

Grafts in “closed” rhinoplasty

Innesti in rinoplastica “chiusa”

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SUMMARY

Rhinoplasty is a fascinating and complex surgical procedure aiming at attaining a well-functioning and aesthetically pleasant nose. The use of grafts is of the utmost importance for the nasal surgeon to achieve such results. However, the philosophy and technical use of nasal grafts are different in “closed” and “open” rhinoplasty. The aim of this paper is not detailed description of the numerous grafts reported in the literature; we will describe the main principles of grafts use in “closed” rhinoplasty derived from our experience, with special reference to the philosophical and technical differences in their employment between “closed” and “open” rhinoplasty. Some cases are reported as an example of graft use in “endonasal” approach rhinoplasty.

KEY WORDS: “Closed” rhinoplasty • Graft • Surgery • Review

RIASSUNTO

La rinoplastica è una procedura chirurgica affascinante e complessa che ha l’obiettivo di ottenere una naso funzionalmente efficiente ed esteticamente piacevole. L’uso di innesti è di assoluta importanza per il chirurgo nasale allo scopo di ottenere tale risultato. Tuttavia, la filosofia e le tecniche di impiego degli innesti sono estremamente differenti nella rinoplastica “chiusa” ed “aperta”. Scopo di questo capitolo non è una descrizione dettagliata dei numerosi innesti già descritti in letteratura; descriveremo invece i principi fondamentali dell’utilizzo degli innesti nella rinoplastica “chiusa” sulla base della nostra esperienza, con particolare riferimento alle differenze filosofiche e tecniche nel loro impiego in rinoplastica “chiusa” ed “aperta”. Riportiamo alcuni casi esemplificativi di utilizzo di innesti mediante approccio “endonasale”.

PAROLE CHIAVE: Rinoplastica “chiusa” • Innesto • Chirurgia • Revisione

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Introduction

Rhinoplasty is a fascinating surgical procedure that has apparently already been described in all its features and details. However, the number of revision procedures has been increasing in the last decade, probably in relation to the rising number of operations performed worldwide, but perhaps also in relation to the poor knowledge and experience of some surgeons performing this procedure. We agree with Rollin Daniel, who starts his book “Mastering rhinoplasty” stating: “based on my 25-year experience of practicing, teaching and writing about rhinoplasty surgery, I have come to the conclusion that we must simplify the rhinoplasty operation”¹. Such simplification is one of the keys to obtain an aesthetically pleasing nose with the lowest risk of complications and need for surgical revision. The principle of “simplify” is also considered in the long-lasting debate between “closed” (endonasal) approach rhinoplasty and “open” (transcolumellar) rhinoplasty supporters. For both groups, the final purpose of

rhinoplasty is a pleasing, natural nose with good breathing function: such a result can be achieved with both “endonasal” and the “transcolumellar” approaches. However, “open” rhinoplasty has become more and more popular in the last decades, especially thanks to the American surgical school¹⁻³. The reason for this success is probably related to the apparently greater “simplicity” of “open” rhinoplasty, because of the superior anatomical exposure and control offered by this approach¹⁻³. However, modern surgery is continuously searching for minimally-invasive techniques without visible scars, reduced surgical time, quicker postoperative healing, preservation of the natural anatomy and aesthetic appearance, and restoration of the physiologic elasticity of operated structures. Basing on these principles, “closed” rhinoplasty seems extremely modern, since it allows appropriate repositioning of nasal elements with modest anatomical modifications and minimal use of grafts (only when strictly needed)⁴. According to “closed” rhinoplasty supporters, these principles

are the main reason to define the higher “simplicity” of the “endonasal” approach compared to the “transcolumellar” one. Therefore, “simplifying” rhinoplasty would also mean answering the question of “when should grafts be used?” The answer is simple: “always” in “open” rhinoplasty, and “only when necessary” in “closed” rhinoplasty procedures^{1,3,4}.

The aim of this chapter is not accurate description of every single graft potentially used in rhinoplasty, since an immense amount of books and articles has already been published on this topic. We will focus on the different philosophies and use of grafts in “closed” rhinoplasty compared to the “transcolumellar” approach. We will describe the most commonly used grafts in “closed” rhinoplasty, with special reference to the insertion/fixation technique, to show the possibility to use grafts “simply” in both the “endonasal” approach and the “transcolumellar” one. In particular, we will provide a more accurate description of our personal use of “spreader grafts” (the so-called “rail-spreader”), which is traditionally considered one of the main advantages of “open” rhinoplasty compared to an “endonasal” approach¹⁻⁸. The description of the “rail-spreader” is used to confirm the possibility to use grafts “simply” in both an “endonasal” and “transcolumellar” approach.

