DEEP PLANE CERVICOFACIAL FLAP: A USEFUL AND VERSATILE TECHNIQUE IN HEAD AND NECK SURGERY

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Abstract: Background. Large oncosurgical defects of the cheek present a challenging reconstructive problem, especially when skin resections are combined with other procedures such as parotidectomy and/or neck dissection.

Methods. We present our experience with the deep plane cervicofacial flap (DPCFF) for reconstructing zone 1 \((n = 7)\), zone 2 \((n = 6)\), and zone 3 \((n = 5)\) cheek defects resulting from excision of primary cutaneous malignancies \((n = 13)\) and metastatic parotid \((n = 6)\) and/or neck \((n = 4)\) disease with skin involvement. The patients were between 65 and 88 years of age (mean, 76.7 years). The design of the flap was determined by the location of the defect and the need for simultaneous parotidectomy and/or neck dissection. Sixteen flaps were anteriorly based, whereas two were posteriorly based.

Results. Twelve patients underwent simultaneous parotidectomy \((n = 11)\) and/or neck dissection \((n = 10)\) and/or facial reanimation procedures \((n = 6)\). The size of the cutaneous defects ranged from 4 \(\times\) 4 to 10 \(\times\) 10 (mean, 5.6 \(\times\) 5.3) cm. Eight patients received postoperative adjuvant radiotherapy to the primary site and/or parotid bed and neck. Superficial marginal flap necrosis occurred in one of the three patients who received definitive radiotherapy before salvage surgery and repair with DPCFF. Other complications included one hematoma, one ectropion, and one retraction of the lower eyelid. Apart from mild facial contour deficiency in two patients, excellent functional and cosmetic outcome with good skin color and texture match were achieved in all patients.

Conclusions. The DPCFF is a versatile reconstructive technique in head and neck surgery. It provides a simple solution for a variety of cheek defects as an excellent alternative to regional or free tissue transfer. It can be used when simultaneous parotidectomy and/or neck dissection and/or facial reanimation procedures are required. This composite musculo-fasciocutaneous unit is reliable with excellent vascularity, because it has an axial blood supply. Division of the facial suspensory ligaments during elevation of the flap in the sub-superficial musculo-aponeurotic system (SMAS) plane increases the mobility of this flap, which facilitates transfer. © 2005 Wiley Periodicals, Inc. Head Neck 28: 46–55, 2006

Keywords: deep plane; cervicofacial flap; SMAS; cheek defects; reconstruction

Since its first description by Mustarde,¹ the cheek advancement-rotation flap has been widely used for reconstructing cheek defects. However, when this flap is raised in a subcutaneous plane in its original description or one of the several modifications,² the flap includes a random pattern blood supply and hence the need to maintain a wide pedicle, which reduces its mobility. Consequently, the flap is often sutured under tension, and thus it is not uncommonly associated with

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distal edge necrosis, especially in smokers or if the skin has been irradiated. The deep plane cervicofacial flap (DPCFF), first described by Barton and Zilmer and popularized by Kroll et al., represents a significant modification of the original technique. Based on the superficial musculoaponeurotic system (SMAS) deep plane facelift technique, this flap has several advantages over the traditional cheek flap.

The SMAS is a superficial investing layer in the head and neck area, first described by Mitz and Peyronie. It is a distinct musculoaponeurotic layer that lies deep to the subcutaneous fatty tissue of the face, lies superficial to the parotid fascia, and is in continuity with the platysma muscle. The muscles of facial expression are considered part of the SMAS layer, with the facial nerve branches supplying these muscles lying deep to the SMAS.

The DPCFF, which includes the SMAS, is a musculo-fascio-cutaneous flap with an axial blood supply. An anteriorly based flap derives its blood supply from the submental and perforating branches of the facial vessels (Figures 1–3), whereas a posteriorly based flap is supplied by perforating branches of the superficial temporal vessels (Figure 4).

We present our experience with the DPCFF in 18 consecutive patients undergoing head and neck surgery. Representative cases with various sizes and types of skin defects at different locations with or without simultaneous parotidectomy and/or neck dissection and/or facial reanimation procedures are presented to illustrate the indications, our surgical planning and technical refinements, execution, and operative nuances of this technique.

