Rhinology, 38, 72-78, 2000

A review of practical guidelines for correction of the deviated, asymmetrie nose*

H.D.Vuyk

Department of Otolaryngology, Facial Plastic Surgery Gooi Noord Hospital, Blaricum, the Netherlands

SUMMARY *Repair of the twisted nose presents a challenge, as often functional problems as well as aesthetic deformities must be addressed. Traditional correction of the deviated nose involves septal correction, separation ofboth upper lateral cartilages from the septum and bony pyramid manipulation after osteotomies. Nowadays autogenous cartilage grafts are being used for repositioning, reinforcement, recontouring and reconstruction ofvirtually every component of the nasal skeleton. These restructuring techniques follow the modem principles mentioned above and may well be applied to the deviated asymmetrie nose. The grafting manoeuvres increase the stability of the realigned cartilaginous nasal framework, including the nasal sep tum, but may also be used for camouflaging purposes. The large number ofpossible individual anatomie variations including facial asymmetry does callfor a systematic approach based on succinct individualised analysis.*

Key words: asymmetry, deviation, nose

INTRODUCTION

Repair of the twisted nose presents a challenge, as often functional problems as well as aesthetic deformities must be addressed (Gunther, 1988; Johnson, 1977). Moreover, the functional and aesthetic goals are sometimes conflicting making perfect correction difficult to achieve (McGuire, 1989; Stucker, 1992; Murakami, 1995). Although there is extensive literature on rhinoplasty, only a relatively small number deal with correction of the deviated nose. The terminology used: deviated, twisted, crooked, hooked, asymmetrie, scoliotic and deflected, is confusing. Facial asymmetry, often presents a limiting factor in surgical correction and is rarely discussed. Traditional correction of the deviated nose involves septal correction, separation of bom upper lateral cartilages from the septum and bony pyramid manipulation after osteotomies. These manoeuvres involve mobilisation and realignment which are intrinsically destabilising. This may account for a certain degree of unpredictability (Younger, 1997; Fanous, 1997).

Rhinoplasty in general has evolved from framework reduction and mobilisation, with concomitant loss of support, to surgery characterised by conservatism, rearrangement and augmentation (Vuyk, 1998a; Tardy, 1992). Nowadays autogenous cartilage grafts are being used for repositioning, reinforcement, recontouring and reconstruction ofvirtually every component of the nasal skeleton (Gunther, 1997; Toriumi, 1997; Vuyk, 1993; Vuyk, 1998a; Vuyk, 1998b, Tardy, 1995; Kinney, 1979, Younger, 1997; Rettinger, 1992). These restructuring techniques follow the modern principles mentioned above and may well be applied to the deviated asymmetrie nose (Toriumi, 1993; Murakami, 1995). The grafting manoeuvres increase the stability of the realigned cartilaginous nasal framework, including the nasal septum (Toriumi, 1993; Vuyk and Adamson, 1998; Rettinger, 1992), but may also be used for camouflaging purposes. By defmition, camouflage aims to create the illusion of a mid-line position or straightening (Tardy, 1995). For example, filling in depressions with thin cartilage wafers, asymmetries may be improved and sometimes totally corrected. A crooked nasal dorsum may be hidden by onlay grafts which may extend over the whole length of the nasal dorsum (Kinney, 1979). Addition procedures aim to achieve volume enhancement rather than architectural shifts, adding postoperative stability while preven-ting postoperative drifting to a malalinged state (Younger, 1997). However, the volume added with grafting should be balanced to unesthetic nasal width and possible graft visibility. Obviously camouflaging techniques may be supplemented with established reduction manoeuvres like contra-lateral dorsal rasping or cartilage shaving (Murakami, 1995). Thus, camouflaging may involve addition, as well as removal of tissues.

