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CERVICOFACIAL FLAPS IN HEAD AND NECK RECONSTRUCTION

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Despite the advent of vascularised free tissue transfer flaps, cervicofacial flaps remain a “workhorse” for reconstruction of large cheek defects, especially in regions where economic or infrastructural facilities limit the use of free tissue transfer flaps.

First described by *Esser* in 1918, the cervicofacial flap was subsequently described in its modern form by *Juri and Juri* in 1979¹. It is a random flap comprising skin, subcutaneous fat, superficial neck veins, and platysma muscle. It includes the delicate superficial cervical fascia just deep to skin that envelops the platysma and muscles of facial expression and extends from the episcanium above to the axilla and upper chest below; over the face it is represented by the superficial musculoaponeurotic system (SMAS).

The cervicofacial flap has a wide pedicle and can be employed to cover large anterolateral craniofacial defects. Superiorly it can reach the supraorbital margin, laterally the postauricular area, and medially up to the midline.

The cervicofacial flap provides an excellent colour match as well as thickness and texture, can be performed under local anaesthesia, and provides concomitant exposure for neck dissection and parotidectomy, has very acceptable donor site scars, scars are camouflaged in the cheek borders, and it requires minimal surgical time and has minimal postoperative morbidity.

As it is a thin flap, additional bulk may be provided with a pectoralis major muscle flap placed deep to the cervicofacial flap. It may also be an option for patients not suitable for free tissue transfer flaps *e.g.* elderly or medically unfit patients who cannot tolerate prolonged operations.

Indications

- Superficial defects of up to 14 x 10cms
- All zones of the cheek, external ear
- Temporo-frontal and brow defects
- Orbital exenteration defects
- To provide skin cover in combination with muscle flaps *e.g.* [pectoralis major](#) and [temporalis](#) flaps

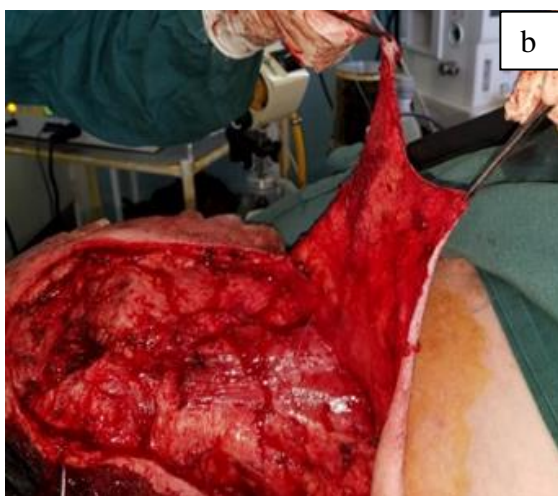
Contraindications

- Poor skin laxity
- Active wound infection
- Smoking: stop 2 weeks pre- and 1 week postoperatively
- Previous radiation to surgical site
- High risk of keloid
- Through-and-through defects particularly when the following structures are missing: masseter, mandible, maxilla and temporalis muscle

Advantages

- Technically simple
- Reliable, with low failure rate *i.e.* “very forgiving” even with inexperienced surgeons
- Single team approach
- Shorter anaesthetic and surgical time than for free flaps with cost-saving and favoring unfit patients
- Can be performed under local anaesthesia
- No postoperative ICU monitoring required
- Single-stage procedure
- Few perioperative complications and morbidity
- Versatile with multiple applications
- Proximity to the defect
- Good arc of rotation
- Covers defects up to 14 x10cms

- Excellent colour and texture match with facial skin
- Camouflage scars in the cheek borders (inconspicuous and follows borders of facial subunits)
- Reduced costs: short operating time and hospital stay
- Simultaneous exposure for parotidectomy and neck dissection (*Figure 1*)



Figures 1 a & b: demonstrate excellent exposure of cervicofacial flap for parotidectomy and neck dissection; Figure c: shows immediate postoperative view of cervicofacial flap for patient in image 1b

Relevant Anatomy

The cervicofacial flap is divided into 2 portions, the facial (cheek) and the cervical portions. The cheek is a laminated structure (*Figure 2*) composed superficial-to-deep of:

