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NEÜ YAYINEVİ

# Use of the First Dorsal Metacarpal Artery Flap in Finger Defects – Case Series

## *Parmak Defektlerinde Birinci Dorsal Metakarpal Arter Flebinin Kullanımı – Vaka Serisi*

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### *Öz*

**Amaç:** Bu çalışmanın amacı, parmaklardaki yumuşak doku defektlerinde FDMA flep kullanımının çok yönlülüğünü değerlendirmektir.
**Hastalar ve Yöntemler:** Mayıs 2018-Mayıs 2021 tarihleri arasında üst ekstremitede yumuşak doku defekti sebebiyle rekonstrüksiyon yapılan hastalar dosya üzerinden tarandı. Bu hastalardan parmakta defekti olan ve birinci dorsal metakarpal arter flebi ile rekonstrükte edilen hastalar çalışmaya dahil edildi.
**Bulgular:** 12 hasta çalışmaya dahil edildi. Defektin etiyolojisi tüm hastalarda travma idi. Flep adaptasyonu için 5 hastada tünel açma tekniği kullanıldı. Hiçbir hastada total flep veya greft kaybı yaşanmadı. Komplikasyonlar açısından yaş, cinsiyet, komorbidite, defekt lokalizasyonu, defekt boyutu ve operasyon süresi incelendi. İstatistiksel olarak anlamlı bir fark saptanmadı. Sigara içenler ve içmeyenler incelendi, istatistiksel olarak anlamlı fark bulunmadı. Flep adaptasyonu için tünel kullanımı komplikasyon açısından istatistiksel olarak anlamlı bir fark yaratmadı.
**Sonuç:** Birinci dorsal metakarpal arter flebi 1. ve 3. parmaklardaki defektlerde oldukça güvenilir bir seçenektir. Tünel tekniği kullanılıyorsa tünel genişliğinin yeterli olduğundan emin olunmalıdır.

**Anahtar Kelimeler:** Dorsal metakarpal arter, flep, parmak defekti

### *Abstract*

**Aim:** The aim of this study is to evaluate the versatility of the use of FDMA flaps in soft tissue defects in the fingers.
**Patients and methods:** Patients who underwent reconstruction due to soft tissue defect in the upper extremity between May 2018 and May 2021 were scanned over the file. Among these patients, patients who had a finger defect and were reconstructed with the first dorsal metacarpal artery flap were included in the study.
**Results:** 12 patients were included in the study. The etiology of the defect was trauma in all patients. Tunneling technique was used in 5 patients for flap adaptation. No patient experienced total flap or graft loss. Age, gender, comorbidity, defect localization, defect size and operation time were examined in terms of complications. No statistically significant difference was detected. Smokers and non-smokers were examined, no statistically significant difference was found. The use of tunnel for flap adaptation did not make a statistically significant difference in terms of complications.
**Conclusion:** First dorsal metacarpal artery flap is a very reliable option for defects in the 1st and 3rd fingers. If the tunnel technique is used, it should be ensured that the tunnel width is sufficient.

**Key words:** Dorsal metacarpal artery, flap, finger defect

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## INTRODUCTION

As global rates of mortality decrease, rates of non-fatal injury have increased (1). Hand trauma is one of the most common non-fatal injuries and most of them require specific treatment. They constitute between 6.6% and 28.6% of all injuries (2-4). The main group affected by these traumas are young men who are actively working and most of the traumas occur in the workplace (5). They can be also occur at home, traffic accidents and sports etc (6).

Even minor injuries, if not treated well, can lead to consequences such as decreased quality of life, loss of productivity, chronic pain and limitation of movement (1). Therefore, appropriate repair of defects around the fingers and hand is important. Soft tissue defects in the hands and fingers are no different and can lead to poor outcomes if not treated appropriately.

Hand surgeons should know the reconstructive options for hand injuries with soft tissue defects. Today, there are many reconstruction options for soft tissue defects in the hands and fingers, ranging from local pedicled flaps, distant pedicle flaps and microsurgical flaps such as free flaps, finger transfers and toe-to-thumb (7-10).

The aim of this study is to evaluate the versatility of the use of FDMA flap in soft tissue defects in the fingers.