* Received for publication December 8, 1998; accepted November 17, 1999

Figure IA

Figure l B

Figure IC

Figure l D

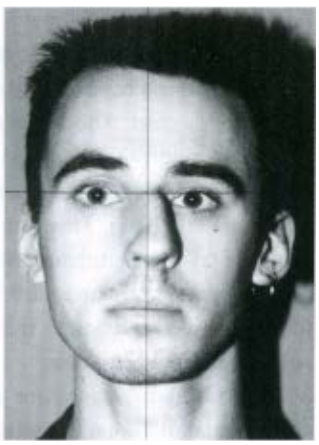

Figure IE

Figure 1. Six categories of facial asymmetries illustrated by representative patients.
a. Left-Right difference in facial width b. Left-Right difference of orbital level c. Rotation displacement of upper jaw/piriform aperture d. Isolated lateral placement of piriform aperture e. Non-horizontal alar base
f. More pronounced facial asymmetry sometimes associated with cheek flattening and slanting of the whole midface to one side.

Generally speaking camouflaging techniques are more conservative, less destabilising and thus more predictable than reaiignment (Younger, 1997). Most often an individualised selection of modern rhinoplasty techniques including reaiignment, restructuring and camouflaging are necessary to give the patiënt the best possible result. This paper will outline the analysis of the often complex deviated, asymmetrie nose, including an attempt to categorise concomitant facial asymmetry. Furthermore, a personal selection of surgical techniques to correct the various nasal components will be highlighted with appropriate literature discussion.

ANALYSIS/CLASSIFICATION

Facial asymmetry

For evaluation and patiënt education purposes, marker points, rulers and line drawings may be used on frontal photographs and/or on the patients (Daniel, 1993). Possibly the only consistent reference point in A-P view is the facial centrepoint lying halfway in between the medial canthi on the nose with the head in the Frankfurt position. All other soft tissues or bony landmarks are inconsistent because of possible asymmetries (Farkas, 1997). Full face asymmetry is assessed using a midline vertical, which intercepts the glabella, nasal dorsum, nasal tip, columella base (nasal spine), philtrum, upper incisors and men-ton. However, a skewed head position complicates, and sometimes prevents determination of facial balance. About 10% of patients do seem to have a consistent, preferred head position which is off the Frankfurt plane (personal observation).

A number of additional lines may be drawn to further evaluate facial components. Two lines drawn parallel to the midline vertical through both medial canthi defmes position and width of both nasal bones and alar base. A line though lateral canthi should ideally be perpendicular to the midline vertical. Similarly two horizontal lines through alar base and through lateral commissure should also come to lie perpendicular to the midline vertical. The occlusion plane demonstrated with a patiënt biting on a wooden tongue depressor, should be horizontal. It is not uncommon to fmd one or more reference points away from the midline or at varying degrees from the horizontal and midline vertical. A study of over 125 patients for whom asymmetric/deviated noses (excluding palatopharyngoschisis) was the reason for rhinoplasty, revealed 5 broad categories of facial asymmetries. The five categories are listed below and illustrated by representative patients.

a) Left-Right difference in facial width (Figure 1)
b) Left-Right difFerence of left-right orbital level (Figure 1)
c) Rotation displacement of upper jaw/piriform aperture (Figure 1)
d) Isolated lateral placement of piriform aperture (Figure 1)
e) Non-horizontal alar base (Figure 1)
f) More pronounced facial asymmetry sometimes associated with cheek flattening and slanting of the whole midface to one side (Figure 1). A tilted occlusion plane may signify an offF-horizontal upper jaw. Lower jaw asymmetry may compound the already complex analysis.

A spectrum of progressively severe asymmetries fmally involve cranio-facial malformations, such as palatopharyngo schisis and hemifacial microsomia (Munroe, 1994) which are beyond the scope of this article.

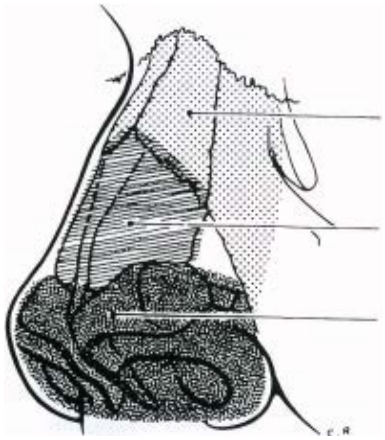

Figure 2.
Upper/middle/lower nasal third to be analysed and planned as separate but interdependent entities.