PATIENTS AND METHODS

Patients. Eighteen consecutive patients undergoing repair of a variety of defects in the cheek with the DPCFF were included in this study. There were 11 male and seven female patients with a mean age of 76.7 years (range, 65–88 years). The defects were categorized into zone 1 (suborbital), zone 2 (preauricular), and zone 3 (buccocondylar). The patients were followed up for an average of 21.1 months (range, 6–55 months).

Flap Design. The cheek defects were categorized according to the classification proposed by Zide. The excision margins are outlined, and the DPCFF is designed incorporating the parotidectomy and/or neck dissection incisions as required. For reconstruction of zone 1 defects, the flap can be based either anteriorly (Figure 1) or posteriorly (Figure 4). However, if simultaneous parotidectomy and/or neck dissection is planned, an anteriorly based flap must be used (Figure 1). For zone 2 (Figure 2) and zone 3 (Figure 3) defects, an anteriorly based flap is chosen, particularly if simultaneous parotidectomy and/or neck dissection is required.

Reconstruction with DPCFF involves transfer of excess skin in the neck and jowl to repair the cheek defect by an advancement-rotation (Figures 1, 2, and 4) or a transposition (Figure 3) principle. The design commonly incorporates a V-shape incision in the neck centered on the vertical limb of a triradiate neck dissection incision (Figures 1 and 3). The width of the base of the V incision is determined by pinching its two limbs together. The donor site is closed directly (Figures 1 and 3), with a Z-plasty (Figures 2 and 4) or in a V-Y fashion.

If an anteriorly based flap is used for reconstructing zone 1 defects, particularly when the excision defect extends to include the lower eyelid (Figure 1), the flap is designed with a high lateral arch over the temple so that it can be suspended higher than the lateral canthus. In addition, the flap is sutured at its deep aspect to the periosteum of the lateral orbital rim to prevent ectropion of the lower eyelid.

Flap Dissection. For an anteriorly based DPCFF (Figure 1), the preauricular dissection is carried out initially in the subcutaneous plane anteriorly for 1 cm from whence the dissection is deepened to a plane just deep to the SMAS. The flap is thus raised in the sub-SMAS plane toward the skin defect in a manner similar to the deep plane facelift. Similarly, the dissection of the flap is carried out deep to the platysma in the neck, and the marginal branch of the facial nerve is identified and protected. To prevent injury to the frontal branch of the facial nerve, dissection proceeds superiorly in the plane just superficial to the superficial temporoparietal fascia from the level 1 cm below the zygomatic arch. As the flap is elevated, the facial suspensory ligaments are divided, which increases its mobility markedly, thus facilitating transfer. The dissection is continued as far anteriorly as necessary over the zygomaticus muscles, which lie superficial to the facial nerve branches. Elevation of the DPCFF
thus allows exposure of the parotid gland and the neck structures in preparation for parotidectomy and/or neck dissection if these are planned (Figures 1–3).

A posteriorly based flap (Figure 4) is raised initially in the subcutaneous plane following the incision along the nasolabial crease, which is extended to the upper neck. The dissection is deepened to a plane just superficial to the facial muscles as the dissection proceeds posteriorly and away from the excision defect. As for the anteriorly based flap in the upper neck, the dissection plane is just deep to the platysma.

Case Reports.

Patient 1. An 84-year-old woman (Table 1) was initially seen with a 6- × 6-cm subcutaneous...
lesion on the right cheek that had grown over 18 months. The lesion was adherent to the overlying skin but was mobile over the underlying maxilla (Figure 1A). There was a 3-cm ipsilateral parotid swelling. The facial nerve was functioning, although there was senile ectropion of the lower eyelid. CT and MRI scanning confirmed the lesion in the cheek and a 3-cm and a 1.6-cm metastasis in the superficial lobe of the ipsilateral parotid without cervical lymphadenopathy. Fine-needle aspiration cytology revealed spindle cell carcinoma. The patient underwent excision of the cheek tumor with a 2-cm skin margin, including the skin of the lower eyelid and the periosteum of the underlying maxilla, a superficial parotidectomy, and supramohyoid neck dissection. Intraoperative frozen sections showed clear excision margins. A biopsy showed tumor involvement of the thickened zygomatic branch of the facial nerve, which was sacrificed up to its junction with the buccal branch. Biopsy of the infraorbital nerve showed no tumor involvement. The large

