

Frontalis-based island pedicle flaps for the single-stage repair of large defects of the forehead and frontal scalp

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Summary

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Medium- to large-sized surgical defects of the forehead and frontal scalp provide a challenge for the reconstructive surgeon. When primary closure is not possible and the underlying outer table is exposed, alternative methods of wound closure must be employed. Herein we highlight the utility of a frontalis-based island pedicle flap (FIPF) for the single-stage, aesthetic reconstruction of such defects.

Surgical technique

A full-thickness defect with exposed outer table following Mohs tumour extirpation of a sebaceous carcinoma on the upper central forehead is illustrated in Figure 1(a). The wound is prepared and draped in a standard fashion and the procedure performed under local anaesthetic as a day case. Supratrochlear and supraorbital nerve blocks facilitate anaesthesia.

An inferior FIPF was designed in this case, taking into account the defect orientation, tissue reservoir location, skin laxity, hairline position and placement of incision lines where possible in pre-existing rhytids or scars. The distance from the base to the apex of the inverted triangular-shaped flap should be two to three times the vertical height of the defect to ensure recruitment of a broad, laterally based frontalis pedicle.

Background Medium- to large-sized surgical defects of the forehead and frontal scalp provide a challenge for the reconstructive surgeon.

Objectives To highlight the utility of a frontalis-based island pedicle flap (FIPF) for the single-stage, aesthetic reconstruction of such defects.

Methods The design and detailed surgical technique required for a FIPF are described.

Results The long-term results are illustrated.

Conclusions FIPFs, despite significant tissue dissection, are readily performed under local anaesthesia and are well tolerated by patients. The FIPF adds to the dermatological surgeon's armamentarium in the reconstruction of large defects of the central forehead and frontal scalp.

A full-thickness incision is performed along the medial edge of the flap down to the periosteum (Fig. 1b). Along the lateral border of the flap, however, the incision is just down to subcutaneous fat (Fig. 1b,d). From this precise lateral incision, tissue dissection occurs in a subcutaneous plane laterally up to the level of the temporal ridge. Medially, tissue dissection occurs 'underneath' the inverted triangular-shaped island pedicle (Fig. 1c) in a subgaleal plane, and also extends laterally to the temporal ridge. Consequently, following this bilevel dissection, a frontalis pedicle is created. Meticulous tissue dissection is paramount to ensure the lateral vascular supply of the flap (the frontal branch of the superficial temporal artery) is preserved.

A full-thickness incision approximately half way along the eyebrow edge of the frontalis, initiated medially at the glabellar and directed laterally towards the temple (dotted line Fig. 1d) is then made and the supratrochlear and supraorbital vessels identified and ligated. Following this 'releasing incision' (which is kept as short as possible), the flap is able to swing freely without tension into the primary defect (Fig. 1e). The flap is then inset into the defect (Fig. 1f) using absorbable 5/0 monofilament buried vertical mattress sutures and 6/0 polypropylene (Prolene[®], Ethicon, Inc., Somerville, NJ, USA)