Grafts

In 1931, in his masterpiece “*Nasenplastik und sonstige Gesichtsplastik*”⁹, Joseph described septal and auricular cartilage grafts for the repair and reconstruction of nasal defects; since then all kinds of grafts (as we know and use them today) have been described. All grafts were inserted through endonasal incisions until the 1970s (i.e. the shield and spreader grafts proposed by Sheen in 1984, the columellar strut and spreader graft described by Baum in 1977, the columellar batten proposed by Goldman in 1953 and the “onlay graft” placed on the domes described by Peck in 1983)⁸⁻¹².

The use of grafts in “closed” rhinoplasty is substantially different from their application in “open” rhinoplasty. Such a difference is mainly in primary rhinoplasties. According to Daniel, in “open” rhinoplasty grafts must be an integral part of the analysis and operative planning, and not an intraoperative necessity”. In the “transcolumellar” approach, grafts have a “structural” role, thus becoming an essential part of the new, altered, (sometimes) unnatural anatomy of nasal structures: grafts are used in about 99% of all “open” rhinoplasties^{1,3}. On the contrary, in “closed” rhinoplasty, grafts have a “defining” role and should be used only when necessary during the surgical procedure: preserving the integrity of nasal skin enables a precise assessment of the result obtained during surgery (and therefore the intraoperative necessity of grafts), thus allowing to determine the need for possible modifications or removal of grafts^{4,8,13}.

Therefore, the aims of graft use in “closed” rhinoplasty can be summarized as follows:

- a) better definition of the result (already partially obtained with other procedures) in relation to an increase of tip projection;
- b) better definition of nasal tip rotation;
- c) modification and definition of the (acute) naso-labial angle;
- d) widening and definition of a (too deep) naso-frontal angle;
- e) defining the columellar “double break”;
- f) hiding minor irregularities of the dorsum after hump removal and osteotomies.

Even though these aesthetic results can often be obtained (for the most part) without the use of grafts, their employment helps to stress and better define these aesthetic elements^{4,8,13}.

Some exceptions to this rule are represented by those situations in which the absolute need of grafts can be foreseen preoperatively: a) increasing a (too much defined) naso-frontal angle, thus allowing better assessment of hump removal; b) widening an acute naso-labial angle (especially in the feminine nose); c) modifying a short columella, especially in the “Binderian” nose^{4,14-16}.

Also, graft positioning and fixing is different in “closed” vs “open” rhinoplasty. According to Tardy, “the graft should be laid in its bed as a hand in a glove”. The preservation of skin continuity in “closed” rhinoplasty allows to allocate the graft in a precise envelope pocket, which can keep it in place avoiding any graft distortion or displacement; if needed, the graft can be fixed to the nasal structures with reabsorbable sutures (different from the non-reabsorbable sutures used to fix grafts in “open” rhinoplasty)⁴.

Thus, the “endonasal” approach allows to respect natural anatomical structures and reposition them in the most natural and physiological way, with no need to support them with unnatural grafts or fix them in place with non-reabsorbable sutures. The operated nose, after a relatively short healing time, will return to its previous elasticity and mobility (especially in the articulation among lower lateral, upper lateral, and septal cartilages) and will maintain a mobile and elastic fibrous septum⁴.

Personal experience

Herein, we present the theoretical and practical principles we have developed over 26 years of experience on 2400 rhinoplasties performed with an “endonasal” approach. The grafts we used were all cartilaginous, obtained from the nasal septum or auricular concha, and occasionally in association with the bony septum. The costal cartilage was used only in three revision procedures. No synthetic material (Gore-Tex or silicone) was used, while minor corrections were obtained with fat or filler injection.

As with cartilage grafts, we used them either “unmorcelized” (only by tailoring its edges or with superficial cross-hatching) or “morcelized” (to cover irregularities, especially in case of thin skin). Cartilage grafts were kept in place by inserting them into “precise” nasal pockets, suturing them to other nasal structures with reabsorbable sutures, or with a “gelfoam sandwich” or fibrin glue (more rarely). In revision rhinoplasty with saddling of the nasal dorsum, we often used a diced cartilage obtained by cutting the cartilage into small (1-2 mm) fragments occasionally wrapped by fascia temporalis.