While contributing to nasal deviation and asymmetry, minor facial asymmetry often goes unnoticed by the patiënt. These facial variations should be pointed out to the patients preopera-tively, and they should be made to understand the limitations these asymmetries pose in surgery of the deviated, asymmetrie nose (Olde Kalter, 1995).

Nasal deviation/asymmetry

The position and shape of the various components of the nose is systematically analysed. Conceptualisation of the often complex situation is greatly facilitated by dividing the nose into horizontal thirds (upper, middle and lower) and examining each third in relation to the relative midline (Murakami, 1995) (Figure 2). The upper third corresponds to the bony pyramid. The middle third encompasses dorsal septum and conjoined upper lateral cartilages, the lower third corresponds to alar carti-lages, caudal septum and alar base. Each third is categorised as being midline or *deviated* to the right or to the left. The division into thirds not only facilitates the analytic process, but is of practical importance as surgical treatment of each third is different.

The analysis of the positional configurations of the nasal thirds may be further complicated by left/right differences in shape, width and length of the nasal components giving rise to specific *asymmetries.* For example, nasal bones may be concave on one side and convex on the other (Fanous, 1997). Slight left and right differences in the bony and cartilaginous nasal dorsal width give rise to concavities or convexities which interrupt the flowing line which ideally follows the brow, lateral nasal wall/dorsal transition down to the nasal tip. Asymmetries involving nasal tip such as a one sided fullness of the lateral supratip, in combination with onesided domal boxiness and/or a hanging ipsilateral medial crus may give the impression of nasal tip deviation but should be characterised and treated as asymmetries.

Acknowledging the difference between asymmetry and deviation and categorising these deformities is key to successful cor-rection.

TREATMENT

Septum

As the septum goes, so goes the nose stresses the importance of septal correction (Larrabee, 1993; Gunther, 1988). Severe deformities or deviations of the dorsal and caudal septum (which determine to a large degree nasal shape and position) require extensive septal manipulation facilitated by individualised exposure. A hemitransfixion or even open transcolumellar approach with complete bilateral mucoperichondrial elevation may be needed. Surgical techniques for realignment (suture fixation, locking and cartilage shaving) sometimes combined with weakening (resection, through and through incisions, scoring and morselisation) and subsequent reconstruction (suture approximation, dorsal and caudal battens) reflect emphasis on preservation of cartilaginous tissue. These techniques, which will be briefly discussed below, are applied incrementally depending on the anatomical abnormality. In case of isolated caudal septal deflection, a combination of mobilisation, trimrning/thinning and suturing may bring the posterior septal angle to the midline. A permanent 5-0 nylon suture or PD S 4-0 suture may b e driven through soft tissue including periosteum (or through small drill holes in the nasal spine or premaxillary ridge) at the opposite side of the deviation for septal repositioning (Toriumi, 1993; Wright, 1989). It must be recognised that only slight deviations with minimal residual cartilage tension may predictably be corrected in this manner. If the caudal septum including the anterior septal angle is slight-ly bowed and unilaterally deviated, adequate correction may involve a "contralateral subluxation locking" technique. Locking techniques involve the repositioning of an untrimmed unshortened, but sometimes thinned caudal septum of at least l cm in width, to the contralateral side of the thinned nasal spine/maxillary crest. Additional suturing may be helpful to maintain the position of the locked septum. Slightly bending of the septum will preventing overcorrection and septal airway impingement (Ellis, 1991). This technique is not indicated for severe distal septal malalignment problems (Younger, 1997). Shaving is a conservative variation of resection which, if applied too aggressively, obviously may lead to loss of support, needing subsequent reconstruction.

Scoring techniques used for straightening septal cartilage involve partial incisions to use the interlocked stress of the cartilage. However, the results of partial incisions are inconsistent (Murakami, 1982). Complete through and through cartilage incisions are sometimes necessary for weakening and subsequent correction of a b end dorsal/ caudal septal strut. Castellation involves through and through incisions in an interdigitating fashion to weaken the dorsal or caudal strut while maintaining some degree of integrity. Morselisation, a technique to weaken the cartilage, is not favoured by the author. It increases the surface area, with the increased risk of absorption, and makes secondary dissection and revision extremely difficult.