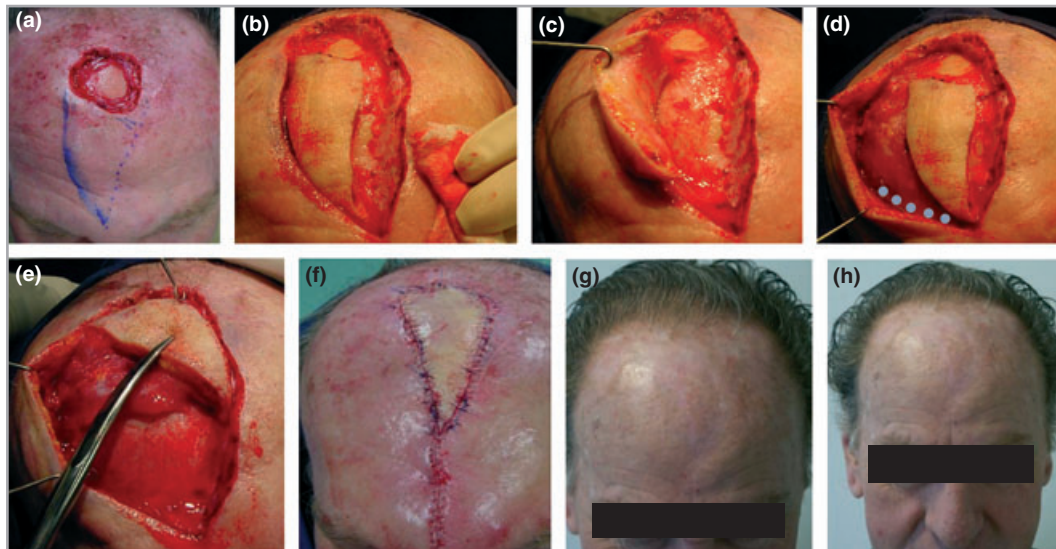


Fig 1. (a) A 3.5×3.8 cm full-thickness defect with exposed outer table on the right upper central forehead. An island pedicle flap is designed inferiorly as shown. The medial dotted incision line overlies an old traumatic scar. (b) The flap is incised. Laterally the incision is only down to the subcutis, ensuring the underlying frontalis muscle is preserved. Medially however, the incision is full thickness down to the periosteum. (c) Medially, tissue dissection extends to the lateral temporal ridge, in a subgaleal plane 'under' the inverted triangular-shaped flap. (d) Laterally, dissection also extends to the lateral temporal ridge, in a subcutaneous plane, above the underlying frontalis muscle. Following this bilvel dissection, a horizontal releasing incision is then made along the eyebrow portion of the frontalis (dotted-line). (e) This 'releasing incision' enables the flap to move without tension into the primary defect. (f) Immediately at closure. (g, h) Three-month follow-up.

surface sutures to be removed in 6 days. A nonadherent pressure dressing is applied for 48 h or longer if the patient is on antiplatelet or anticoagulant medication.

Results

We routinely review patients at the time of pressure dressing and suture removal, and again at 4 and 12 weeks. Long-term follow-up results are depicted in Figure 1(g,h).

Discussion

Given the aesthetic importance of the central face, large defects of the central forehead provide a reconstructive challenge for the dermatological surgeon. Full- or partial-thickness skin grafts in this location generally yield poor aesthetic results and are not cosmetically desirable. Furthermore, when the outer table is exposed, the avascularity of exposed bone does not lend itself to supporting a skin graft placed directly on it.¹ Even if a vascularized wound bed is created (for example via a muscular/galeal hinge flap^{2,3} or cortical bone fenestration⁴ with delayed grafting), the overall result remains suboptimal aesthetically when compared with a local flap which recruits neighbouring skin of a similar quality to the defect site.

A FIPF may be based laterally or inferiorly taking into account factors mentioned previously (defect orientation, tissue laxity, etc.). Our patient had very little tissue laxity laterally and thus an inferiorly designed FIPF was chosen (i.e. a laterally based myocutaneous pedicle enables vertical flap move-

ment). Additionally, the medial incision line of the FIPF was designed to fall precisely within an old traumatic forehead scar, thus concealing scar lines as best as possible.

Our method differs from that proposed in the plastic surgery literature,⁵ in that a further incision along the anterior hairline portion of the frontalis is unnecessary to facilitate the flap's tension-free movement superiorly. Furthermore, any postoperative morbidity, for example paraesthesia associated with the flap, is minimized by keeping the incisions through the frontalis to a minimum.

The exact same principles of the FIPF may be applied when reconstructing a vertically oriented defect where lateral tissue laxity exists. Figure 2 highlights a Mohs surgical defect after extirpation of an infiltrating basal cell carcinoma on the frontal hairline. An inferiorly based FIPF is thus executed (i.e. an inferiorly based myocutaneous pedicle enables horizontal flap movement), as illustrated.

Since 2004, we have performed this flap for the repair of forehead and scalp Mohs defects in 17 patients. Although we have generally found the flap to be robust and well tolerated by patients a number of caveats are worthy of mention.

Firstly, as an inherent consequence of the design and execution of the flap, patients must be warned about the previously mentioned paraesthesia associated with this type of repair. In varying degrees this may extend from the lateral to mid-forehead as well as the frontoparietal scalp. However, universally in our experience this improves with time and has not been a source of distress to our patients who are all forewarned about it.