## PATIENTS AND METHODS

The study was planned as a retrospectively. The approval of the ethics committee and also informed consent forms was obtained before surgery from the patients or their legal representatives if necessary (İzmir Katip Çelebi University, Non-Interventional Clinical Studies Instituonel Review Board, Date: 24.11.2022, IRB: 0483). Between May 2018 and May 2021, patients who applied to our clinic with soft tissue defect in the upper extremity and underwent reconstruction were scanned over the file. Demographic data (age and gender), details of the injuries (etiology, affected anatomical area, and defect size), and preferred flaps were examined retrospectively using the hospital's patient data system and archives. Among these patients, the patients whose defect was in the fingers and reconstructed with the first dorsal metacarpal artery flap were included in the study. Patients who did not have a defect in the finger or were repaired with another method, and did not comply with the postoperative recommendations (such as not quitting smoking, wound care recommendations) were excluded from the study. All operations were performed by the senior author. Operations were performed under regional and local anesthesia. The patients were followed up regularly in the postoperative period. During the follow-ups, the patients were photographed, physical examination was performed in terms of flap viability, wound dehiscence, soft tissue infection, and the datas were recorded.

### *Surgical technique*

Debridements were continued until capillary bleeding was observed at the base of the defects and wound lips. When the wound sites were suitable for closure, the dorsal metacarpal artery was marked with hand doppler at the base of the 1st metacarpal bone on the dorsum of the hand. (Figure 1) Skin flap which is not smaller than the defect size was designed on the dorsal surface of the proximal phalanx of the index finger. Drawings were made from the base of the flap to the 1st dorsal metacarpal artery, a skin incision was made in accordance with the drawings, the skin flaps were elevated as a graft. Then, the flap was elevated over the paratenon with a subcutaneous pedicle of at least 1.5 cm width and the flap was obtained as a island flap. (Figure 2) The flap was adapted over the defect under the minimum tension as possible and sutured. Full-thickness skin grafts obtained from the inguinal region or inner arm were used to closure of the donor area. Graft donor areas were primarily repaired. Postoperative wound care, immobilization and elevation were applied for 2 weeks for the grafted defect on the index finger. In order to evaluate the results, the operation areas of the patients were observed clinically during their stay in the hospital,

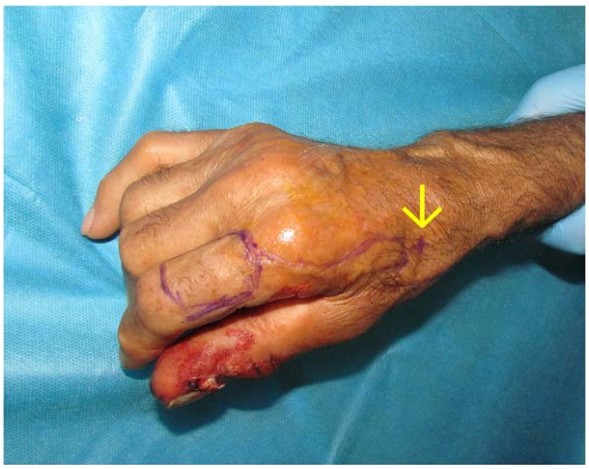

**Figure 1.** The location of the 1st dorsal metacarpal artery is determined by hand doppler.

**Figure 2.** Care should be taken to ensure that the width of the pedicle on the flap is not less than 1.5 cm.

patients were called for controls in the postoperative period, physical examinations were performed, and the datas were recorded.

***Statistical analysis***

IBM SPSS Statistics Version 20 (IBM, USA) was used for statistical analysis. The Shapiro Wilk test was used for normality analysis. Chi square test was used for binomial values, independent samples T-test and Kruskal Wallis test were used for other values.

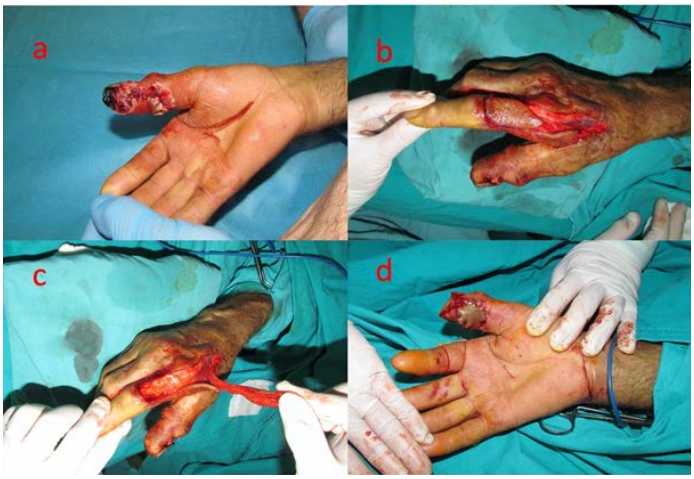


**Figure 3.** Preoperative and intraoperative views of a patient with a first finger injury.
a: Preoperative view of the defect.
b, c: Views of the prepared and raised flap.
d: View of the flap adapted to the defect.