FIGURE 2. A patient with local recurrence after ear amputation and postoperative adjuvant radiotherapy for a squamous cell carcinoma of the right ear (A). Re-excision was performed in continuity with a superficial parotidectomy and sacrifice of the frontal branch of the facial nerve (B). The zone 2 cheek defect was repaired with an anteriorly based deep plane cervicofacial flap incorporating the parotidectomy incision. The broken line marked the position of the nasolabial crease. The flap was supplied by the perforating branches of the facial vessels (depicted as *). The donor site in the neck was closed with a Z-plasty. The “dog-ear” over the malar prominence was excised horizontally to avoid vascular compromise to the flap (C to E). Results 9 months postoperatively (F).
zone 1 cheek defect was repaired with an anteriorly based DPCFF flap that was designed to incorporate the incisions for parotidectomy and neck dissection (Figure 1A). The excess skin in the neck and jowl was transferred to the cheek defect by taking a V-shape flap centered along the vertical limb of the triradiate neck dissection incision. The flap was raised in the sub-SMAS plane and the narrow pedicle of this flap included the submental and perforating branches of the facial artery (Figure 1B, C). The flap was designed with an upward curve over the temporal region above the level of the lateral canthus, and the flap was suspended to the periosteum of the lateral orbital margin to avoid ectropion of the lower eyelid. A 1-g gold weight was inserted into the upper eyelid, and a lateral tarsorrhaphy was performed for corneal protection. The histologic findings confirmed spindle cell carcinoma and complete surgical excision. The patient underwent postoperative adjuvant radiotherapy to the primary site and parotid bed. There was marked soft tissue swelling during radiotherapy, and she had lower lid ectropion developed, which was corrected with a conchal cartilage graft and a Tripier flap to the lower eyelid 9 months postoperatively with satisfactory results (Figure 1D).

Patient 6. A 74-year-old man (Table 1) was initially seen with local recurrence after ear amputation and postoperative adjuvant radiotherapy for a neurotrophic squamous cell carcinoma of the right ear with widespread perineural and lymphatic infiltration. Re-excision was performed with a 2-cm skin margin (Figure 2A) down to include the deep temporoparietal fascia and periosteum of the zygomatic arch in continuity with a superficial parotidectomy with sacrifice of the frontal branch of the facial nerve (Figure 2B). The zone 2 cheek defect was repaired with an anteriorly based DPCFF incorporating the parotidectomy incision. The flap was supplied by perforating branches of the facial vessels. The donor site in the neck was closed with a Z-plasty. The “dog-ear” over the malar prominence was excised horizontally to avoid vascular compromise to the flap (Figure 2C–E). Despite a clear excision margin, the patient had a local and neck recurrence within 10 months requiring further salvage surgery but died from the disease 17 months later.

Patient 9. An 80-year-old man (Table 1) who previously underwent excision and radiotherapy for multiple cutaneous malignancies, including a squamous cell carcinoma of the right temple, was seen with neck and parotid metastasis. An extended modified radical neck dissection including a superficial parotidectomy and excision of the involved skin was performed. The 8- × 5-cm zone 3 cheek and adjacent upper neck defect was repaired with DPCFF with a V-shape flap in the neck centered along the vertical limb of the triradiate neck dissection (Figure 3A).
The flap, which was supplied by submental and perforating branches of the facial vessels, was transferred as a transposition flap, and the donor site was closed directly (Figure 3B). The patient underwent adjuvant postoperative radiotherapy (Figure 3C).

**Patient 17.** A 76-year-old woman (Table 1) was initially seen with a 4- × 4-cm melanoma in situ in the right cheek (Figure 4A). The lesion was excised with a 5-mm margin, and the resultant zone 1 cheek defect was reconstructed with a posteriorly based DPCFF (Figure 4B). The flap, which derived its blood supply from perforating branches of the superficial temporal vessels (Figures 4B), was raised and transferred to the defect (Figure 4C) and the donor site closed with a Z-plasty (Figure 4D–F).