Secondly, the extensive tissue dissection required in performing a FIPF, although well tolerated by patients, may result

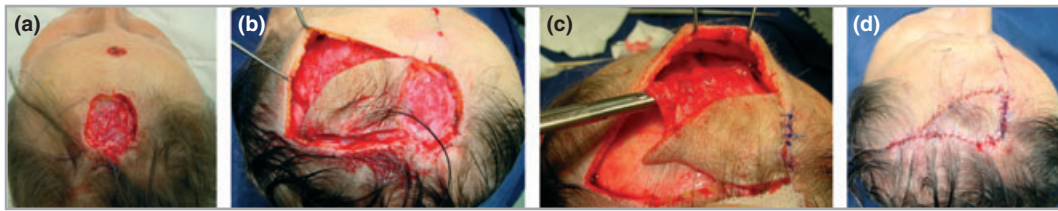


Fig 2. (a) A 4.6×3.2 cm Mohs defect after removal of an infiltrating basal cell carcinoma of the frontal hairline. A smaller Mohs defect is also present on the central forehead. (b) With a vertically oriented defect, a laterally designed FIPF is created, based on an inferior frontalis pedicle. Here, the superior limb of the incision is full thickness down to the periosteum; the inferior limb is down to subcutaneous tissue only, preserving the frontalis as shown. (c) The flap is advanced. Bilevel dissection preserves the frontalis inferiorly as shown, and creates the pedicle on which the flap relies. (d) At closure.



Fig 3. (a) A full-thickness defect after Mohs removal of a moderately differentiated squamous cell carcinoma. An inferiorly designed, laterally based FIPF is created. (b) Immediately at closure. (c) The significant tissue dissection associated with this type of reconstruction may result in transient bruising of the forehead, eyelids and mid-face. Superficial necrosis of the flap was also seen in this case following a small postoperative bleed (day 6 postoperatively). (d) Nonetheless, the postoperative result at 2 months is pleasing.

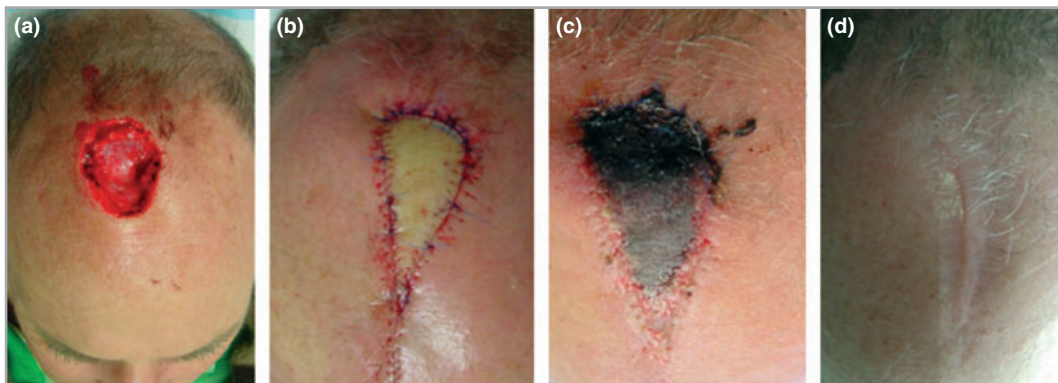


Fig 4. (a) A 4.2×3.1 cm Mohs defect following extirpation of a morphoeic basal cell carcinoma. (b) An inferiorly designed, laterally based FIPF immediately at closure. (c) Despite careful tissue dissection, significant haemorrhagic crusting seen at day 7 indicates flap ischaemia. (d) Three-month follow-up. Partial flap necrosis with subsequent healing by secondary intention has resulted in a hypertrophic scar and a suboptimal aesthetic result.

in significant albeit transient periocular and mid-face bruising (Fig. 3).

Finally, the viability of a FIPF is dependent on the aforementioned meticulous, bilevel tissue dissection to ensure a robust, well-vascularized myocutaneous pedicle. Despite this, we have seen nonconsequential superficial tissue necrosis at

the leading edge of the flap in a minority of cases. However as shown in Figure 4, occasionally (in a single case in our series), this may be significant and produce a suboptimal aesthetic result.

In conclusion, the benefits of FIPF are that it is a single-stage, local flap repair, harvesting a robust frontalis-

based myocutaneous pedicle. In our experience, despite the meticulous and significant tissue dissection required, it is well tolerated by patients under local anaesthesia and can produce excellent aesthetic results.

What's already known about this topic?

- The repair of large defects of the forehead and frontal scalp present a challenge for the reconstructive surgeon.
- The use of skin grafts in such a location often yields sub-optimal aesthetic results and may not be feasible if underlying calvarium is exposed.
- A variety of local flaps may be performed to close such defects.

What does this study add?

- We highlight the design and execution of frontalis-based island pedicle flaps (FIPF) for the single-stage, aesthetic repair of large defects of the forehead and frontal scalp.

- Such flaps, despite significant tissue dissection, are readily performed under local anaesthesia and are well tolerated by patients.
- The FIPF adds to the dermatological surgeon's armamentarium in the reconstruction of large defects of the central forehead and frontal scalp.

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