Introduction

In the last century all kinds of biological and nonbiological materials were used for augmentation of the nasal dorsum and to correct tip deformities. Nonbiological implants have a high risk of local infection and extrusion of the implant, compared to biological grafts. Although the common use of new biocompatible synthetic materials (teflon, mersilene, goretex, etc) give very good results in other parts of the body, this is not so for the nose due to its vulnerability for trauma inducing an antigenic reaction in the tissue surrounding the implant. Allogeneic (homologous) and xenogeneic (heterologous) materials still have some extended resorption of the graft. Up until now, autogenous (autogeneic, autologous) material has always been regarded as the graft material of choice in nasal surgery, despite the additional harvesting procedure. In most cases there is a preference for autogenous cartilage over bone, because of the lack of flexibility of bone and its tendency to be resorbed.

Autogenous graft materials

As autogenous graft material for the nose, one can use single or composite grafts:

<table>
<thead>
<tr>
<th>Single grafts</th>
<th>Composite grafts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartilage</td>
<td>Double layer graft (skin, cartilage)</td>
</tr>
<tr>
<td>Bone</td>
<td>Triple layer graft (skin, cartilage, skin)</td>
</tr>
<tr>
<td>Skin</td>
<td></td>
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</tbody>
</table>

Donor sites

Most donor sites for autogenous grafts are easily accessible during nasal surgery. There are, however, two exceptions: costal cartilage and iliac crest bone.

The most frequently used donor sites are:
- For cartilage *(Figure 1a,b,c)*
  - Nasal septum
  - Auricle
  - Costal cartilage
- For bone *(Figure 2)*
  - Iliac crest
  - Cranium
- Full skin & composite grafts *(Figure 3)*
  - Auricle

*Figures 1a,b,c: Donor sites for autogenous cartilage grafts – dark blue areas*
Figure 2: Iliac crest with brown area as donor site for bone

Figure 3: Different areas of the auricle for harvesting composite grafts

Recipient sites

The recipient site for bone is usually confined to the dorsum. Single full thickness skin grafts have a tendency to retract and are therefore only suitable for small skin defects over the cartilaginous and bony nasal skeleton. Double and triple layer composite grafts are indicated for defects with tissue loss of the tip, ala or columella. Autogenous cartilage is generally used in most recipient sites.

The main recipient sites for grafts in nasal surgery are:
- radix
- septum
- dorsum
- nasal side wall
- tip
- ala
- columella
- nasolabial groove

Indications

Radix

By changing the horizontal and vertical positions of the deepest depression of the root of the nose using a small cartilaginous graft, will result in lengthening of the nose and diminishing an apparent over-projection of the nasal tip (Figures 4a,b).

Septum

The choice of graft for augmentation of the nasal dorsum depends on the aetiology and extent of the correction needed. Postoperative sagging of the cartilaginous dorsum after septal surgery is best treated with rebuilding or repositioning of the cartilaginous septum (Figures 5a,b). For rebuilding the septum autogenous cartilage from the posterior portion of the septum (if still available), conchal cartilage or costal cartilage (less accessible) is suitable. In case of a septal abscess with excessive loss of septal cartilage, immediate rebuilding with autogenous costal cartilage or allogeneic ‘bank’ cartilage is indicated, to prevent saddling and, if it concerns a growing child, additional midfacial growth disturbances.
Figure 4a: A too deep nasofrontal groove resulting in an apparent overprojection of the nose

Figure 4b: Autogenous cartilage graft (blue striped area) to lengthen the nose and to correct the apparent overprojection

Figure 5a: Sagging of the cartilaginous dorsum, diminished tip support and retraction of the columella due to overresection of the caudal part of the septum

Figure 5b: Rebuilding the septum with autogenous septal cartilage (blue striped area). Reimplantation of crushed left-over cartilage in the donor site to prevent a septal perforation
Dorsum

In a saddle nose caused by a too low cartilaginous dorsum with normal tip support, a cartilaginous septal or conchal graft is appropriate (Figures 6a,b).