**RESULTS**

The defects in zone 1 (n = 7), zone 2 (n = 6), and zone 3 (n = 5) of the cheek resulted from excision of primary cutaneous malignancies (n = 13) and metastatic parotid (n = 6) and/or neck (n = 4) disease with skin involvement. Histologic diagnosis included squamous cell carcinoma (n = 12), invasive melanoma (n = 3), melanoma in situ (n = 2), and spindle cell carcinoma (n = 1) (Table 1).

**FIGURE 4.** A 76-year-old woman with a melanoma in situ in the right cheek underwent excision; the resultant zone 1 cheek defect was reconstructed with a posteriorly based deep plane cervicofacial flap. The blood supply was derived from perforating branches of the superficial temporal vessels (depicted as *) (A and B). The flap was raised and transferred (C), and the donor site was closed with a Z-plasty (D). Result 14 months postoperatively (E and F).
**Table 1.** Eighteen consecutive patients undergoing resection and reconstruction with deep plane cervicofacial flap.

<table>
<thead>
<tr>
<th>Flap design</th>
<th>Patient</th>
<th>Age, y</th>
<th>Sex</th>
<th>Diagnosis</th>
<th>Site</th>
<th>Size, cm</th>
<th>Parotidectomy</th>
<th>Neck dissection</th>
<th>Other procedure(s)</th>
<th>Postoperative XRT*</th>
<th>Complications</th>
<th>Follow-up, mo</th>
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<tbody>
<tr>
<td>Anteriorly based flap</td>
<td>1</td>
<td>84</td>
<td>F</td>
<td>Spindle cell carcinoma with parotid metastasis</td>
<td>Zone 1</td>
<td>10 × 10</td>
<td>Superficial †</td>
<td>SoHND</td>
<td>GW + tarsorrhaphy</td>
<td>+</td>
<td>Ectropion lower eyelid</td>
<td>24</td>
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<tr>
<td></td>
<td>2</td>
<td>65</td>
<td>M</td>
<td>Recurrent SCC</td>
<td>Zone 1</td>
<td>5 × 5</td>
<td>Superficial †</td>
<td>–</td>
<td>–</td>
<td>+</td>
<td>Hematoma + neck recurrence</td>
<td>23</td>
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<tr>
<td></td>
<td>3</td>
<td>86</td>
<td>F</td>
<td>SCC</td>
<td>Zone 1</td>
<td>4 × 4</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Mild eyelid retraction</td>
<td>50</td>
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<tr>
<td></td>
<td>4</td>
<td>79</td>
<td>F</td>
<td>MM (10-mm thick)</td>
<td>Zone 1</td>
<td>4 × 4</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td>50</td>
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<td></td>
<td>5</td>
<td>84</td>
<td>F</td>
<td>MM (1.2-mm thick)</td>
<td>Zone 1</td>
<td>5 × 5</td>
<td>–</td>
<td>–</td>
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<td>–</td>
<td>–</td>
<td>41</td>
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<td></td>
<td>6</td>
<td>74</td>
<td>M</td>
<td>Recurrent SCC ‡</td>
<td>Zone 2</td>
<td>6 × 6</td>
<td>Superficial §</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>27†</td>
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<tr>
<td></td>
<td>7</td>
<td>69</td>
<td>M</td>
<td>SCC</td>
<td>Zone 2</td>
<td>9 × 8</td>
<td>Superficial †</td>
<td>–</td>
<td>GW + tarsorrhaphy</td>
<td>+</td>
<td>–</td>
<td>44</td>
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<tr>
<td></td>
<td>8</td>
<td>88</td>
<td>M</td>
<td>Recurrent SCC ‡</td>
<td>Zone 2</td>
<td>6 × 6</td>
<td>Superficial †</td>
<td>SoHND</td>
<td>GW + tarsorrhaphy</td>
<td>+</td>
<td>–</td>
<td>7</td>
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<td></td>
<td>9</td>
<td>80</td>
<td>M</td>
<td>Previous excision SCC temple</td>
<td>Zone 3</td>
<td>8 × 5</td>
<td>Superficial</td>
<td>mRND</td>
<td>–</td>
<td>+</td>
<td>–</td>
<td>9</td>
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<tr>
<td></td>
<td>10</td>
<td>79</td>
<td>M</td>
<td>MM (4.3-mm thick) with level I neck metastasis</td>
<td>Zone 3</td>
<td>4 × 4</td>
<td>–</td>
<td>SoHND</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>68</td>
<td>M</td>
<td>Metastatic SCC level I neck with skin involvement</td>
<td>Zone 3</td>
<td>4 × 4</td>
<td>Superficial</td>
<td>mRND</td>
<td>–</td>
<td>+</td>
<td>–</td>
<td>24</td>
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<tr>
<td>No.</td>
<td>Age</td>
<td>Gender</td>
<td>Pathology</td>
<td>Side</td>
<td>Zone</td>
<td>Treatment</td>
<td>Details</td>
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<tr>
<td>12</td>
<td>71</td>
<td>F</td>
<td>Previous excision SCC left ear</td>
<td></td>
<td>Zone 3</td>
<td>Radical</td>
<td>SoHND, GW + tarsorrhaphy, temporalis transfer &amp; TFL, digastric transfer</td>
<td></td>
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<tr>
<td>13</td>
<td>83</td>
<td>F</td>
<td>Metastatic SCC left ear</td>
<td></td>
<td>Zone 3</td>
<td>Total**</td>
<td>mRND</td>
<td>Marginal mandibulectomy, petrosectomy, myelohyoid transfer &amp; TFL</td>
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<tr>
<td>14</td>
<td>74</td>
<td>M</td>
<td>Post-XRT recurrent SCC right preauricular region</td>
<td></td>
<td>Zone 2</td>
<td>4 x 5</td>
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<td>SoHND</td>
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<tr>
<td>15</td>
<td>80</td>
<td>M</td>
<td>Recurrent metastatic SCC left parotid**</td>
<td></td>
<td>Zone 2</td>
<td>4 x 4</td>
<td>—</td>
<td>SoHND</td>
<td></td>
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<tr>
<td>16</td>
<td>74</td>
<td>M</td>
<td>Recurrent SCC left temple with complete facial paralysis</td>
<td></td>
<td>Zone 2</td>
<td>4 x 5</td>
<td>Radical</td>
<td>SoHND</td>
<td></td>
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Posteriorly | 17  | 76  | F | MM (in situ) | Zone 1 | 5 x 5 | — | — | — | — | — | — | — |