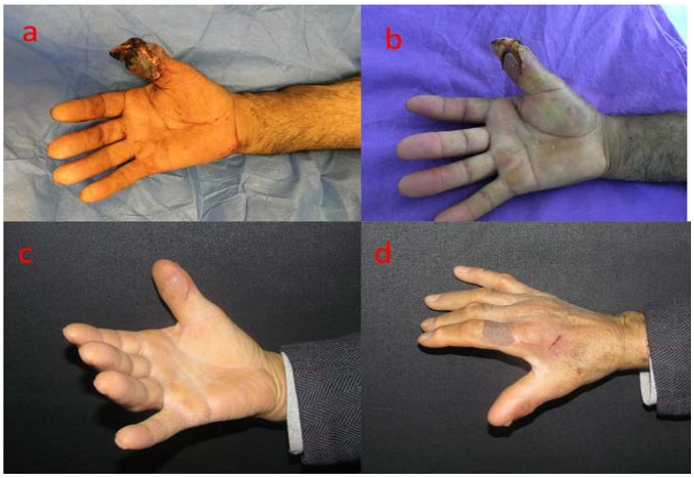


**Figure 4.** Postoperative views of the patient in figure 1.
a: Postoperative first week view of the patient. There is venous insufficiency in the flap.
b: Postoperative third week view of the patient. Deepitelization occurred in the flap.
c, d: Postoperative 18th month view of the patient.

Statistical significance was set as $p < 0.05$.

## RESULTS

A total of 57 patients were followed up due to upper extremity defects. Twelve of these patients were included in the study. Ten of the patients were male and 2 were female. The mean age of the patients was 47.4 years. The mean defect size was 4.3 cm2. 8 of the patients was smoker. 3 patients had diabetes mellitus (DM). The etiology of the defect was trauma in all patients. The defect was located in the 1st finger in 9 patients and in the 3rd finger in 3 patients. Tunneling technique was used in 5 patients for flap adaptation. For donor site repairs, skin grafts were taken from the inner arm in 8 patients and from the inguinal region in 4 patients. The mean operation time was 38.3 minutes. The mean hospital stay of the


**Figure 5.** Preoperative, intraoperative and postoperative views of a patient with a third finger injury.
a: Preoperative view of the defect.
b: View of the flap adapted to the defect.
c: Postoperative sixth month view of the patient.

patients was 4.8 days. The mean follow-up period of the patients was 15.4 months. In the postoperative period, local soft tissue infection was detected in 3 patients, and deepitelization was detected on the flap due to venous insufficiency in 4 patients. Extremity elevation was applied to patients who developed venous insufficiency, intravenous steroid therapy was given to reduce edema in the tunnel. All patients were healed with antibiotherapy and appropriate wound care. No patient experienced total flap or graft loss. (Figure 3, 4 and 5) (Table 1)

Age, gender, comorbidity, defect localization, defect size and duration of operation were examined in terms of complications. No statistically significant difference was found. When smokers and non-smokers were examined, no statistically significant difference was found in terms of complications. The use of tunneling for flap adaptation did not make a statistically significant difference in terms of complications. There was a statistically significant difference between the length of hospital stay and complications. (Table 2)

## DISCUSSION

First dorsal metacarpal artery (FDMA) flap is a local flap which is supplied by dorsal carpal arch. Traditional use of this flap is soft tissue defects in the fingers and webs. This flap can be also elevated with dorsal sensory branch of the radial nerve as a sensory flap (7).

Earley and Milner (11) reported that the FDMA was absent in only 1.1% of hands in their study. In addition, as shown in anatomical studies, the perforator at the flap site is constant and originates from the branches of the deep palmar arch, even in the absence of the dorsal metacarpal artery (12). In 2010, Bailey et al. (13) succeeded in using the dorsal metacarpal artery