The types of graft we used in “closed” rhinoplasty are the same adopted in “open” rhinoplasty. However, the purpose of their use and the insertion modalities are different (see above for details). In particular, preserving nasal skin continuity allows keeping the graft in place without suture fixation or by suturing it in place with reabsorbable suture. The frequency of their employment is also much different: Toriumi and Daniel reported using grafts in 99% of their rhinoplasties^{13 15}. In our experience, we used grafts in only 35% of “closed” rhinoplasties. The most important difference is related to considering the graft as an “element of definition” (rather than a “structural element” as in “open” rhinoplasty) to be used as a “not-a-priority” element, only to improve or attain a better definition of the result already obtained by recomposing the nasal anatomical structures (especially cartilaginous).

Most common grafts used in “closed” rhinoplasty

Floating graft (Goldman)

The “floating graft”, firstly described by Goldman, is used to define the columellar profile or correct a “hidden” columella. It is moulded and weakened to prevent it from appearing under the skin. It is inserted through the columellar segment of the marginal incision (Figs. 1a-c). Preserving the integrity of columellar skin in “closed” rhinoplasty guarantees graft stability without the need for graft

fixation with suture (differently from “open” rhinoplasty). When Goldman described this graft in 1953, he underlined: “the necessity for insertion of a batten or button of cartilage becomes a matter of judgement”¹¹. The result of this graft is cosmetic improvement of the columellar profile and a possible influence on tip projection (due to strengthening of the columellar cantilever).

Shield graft (Sheen)

The shield graft is usually attained from septal cartilage; it is accurately moulded and edge-bevelled to obtain a shield-like shape¹³. The graft is inserted at the tip-columellar junction (anterior to the intermediate crura) to define the “double-break” columellar profile. The graft stiffness should be adjusted to prevent it from appearing under the skin. Once again, the “endonasal” approach offers the surgeon a precise skin pocket for graft insertion (Figs. 2a, b), thus allowing an immediate verification of graft positioning and avoiding the risk of graft excessive pressure under the skin (“tent-effect”). Alternatively, the graft can be fixed to the inferior lateral crura (after a “delivery” procedure) with reabsorbable suture.

Onlay graft (Peck)

“Peck’s onlay” is one of the most commonly used grafts. It is placed on the domal area¹² and can be used in both “closed” and “open” rhinoplasties with similar effects:

- increase of tip projection (adapted by the use of multi-layer onlay graft);
- variation of tip rotation, in relation to its more cranial or caudal placement.

Special attention should be paid in case of thin skin because of the risk of the graft becoming visible through the cutaneous envelope. In contrast, the onlay graft is extremely useful to increase tip projection in case of a thick fatty skin. It can be sutured directly (Figs. 3a, b) to the domes (after the “delivery” of the inferior lateral cartilages) or can be inserted and fixed in place (Figs. 3c-e) with a “U” transcutaneous suture (in this case, marking the desired position of the graft on the



Fig. 1. Goldman “floating graft”. Drawing on the columella (A); shaped graft (B); graft insertion through the columellar segment of the marginal incision (C).

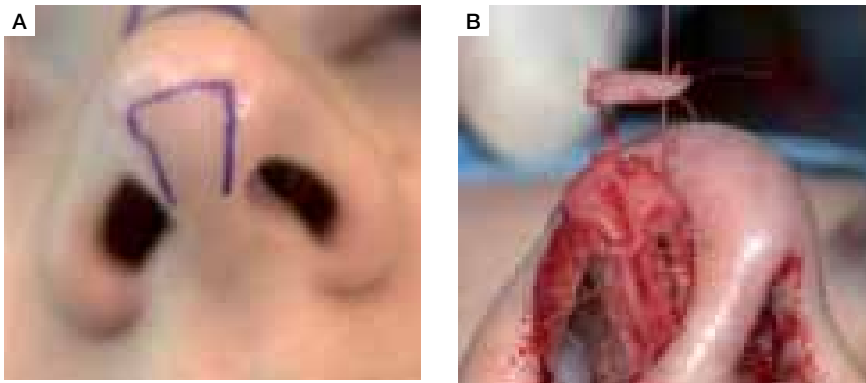


Fig. 2. Sheen “shield graft”. Drawing on the columellar (A), the graft is fixed to the inferior lateral crura (after a “delivery” procedure) with reabsorbable suture (B).

skin before suture insertion can help to achieve the exact graft positioning).

Pre-spinal graft

The pre-spinal graft is used to widen an acute naso-labial angle, thus increasing tip rotation. It can be prepared with cartilage fragments trespasssed with a single reabsorbable

suture (similar to a “pearl necklace”). A pre-spinal pocket is created through the hemitransfixion incision. The suture is passed transcutaneously to lay the cartilage “pearl necklace” in the pre-spinal pocket (Figs. 4a, b). The suture, cut and stuck to the pre-spinal skin with a steri-strip, stabilizes the graft during the healing process. The hemitransfixion incision is sutured to immobilize the graft in the pre-spinal pocket ⁴.

