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REVIEW

Augmentation Rhinoplasty with Autologous Grafts

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Abstract The authors present their experience with nasal reconstructive surgery using autologous grafts. Currently, grafts are classified into four categories: skin grafts, cartilage grafts, bone grafts, and composite grafts (Table 1). A sample of 132 patients with nasal defects requiring reconstruction was selected. Two cases, presenting nasal valve collapse and deformities after aesthetic nasal surgery, were analyzed in detail. Overall, satisfying aesthetic results (balanced tip projection, dorsum fullness, widening of internal nasal valve angle, minor scar retraction) were achieved for both patient and surgeon in 79% of the cases.

Keywords Augmentation rhinoplasty · Composite graft · Grafts

Defects of the nasal tip, dorsum, and nasal pyramid present complex reconstructive problems because these structures are important from an anatomic and functional point of view [1]. We present our experience with nasal reconstructive surgery using autologous grafts (Table 1). We selected a sample of 132 patients (mostly women about 60 years of age) with nasal defects requiring reconstruction. Two cases presenting nasal valve incompetence and deformities after aesthetic nasal surgery were analyzed in detail.

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Overall, satisfying aesthetic results (balanced tip projection, dorsum fullness, widening of internal nasal valve angle, minor scar retraction) were achieved for both patient and surgeon in 79% of cases. Dissatisfied patients complained of scar retraction in the tip region, thickness, texture, and color of the grafted skin. With few exceptions, all the patients had a good postoperative course with no problem worthy of mention.

Materials and Methods

In the Department of Plastic and Reconstructive Surgery at the University of Rome Tor Vergata, from January 1995 to December 2004, 652 patients underwent aesthetic and reconstructive nasal surgery. Of these patients, 15 presented with nasal valve stenosis, 33 presented with nasal dorsum deformities, and 132 presented with nasal tip anatomic or functional derangements. The selected sample (132 patients with nasal tip deformities) consisted of 101 women and 31 men ranging in age from 25 to 80 years (average, 60 years). Two cases, presenting with nasal valve incompetence and deformities after aesthetic nasal surgery, were analyzed in detail.

Before surgery, standard pictures of the face and nose were taken, and the specific nasal defect was analyzed. Appropriate reconstruction was planned, and anterior rhinoscopy was performed to evaluate the nasal fossae, nasal septum, and turbinates.

In more complex cases, such as those involving very large tumors, computed tomography (CT) multislice scans with three-dimensional elaboration was performed for better visualization of anatomic structures. Follow-up visits were scheduled to occur 2 and 6 weeks after surgery, then after 3, 6, and 12 months. Thereafter, the visits were scheduled annually for up to 8 years.

Table 1 Autologous graft use

Graft type	Site of harvest	Indications
Cartilage tissue	Costal, auricular, septal	Saddle nose, deficit of the nasal dorsum, valve stenosis, "low projection" of nasal tip
Bone	Calvarial, costal, iliac crest	Deformities of nasal pyramid, saddle nose
Soft tissue	Temporal fascia, fascia lata	Deformities of nasal dorsum
Skin	Retroauricular, nasolabial groove, preauricular, supraclavicular	Supratip deficit
Skin and adipose tissue	Ear lobe	Nasal alar defects
Chondrocutaneous tissue	Helical apex and radix	Deficit of nostril rim

Results

Overall, satisfying aesthetic results (balanced tip projection, dorsum fullness, widening of internal nasal valve angle, minor scar retraction) were achieved for both patient and surgeon in 79% of the cases. Dissatisfied patients complained of scar retraction in the tip region, thickness, texture, and color of the grafted skin. With few exceptions, all the patients had a good postoperative course with no problem worthy of mention.

Broad-spectrum antibiotic coverage and meticulous aseptic technique were used, and no patient experienced infection. One case of skin necrosis occurred, and 13% of the cases required revision surgery because of graft dislocation, skin necrosis, or patient dissatisfaction with aesthetic results (Table 2).