Figure 6a: Saddle nose caused by a too low cartilaginous dorsum with normal tip support

Figure 6b: Autogenous septal or conchal cartilage (blue striped area) to rebuild a sagging cartilaginous dorsum

A nose with severe saddling involving the whole osseocartilaginous vault could be a good candidate for a bone graft (Figures 7a,b).

Figure 7a: Severe saddling involving the whole osseocartilaginous vault

Figure 7b: Autogenous bone graft – brown striped area – to augment the nasal (bony and cartilaginous) dorsum

Due to the tendency of iliac crest bone to be resorbed, cranial bone or costal cartilage grafts are now more popular. When this
severe saddling is combined with loss of tip support, a (two piece) costal cartilage graft is very suitable (*Figures 8a,b*).

*Figure 8a*: A combination of severe saddling and diminished tip support

*Figure 8b*: A two piece autogenous costal cartilage graft (blue striped areas) to reconstruct the normal projection of the nose

**Nasal side wall**

Mid-nose collapse due to excessive resection of the upper lateral or avulsion of the upper lateral from the nasal bone (K-area) can be treated with a septal cartilage graft (*Figures 9a,b*).

*Figure 9a*: Spreader grafts of autogenous septal cartilage (blue striped areas) to restore a too narrow nasal valve and an aesthetically too narrow mid-nose

*Figure 9b*: Autogenous septal onlay graft (blue striped area) to camouflage avulsion of the upper lateral from the nasal bone
**Tip, ala and columella**

For tip augmentation, cartilaginous grafts from the concha, septum, or a combination of these, can be used depending on the operative technique and extent of the correction. Conchal cartilage is very suitable as an onlay tip graft because of its natural bending properties (*Figure 10*).

*Figure 10: Onlay tip graft of autogenous cartilage of the concha, which is very suitable due to its natural bending*

Septal cartilage is the material of choice for a columella strut for extra tip support, and for a shield-type tip graft for extra tip definition and projection (*Figures 11a,b*).

*Figure 11a: Columella strut of autogenous septal cartilage for extra tip support fixed by mattress sutures to the medial crura*

*Figure 11b: Shield-type tip graft sculptured from autogenous septal cartilage to gain extra tip projection and definition*

In certain cases of alar rim defects, resulting in alar collapse, a conchal cartilage graft with its concave side towards the vestibulum can be very effective. When there are not very large alar, tip or columellar defects with cartilage and soft tissue loss, and in cases of vestibular stenosis, composite grafts are indicated.

**Nasolabial angle**

To correct an acute nasolabial angle, due to some retraction of the columellar base, small pieces of available septal or conchal cartilage in a subcutaneous pocket are appropriate (*Figure 12*).

*Figure 12: Small pieces of autogenous cartilage to correct an acute nasolabial angle*
Harvesting technique

The harvesting technique described in this chapter is restricted to only the most frequently used autogenous grafts in nasal surgery.

Septal cartilage

Hydraulic dissection with a local anaesthetic will facilitate this procedure (Figure 13a). When there is no indication for correction of a deviated septum, the hemitransfixion incision should be replaced by a Killian incision (blade No. 15), so as not to disturb the septocolumellar junction (Figure 13b). The initial incision through the mucoperichondrium can be made at either side of the septum. With a sharp, pointed, curved pair of scissors, dissection is started in the subperichondrial plane and continued with a Cottle or Joseph elevator to free the mucoperichondrium over the area of septal cartilage to be resected (Figure 13b). After incising the cartilage, a subperichondrial tunnel is made over the corresponding area at the opposite side of the cartilage (Figure 13c). Care should be taken not to damage the mucoperichondrium to prevent perforation of the septum.