**Table 1.** Demographic data of the patients.

| Patient | Age/Gender | Etiology | Defect size(cm) | Defect location(finger) | Comorbidity | Smoking | Operating time | Tunelization | Greft donor area | Complication | Hospitalization time (day) | Follow up (month) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 72/M | Trauma | 2*2 | First | None | + | 35 | + | Arm | Venous insufficiency | 7 | 18 |
| 2 | 37/M | Trauma | 3*2 | First | None | + | 33 | - | Inguinal | None | 2 | 14 |
| 3 | 52/M | Trauma | 2*1 | First | DM | + | 35 | - | Arm | Infection | 8 | 15 |
| 4 | 43/F | Trauma | 2*2 | First | None | - | 42 | - | Arm | None | 2 | 13 |
| 5 | 38/M | Trauma | 3*2 | First | None | - | 47 | - | Inguinal | Infection | 7 | 18 |
| 6 | 50/M | Trauma | 3*2 | Third | None | + | 40 | + | Inguinal | None | 1 | 6 |
| 7 | 45/M | Trauma | 2*2 | First | DM | - | 53 | + | Arm | Venous insufficiency | 6 | 12 |
| 8 | 51/M | Trauma | 2*1 | First | None | + | 30 | - | Arm | Infection | 7 | 15 |
| 9 | 46/F | Trauma | 3*2 | Third | None | + | 34 | - | Inguinal | None | 2 | 19 |
| 10 | 23/M | Trauma | 2*2 | Third | DM | - | 32 | - | Arm | None | 2 | 17 |
| 11 | 63/M | Trauma | 2*2 | First | None | + | 36 | + | Arm | Venous insufficiency | 8 | 22 |
| 12 | 49/M | Trauma | 2*2 | First | None | + | 43 | + | Arm | Venous insufficiency | 6 | 16 |

**Table 2.** Statistical analysis results in patients.

| | Age | Gender | Defect size | Location | Comorbidity | Smoking | Tunelization | Surgery time | Hospitalization |
|---|---|---|---|---|---|---|---|---|---|
| **Complication** | 0.153 | 0.178 | 0.065 | 0.07 | 0.76 | 0.719 | 0.222 | 0.342 | 0.012 |

flap from the previously grafted defective area in their study. In 2011, Isaraj (14) reported that perforator constancy was maintained even in scarred dorsum of the hand. In our study, the presence of dorsal metacarpal artery was confirmed by preoperative hand doppler scanning in all cases. Absence of the first dorsal metacarpal artery was not detected in any patient.

The first dorsal metacarpal artery (FDMA) flap stands out in many ways; it is constant, it is near to trauma zone, simple to raise, single-staged (most of the other treatment options require at least two stages of treatment), early mobilization (decrease risk of contracture and reduced physical therapy time), reduction in hospital stay (increased quality of life, decreased loss of productivity) and minimal donor site morbidity (donor site can be easily closed with a skin graft). As a result of all these, considering the like-to-like principle in reconstruction, this flap is a perfect option for the small to medium size defects (15).

One of the major disadvantage of this flap is that it does not have sufficient pedicle length for the fingers other than the 1st and 3rd fingers. Another down side of the flap is that the venous insufficiency and necrosis (15). Partial necrosis was reported in 2 of 42 flaps in the study of Zhang et al. (16), and in 2 of 10 flaps in the study of Couceiro and Sanmartín (17). El-Khatib (18) reported that venous congestion developed in all flaps in their series of 5 cases, while Couceiro and Sanmartín (17) reported that venous congestion developed in 2 patients in their series of 10 cases. Zhang et al. (16) reported that some degree of venous congestion developed in the flaps in their series. We did not encounter total necrosis in our case series, venous insufficiency developed in 4 of our 12 patients and deepitelization of the flap occurred in these patients.

In this study, 12 patients who had soft tissue defects in the 1st and 3rd fingers of the upper extremity and were repaired with the 1st dorsal metacarpal artery flap were retrospectively analyzed. The defect was in the 1st finger in 9 patients and in the 3rd finger in 3 patients. 3 patients had diabetes mellitus, 8 patients were smokers. Tunneling technique was used in 5 patients for flap adaptation. In all patients, flap donor sites were closed with a full-thickness skin graft. In the postoperative period, soft tissue infection developed in 3 patients and venous insufficiency in 4 patients. All patients recovered with antibiotic therapy and wound care. No major complications such as flap or graft loss were found in any of the patients. The use of tunneling for flap adaptation did not make a statistically significant difference in terms of complications. However, in our clinical observations, we found that deepithelialization was more common after venous insufficiency in cases where tunnels were used to adapt the flap. Because in this patient group, the flap pedicle gets stuck in the tunnel due to edema after the operation and this causes venous insufficiency. The lack of significant results may be due to the small number of patients. We think that larger case series will yield different statistical results. There was a statistically significant difference between the duration of hospitalization and complications, that is, the hospitalization of patients who developed complications took longer, as expected.

The disadvantage of this flap is that it does not have sufficient pedicle length for the fingers other than the 1st and 3rd fingers. In addition, the small number of patients and the use of the flap only in finger defects can be considered as limitations of the study.

## CONCLUSION

In conclusion, 1st dorsal metacarpal artery flap is a very reliable option for defects in the 1st and 3rd fingers. If the tunnel technique is using for adaptation, it should be ensured that the tunnel width is sufficient to avoid venous insufficiency and deepitelization in the postoperative period.

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