After realignment and weakening procedures, reconstruction is often necessary involving a selection of the following techniques. "Figure 8" sutures are simple to stabilise adjacent cartilage

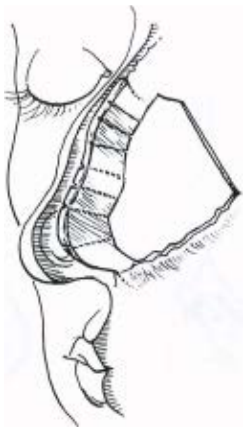

Figure 3A. Dorsal/caudal strut is weakened by partial or complete (sometime interdigitated) incisions.

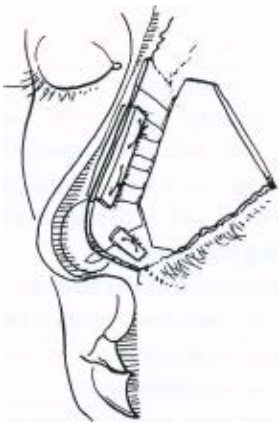

Figure 3B. Internal cartilage splints are sutured in place for further straightening and stabilisation.

Figure 3A,B: (Reprinted with permission from Ramirez OM, Pozner JN The severely twisted nose. Clinics in Plastic Surgery 23, no. 2, April 1996).

segments and prevent overlap. Batten type grafts either from cartilage or bone may be used to reorient and straighten the remaining dorsal and caudal septal struts (Dupont, 1966; Ramirez, 1996) (Figure 3a,b). If positioned at the dorsal septal edge in between the septum, these grafts are similar to spreader grafts (Vuyk, 1993).

The remaining caudal septal strut may likewise be corrected and reinforced with batten type grafts (Rettinger, 1992; Metzinger, 1994) . In extreme cases the caudal and dorsal strut may be replaced partially or completely with autogenous septal or rib cartilage (Toriumi, 1993, Rettinger, 1992). Obviously these manoeuvres are rarely indicated. Complete septal resection with extracorporal correction and exact replacement is difficult and may lead to a high percentage of aesthetic profile deformities in the best of hands (Gubisch 1992).

Bony pyramid

If indicated, profile reduction preceeds repositioning of nasal bones. By lowering the nasal dorsum the most anterior, lateral components are removed, decreasing the degree of deviation (Constantion, 1989). Often the nasal bone at the site of the deviation is oriented more vertically than its counterpart. Tangential hump removal with asymmetrie preservation of the more vertically orientated nasal bone aims to produce a symmetrical shape and position of the nasal bones after osteotomies (Toriumi, 1993, McCarthy, 1990).

To minimise destabilisation of the osseous nasal framework, osteotomies are performed while preserving periosteal and mucosal attachments of the nasal bone (Murakami, 1992). Periosteal tunnels are detrimental to support, which may be unadvantageous (Murakami, 1992). Nasal bone mobilisation is achieved using the smallest possible osteotomies (intranasally and/or percutaneously). The configuration of lateral osteotomies is tailored to the patients anatomy. If possible, the osteotomy is started on the piriform aperture, just above the attachment of the turbinate, aiming to preserve a spickle of bone that supports to the suspensory ligaments of the lower lateral cartila-ges (Vuyk and Adamson, 1998). Sliding low over the nasal facial groove to prevent step off deformities, the osteotomy ends high on the nasal bone at the level of the medial canthus. In case of hump removal medial osteotomies are rarely indicated. If necessary, small transverse percutaneous puncture type osteotomies will provide enough mobilisation for infracture. If nasal dorsal lowering is not performed in case of severe bony deviation, the sequence of osteotomies is changed in order to medialise the nasal bones and bony septum, "like opening a book" (Larrabee, 1993, Murakami, 1995, Ellis, 1991). Working from the less deviated side, a lateral osteotomy is followed by a medial osteotomy and outfracturing. The septum is positioned into the midline using a transverse root osteotomy. Subsequently the opposite nasal bone is infractured after a lateral osteotomy. Irregularities are subsequently smoothed, using a fine rasp.