After additional horizontal and vertical chondrotomies with a beaver knife, the planned amount of septal cartilage can be harvested. In choosing the cartilage harvesting area, care should be taken not to disturb the continuity of that part of the quadrangular cartilage anteriorly to the imaginary line between the most caudal point of the nasal bones (rhinion) and the anterior nasal spine, to prevent sagging of the cartilaginous nasal dorsum (Figures 14a,b). A blunt forceps should be used to remove the graft material in order not to
damage the cartilage. After the sculpturing procedure, the left-over cartilage should be used as a crushed implant in the area of the previously resected cartilage to prevent the mucoperichondrium from sticking together. This procedure diminishes the chance of a septal perforation and stimulates the growth of new septal cartilage.

**Ear cartilage**

For small cartilage onlay grafts for the nasal tip, a retro-auricular skin incision is made over the concha (Figure 15).

![Figure 14a: Donor site of septal cartilage, posterior to the dotted line to guarantee septal support of the nasal dorsum with reimplantation of crushed cartilage](image)

**Figure 14a:** Donor site of septal cartilage, posterior to the dotted line to guarantee septal support of the nasal dorsum with reimplantation of crushed cartilage

![Figure 14b: Harvested septal cartilage for sculpturing columella strut and shield tip graft](image)

**Figure 14b:** Harvested septal cartilage for sculpturing columella strut and shield tip graft

Generally, pieces measuring 5–10 mm are suitable. The cartilage grafts can be harvested from the **cyma conchae** (cranial to the radix helices) or **cavum conchae** (caudal to the radix helicis), depending on the appropriate degree of bending which is needed. After freeing the soft tissue by blunt dissection over the area to be resected, two transcartilaginous incisions (No. 15 blade) are made through the cartilage and ‘post-auricular’ perichondrium (Figure 16), followed by subperichondrial dissection on the preauricular side with a sharp, pointed, curved pair of scissors, and finally by resection of the cartilage graft (Figure 17). If necessary this can be followed by harvesting of a second piece of conchal cartilage (Figures 18a,b). The skin can easily be closed with a 5/0 atraumatic nylon ‘running’ suture (Figure 18c).
To harvest a large piece of conchal cartilage, the preauricular approach is technically easier than the postauricular approach, but is less elegant as it leaves a preauricular scar. After infiltration of a local anaesthetic solution (2% lidocaine with 1:100,000 epinephrine) at the anterior side of the concha into the subperichondrial surgical plane, to facilitate the dissection, the posterior side is infiltrated, but now in the suprapерichondrial plane (Figures 19a, b). To outline the postauricular semicircular skin and cartilage incision, three needles are used, stabbed through the auricle from the anterior side just medial to the antihelix,
following the lateral border of the cavum and cymba conchae (Figure 20). After incising the skin along the line indicated by the needles (Figure 21), the postauricular perichon-drium and conchal cartilage are incised, leaving the perichondrium intact on the anterior side (Figure 22). With a sharp, pointed, curved pair of scissors, subperichondrial tunnelling is then carried out over the cavum and cymba conchae (Figure 23).

Figure 19a: Application of local anaesthesia: anterior side in subperichondrial plane

Figure 19b: Application of local anaesthesia: posterior side in supraperichondrial plane

Figure 20: Three through-and-through needles to mark the postauricular skin and cartilage incisions

Figure 21: Skin incision along the landmark of the needles

Figure 22: Transcartilaginous incision leaving the preauricular perichondrium intact
Figure 23: Subperichondrial tunnelling over the cavum and cymba conchae

The next step is to free the cartilage at the posterior side by blunt dissection in a supraperichondrial plane (Figure 24). The cartilage is now incised just lateral of the ear canal, leaving the radix helicis intact for structural support and finally resected (Figures 25a,b). After meticulous haemostasis, the skin incision is closed with a 5/0 atraumatic running suture. Carefully applied conchal packing, secured with through-and-through mattress sutures (Figures 26), and a light compression ear bandage will prevent the formation of haematoma.

Figure 24: Supraperichondrial dissection at the posterior side

Figures 25 a,b,c: Resection of the cartilage graft leaving the radix helicis intact
Figure 26: Conchal packing fixed with through-and-through mattress sutures

In Figures 27-31 pre- and postoperative views are shown of patients who underwent a rhinoplasty with autogenous cartilage grafting procedures.

