Saddle nose: Classification and therapeutic management

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Introduction

The therapeutic management of saddle nose has always been a surgical challenge. This deformity corresponds to loss of projection of the cartilaginous and/or bony structure of the dorsum of the nose, which has aesthetic as well as functional repercussions. The causes of saddle nose have changed over the years: infectious and toxic causes have become less frequent, while trauma and primary or secondary reduction rhinoplasties now represent the main causes of these deformities.

The purpose of this study is to propose a precise classification of the various stages of saddle nose and the therapeutic management adapted to each situation.

Material and methods

Patients

This retrospective study was based on 25 cases operated between January 2004 and January 2011 in the department of otorhinolaryngology and head and neck surgery of...
Édouard-Herriot hospital in Lyon. Demographic data were collected: the patients’ age and gender and the cause of saddle nose in each case. A precise morphological analysis was performed in each patient to define the stage of saddle nose and to propose the most appropriate management. The surgical technique and surgical approach and the need for surgical revision were therefore recorded for each case. The minimum follow-up for each patient was one year.

**Classification**

Before describing the treatment protocol, it is important to define the various stages of saddle nose as well as their anatomical characteristics. We have used a 3-stage classification.

**Stage 1: minimal saddle nose**

Minimal saddle nose corresponds to a depression above the supratip of the nose due to loss of septal support associated with slight retraction of the base of the columella, while tip projection and rotation are not affected (Fig. 1).

**Stage 2: moderate saddle nose**

Moderate saddle nose corresponds to more marked recession of the dorsum, but not exceeding 5 mm. It induces loss of septal support that can affect its anatomical relations with the triangular cartilages, the tip or even the columella. The nose has a flattened appearance on all views. Decreased projection and/or cephalic rotation of the tip may be observed at this stage and will need to be taken into account (Fig. 2).

**Stage 3: major saddle nose**

Major saddle nose corresponds to a marked lack of bony and cartilaginous support. The bony arch of the middle third of the nose is amputated inducing major retraction of the nasal mucosa, while loss of the height of the cartilaginous septum is responsible for columellar retraction. Tip projection is decreased and the nostrils are broader, giving a short nose.
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Figure 4  Description of the extracorporeal rhinoplasty technique. Endonasal harvesting of the entire septum and modelling of the various components of the framework (top line). Details of the various components, which are then assembled (middle line). Diagram showing the position of the framework after insertion and the role of spreader grafts and tip modelling grafts (bottom line).

appearance. Functionally, this deformity alters the internal (due to collapse of septal support) and external nasal valves (due to lack of central support, the nostrils become flatter and wider) (Fig. 3).

Treatment protocol

Each operation is performed under general anaesthesia. Cartilage derived from multiple origins is used in each case: septum, concha, rib. Three incisions may be used: endonasal, external and sublabial, although this last approach is more rarely used and is confined to specific indications.

Stage 1: minimal saddle nose
Minimal saddle nose can be corrected by restoring satisfactory septal height. As sufficient septal material is available in this case, we prefer extracorporeal rhinoplasty with excision of the nasal septum and constitution of a cartilaginous framework. This technique has already been published in the context of management of crooked nose [1], which remains its main indication, but it is also adapted to these minimal stages of saddle nose. It is able to correct the defect of sagittal projection and restores a harmonious and regular dorsum. Spreader grafts associated with this rhinoplasty help to restore a harmonious appearance of the middle third of the nose and correct the defect of the internal nasal valve. The base of the nose is tightened by means of the sagittal support of the cartilaginous framework (Fig. 4).

Stage 2: moderate saddle nose
In moderate saddle nose, a linear profile cannot be restored exclusively by using the often limited septal cartilage. We therefore prefer to use conchal cartilage, which is harvested
almost entirely via an anterior approach. The harvested conchal cartilage is used to create tailored grafts with an inverted U shape that can be placed on top of each other, like roof tiles or Russian dolls, according to the desired length and height. These grafts are always inserted via an external approach and are sutured to avoid any displacement and secondary deformity. When saddle nose deformity is associated with decreased tip projection and/or modification of tip rotation, this procedure is completed by placement of a columellar support that can be included in the previously described cartilaginous framework, as a simple augmentation effect on the dorsum does not resolve the deficient support of the base of the nose characterized by splayed nostrils, poor tip projection and a short columella (Fig. 5).