Limited external deviations may be corrected with a unilateral osteotomy leaving the opposite bony sidewall in its former position providing stability in the osteocartilaginous nasal framework. If indicated unilateral osteotomy does allow for nasal bone outfracturing. Additional support by cartilage spreader graft reaching up into the bony vault may be used to prevent recurrent collapse. Medialisation of the lateral side wall after hump resection and unilateral osteotomy is a straightforward procedure. However, if the nose has no hump, then a unilateral vertical osteotomy will achieve limited results, since the free movement of the lateral wall and lateral nasal skin toward the septum is restricted by the presence of the dorsal plateau (Fanous, 1997). Therefore, the proper management would be to first resect half the plateau on the deviated side (Jeppensen, 1991), followed by the performance of a unilateral vertical osteotomy. The lateral nasal wall would then be allowed to move freely towards the midline (Fanous, 1997).

It is my personal opinion that other type of osteotomies are rarely indicated. Intermediate osteotomies are meant to convert

a convex bony sidewall into a straight confïguration. Intermediate osteotomies performed halfway up the the nasal bone risk visible irregularities or step-off deformities as local skin covering is often thin. Lateral wedge resection to correct differences in nasal bone height while aiming to facilitate medialisation may be considered destabilising. One should realise that short nasal bones are a relative contraindication for osteotomies. Osteotomies in these patients risk bony communication, while yielding limited results.

Many times total correction of the bony pyramid is impossible using reduction and osteotomy techniques only (Larrabee, 1993). Camouflaging techniques may be used in addition to or as an alternative for osteotomies and nasal bone fracturing. Concave or depressed nasal bones may be visually straightened using onlay techniques. High lateral augmentation aims to lateralise the most anterior part of the nasal bone creating the illusion of straightening. Dorsal onlay grafts may be efficiënt to hide residual deviations (Kinney, 1979) and close a remaining open roof. Septal cartilage cut in thin wafers with only minimal crushing is the material of choice. Resected cephalic portions of lower lateral cartilages are very flexible and versatile, but come in limited quantities. Temporalis fascia may also be used (Vuyk, 1998b). These camouflaging manoeuvres sometimes supplemented with contralateral bony reduction may prevent the need for osteotomies while completely avoiding its destabilising side-effects.

Middle third

Before correction of the middle third of the nose which includes the dorsal septal edge and upper lateral cartilage, the septum should be straightened and the profile reduced if necessary. Unilateral concavity may be corrected by repositioning the upper lateral cartilage using spreader grafts or by camouflaging techniques using onlay grafts (Figure 4). The choice of technique depends on the patients airway. If the concavity is associated with nasal valve collapse, spreader grafts are indicated and a functional as well as aesthetic improvement may be anticipated

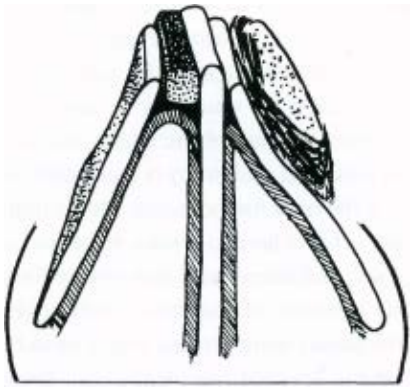

Figure 4. Lateral nasal wall repositioning with right sided spreader grafts for both functional and anaesthetic improvement. On the left side an onlay graft is depicted used for correction of anaesthetic unilateral concavity.

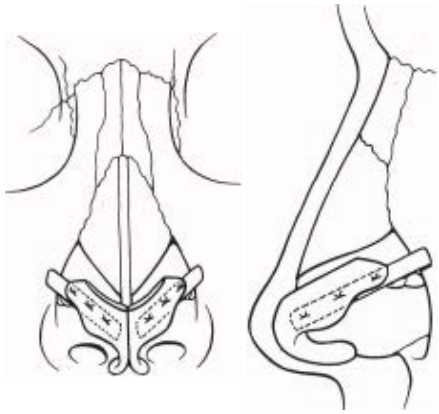

Figure 5. Subalar batten graft. These strut type grafts are sutured to the deep surface of the lateral crurae. Possible applications for this versatile graft include lateral alar crus repositioning, reinforcement after the previous overresection and reshaping of concave as well as convex alar cartilages.
(Reprinted with permission from Gunther JP, Friedman R (1997) Lateral crural strut graft: technique and clinical application in Rhinoplasty. Plastic Reconstructive Surg 99,4:943-955).

