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Suzanne Decaudaveine^a
Jean-Thomas Bachelet^{b,c}

Christian Vacher^d

Floriane Combes^d

Ali Mojallal^e

Ludovic Benichou^a

^aService de Chirurgie Maxillo-Faciale, Groupe Hospitalier
Paris Saint-Joseph, 185 rue Raymond Losserand,
Paris, France

^bService de Chirurgie Maxillo-Faciale, Hôpital de la Croix
Rousse CHU de Lyon, 103 Grande Rue de la Croix Rousse,
Lyon, France

^cINSERM, UMR 1052, Groupe de Radiobiologie, 28 rue
Laennec, Lyon, France

^dService de Chirurgie Maxillo-Faciale, Hôpital Beaujon –
APHP, 100 Boulevard du Général Leclerc Clichy, France

^eService de Chirurgie Plastique Reconstructrice et
Esthétique, Hôpital de la Croix Rousse CHU de Lyon, 103
Grande Rue de la Croix Rousse, Lyon, France

E-mail address: jean-thomas.bachelet@chu-lyon.fr

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<https://doi.org/10.1016/j.bjps.2018.01.027>

Aesthetic and functional outcomes of radial forearm flap donor site reconstruction with biosynthetic skin substitutes



Dear Sir,

Introduction

The radial forearm fasciocutaneous flap (RFFF) is a work-horse flap in reconstructive microsurgery that is favoured for its thinness, reliable vascularity, consistent anatomy, and

ability to be harvested concurrently during oncologic resection.¹ Despite its popularity, RFFF elevation may lead to wound healing complications, wrist stiffness, weakened grip, sensory impairment, and a visible, potentially stigmatizing forearm scar.² Various strategies have been investigated to reduce donor site morbidity, including suprafascial dissection, full thickness skin grafting, primary closure with local flaps, and the use of alternative flaps.³ Biosynthetic skin substitutes such as acellular dermal matrix, derived from human dermis, and Integra, a bilayer construct of bovine glycosaminoglycan with a silicone membrane, are useful for wound coverage in burn reconstruction. These substitutes represent a potential adjunctive strategy to split-thickness skin grafts for RFFF donor site reconstruction. The objective of this study was to review aesthetic and functional outcomes of RFFF donor site reconstruction with biosynthetic skin substitutes.

Methods

A systematic literature review was conducted and reported as per PRISMA guidelines. PubMed, Medline, EMBASE, Cochrane Library, and Web of Science were searched up to October 2016 for articles in English or French. Studies were included if functional or aesthetic outcomes were reported following RFFF elevation and donor site coverage with a biosynthetic skin substitute. Study selection and data extraction were performed by two independent reviewers and discrepancies were resolved by consensus. Data was collected on patient demographics, indication for RFFF harvest, defect size, reconstruction method, follow-up duration, aesthetic outcomes, functional outcomes, and complications.

Results

Of 363 identified articles, 15 studies met inclusion criteria after abstract and full-text review. A total of 261 patients with a mean age of 55 years (range, 44–79 years) underwent RFFF elevation and donor site coverage with Alloderm (n = 162), Integra (n = 60), Terudermis (n = 17), Rapiderm (n = 10), Matriderm (n = 4), or biodegradable temporizing matrix (n = 8) with or without skin grafting (mean substitute size, 68 cm², range, 25–125 cm²). Mean follow-up time was 12.2 months post-reconstruction. Aesthetic outcomes were reported in 10 of 15 studies (67%) and were satisfactory according to both patients (mean score 7.98/10) and surgeons (mean score 6.73/10). Functional outcomes were satisfactory as measured by wrist range of motion (9/9 studies), grip strength (4/4 studies), sensation (5/5 studies), and patient satisfaction (4/4 studies) (Table 1). The most common complications were infection (12%), seroma (9%), and partial skin graft loss (7%). There were 4 comparative cohort studies which demonstrated an equivocal benefit of skin substitutes when outcomes were compared to reconstruction with skin grafts alone (Table 2).

Discussion

The radial forearm fasciocutaneous flap (RFFF) is thin and pliable, making it a versatile flap for complex

^{*}This article has been presented in part, as a poster, at the American Society for Surgery of the Hand 72nd Annual Meeting, San Francisco, USA, September 5–9, 2017.

