CONCLUSION

We conclude that FDMA flap is a good option for thumb defect reconstruction as it provides "local and like" tissue and with no donor site morbidity. Flap is easy to harvest and is able to cover the most of the defects, whether dorsal or volar. We recommend more studies with large number of patients and longer follow-up to assess the functional integrity.

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