Discussion

The goal of augmentation rhinoplasty is to restore the normal anatomy and the aesthetic proportions of the nose, to increase the projection of the nasal dorsum and nasal tip on the profile view, and to improve the passage of air through the external and internal nasal valves. The choice of reconstructive technique is based on depth, width, size, and location of the defect.

Table 2 Complications relative to the use of autologous grafts

Complication	Cases	%
Infection	0	0
Dislocation	2	6.1
Reabsorption	1	3
Skin necrosis and graft exposure	0	0
Persistent nasal obstruction (>6 mos)	2	6.1
Septal perforation	0	0
Secondary surgery	3	9.1

From 1900 to the present, a variety of reconstructive augmentation techniques have been devised. In 1913, J. S. David [2] proved that autologous grafts behave as omologous grafts in animal subjects. In 1936, Sheehan [3] proposed correcting the nasal dorsum by means of alar cartilage grafts. From 1941 to 1951, Peer [7] introduced the use of autologous nasal cartilage and auricular conchal cartilage to treat saddle nose and nasal tip deformities. In 1953, Goldman described the "floating graft" (Fig. 11), and in 1975, Sheen described the "shield graft" (Fig. 12). In 1979 Juri described the "anchor graft" (Fig. 13). In 1984 Peck described the "onlay graft" (Fig. 14), and Sheen described the "spreader graft."

Currently, grafts are classified into four categories: skin grafts, cartilage grafts, bone grafts, and composite grafts. The use of skin grafts, necessary for large defects, is based

Fig. 1 Preoperative situation in frontal projection

Fig. 2 Postoperative situation in frontal projection

Fig. 3 Preoperative situation in lateral left

on four elements: extention (width and depth) of the defect, thickness of the skin surrounding the defect, and color and texture of the skin surrounding the defect. To achieve optimal results, the grafted skin must match the skin surrounding the defect at the recipient site as much as possible.

For skin defects in the upper two-thirds of the nose and for defects of the nasal pyramid, full-thickness skin grafts are used. These grafts usually are harvested from the preauricular and supraclavicular regions [8]. Split-thickness skin grafts are used to create a base on which to attach a nasal implant because they usually undergo a much greater degree of "retraction" and appear more shiny and smooth, thus contrasting with the surrounding skin of the midface.

Small nasal alar defects can be repaired with composite grafts of auricular tissue harvested from the ear lobe, the helical rim, or the helical radix. The most common composite grafts are composed of skin and adipose tissue for repair of nasal alar defects, and of chondrocutaneous (cartilage + skin) for repair of nostril rims. A composite graft placed farther than 5 mm from a vascular bed is at risk for necrosis. Composite graft size should not exceed 1.5 cm [9].

The authors prefer cartilage skin composite grafts, cartilage-mucosa composite grafts, and spreader grafts [5]. The latter, described by Sheen [6], is a strut of cartilage designed for placement in the extramucosal tunnel interposed between the cartilaginous septum and the nasal sidewall structures. It enables the "spreading" of the triangular cartilages away from the septum, thus widening the internal nasal valve and allowing better passage of air in case of a collapsed nasal valve.

In this study, we achieved the best results with the use of composite grafts, as exemplified by the following case. In July 2003, a 33-year-old woman presented to our department with marked nasal valve stenosis (Figs. 1 and 3), accentuated on the right side. She had undergone aesthetic rhinoplasty elsewhere 1 year previously. Nasal obstruction was very marked in this patient. External nose analysis showed external valve collapse, raised nasal tip, deficit of supratip projection, columella deviation, and nasal tip hypertrophy. Anterior rhinoscopy showed a deviated nasal septum and bilateral stenosis of the internal valves.