(Vuyk, 1993). If the airway is adequate, simple onlay grafts may be sufficient (Perkins, 1993) (Figure 5). Sometimes a combina-tion of both is necessary.

If the contralateral middle third is too wide, narrowing may be achieved by lateral shaving and/or disconnecting the upper lateral cartilage from the septum resulting in a slightly lower medialised position. In cases of extreme width, a strip of the most medial horizontal component of the upper lateral cartilage, adjacent to the septum may be removed (Johnson, 1990). If facial asymmetry does exclude nasal midline postion, the width and height as well as length of the most medial half of the cartilaginous/bony dorsum and tip may be accentuated enhancing the illusion of straightness.

Nasal tip

The position of the nasal tip is largely determined by facial (a) symmetry and septal position. Septal correction must therefore precede any tipwork. The alar cartilages are reshaped, reoriented and restructured using a combination of conservative (asymmetrie) reduction, suture repositioning (Vuyk, 1995) and variety of grafting techniques.

In most cases a strut is placed in between the medial crura for support and realignment. A strut allows resection of the most caudal part of the deviated septum without risking columellar retraction. A limited resection of excess vestibular skin on the deviated side may further enhance symmetry. The caudal aspect of the medial crura may be shaved or augmented using batten type onlay grafts. In the domal and infratip region symmetry may be created using onlay (Peck, 1983) and/or shield (Sheen, 1975) type cartilage grafts. Position and shape of these grafts is determined by the patients anatomical abnormality. Asymmetrie grafting may be necessary to create symmetry.


Figure 6A


Figure 6B


Figure 6C

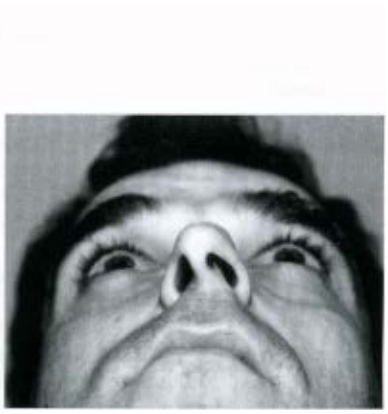
Figure 6D

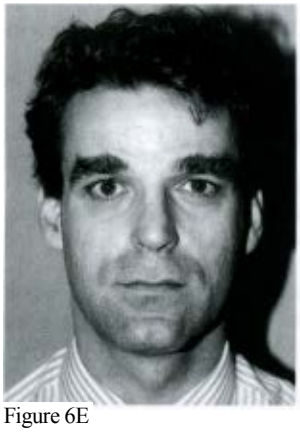
Figure 6E


Figure 6F


Figure 6G

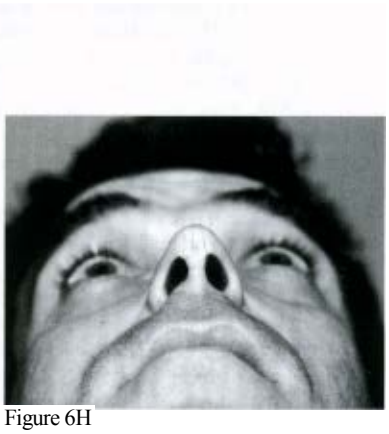
Figure 6H

Figure 6A-D:

- Representative patiënt demonstrating slight tilted head position to the right. The upper bony third deviated to the left. Bony excess lateral K-area and lateral position of left nasal bone. Concave and medial position of right nasal bone. Middle third concave on the right side. Slight excess on the left side because of septal deviation. Severe septal deviation causes lower third nasal tip deviation to the right. Upper, middle, lower third would be left-left-right on analysis with a severe septal deviation. On profile slightly low nasal frontal angle relative hump, relatively low supratip area and slightly underprojected nasal tip.
- Correction of deformity by external approach. Septal alignment and reinforcement by rightsided dorsal batten graft which lateralises the upper lateral cartilage. Additional onlay grafting bony and cartilaginous right nasal sidewall. Unilateral osteotomy left side with infracture. Substraction of left lateral K-area. Supratip and nasal frontal angle onlay grafts.
- Tip reprojected by medial crural advancement and tongue improved fixation on realigned caudal septum. Cephalic trim right alar cartilage. Autogenous domal onlay graft.