1. Epidermis
2. Dermis
3. Subcutaneous tissue
4. Superficial muscular aponeurotic system (SMAS)

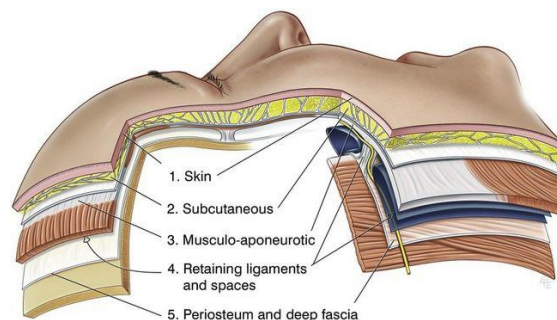


Figure 2: Layers of facial / cheek portion ([Pinterest](#))

Immediately deep to the SMAS are branches of the facial nerve, the parotid gland, the buccal fat pad, and the mandible inferiorly. The branches of the facial nerve are protected beneath the SMAS in most locations. Thus, a surgeon who prefers to dissect beneath the SMAS layer must be familiar with facial nerve anatomy.

Identifying the borders of the cheek with other facial subunits is essential to camouflage the scar lines, including the infra-orbital rim, nasolabial fold, preauricular crease, and inferior mandibular margin.

The SMAS was first described by *Mitz and Peyronie* in 1976². It encloses the platysma, risorius, triangularis, auricularis, occipitalis, and frontalis muscles. The SMAS is connected to the dermis by fibrous septae allowing movement of the skin for facial expression. It is confluent with the galea layer of the scalp and with the temporoparietal fascia in the temporal region. In the neck, the SMAS continues as the superficial cervical fascia. The surgical importance of the SMAS lies in its relationship with the facial nerve. The facial nerve branches are found deep to the fascia, whereas the sensory supply to the face is located superficial to it.

The vascularity of the SMAS has been debated for many years. Although anatomic studies report that the SMAS is an avascular layer, there is clinical evidence suggesting otherwise. *Schaverien*³ used sequential dyeing and 3-dimensional computed tomographic angiography and venography on 24 hemifaces². They reported that the SMAS is perfused by the transverse facial artery perforator branches on their route to the subdermal plexus. This finding is supported by the observation that skin necrosis is more frequently encountered in subcutaneous face-lifts where the SMAS is not included in the flap.

Arterial supply

The blood supply of the cervicofacial flap can be divided into **2 portions i.e. facial and cervical**.

The **facial portion** of the cervicofacial flap is generally dissected in a subcutaneous plane. The flap receives its blood supply via the subdermal plexus in a random pattern from the facial artery, transverse facial artery and the superficial temporal artery via its orbito-zygomatic branch. A modification of the facial portion of the flap is to incorporate the SMAS as proposed by *Kroll*⁴ to enhance the vascularity by providing the flap with an axial blood supply via perforators from the transverse facial artery.

The **cervical portion** of the flap, on the other hand, is dissected in a subplatysmal plane. By doing so, the platysma provides blood supply to this region. The platysma, as described by *Hurwitz*⁵, is supplied by the occipital and postauricular arteries posteriorly, the submental artery superiorly and medially, the superior thyroid artery centrally, and the transverse cervical artery inferiorly (*Figure 3*). However, during flap elevation, only the perforators from the submental artery are preserved.

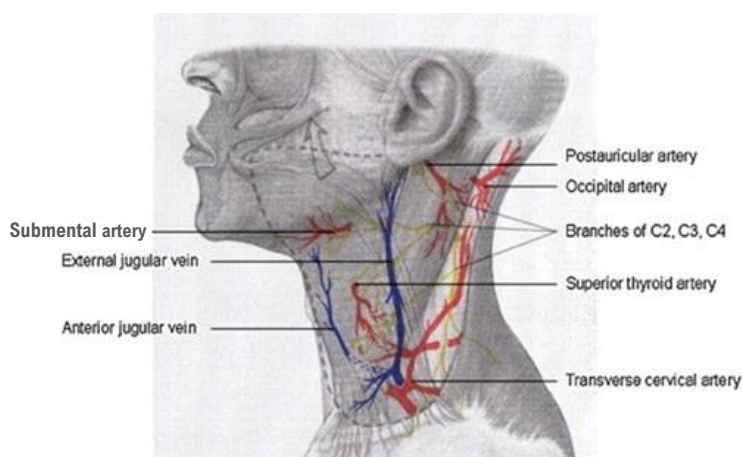


Figure 3: Neurovascular supply

Venous drainage

Both the facial and cervical portions have a venous system that accompanies the arteries. The venous drainage is however mainly by the external jugular vein and randomised dermal venous drainage (*Figure 3*). Including the external jugular vein in the flap helps to reduce venous congestion and the risk of flap necrosis.