For this case, we used a chondrocutaneous composite graft. The graft, harvested from the retroauricular part of left ear, was placed "astride" by fixing the cutaneous side of the graft on the mucosal side with absorbable stitches and securing the cartilaginous part of the graft to the cartilaginous part of the nasal dorsum with nonabsorbable stitches. Postoperative follow-up evaluation has shown optimal aesthetic results (Figs. 2, 4, 6, 8, and 10) and improvement of nasal obstruction.

These grafts (composite grafts) provide functional support to the alar cartilages, usually collapsed because of excessive resection during previous surgery. Transcolumellar open-tip access is necessary to allow for better visualization of the dorsum and for fixation of the cartilaginous structures, to allow for placement of unexposed absorbable stitches (to avoid being felt from the outside)

Fig. 4 Postoperative situation in lateral left, with augmentation of the columellar and nasal tip

Fig. 5 Preoperative three-fourths left, with nasal valve collapse

Fig. 6 Postoperative three-fourths left, with nasal valve collapse corrected

Fig. 7 Preoperative situation in lateral right

for strong fixation of the graft, and to avoid graft distortion that could compromise the aesthetic outcome (Figs. 3 and 4).

It is important that the graft be strongly secured to avoid movement because absorption is determined mainly by mobility. From a biologic standpoint, the graft in fact is nourished by imbibition and by new microvascular channels established between the graft and the recipient bed. Therefore, if the graft is not perfectly stable, vascularization will be compromised, and it will undergo dehydration and reabsorption.

Fig. 8 Postoperative situation in lateral right

Fig. 10 Postoperative three-fourths right

Fig. 9 Preoperative three-fourths right

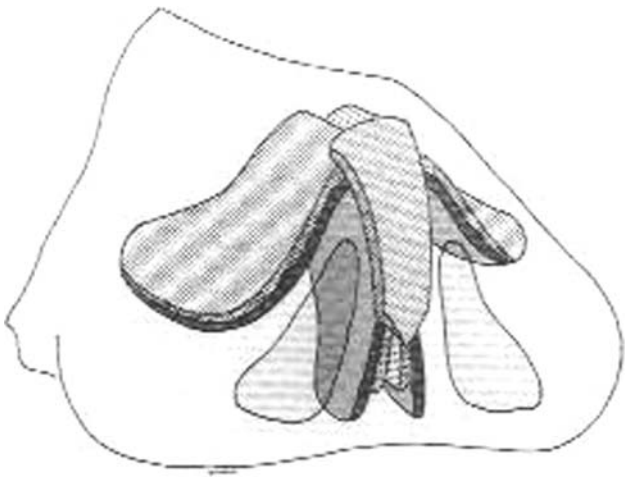

Fig. 11 Floating graft (Goldman, 1953)

As compared with skin grafts, composite grafts have only one recipient bed along the margins that directly surround the defect, so revascularization and graft take are limited by the size of the composite graft used. In general, a composite graft placed farther than 5 mm from a vascular bed is at risk for necrosis. Nevertheless, we achieved surprising results that can be explained as follows. Highly vascularized tissues, such as nose and the ear tissue, have a more extended and dense network of endothelial vessels than other tissues [8] (Figs. 5 and 6). This property facilitates imbibition from the recipient site and keeps the graft well hydrated until neoangiogenesis, neovascularization, and vascular in-growth toward the graft establish permanent vascular connections that nourish the graft. As with skin grafts, stereomicroscopic observations in humans show that vascular flow can be seen as early as 48 h after implantation of composite grafts.