Figure 6E-H:

- Postoperative view; One year postoperative view demonstrates enhanced midline position and profile. Nasal tip deviation and asymmetry caused by septal deviation reasonably well corrected using the external approach.

The lateral alar cartilages may also be augmented with batten type cartilage grafts (Toriumi, 1997). Extreme medial position of the most lateral aspect of the alar cartilages diagnosed as a herniation into the nasal vestibulum, may have functional, as well as aesthetic implications. Slight lateral repositioning of the lateral cartilages may be a secondary effect of spreader grafts used for middle third problems. The lateral alar cartilage may be further supported and lateralised by thin subalar batten type grafts, positioned in between the undersurface of the alar cartilage and the vestibular skin reaching out onto the piriform aper-ture (Gunther, 1997; Rettinger, 1992) (Figure 5).

CONCLUSION

The large number of possible individual anatomie variations including facial asymmetry does call for a systematic approach based on succinct individualised analysis (Murakami, 1995).

In addition to (or even in stead of) traditional realignment techniques camouflage is suggested as an alternative treatment option for the asymmetrie deviated nose. A representative patiënt demonstrating the surgical guidelines described is depicted in Figure 6.

REFERENCES

1. Constantian MB (1989) An algorithm for correcting the asymmetrical nose. Plast Reconstr Surg 83: 801-811.
2. Daniel RK (1993). Rhinoplasty planning. Chapter V, pp. 79-108. In Aesthetic Plastic Surgery Rhinoplasty. Eds. R.K. Daniel. Little Brown Company, Boston.
3. Dupont C, Cloutier GE, Prevost Y. (1966) Autogenous vomer bone graft for permanent correction of the cartilaginous septal deviations. Plast. Reconstr. Surg. 38, no.3, 243-247.
4. Ellis DAF, Shaikh AJ (1991) The twisted nose. Chapter 18. In: Aesthetic Facial Surgery. Krause, M. (ed). Lippincott Cie, pp.313-320.
5. Fanous R (1997) Unilateral osteotomies lor external bony deviation of the nose. Plast Reconstr Surg 100, no. 1:115-123.