Innervation

Sensory innervation is provided by branches of the greater auricular (C2-C3) and lesser occipital (C2) nerves. Careful dissection reduces the risk of sensory loss; patients should be informed of this potential consequence.

Flap elevation

- The patient is placed in a supine position with the head turned to the opposite side and with a head ring to stabilise the head and shoulder roll to extend the neck
- Inject local anaesthetic mixed with adrenaline in the subcutaneous plane
- Defects less than 3 x 3cm can be closed under local anaesthesia. Though supra-SMAS dissection can easily be performed under local anaesthesia, subplatysmal dissection is difficult to perform under local anaesthesia because of risk of bleeding and patient discomfort
- An attempt to camouflage postoperative scars is made by placing incisions along the various grooves, facial subunits and shadows in the head and neck region
- The incisions generally follow an imaginary line drawn along the following landmarks (*Figure 4*)
 - Nasolabial fold
 - Infraorbital, subciliary or subtarsal
 - Zygomatic arch/hairline
 - Preauricular crease
 - Retroauricular / posterior hair line

- Lateral border of trapezius
- A modification includes extension along deltopectoral groove

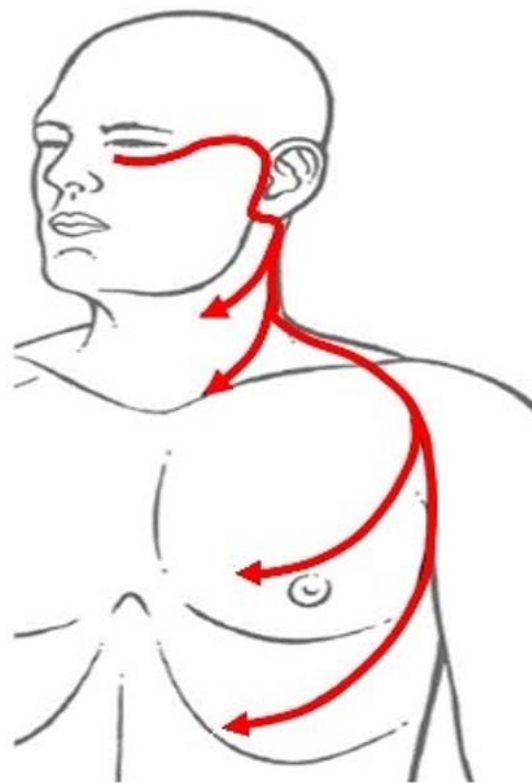


Figure 4: Incisions for cervicofacial flap

- The flap components depend on the anatomical location
 - ***Superior to zygomatic arch:*** skin and subcutaneous tissue
 - ***Inferior to zygomatic arch:*** skin, subcutaneous tissue, and SMAS
 - ***Cervical portion:*** platysma and skin. The importance of including platysma in the cervical portion of the flap has been demonstrated by *Hakim* ⁶

Reconstruction

Roth ⁷ divided the cheek into Zones to help determine the method of cheek reconstruction (*Figure 5*)

- Zone 1: Infraorbital and lower eyelids
- Zone 2: Preauricular and parotid
- Zone 3: Chin and antero-inferior cheek



Figure 5: Cheek zones as described by Roth⁷. Cabrera and Zide⁸ have a similar classification

The versatility of the cervicofacial flap is demonstrated by its ability to close defects in all three zones.

Zone 1 presents a unique challenge because of its proximity to nearby vital structures. Inappropriate flap selection in Zone 1 reconstruction can cause ectropion and hence significant aesthetic and functional problems. **Zones 2 and 3** provide the best opportunity for direct closure, especially in elderly patients. **Zone 2** is reconstructed mainly with the cervical (platysmal) portion of the cervicofacial flap (Figures 8,10, 12). The flap design for Zone 2 is also known as the *Mustarde flap* (Figures 6 and 7).

