Techniques of nasal reconstruction

The contours of the nose have convex and concave surfaces in close contact with varying skin texture and colour. The human eye notices any asymmetry. Whole aesthetic subunits are often replaced for a better cosmetic result. The paramedian forehead flap gives consistently good results in major nasal reconstruction. Full thickness defects require all three layers to be replaced.

The shape of the nose varies from person to person but most people examine the eyes and mouth, the expressive parts of the face, in preference to the nose (Burget and Menick, 1994). The nose receives little attention unless it is asymmetrical. Gonzalez-Ulloa et al (1954) described the aesthetic units, segments of contour broken by a change in undulation, skin quality or shadow. The subunits comprise the tip, dorsum, two side walls, the alar-nostril sills, soft triangles and the columella (*Figures 1a* and *b*).

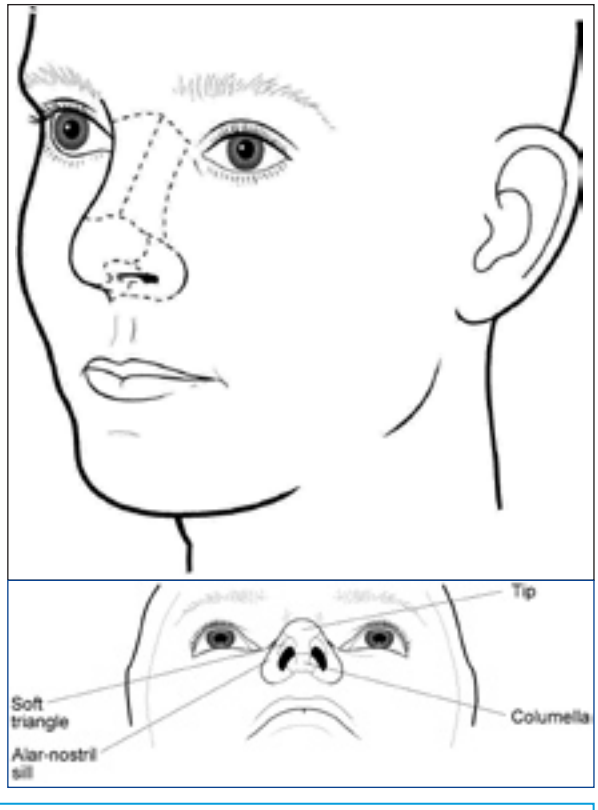
Placing incisions along the border between subunits minimizes the visibility of any scar. Burget and Menick (1994) have advocated that the whole of a subunit be replaced if a defect involves more than half a subunit. In practice this initially appears dramatic as some healthy skin is discarded. While defects less than 1.5 cm can usually be replaced with a local rotation flap, anything greater than this will require a nasolabial or paramedian forehead flap. Replacing the whole aesthetic segments usually gives a superior result although there is the inconvenience of having the unsightly pedicle of a forehead flap for 4 weeks until it is divided.

> **'The results of regional flaps are superior to those of local flaps even when the defect is relatively small. The forehead flap is underused' (Menick, 2004).**

A minority of authors have questioned the >50% principle (Rohrich et al, 2004) but these claims have not been supported by photographic evidence equal to that of the proponents of this principle. While the patient's primary concern is to have a good aesthetic result it is important not to forget function and this relies on having an inner lining, the supporting cartilages, and avoiding vestibular stenosis and a septal perforation. A defect is replaced with tissue of the same type except at the nostril margin, which normally contains no cartilage, but when reconstructed needs to be supported by a 0.5 cm strut or batten graft of cartilage within its rim to avoid notching.

Reconstruction following Mohs micrographic surgery can then be done with the knowledge that the disease has been removed. No defect should be reconstructed if there is any uncertainty as to whether the tumour has been completely excised. If this is the case it is best to place a dressing and await the histological result from a paraffin section. This article outlines the surgical options in nasal reconstruction excluding the management of small lesions.

Figure 1a and b. The aesthetic subunits of the nose.



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Local flaps

These are best for reconstructing the convex subunits of the nose but they are limited in length and size, being based on a random blood supply. The bilobed flap is ideal for small defects (<1.5 cm) of the nose where local skin of the same thickness and colour can be used to fill a defect (*Figures 2a–d*). If these flaps rotate skin through an arc of more than 110° in the relatively inflexible thick skin of this region it produces a dog-ear.

Nasolabial flap

This flap is suitable to replace the alar subunit and it can be based inferiorly or superiorly or it is possible to create an island flap based on the perforating branches

Figure 2a–d. 1.5 cm is the upper limit of what can be repaired with a bilobed flap. Wide undermining of the flaps just above the subcutaneous muscular aponeurotic system is needed to avoid flap tension. Note the outline of the flap seen (c) at 2 months is barely discernible by (d) 1 year.

of facial and angular arteries that supply this area (Arden et al, 1999) (*Figures 3a* and *b*). If the alar groove is lost it can be created by not suturing the tissue at the maximum convexity of the alar margin as this causes it to contract and roll up creating a natural looking nostril. This technique requires cheek tissue to be advanced a few millimetres under the new nostril margin to get the best result (Chait and Fayman, 1989)(*Figures 4a–c*).