Stage 3: major saddle nose
Major saddle nose is observed less frequently and is secondary to major trauma or malformative syndromes such as Binder’s syndrome. This deformity requires a major reconstructive procedure using a sufficient quantity of robust material. Costal cartilage meets all of these criteria. It is harvested from the 7th, 8th and possibly the 9th ribs depending on the quantity of material required. These costal grafts are modelled to reconstitute the L-shaped frame of the dorsum. The prefabricated graft is generally inserted via an endonasal or sublabial approach, depending on the severity of skin retraction. An external approach is not suitable in this indication, as it could induce excessive skin traction or disunion of the columellar incision. Nose contour improvement procedures can be associated, but are often difficult due to the characteristic mucocutaneous retraction of these short, constricted noses (Fig. 6).

Results

This series of 25 cases comprised 18 women and 7 men with a mean age of 41 years. The causes of saddle nose, in decreasing order of frequency, were: surgical (14 cases, 56%), traumatic (7 cases, 28%) and malformative corresponding to Binder’s syndrome, a developmental abnormality of the anterior part of the maxilla and nasal complex (3 cases, 12%) and one case of auto-immune disease (4%).

Figure 5 Description of the multilayer conchal graft, top view (top left), bottom view (top right) and lateral view (bottom).

Figure 6 Photos of costal cartilage grafts with design of a mortise and tenon system (left) and after assembly (right).
Three cases of minimal saddle nose, 17 cases of moderate saddle nose and 5 cases of major saddle nose were identified. Each stage corresponds to a specific treatment, as described above. Grafts were harvested from the septum in 3 cases, conchal cartilage in 17 cases and costal cartilage in 5 cases, corresponding to the 3 stages. The surgical approach was external in 17 cases, endonasal in 6 cases and sublabial in 2 cases. In 10 cases of minimal saddle nose, a columellar support was used to correct the deficient tip. No cases required surgical revision for mobilization or deformity of the graft or because of patient dissatisfaction. All results are described in Table 1.

### Clinical cases

#### Stage 1: moderate saddle nose

This 23-year-old woman presented with post-traumatic minimal saddle nose. Analysis of the profile revealed a depression above the supratip with moderate retraction of the base of the columella. The impression of flattening of the nose when viewed from the front was only moderate. Viewed from below, the nostrils had a splayed appearance (Fig. 7).

The extracorporeal rhinoplasty technique with creation of a cartilaginous framework allowed correction of the depression observed on the lateral view and re-tightening of the base of the nose. The depression of the middle third of the nose was corrected on the frontal view. Tightening of the columella allowed correction of the splayed nostrils when viewed from below.

#### Stage 2: moderate saddle nose

This 55-year-old woman presented with moderate saddle nose following primary rhinoplasty due to excessive reduction of the dorsum. On the frontal view, she presented an inverted V appearance of the middle third of the nose with interruption of Sheen’s lines. On the lateral view, she presented loss of projection over the entire length of the dorsum with no major deformity of the tip, resulting in a satisfactory appearance when viewed from below. The nasofrontal angle was abnormally small (Fig. 8).

This patient was treated by external rhinoplasty with placement of a multilayer conchal cartilage graft. One concha was sufficient for this procedure. No tip procedure was performed due to the normal tip projection and placement of a columellar support was unnecessary. The postoperative result at 6 months showed restoration of a regular dorsum and aesthetic Sheen’s lines on the frontal view. The lateral view showed correction of the depression with redefinition of a correctly situated radix and a satisfactory nasofrontal angle.

### Stage 3: major saddle nose

This 32-year-old man presented major saddle nose of autoimmune origin. Almost complete amputation of the middle and superior thirds of the nose gave the impression of a short nose, accentuated by decreased projection and cephalic rotation of the tip (Fig. 9).

This patient was treated by costal cartilage graft reconstruction to redefine the height and projection of the nose. This procedure was performed via an endonasal approach due to the moderate mucocutaneous retraction.