Based flap | 18  | 67  | M | MM (in situ) | Zone 1 | 5 x 5 | — | — | — | — | — | — |

**Abbreviations:** XRT, radiation therapy; F, female; SoHND, supraomohyoid neck dissection; GW, insertion of gold weight to the upper eyelid; M, male; SCC, squamous cell carcinoma; MM, malignant melanoma; mRND, modified radical neck dissection; TFL, tensor fascia lata extension.

*Postoperative adjuvant radiotherapy to primary site and/or parotid and/or neck.
**With sacrifice of zygomatic branch.
†Previously underwent ear amputation and postoperative adjuvant radiotherapy for SCC of the ear with extensive lymphatic and perineural infiltration.
§With sacrifice of the frontal branch.
¶Developed local and neck recurrence.
‖Local recurrence after previous incomplete excision and radiotherapy for SCC.
**Prior maxillectomy for SCC of maxilla.
§§With sacrifice of the marginal mandibular branch.
††Recurrent metastatic SCC left parotid after previous superficial parotidectomy with incomplete excision margin and XRT.
The size of the defects ranged from 4 × 4 to 10 × 10 cm (mean, 5.6 × 5.3 cm). Twelve patients underwent simultaneous parotidectomy (n = 11) and/or neck dissection (n = 10). Seven of these 12 patients also had facial reanimation procedures after sacrifice of the facial nerve (or its branches) for tumor clearance.

One patient (Table 1) who was a heavy smoker had a hematoma developed after a bout of violent coughing immediately on extubation, which required formal drainage. Three patients underwent definitive radiotherapy before salvage surgery and repair with DPCFF. Superficial marginal flap necrosis occurred in one of these patients, who underwent salvage procedure for parotid recurrence after previous radical primary radiotherapy. The wound healed spontaneously over 3 weeks. Eight other patients received postoperative adjuvant radiotherapy to the primary site and/or parotid bed and neck. There was no other complication.