Even if it seems that the greater the contact surface between the composite graft and the recipient site, the

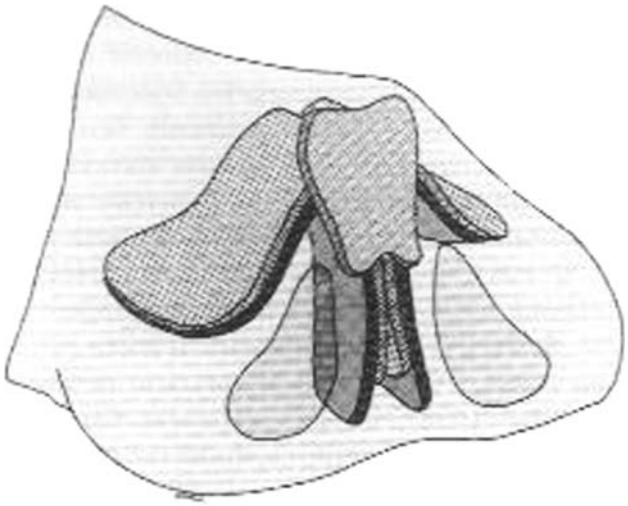

Fig. 12 Shield graft (Sheen, 1975)

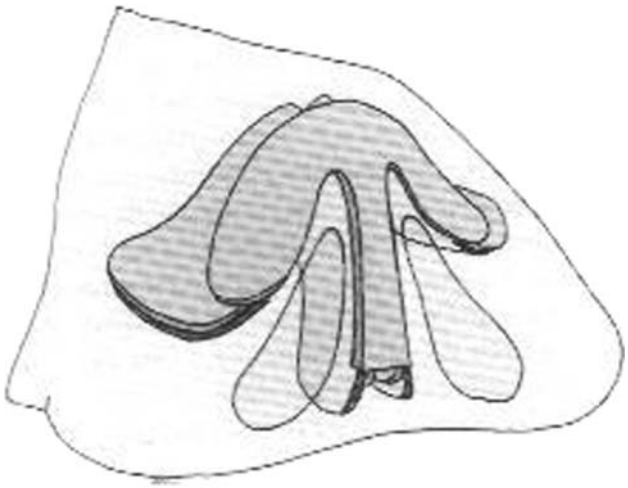

Fig. 13 Anchor graft (Juri, 1979)

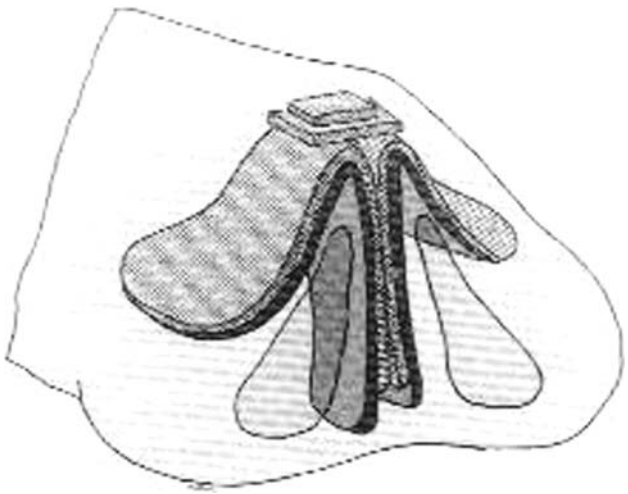

Fig. 14 Onlay graft (Peck, 1984)

