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Free-style local perforator flaps: concept and classification system

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KEYWORDS
Free-style;
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Summary *Background:* Defect reconstruction according to the free-style concept applied to perforator flaps allows flap harvesting in any anatomical region where an audible Doppler signal of a perforator is detected. We report the results of a study in which local perforator flaps were selected for reconstruction in different anatomical areas and were harvested using the free-style concept.
Methods: During a 2-year period, defect coverage was carried out in 21 patients ($n = 21$) in the following anatomical areas: cervical ($n = 3$), sternal/parasternal ($n = 4$), axillary ($n = 2$), tibial ($n = 5$), trochanteric ($n = 2$) and sacral/gluteal ($n = 5$). The mean age of patients (15 male and six female) was 57.8 years. Flap selection was based solely on preoperative Doppler mapping in areas adjacent to soft-tissue defects. The mean follow-up period was 1 year.
Results: All flaps survived, demonstrating postoperatively acceptable aesthetic results with good patient satisfaction. The donor sites were closed primarily in 17 patients; four patients required skin grafting. Two patients required surgical revision due to flap-margin dehiscence. There was no loss of function at donor sites. Increased flap mobility could be achieved through extended perforator dissection. One perforator-based flaps offered the widest arc of rotation serving as propeller flaps. If more than one perforator vessel was preserved, flap mobility was limited, but still allowed sufficient flap movement either as a rotation or advancement flap or as a combination of both. A classification is proposed according to the number of perforator vessels preserved and to the type of flap movement.
Conclusions: The concept of free-style local perforator flaps represents a safe, versatile and reliable surgical procedure. It not only offers a greater freedom in flap selection but also provides good aesthetic results. The classification proposed might aid in the decision-making process involved in order to achieve adequate results with this procedure.

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The use of perforator flaps today represents a safe and reliable procedure in reconstructive plastic surgery. The major reason for selecting this type of flap as compared to conventional musculocutaneous flaps is the reduction of morbidity at the donor site with the preservation of nerves and muscles.[1,2] Normally, the procedure of perforator-flap planning follows the guidelines of angiosome mapping introduced by Taylor and Palmer.[3–5] The concept of free-style perforator-flap surgery offers greater freedom in choosing a donor-site area because flap selection is based on the quality and volume of soft tissue required at the recipient site.[6] Flap design and harvest are carried out according to previous Doppler mapping.[7]

The purpose of our study was to evaluate the reconstruction of defects in different anatomical areas with local perforator flaps using the free-style concept. Moreover, an effort has been made to classify the different types of free-style local perforator flaps according to the number of perforator vessels preserved and to the type of flap movement carried out.

Patients and methods

Between September 2004 and October 2006, a total of 21 patients ($n = 21$) underwent surgery secondary to trauma, tumour or pressure-sore-induced soft-tissue defects that were located at various anatomical sites: sternal and parasternal ($n = 4$), cervical ($n = 3$), axillary ($n = 2$), tibial ($n = 5$), trochanteric ($n = 2$) and sacral/gluteal ($n = 5$). The study comprised 15 male and six female patients, with a mean age of 57.8 years (range: 41–72 years). Detailed patient information is presented in Table 1. A total of 21 local perforator flaps within an area adjacent to the defect were harvested using the free-style technique. Doppler investigation of perforator vessels was carried out using a portable acoustic Doppler ultrasound device (Medasonics, Newark, NJ, USA) connected to a 5-MHz vascular probe (VP5). Doppler mapping was performed after the administration of anaesthesia and before marking the flap dimensions. All flaps were dissected in the suprafascial plane until the vicinity of the marked perforator was reached. At this point, flap elevation was continued subfascially to facilitate the localisation and dissection of the perforators.

Surgical technique

After evaluating the defect, an appropriate area adjacent to the injury site is selected. Doppler investigation and mapping within the area of interest are carried out, followed by marking of the flap design. The decision of the number of perforator vessels to be preserved during

Table 1 Patient profile and characteristics

Patient Flap	Age/Sex/ type	Diagnosis/ Location/Source vessel	Flap shape (size in cm), No. of perforator vessel/type of flap movement	Complication	Follow-up (months)
1	58/m/I	pressure sore, distal lower extremity, PTA	elliptical (7 × 22), 1, propeller flap	0	8
2	52/m/I	pressure sore, distal lower extremity, PTA	elliptical (9 × 32), 1, propeller flap	dehiscence flap margin	9
3	65/f/I	trauma, distal upper extremity, RA	elliptical (6 × 14), 1, propeller flap	0	9
4	57/f/I	trauma, distal upper extremity, RA	elliptical (4 × 12), 1, propeller flap	0	12
5	61/m/I	trauma, cervical, TCA	triangular (10 × 23), 1, propeller flap	0	6
6	63/m/I	pressure sore, trochanteric, SGA	V-rectangular (12 × 22), 1, propeller flap	0	12
7	61/f/II	pressure sore, trochanteric, SGA	V-rectangular (16 × 30), 3, rot., advm. flap	0	14
8	66/m/II	pressure sore, sacral, SGA	elliptical (18 × 27), 3, rot., advm. flap	0	10
9	72/m/II	pressure sore, sacra, SGA	rectangular (17 × 30), 4, rot., advm. flap	0	12
10	68/m/II	pressure sore, sacral, SGA	triangluar (13 × 18), 3, advm. flap	0	14
11	71/m/III	pressure sore, sacral, SGA	peninsular (12 × 19), 3, rot., advm. flap.	0	5
12	52/m/II	trauma, para-, sternal, IMA	triangluar (12 × 21), 2, advm. flap	0	14
13	41/m/II	trauma, para-, sternal, IMA	elliptical (11 × 23), 3, advm. flap	0	12
14	54/f/II	trauma, para-, sternal, IMA	triangluar (13 × 20), 2, advm. flap	0	13
15	61/f/II	trauma, para-, sternal, IMA	triangluar (12 × 19), 3, advm. flap	dehiscence flap margin	10
16	49/f/II	trauma, axillary, TDA	elliptical (14 × 27), 2, advm. flap	0	9
17	41/m/II	tumor, axillary, TDA	elliptical (13 × 24), 2, advm. flap	0	12
18	58/m/II	trauma, cervical, TCA	triangluar (10 × 20), 2, advm. flap	0	9
19	61/m/II	trauma, cervical, TCA	triangluar (9 × 17), 2, advm. flap	0	6
20	52/m/II	trauma, cervical, TCA	elliptical (10 × 18), 2, advm. flap	0	10
21	62/m/III	pressure sore, sacral, SGA	peninsular (19 × 25), 5, rot., advm. flap	0	3

Index: female (f), male (m), posterior tibial artery (PTA), radial artery (RA), thoracodorsal artery (TDA), internal mammary artery (IMA), superior gluteal artery (SGA), transverse cervical artery (TCA); rotation (rot.), advancement (advm.).