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Routine closure of the donor site with a second dorsal metacarpal artery flap to avoid the use of a skin graft after harvest of a first dorsal metacarpal artery flap



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KEYWORDS

Modified incision;
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Summary *Aim:* Closure of the donor site on the index finger after raising a first dorsal metacarpal artery (DMA) flap harvest is challenging. The conventional choice is to use a full-thickness skin graft. However, this procedure is associated with several complications and a second donor site to harvest the skin graft is inevitable. The aim of this study was to design a modified incision to allow harvest of a first DMA flap without skin graft.

Methods: From 2015 to 2016, 18 patients with a soft tissue defect of the thumb had reconstruction of the defect using a first DMA flap. A modified incision was used and a relaying perforator flap pedicled on the second DMA was raised through the same incision to cover the donor site. Patient satisfaction, appearance of the injured hand, and the active range of motion (ROM) were assessed. The sensitivity was evaluated by the 2-point discrimination (2-PD) test.

Results: All flaps survived completely without complications. Good coverage was obtained with only one linear scar in the dorsum of the hand and no skin grafts. All patients recovered full range of movement in their fingers and regained sensitivity of the flaps. All patients were satisfied with their hand function according to the Michigan Hand Outcomes Questionnaire (MHQ). The mean cosmetic score for the appearance of the injured hand was 8.2 out of 10.

Conclusions: Using our modified incision, it was possible to harvest a second DMA flap at the same time as a first DMA flap allowing simultaneous coverage of the donor defect on the index finger. This prevented the need for a skin graft with all of the associated disadvantages.

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Introduction

The dorsal metacarpal artery (DMA) flap is widely used in hand surgery.¹⁻³ Holevich first described the first DMA flap.⁴ Then, a sensate island flap raised on the first DMA with its concomitant veins and a sensory branch of the superficial radial nerve was designed by Foucher and Braun.⁵ Since then the first DMA flap has become widely used to reconstruct soft tissue defects of the thumb.⁶⁻⁸ However, there are some problems with its routine clinical application. In particular, the donor site on the dorsum of the index finger cannot be closed primarily, and a full-thickness skin graft is necessary for cover. A second donor site is required to harvest a skin graft, which may have an effect on metacarpophalangeal joint motion and there is the additional morbidity related to a second donor site. According to the literature, there may be anatomical variations or even an absence of the first DMA.⁹⁻¹¹

To address this problem, we have designed a novel surgical incision along the ulnar border of the second metacarpal which is used to harvest the flap and tunnel it through to the soft tissue defect on the thumb. The main advantage of this modified incision is that we can raise a relaying perforator flap pedicled on the second DMA using the same skin incision. This second flap is used to cover the donor defect on the index finger while allowing direct closure of the primary donor site. The objective of the current study was to demonstrate the safety of using this modified incision. We now describe our clinical experience of 18 cases with the use of this incision.

Patients and methods

From June 2015 to October 2016, the modified incision for the first DMA flap was used in 18 patients at our hand surgery

center. Our series included 12 males and 6 females with an average age of 34.1 years (range, 19–55 years) at the time of surgery. The mechanisms of injury were: sharp cut ($n = 6$), avulsion ($n = 8$) and crush ($n = 4$). Six patients also underwent internal fixation of a fracture of the thumb. The size of the defects ranged from 2.0 to 5.5 cm long (mean, 3.4 cm) and 2.0 to 3.5 cm wide (mean, 2.6 cm). The length of the first DMA flap pedicle was 5.8–9.6 cm (mean, 7.9 cm) (Table 1). The flap transfer was performed within 6 hours of the initial trauma in 14 cases, and in 4 cases, reconstruction was delayed to within 1 week of initial trauma.

Surgical technique

The traditional skin incision for the first DMA flap is continued along the radial aspect of the second metacarpal (Figure 1A. Solid line in red). We designed a novel C-shaped incision along the ulnar border of the second metacarpal for the first DMA dissection (Figure 1A. Dotted line in green). The skin on the radial side of the incision is raised and a retractor is used to provide traction. Our dissection includes raising the periosteum on the radial border of the second metacarpal bone, and continuing proximally to include the fascia over the ulnar head of the first dorsal interosseus muscle. It is not difficult to dissect and expose the first DMA from the ulnar to the radial side under this incision as the skin on the dorsum of the hand is elastic. Once this has been done, the first DMA flap should be harvested and the pedicle should now include the first DMA, the concomitant veins, and a branch of the superficial radial nerve which can be dissected out carefully with the assistance of 4× loupe magnification. Then the flap is transferred to cover the thumb defect through a subcutaneous tunnel. These surgical steps are the same as those used to raise a conventional first DMA flap. Next, a relaying flap based on the second DMA can be

Table 1 Patient demographics and surgical details.

Case	Age (y)	Gender	Side	Type of injury	Combined with fracture	Immediate/delayed reconstruction	Defect size (long × wide, cm)	FDMA flap pedicle length (cm)
1	36	M	R	Sharp cut	No	Immediate	3.2 × 2.5	7.2
2	42	F	L	Sharp cut	Yes	Delayed	2.8 × 2.2	8.0
3	22	M	R	Avulsion	No	Immediate	5.0 × 3.5	7.0
4	19	F	R	Crush	Yes	Immediate	2.0 × 2.0	8.5
5	44	M	L	Avulsion	No	Immediate	3.5 × 2.8	6.5
6	37	F	R	Avulsion	No	Delayed	2.2 × 2.5	8.8
7	35	F	L	Crush	Yes	Immediate	4.0 × 2.6	7.8
8	25	M	L	Sharp cut	No	Immediate	2.5 × 2.0	9.2
9	19	M	R	Avulsion	No	Immediate	3.6 × 2.8	9.6
10	29	M	R	Sharp cut	No	Immediate	2.0 × 2.0	8.6
11	36	F	R	Avulsion	No	Immediate	3.8 × 2.8	7.8
12	42	M	L	Sharp cut	No	Immediate	5.5 × 3.5	8.2
13	34	M	R	Crush	Yes	Delayed	4.5 × 2.8	8.5
14	49	F	L	Sharp cut	No	Immediate	4.0 × 2.5	5.8
15	20	M	R	Avulsion	Yes	Immediate	3.5 × 2.5	7.2
16	55	M	R	Avulsion	No	Immediate	2.8 × 2.2	7.0
17	38	M	L	Crush	Yes	Delayed	3.6 × 2.5	8.0
18	31	M	R	Avulsion	No	Immediate	3.5 × 2.4	8.2
Mean	34.1	-	-	-	-	-	3.4 × 2.6	7.9

M, male; F, female; R, right; L, left.

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