Author Contributions

KJZ did the conception and methods and primary data retrieval, and is a manuscript author; MR did the conception and methods and primary data retrieval and is a manuscript author and reviewer; FM and YB did the conception and methods and are both manuscript reviewers; and SOPH did the conception and methods and is the primary manuscript reviewer, supervising author and corresponding author.

Table 1 Donor site outcomes of radial forearm fasciocutaneous flap reconstruction with biosynthetic skin substitutes.

Author	Skin substitute	FU (mo)	n	Aesthetic outcomes	Functional outcomes
Byun et al, 2016 ⁷	Rapiderm	6	10	Patients 7.65/10	ROM 56.8° /56.8°
Duteille et al, 2004 ⁸	Integra + STSG	12.7	9	Patients 8.9/10; Surgeons 7.3/10	ROM no limitation
Gravvanis et al, 2007 ⁹	Integra + STSG	9	NR	Patients: very good	ROM 60° /61°; grip strength 99% of preop
Haslik et al, 2010 ¹⁰	Matriderm + STSG	NR	NR	Surgeons: Vancouver; Scar Scale 1.3	ROM no limitation DASH 27.2
Ho et al, 2006 ¹¹	Alloderm + STSG	18	7	Surgeons: 2.94/5	ROM 101%/103% of other hand; grip strength 89% of preop; Semmes-Weinstein equal to skin graft group; patient satisfaction 99%
Lee et al, 2005 ¹²	Terudermis + STSG	NR	13	NR	NR
Murray et al, 2011 ¹³	Integra + STSG		26	NR	ROM no limitation; grip strength no impairment
Pena et al, 2012 ¹⁴	Integra + autologous skin equivalent	NR	NR	Patients: good aesthetic result	Sensation normal
Rowe et al, 2006 ¹⁵	Alloderm + STSG	8	12	NR	ROM 73.5° /50.8°; grip strength 93% of other hand; 2PD 5.6 mm; patient satisfaction 4.6/5
Sinha et al, 2002 ¹⁶	Alloderm	14	NR	NR	ROM no limitation; sensation normal
Tane et al, 1996 ¹⁷	Terudermis + STSG	NR	8	NR	NR
Wagstaff et al, 2015 ¹⁸	BTM + STSG	NR	NR	POSAS Patient Scale 1.97; POSAS Observer Scale 2.33	NR
Wax et al, 2002 ¹⁹	Alloderm	>6	4	Patients: no dissatisfaction	NR
Wester et al, 2014 ⁶	Alloderm + STSG	5	10	Patients: 3.7/5; Surgeons: 3.5/5	NR
Wirthmann et al, 2014 ²⁰	Integra + STSG	23.8	NR	Surgeons: Vancouver; Scar Scale 4.2	ROM 103.8°; sensation absent 2/13

STSG, split-thickness skin graft; BTM, biodegradable temporizing matrix; FU, follow-up; NR, not recorded; ROM, range of motion, reported as flexion/extension; DASH Score, Disabilities of the Arm, Shoulder, and Hand Score, lower score represents lower level of impaired function; preop, preoperative; 2PD, 2-point discrimination; POSAS, Patient and Observer Scar Assessment Scale, lower score represents better aesthetic result.

Table 2 Comparative studies of techniques for radial forearm fasciocutaneous flap donor site reconstruction.

Author	Method of reconstruction	Conclusion
Ho et al, 2006 ¹¹	STSG only	Comparable postoperative functional and aesthetic outcomes among all three groups
Rowe et al, 2006 ¹⁵	Alloderm + STSG FTSG only STSG only	Alloderm + STSG comparable (trending to superior) functional result with traditional STSG and aesthetically superior
Wax et al, 2002 ¹⁹	Alloderm + STSG Alloderm	Alloderm may be viable alternative to STSG but prolonged healing period requires increased health services
Wester et al, 2014 ⁶	STSG only Alloderm + STSG STSG only	Alloderm + STSG has superior cosmetic result compared with STSG alone

STSG, split-thickness skin graft; FTSG, full-thickness skin graft.

three-dimensional soft tissue coverage or reconstruction. Despite these advantages, a large donor defect with inadequate adjacent skin laxity precludes direct closure.³ Conventional split-thickness skin grafting may be associated with

complications such as delayed healing, partial graft loss leading to tendon exposure, or infection.² Functional complications are non-negligible and may include loss of sensation, cold sensitivity, paresthesia, wrist stiffness, and reduced

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