Septal and turbinate flaps

An anterior septal mucosa is fed by the septal branches of the superior labial artery and a flap can be extended posteriorly like an upturned 'L' and rotated forwards and laterally to form the lining of the nasal vestibule. A posterior septal flap supplied by the sphenopalatine artery can be used to recreate the internal lining but it needs to

Figure 3a and b. An island nasolabial flap is mobilized based on high perforators to allow the flap to be rotated into position and redundant skin is excised to create a new nasolabial crease.

Figure 4a–c. A cheek advancement flap has blunted the right alar facial sulcus. An incision is made in the position of the nasofacial groove and the area is thinned to produce the correct contour. Note (b) that the alar margin has not been sutured in order to allow it to contract, roll up, and (c) create a natural-looking alar margin.

be raised from the very front of the septum if it is to come anywhere near the inside of the nostril margin. Providing an internal lining is important to ensure the survival of any cartilage graft and prevent the external skin contracting (Tollefson and Kriet, 2005).

Free cartilage grafts

Septal, conchal bowl or rib cartilage are good for making a scaffold in nasal reconstruction but the nasal bones are best replaced with the outer temporal calvarial plate. Like should be replaced with like, except at the nostril margin which needs to be reinforced with a strut of cartilage in order to avoid contraction and notching. Rhinoplasty techniques help in suturing cartilage grafts to shape the lower third if the nose.

Figure 5a–d. A post-traumatic defect in the nostril margin was reconstructed using a composite conchal graft.

Figure 6a–c. A defect of the left side of the nose and medial canthus was reconstructed under local anaesthetic with a glabella flap and advancement of the tarsal plates.

Composite cartilage grafts

A composite graft consists of skin and cartilage. The conchal bowl contains cartilage with a range of contours which can be used to replace most of the parts of the upper and lower lateral cartilages including its nasal lining (Raghavan and Jones, 2001). It should be placed on a good vascular bed, with minimal intervening dead space and no shear forces between it and its bed in the first few days. Composite grafts have been used to correct defects of the alar margins (*Figures 5a–d*).

The glabella flap

A small midline flap can be rotated down to reconstruct the nasal dorsum and the lateral nasal segment if necessary (*Figures 6a–c*).

The midline forehead flap

This has been used for large nasal defects but it is unreliable for the lower third of the columella. It is used for subunit repair, hemi nasal reconstruction or total nasal reconstruction (*Figures 7a–d*) (Park, 2000).

Figure 7a–d. A squamous cell carcinoma of the nose was removed using Mohs micrographic surgery. A large forehead flap and bilateral composite conchal grafts were used. After division of the pedicle further refinement was offered to obtain more symmetry but this was declined.

The paramedian forehead flap

This is better than the midline forehead flap and is the best choice for reconstructing major nasal defects (Menick, 1990) (*Figures 8a–d*). The flap is based on the supratrochlear artery. The paramedian forehead flap is not only robust but the donor site heals well, even when it is not possible to close the upper part of the donor site of the forehead and this heals by secondary intention. The use of ultrasound to locate the supratrochlear artery allows the pedicle to be narrowed (*Figure 9*). The main problem of any forehead flap is its thickness. It is possible to thin this skin down for up to 2 cm from its distal rim. Very sharp scissors are needed to thin it down to the subdermal plexus to the extent that this can remove some of the hair follicles that are present.

At 2–3 weeks after the first stage it is possible, without dividing the pedicle, to thin down much of the rest of the forehead skin to within 1 cm from its distal attachment to help match the thickness of the flap (Menick, 2002). However, many workers divide the pedicle after 4 weeks and if the medial part of the eyebrow has been displaced inferiorly this needs to be aligned to match the other eyebrow. Although the concept of replacing the whole of an aesthetic segment if more than 50% of it has

Figure 8a–c. A defect after wide resection of a squamous cell carcinoma has been removed and the edges of the periosteum and mucoperichondrium checked by frozen section. Posteriorly based septal flaps helped to make the internal lining with composite conchal grafts to fill the remaining internal defects. Split calvarial bone was fixed with miniplates. Note that the sides of the pedicle were sutured to the skin to obtain complete coverage of the bone graft while it became vascularized and radiotherapy was given. d. The patient's appearance 6 months after radiotherapy and 4 months after the pedicle of the forehead flap had been removed.

Figure 9. The supratrochlear artery can be localized by ultrasound allowing the pedicle of the flap to be narrowed.

been lost is generally sound, parts of tip lobule and alar segments can be left in position if any skin replacement is carried out symmetrically. If the flap grows hair this can be dealt with by laser treatment in people with dark hair otherwise electrolysis or depilatory creams such as eflorinthene hydrochloride can be used. Dermabrasion can refine minor irregularities.

Microvascular free flaps

Large or complex defects with a full thickness tissue defect require regional flaps in conjunction with free or local flaps and grafts (*Figures 10a–d*). Free flaps have been described for use in total nasal reconstruction but they are bulky as the underlying fat is thick and it is difficult to thin it evenly, even after several stages (Moore et al, 2003; Walton et al, 2005). A pericranial flap has been described to provide an internal lining for total nasal reconstruction (Brackley and Jones, 2002).