Clear excision margins were achieved in all patients. Eight patients received postoperative adjuvant radiotherapy for unfavorable histologic findings (including perineural and lymphatic infiltration, extracapsular nodal spread, and multiple nodal involvement) without deleterious effect to the flaps. One patient (Table 1) who had senile ectropion preoperatively ectropion of the lower lid developed. This patient had the zygomatic branch of the facial nerve sacrificed for tumor clearance for which a gold weight was inserted to the upper eyelid with lateral tarsorrhaphy in the original operation. She subsequently underwent correction of the ectropion with a Tripier flap and a conchal cartilage grafting to the lower eyelid with a satisfactory final outcome (Figure 1).

Although a mild degree of contour deficiency was noted in two patients, all patients had an excellent final functional and cosmetic result, with good skin color and texture match (Figures 1–4).

One patient (Table 1) who had previously undergone amputation of the ear and postoperative adjuvant radiotherapy for a squamous cell carcinoma with widespread perineural and lymphatic infiltration had local and neck recurrence develop with multiple subcutaneous nodules 10 months after wide excision, superficial parotidectomy, and DPCFF repair (Figure 2). This patient died from the disease 17 months after further wide local excision, neck dissection, and temporal bone resection and reconstruction with free tissue transfer and facial reanimation procedures. Another patient (Table 1) who underwent wide local excision of a recurrent squamous cell carcinoma of the cheek, superficial parotidectomy, and DPCFF repair followed by adjuvant radiotherapy required a modified radical neck dissection for cervical lymph node metastases 6 months later. He remained free of disease at 23 months.

**DISCUSSION**

Large oncosurgical defects of the cheek present a reconstructive challenge in head and neck surgery, especially when simultaneous parotidectomy and/or neck dissection is required. The DPCFF is a simple and versatile technique for repair of such defects and is an excellent alternative to regional17,18 or free tissue transfer.19 Apart from being a simpler technique than regional or free flaps, the DCFFF provides tissue with excellent color and texture match. There are several advantages with the DPCFF over the conventional cheek advancement-rotation flap that is raised in a subcutaneous plane and has a random pattern blood supply and hence the need to maintain a wide pedicle, which reduces its mobility. Elevating the flap in the sub-SMAS plane provides a thicker flap allowing an improved contour. The inclusion of the perforating branches of the facial or superficial temporal vessels converts a random pattern flap into an axial musculo-fascio-cutaneous flap, thus reducing the width of the pedicle without compromising its vascularity. This, together with the division of the facial suspensory ligaments,16 results in an improved mobility of the flap and thus increases the ease of transfer and reduces the likelihood of the flap being sutured under tension. The increased reliability of the DPCFF is particularly desirable in smokers and diabetics and when salvage surgery is required after radiotherapy.

This report, to the best of our knowledge, represents the largest published series of DPCFF. Our design of the DPCFF adds significant refinements to its previous descriptions. We emphasise transfer of the excess skin in the neck and jowl area to the defect in the cheek by rotation-advancement or transposition principles and closing the defect either directly (along the vertical limb of the tri-radiate neck dissection incisions) or by incorporating a V-Y closure or a Z-plasty in the neck. This enables skin closure in the donor site of the flap without undue tension on the wound.

In reconstructing zone 1 defects of the cheek, it is important to design the flap with an upward curve over the temporal region and suspend the flap to the periosteum of the lateral orbital rim.
This is mandatory to negate the effect of gravity and avoid the development of ectropion. A combined lower lid and zone 1 cheek defect can be reconstructed with a DPCFF flap, although an additional Tripier flap\(^20\) may be used, especially if total lower eyelid reconstruction is needed. In addition, if the lower eyelid is lax, a lid-tightening procedure such as a Kuhnt-Szymanowski procedure or a lateral canthopexy\(^21,22\) should be performed to prevent ectropion, which occurred in one of our patients.

The aims of head and neck surgery are locoregional control, preservation of quality of life, and long-term survival.\(^23\) In cases in which sacrifice of the facial nerve or its branches is needed for tumor clearance, immediate facial reanimation procedures should be performed\(^23\) as illustrated in this report.

**Acknowledgment.** We thank our radiation oncology colleagues from Palmerston North Hospital for their contribution to the management of some of the patients presented in this article.

**REFERENCES**