This child presented Binder’s syndrome, responsible for an anomaly of anterior development of the maxilla and nasal complex. On the frontal view, the nose was effaced with almost absent middle and superior thirds of the nose with a flat tip and broad nostrils. The lateral view revealed a short nose with a very short septum (Fig. 10).

Placement of a costal cartilage graft via a sublabial approach restored satisfactory sagittal height, corrected the insufficient tip projection and allowed redefinition of the tip. On the lateral view, the aesthetic dorsal lines of the nose were clearly visible and the nostrils were smaller and less flattened.

### Discussion

Correction of saddle nose constitutes one of the most controversial aspects of rhinoplasty. Many authors, such as Sheen, Tardy, Gunter or Daniel [2–5], have already published reference studies on this subject. The present study does not claim to be innovative, but was designed to describe adapted therapeutic management based on a specific anatomical and functional analysis.

The first element of discussion concerns the reconstruction materials used to correct saddle nose. We use cartilage derived from various sites depending on the shape and number of grafts required: septum, concha or rib, as cartilage is an easily harvested material that can be easily modelled to form fine, anatomical grafts to correct superficial irregularities, or very large grafts to fill large defects.
We use the extracorporeal rhinoplasty technique with the
design of a cartilaginous framework to treat minimal saddle
nose. The original indication for this technique was crooked
nose, but we have found that it provides satisfactory results
for this type of saddle nose. Most authors, such as Daniel,
prefers to use a septal graft to treat minimal saddle nose,
with good results. However, saddle nose is rarely an isolated
deformity, as confirmed by our series, and our technique
allows correction of certain associated septal abnormalities
and can also be used to correct retractions of the base of
the columella.

The majority of cases in this series presented a moderate
stage of saddle nose, responsible for aesthetic as well as
functional complaints. External surgery appears to be essen
tial, as it allows a better analysis and precise correction
of the deformities. This stage is associated with an insuffi
cient quantity of septal material that often cannot be used
for grafts. The frequently associated mucosal retractions
make septal harvesting more complex and with a risk of
septal perforation. Conchal cartilage appears to be more
suitable. It can be easily harvested, preferably via a sim
ple anterior approach with a minimal scar. Almost all of
the concha can be harvested without incurring any aesthetic
or functional sequelae. Modelling of single or multilayered
grafts was sufficient in our study to restore satisfactory pro
jection of the dorsum, thereby avoiding the need for the
more complex costal cartilage harvesting procedure. The
DC-F technique (Diced Cartilage wrapped in deep tempoal Fascia) described by Daniel [6,7] consists of creating a
composite graft of diced cartilage wrapped in a sheet of
depth of temporal fascia. It is particularly adapted to this type
of saddle nose when the available cartilaginous material
cannot be used. This technique was not used in the present
series, as good quality cartilaginous material was available
in every case. Conchal cartilage can also be used to correct
defects of tip projection or rotation by designing a columnel
support or other grafts designed to correct the shape of
the tip.

In the case of major saddle nose deformities, requir
ing a considerable volume of graft material, bone grafts
derived from the skull or iliac crest are classically used [8].
Costal cartilage graft can also be used to treat major sadd
le nose, despite its reputation for a tendency to resorption
and deformity over time. The study by Toriumi [9] on the
use of concentric grafts rather than eccentric grafts or the
study by Gunter [10] on the need for internal stabilization
of grafts by Kirschner wire did not demonstrate this ten
dency. No cases of secondary displacement of costal graft or
marked resorption requiring surgical revision were observed
in this relatively small series.

The use of synthetic or homologous cadavre grafts
is rejected by most teams for the treatment of saddle
nose, as many cases of extrusion and infection have been
reported.
Figure 8  Preoperative (left column) and postoperative (right column) frontal, lateral and basal views.

Figure 9  Preoperative (left column) and postoperative (right column) lateral views.
Conclusion

Saddle nose is a classical but difficult problem in nasal reconstruction, requiring detailed analysis of the clinical signs in order to identify all of the deformities. The treatment strategy proposed here is based on a classification that is designed to be as practical as possible and which allows progressive and adapted therapeutic management. The results obtained support our belief that correction of saddle nose must be adapted to the severity of each case rather than using a single technique for all cases.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