6. Farkas LG (1997) Asymmetry of the head and face. Chapter VII, pp. 103-111. In: Anthropometry of the head and face, 2nd edition. Farkas (Ed). Raven Press.
7. Gubisch W (1992) Neue Techniken zur Korrektur des schwierigen Septums. Laryngo- Rhino-Otol 1971:39-42.
8. Gunther JP, Rorich RJ (1988) Management of the deviated nose. The importance of septal reconstruction. Clin Plast Surg 15 1:43-55.
9. Gunther JP, Friedman RM (1997). Lateral crural strut graft: technique and clincial application in Rhinoplasty. Plastic Reconstructive Surg 99, 4:943-955.
10. Jeppensen F (1991) Anterior wedge excision in deflected nasal dorsum. A pilot study. Rhinol 29: 201-212.
11. Johnson CM, Anderson JR (1977) The deviated nose- its correc-tion. Laryngoscope 87:1680-1684. Johnson CM, Toriumi DM (1990) Open structure rhinoplasty. Saunders (Philadelphia)
12. Kinney P, Shively R (1979) Straightening the twisted nose. Plast Reconstr Surg 64, 2:176-179.
13. Larrabee WF (1993) Special considerations in rhinoplasty. Chapter 165, pp. 2166-2175. In: Head and Neck Surgery-Otolaryngol. Bailey (ed.) Philadelphia, Lippincott Comp.
14. McCarthy JG, Wood-Smith D (1990) Rhinology. Chapter 35, pp. 1785-1894. Plast Surg 3. The Face, part 2. Mc Carthy JG (ed). Saunders Comp 1990.
15. McGuire AJ (1989) Open rhinoplasty approach to the deviated nose. Facial Plast Surg 6 2:83-87.
16. Metzinger SE, Boyce RG, Rigby PL, Joseph JJ, Anderson JR (1994). Ethmoid bone sandwich grafting for caudal septal defects. Arch Otolaryngol Head and Neck Surg 120:1121-1125.
17. Munroe IR (1994) Hemifacial microsomia: the skeletal correction. Operative Techniques in Plast Reconstr Surg 1:77-92.
18. Murakami WT, Wong LW, Davidson TM (1982) Applications of the biomechanical behaviour of cartilage to nasal septoplastic sur-gery. Laryngoscope 92,300-309.
19. Murakami CS, Larrabee WF (1992) Comparison of osteotomy techniques in the treatment of nasal fractures. Facial Plast Surg 8,4:209-219.
20. Murakami CS, Younger RAL (1995) Managing the postrhinoplasty or posttraumatic crooked nose. Fac Plast Surg Clin North Amer 3, 4:421-448.
21. Olde Kalter P, van der Baan S, Vuyk HD (1995) Medico-legal aspects of otolaryngologic, facial plastic and reconstructive surgery. Facial Plastic Surgery International Quarterly Monographs. 11, no. 2:105-110.
22. Peck GC (1983) The onlay graft for nasal tip projection. Plast Reconstr Surg 71:27-39.
23. Perkins, SW, Tardy ME (1993) External columellar incisional approch to revision of the lower third of the nose, pp. 79-98. Facial Plast Surg Clin North Amer l (1).
24. Ramirez OM, Pozner JN (1996) The severely twisted nose: treatment by separation of its components and internal cartilage splinting. Clin Plast Surg 23:327-340.
25. Rettinger, G (1992) Aktuelle Aspekte der Septorhinoplastik. Otorhinolaryngol Nova 70-79.
26. Rohrich RJ, Hollier LH (1996) Use of spreader grafts in the external approach in rhinoplasty. Clin Plast Surg 23:255-262.
27. Sheen JH (1975) Achieving more nasal tip projection by the use of a small autogenous vomer or septal cartilage graft. Plast Reconstr Surg 56:35-40.
28. Stucker FJ (1992) Management of scoliotic nose. Laryngoscope 82:128-134.
29. Tardy ME, Toriumi DM (1992) Philosophy and principles of rhinoplasty. In: Facial Plastic and Reconstructive Surgery. Papel I.E. Nachlas N.E. (eds) Chapter 31, 278-294.
30. Tardy ME, Becker D, Weinberger M (1995) Illusions in rhinoplasty Facial Plastic Surgery 11, no. 3: 117-137.
31. Toriumi DM, Ries WR (1993) Innovative surgical management of the crooked nose. Fac Plast Surg Clin 1:63-78.
32. Toriumi DM, Josen J, Weinburger M, Tardy ME (1997) The use of alar batten grafts for correction of nasal valve collapse. Arch Otolaryngol Head Neck Surg 123:802-808.
33. Vuyk HD (1993) Cartilage spreader grafting for lateral augmentation for the middle third of the nose. Face 3:159-170.
34. Vuyk HD (1995) Suture tip plasty. Rhinology 33:30-38.
35. Vuyk HD, Adamson PA (1998a) External nasal deformities. Chapter 50, pp 772-783. in: Diseases of the head and neck, nose and throat. Eds. Hilgers, F.J.M. Jones A.S., Phillipps D.E. Arnold publ. 1998.
36. Vuyk HD, Adamson PA (1998b) Biomaterials in rhinoplasty. A review. Clinical Otolaryngol 23: 209-217.
37. Younger RAL (1997) Conservative substraction-addition rhinoplasty. Otolaryngol Head and Neck Surg 117:330-337.
38. Wright K (1989) Principles of nasal septum reconstruction. Transm Acad Ophthalmol Otolaryngol 73, 252-255.

H.D. Vuyk
Department of Otolaryngology
Facial Plastic Surgery Gooi Noord Hospital
1261 AN Blaricum
the Netherlands