Figure 10a–d. A large nasofacial defect also involving the septum and medial part of the maxilla after a recurrent basal cell carcinoma has been removed using frozen section to define the margins. Reconstruction was delayed until the histology had been checked using paraffin sections. A radial forearm free-flap was placed – note the consequence of excessive tissue – it rolls up and contracts. After 3 weeks, part of the free flap was reflected to help create an internal lining (b) before free cartilage grafts and a paramedian forehead flap were used to reconstruct the sidewall of the nose. The free flap was debulked and the alar sill refined over three further stages.

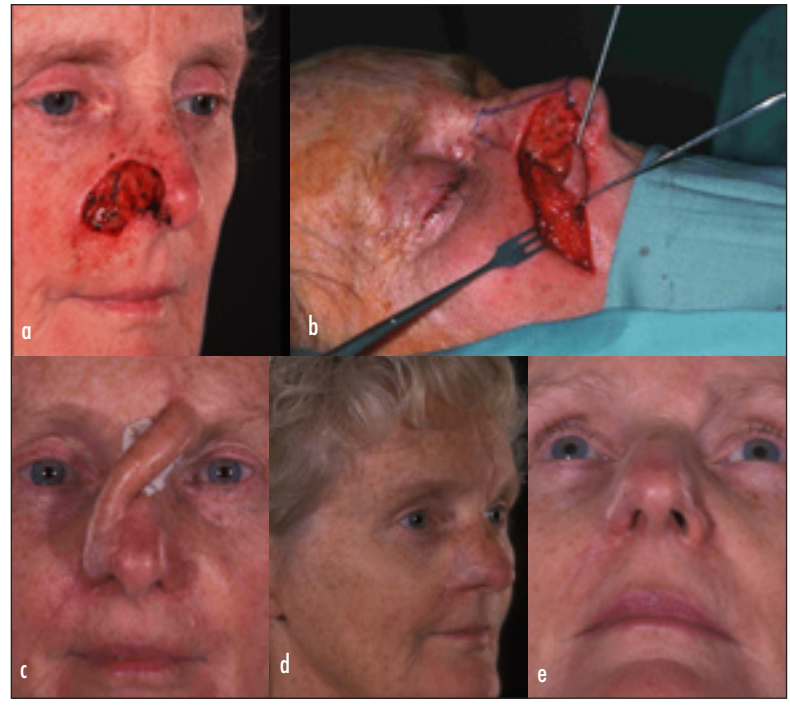
Psychology

The majority of patients who have a nasal tumour removed find the experience distressing. Whatever the patient's psychological profile, time spent addressing fears and expectations helps the patient to adjust to his/her experience. Showing patients pictures so that they have some idea of what to expect, as well as visualizing what their appearance may be like after further stages, is important. If before surgery, patients are able to see and talk to others who have had a similar experience, this is most helpful. Some patients are curious to see pictures of the defect that they had after Mohs micrographic surgery, and this often helps them to accept the unusual appearance that they have while a pedicle is in place. Other patients do not want to see any pictures of their defect and may deny the whole process to a varying degree; these patients need more time and careful and sensitive counselling to help them cope.

Conclusions

The principle of reconstructing all three layers where there is a full thickness defect is important. Whole aesthetic subunits should usually be replaced where more

Figure 11a–e. A nasofacial defect following Mohs micrographic surgery. A small island nasolabial flap was use to create the base of the nostril along with a cheek advancement flap and a paramedian forehead flap seen in position at 4 weeks (c). The pedicle was divided and an alar groove created to obtain symmetry.



than half the unit has been resected but some of the tip lobule and the alar segments can be left as long as the repair is symmetrical. The paramedian forehead flap, in conjunction with other techniques, is the main method of replacing most sizeable nasal defects but the quality of the final result is determined by further refinement of the alar-facial sulcus, the alar-nasal sill and the alar groove (*Figures 11a–e*). BJHM

Conflict of interest: none.

KEY POINTS

- Reconstruction should only be done when the surgeon is sure that the tumour has been removed. Mohs micrographic surgery should be used for morphoeiform basal cell carcinoma or squamous cell carcinoma whose margins are unpredictable. If Mohs is not available, then it is best to wait for the histological result from paraffin sections and dress the wound in the meantime.
- The slightest variation in contour or symmetry of the nose is readily seen and the aim should be to obtain as much symmetry as possible.
- The concept of replacing the whole of an aesthetic segment (a tissue plane with the same thickness, colour and contour of skin) if more than 50% of the segment has been lost is important in obtaining a good cosmetic result.
- Reconstruction requires an inner lining, scaffolding and an external layer otherwise the tissue will contract, roll up, and become thick, firm and featureless.
- Incisions should be made at the junction of aesthetic segments in order to disguise them.
- It is important for an individual's self esteem and psychological wellbeing that they undergo counselling before embarking on nasal reconstruction.

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