Figure 27 shows pre- (Left) and postoperative (Right) views of a patient who underwent a revision rhinoplasty, with the use of autogenous septal cartilage to lengthen the caudal septum with a batten and to augment the nasal dorsum with a septal cartilage onlay graft.

Figure 28 shows pre- (Left) and postoperative (Right) views of a patient who underwent rhinoplasty following severe trauma: Through an external approach the fractured septum was rebuilt which, in combination with a dorsal conchal cartilage onlay graft, resulted in a normal profile.

Figures 29 shows pre- (Left) and postoperative (Right) views of a patient with functional problems due to a too narrow nasal valve (right worse than left), who underwent external rhinoplasty. After a moderate reduction of the dorsal height, spreader grafts were harvested from the cartilaginous septum and placed between septum and upper laterals through an external approach. Due to widening of the nasal valve area forced inspiration did not result in alar collapse anymore.

Figure 30 shows pre- (Left) and postoperative (Right) views of an 11-year-old boy with severe psychological problems with his facial appearance, due to a severe nasal trauma resulting in a saddle deformity. He underwent an endonasal septorhinoplasty to straighten the deformed septum, to narrow the bony pyramid with micro-osteotomies and to augment the nasal dorsum with a conchal cartilage onlay graft.
Figure 28: Pre- (Left) and postoperative (Right) views of a rhinoplasty in case of severe trauma. Through an external approach the fractured septum was rebuilt which, in combination with a dorsal conchal cartilage onlay graft, resulted in a normal profile.

Figure 29: Pre- (Left) and postoperative (Right) views of a patient with functional problems due to a too narrow nasal valve (right more than left), who underwent an external rhinoplasty. After a moderate reduction of the dorsal height, spreader grafts were harvested from the cartilaginous septum and placed between septum and upper laterals through an external approach. Due to widening of the nasal valve area forced inspiration did not result in alar collapse anymore.
Figure 30 shows pre- (Left) and postoperative (Right) views of an 11-year-old boy with a saddle deformity following severe nasal trauma. He underwent endonasal septorhinoplasty to straighten the deformed septum, to narrow the bony pyramid with micro-osteotomies and to augment the nasal dorsum with a conchal cartilage onlay graft.

Figure 30: Pre- (Left) and postoperative (Right) views of an 11-year-old boy with a saddle deformity following severe nasal trauma

Figures 31: Pre- (Left) and postoperative (Right) views of patient after multiple nasal trauma with loss of most of s cartilaginous framework. An external rhinoplasty was performed. Instead of a broken columella incision a V-incision was made at the base
of the columella to perform a V-Y procedure to lengthen the columella. To rebuild the nose, autogenous rib cartilage was used.

Figures 32a-k show the harvesting of rib cartilage and the reconstruction of the nasal framework. The cartilage was harvested from the eighth rib which was sculpted into two pieces, a columella strut and a dorsal onlay graft. To prevent warping the superficial part of the rib cartilage was removed. Through an external approach, airway and dorsal profile were restored by a two-piece reconstruction in combination with a tip onlay graft to restore tip definition.

Figure 32a: Incision over 8th rib cartilage

Figure 32b: 8th rib cartilage exposed

Figure 32c: Incising rib cartilage

Figure 32d: Harvesting rib cartilage

Figure 32e: Rib cartilage

Figure 32f: External approach
Figure 32g: Columella strut

Figure 32h: Columella strut in situ

Figure 32i: Dorsal onlay graft

Figure 32j: Tip onlay graft

Figure 32k: Skin closure

Author

Gilbert Nolst Trenité MD, PhD
Professor of Otorhinolaryngology
Former President of European Academy of Plastic Surgery
Amsterdam, Netherlands
nolsttrenite@gmail.com

Editor

Johan Fagan MBChB, FCORL, MMed
Professor and Chairman
Division of Otolaryngology
University of Cape Town
Cape Town, South Africa
johannes.fagan@uct.ac.za

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