Examples of Zone 1 defect repairs

Case 1: Complete excision of lower eyelid for basal cell carcinoma and use of a cervicofacial flap to reconstruct cutaneous portion of lower eyelid (Figure 6)





Figure 6: (A) Complete excision of lower eyelid in a patient with BCC; (B) Harvesting of labial mucosa to recreate conjunctiva; (C) Nasal septal cartilage used to recreate tarsal plate; (D) Cervicofacial flap to reconstruct cutaneous portion of lower eyelid; (E) Tarsorrhaphy to reduce risk of ectropion

Case 2: Excision of SCC lower eyelid and infraorbital region and reconstruction with cervicofacial flap (Figure 6)



Figure 7: Excision of SCC of lower eyelid and infraorbital region with reconstruction with cervicofacial flap

Example of Zone 2 defect repair: 10cm Zone 2 defect reconstructed with a cervicofacial flap. The underlying deep temporal fascia has been preserved. This demonstrates how the flap can be used for closure of temporal defects particularly when the ear has been sacrificed (*Figure 8*)



Figure 8: 10cm Zone 2 defect reconstructed with a cervicofacial flap

Modifications of Cervicofacial Flaps

Cervicothoracic flap: Inferior extension of over chest wall

The modern cervicofacial flap has facial and cervical portions; however, when a **greater arc of rotation is needed, a pectoral extension can be used.**

The cervicothoracic flap was first described by Conley⁹ in 1960, and later by Garrett¹⁰ in 1966 (Figure 9). In addition to the blood supply to the cervicofacial flap, the cervicothoracic flap also receives blood supply via perforators from the internal mammary artery. To preserve the internal mammary perforators, the medial extent of the flap Elevation **should not extend beyond 2cm from the lateral sternal border.**

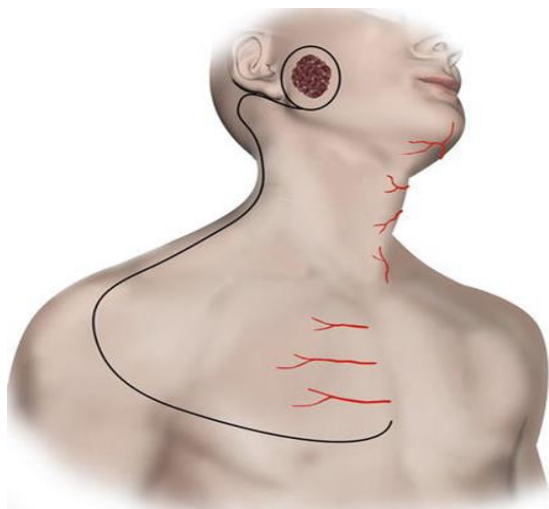


Figure 9: Cervicothoracic flap design, a modification of the cervicofacial flap that includes the deltopectoral flap¹⁰

The facial and cervical portions of the flap are raised in a similar manner to the conventional cervicofacial flap, with the pectoral portion raised in a subcutaneous plane. The cervicothoracic flap can be extended inferiorly to the costal margin, but it is generally recommended not to extend the flap beyond the nipple.

When comparing outcomes of the cervicothoracic and the conventional cervicofacial flap, Moore¹¹ and Liu¹² reported similar complication rates for the two flaps.

Example of Zone 2 and 3 defect repair:

Cervicothoracic flap used for 16 x 10cm Zone 2/3 defect (Figure 10)





Subcutaneous vs. sub-SMAS dissection in facial portion of flap

The dissection plane in the facial portion of the flap can be either in subcutaneous or sub-SMAS levels. The incorporation of the SMAS can theoretically change the blood supply of the flap from a random to an axial pattern via perforators from the transverse facial artery.



Figure 10: 16 x 10cm Zone 2/3 defect closed with cervicothoracic flap. The anterior re-lease incision (green arrow) greatly in-creases flap coverage by combining advan-cement and rotational movements. The orange arrow show distal tip necrosis healing by secondary intension

This benefit was first advocated by *Barton and Zilmer* at the *American Society of Plastic and Reconstructive Surgery* meeting in 1982 and later published by *Kroll*⁴ in 1994. However, this theoretical benefit was challenged in *Whetzel and Stevenson's*¹³ cadaver study, in which they found no difference in blood supply based on ink-injection patterns between the two skin flaps. *Jacono*¹⁴ conducted a retrospective clinical study to compare these 2 techniques, and reported no difference in skin necrosis, except in patients with a history of tobacco smoking. Moreover, dissection beneath the SMAS layer likely increases the risk of injuring the facial nerve. The intimacy of the nerve to the SMAS and the relatively high success rate of the subcutaneous dissection techni-

que has many surgeons questioning the value of incorporating the SMAS.

Anterior release incision and posteriorly based cervicofacial flap

The flap can be based posteriorly. *Boyette and Vural*¹⁵ advocated use of the reverse flap for superomedial cheek defects in which the horizontal axis is greater than the vertical (*Figure 11*). They described its use in 6 cases with a mean flap size of 6 x 4.9 cm and reported no flap failures; 3 patients had ectropion not requiring surgical intervention. The investigators opine that a reverse cervicofacial flap for horizontally oriented defects helps to decrease flap tension and minimises excessive skin excision for standing cone deformities.