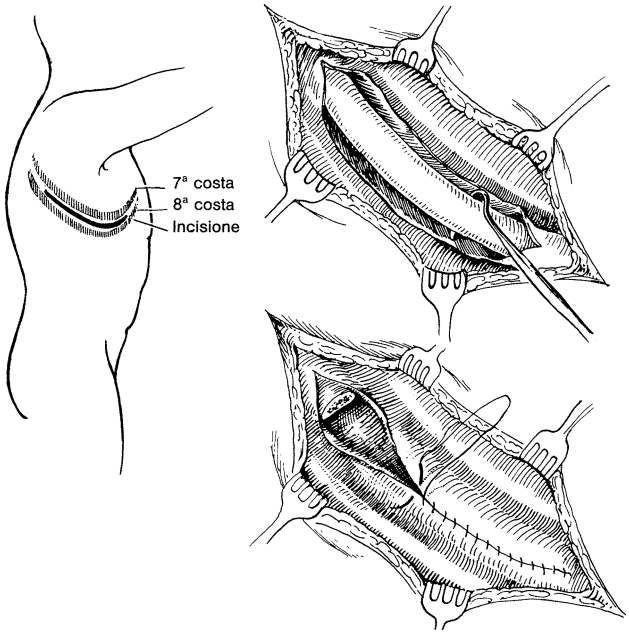

Fig. 15 Costal cartilage graft harvest

greater the neovascularization and thus the graft take, we achieved the best result with a graft size we call "precise." That is, it was neither too small to hinder graft insertion nor too large to cause early mobilization, reabsorption, or retraction of the graft.

If the open-tip access is not used, the recipient bed must be very precise and perfectly shaped for the graft to avoid movement because stabilizing stitches cannot be placed. An intranasal incision is made slightly smaller than the graft so it can be inserted and kept tightly in place. Otherwise, the graft could be extruded from the incision postoperatively.

The most common harvest sites are the nasal septum and the retroauricular region. The former is preferred for its consistency, for its abundance, and because it can be harvested without compromising mechanical stability. It is not chosen only when not available. Retroauricular tissue remains a second choice, because it is curved and must be straightened, and it is not easy to shape. Chondrocutaneous composite grafts harvested from the retroauricular region are used [8] because when retroauricular skin is placed inside the nose, it undergoes metaplasia and becomes mucosa. Also, skin does not need to face the bony surface, and this increases the chances of graft take.

For defects of the nasal dorsum and nasal pyramid, we present the following case. A 25-year-old man came to our department 18 months after previous aesthetic nasal surgery performed elsewhere with a marked deformity of the nasal pyramid. Nasal obstruction was very marked.

We operated on this patient the first time using a cartilage graft taken from the 11th rib. The postoperative

follow-up course showed good aesthetic and functional results. The patient returned to our department because he received a blow to the nose while playing basketball.

An external examination showed lateral septal deviation and graft dislocation with unilateral obstruction.

The patient underwent surgery again. The graft was removed, ensheathed in temporoparietal fascia, and inserted again. In this way, the graft surface was smoother and the aesthetic result more natural.

To fix nasal dorsum defects, autologous materials are of great value, although in recent years, surgeons have turned their interest to alloplastic materials such as Gore-Tex and Medpore [4]. Grafts of autologous cartilage, unlike bone grafts, survive well and do not need contact with nasal bones. Thus, they are well suited for reconstructive surgery cases in which nasal bones are missing [5].

Cartilage tends to return to its original shape and bend, especially in younger patients, because a system of internal forces exist that are in equilibrium in intact cartilage. In young patients, these forces can cause distortions when cartilage is sectioned or bent, whereas the cartilage in older patients is partially calcified, so the tendency to recoil is less [6]. Gibson and Davies [8] described a technique in which cartilage is cut through a balanced cross section to diminish, at least in part, the tendency to recoil. Even when this technique is carried out precisely, a portion of the graft can still bend and distort.

To avoid future cartilage distortions and bendings, graft shaping should always be reduced to a minimum, and a portion of cartilage that most closely resembles the form and shape needed should be selected to reduce graft shaping. The only way to avoid cartilage recoil and graft distortion is not to shape the graft at all. This is possible only by using cartilage harvested from the 11th rib. The 11th rib is identified, the perichondrium detached, a transverse incision placed, and the graft harvested (Illustration 5). Here, cartilage is free, short, and directed medially. The 11th and 12th ribs are called "floating" because they do not articulate with the costal margin (Fig. 15).

Maximal cartilage deformation occurs within 30 min of harvest, so it is advisable to wait this amount of time before placing the graft in the recipient site. A subcutaneous pocket is created below or above the periosteum and above the perichondrium such that it can receive the fragment (or fragments), arranged in the best possible way to fill the defect, temporarily protected by a "Spongostan" tutor.

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