It is the 1st author's (W.M.) experience that combining the anteriorly based cervicofacial flap with an anterior release incision greatly increases the arc of rotation and permits closure of bigger defects of up to 16 x 10cms. This is however associated with a higher incidence of distal flap necrosis as the submental artery is usually sacrificed in the process. Distal flap necrosis has however not been a concern as the wounds eventually heal by secondary intention (*Figures 10, 11,12*).

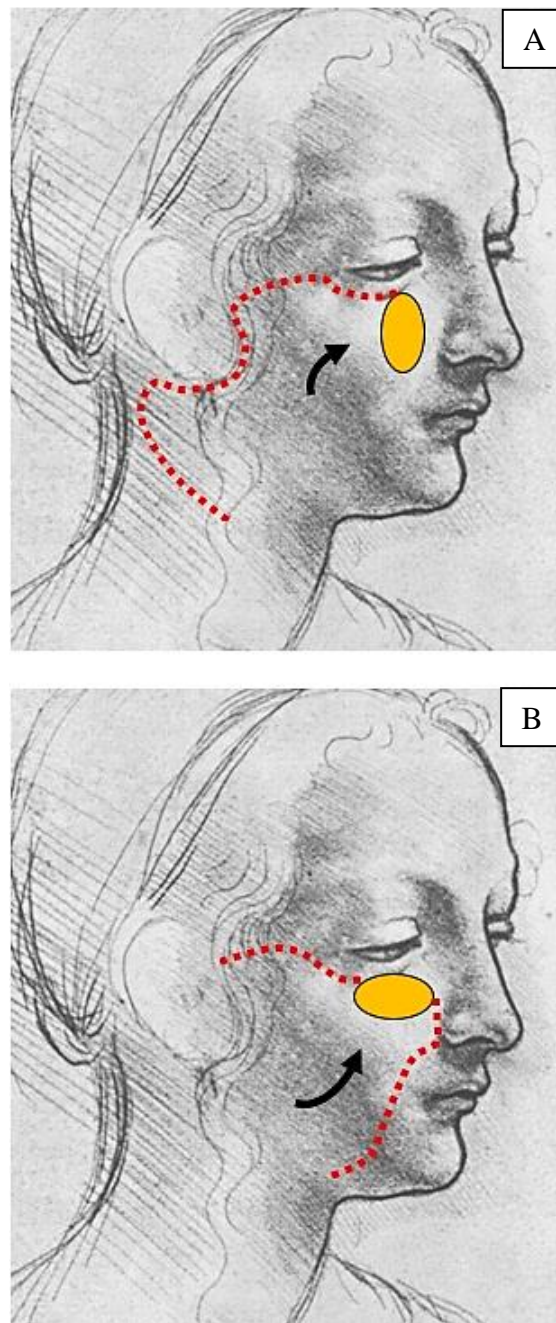


Figure 11: (A) illustrates the typical anteriorly based cervicofacial flap; note the vertical orientation of the infraorbital defect. (B) shows a reverse/posteriorly based cervicofacial flap; note the horizontal orientation of the infraorbital defect. The incision for the reverse cervicofacial flap follows the nasolabial groove

Example of Zone 2/3 defect repaired combining a conventional cervicofacial flap and anterior release incision (Figure 12)



Figure 12: Large squamous cell carcinoma closed by modified cervicofacial flap, combining a conventional cervicofacial flap and an anterior release incision

Combination cervicofacial flap with other flaps for complex defects

Cervicofacial flaps generally do not provide much bulk. For deeper defects, additional bulk can be achieved by placing a free fat

graft or a muscle flap e.g. [temporalis](#) or [pectoralis major](#), deep to the flap. For complex reconstructions, a cervicofacial flap may also be used in combination with free flaps e.g. [free fibula](#), [anterolateral thigh](#) or [radial forearm](#) flaps.

Tissue expansion

Prior tissue expansion can be employed to increase the size of a cervicofacial flap for larger defects (*Figure 13*).



Figure 13: Tissue expander used to increase size of cervicofacial flap ¹⁶

Postoperative care

- Keep the head elevated to reduce oedema of the flap
- Remove drains when output is <50ml/24hrs
- Remove dressings 2 days postoperatively to inspect the wound
- Should distal tip necrosis occur, consider debridement followed by daily dressing until the wound heals by secondary intention

Complications

Patients with decreased skin laxity, sebaceous skin, higher [Fitzpatrick grading](#), or a history of keloids may present a greater surgical challenge. Proper patient selection, gentle handling of tissues, and good haemostasis minimise complications. Haematomas require immediate evacuation because they may jeopardise blood supply to the flap, potentiating risk of necrosis. Infections are treated with drainage and antibiotics.

Complications specifically related to cervicofacial flaps are standing cone deformity, long-term ectropion, distal tip necrosis, and nerve injuries.

Standing cone deformity or dog-ear cosmetic problem: This is best addressed at the time of initial surgery.

Postoperative ectropion: This occurs when a flap is extended to the infraorbital region. Postoperative oedema causes eversion of the lower eyelid, and as healing proceeds, scarring and fibrosis may ensue and maintain the eyelid in an everted position. Extending the flap superiorly to the lateral canthus and suturing it to the periosteum reduces the risk of persistent ectropion.

Another way to prevent this complication is the use of a temporary suspension suture ([Frost suture](#)). A 4-0 nylon suture is passed through the inferior tarsal plate and secured to the supraorbital region. The free ends are then joined and form a sling, counteracting caudal tension.

Another way to prevent ectropion is to use the *Yin-Yang rotation*, as described by *Belmahi*,¹⁷ for cases in which minimal skin laxity is appreciated (*Figure 14*). A temporoparietal scalp flap is raised and rotated in the opposite direction to the cervicofacial flap to close the preauricular cutaneous defect. Raising the additional temporoparietal

scalp flap helps to minimise wound tension and provides cephalic anchorage to the facial flap, which reduces the incidence of ectropion.

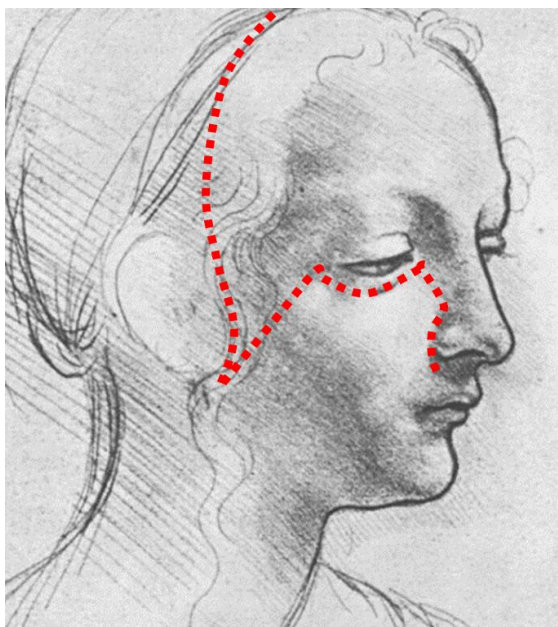


Figure 14: Yin-Yang rotation

Distal tip necrosis (Figure 10): This may occur due to unreliable random pattern vascularisation of the flap. The reported incidence is about 15%. Risk factors include a history of smoking, radiation therapy, thinner skin in older patients and diabetes. Although raising the flap with the SMAS may theoretically increase the blood supply, this has not been borne out by clinical studies. Incorporating the SMAS for patients without risk factors may therefore not be beneficial. However, those with associated risk factors may find significant benefit as demonstrated in a study by *Jacono*¹⁴. Another measure to reduce distal tip necrosis is to improve venous drainage by including the external jugular vein with the flap. When flap tension is unavoidable because of the size of the defect, additional grafts or flaps should be employed to avoid undue tension.

Facial nerve injury: This is a dreadful complication and has major functional and aesthetic consequences. A detailed knowledge

of facial and facial nerve anatomy, and use of blunt dissection and bipolar electrocautery, are mainstays of preventing injury. The incidence of facial nerve injury is low, and when it occurs, it is usually transient. Facial nerve injury should therefore initially be managed conservatively. Persistent paralysis without improvement may warrant [facial reanimation](#) surgery.

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Other flaps described in *The Open Access Atlas of Otolaryngology Head & Neck Operative Surgery*

- [Pectoralis major flap](#)
- [Cervicofacial flaps](#)
- [Deltopectoral flap](#)
- [Buccal fat pad flap](#)
- [Buccinator myomucosal flap](#)
- [Nasolabial flap](#)
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