Dorsal graft

The dorsal graft is similar, in terms of indications and technical details, in “closed” and “open” approaches. It is often used in revision rhinoplasty to correct a saddle dorsum deformity secondary to a previous excessive hump removal. In such cases, no specific difference can be noticed between “closed” and “open” rhinoplasty. As with primary rhinoplasty, in our experience dorsal

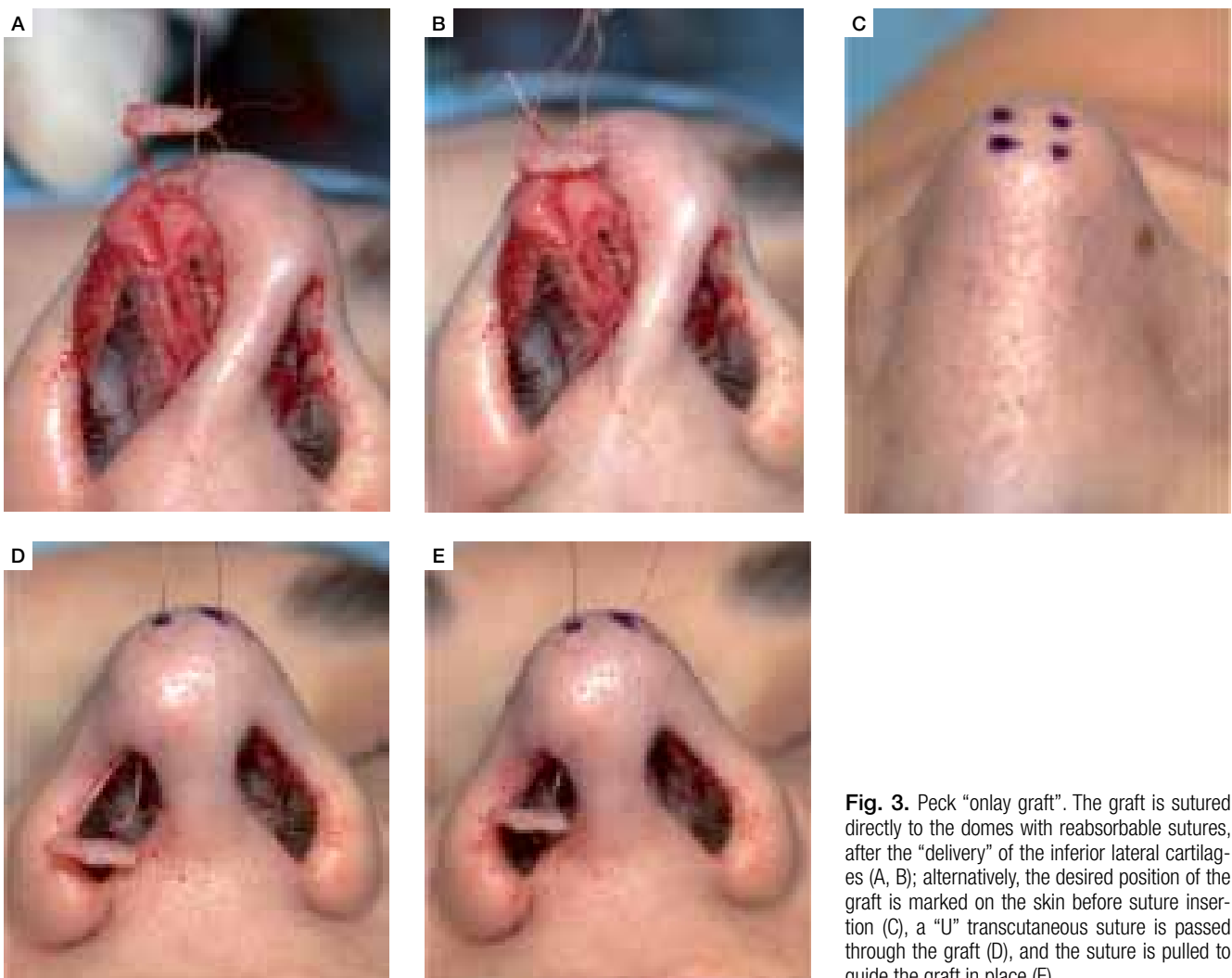


Fig. 3. Peck “onlay graft”. The graft is sutured directly to the domes with reabsorbable sutures, after the “delivery” of the inferior lateral cartilages (A, B); alternatively, the desired position of the graft is marked on the skin before suture insertion (C), a “U” transcutaneous suture is passed through the graft (D), and the suture is pulled to guide the graft in place (E).

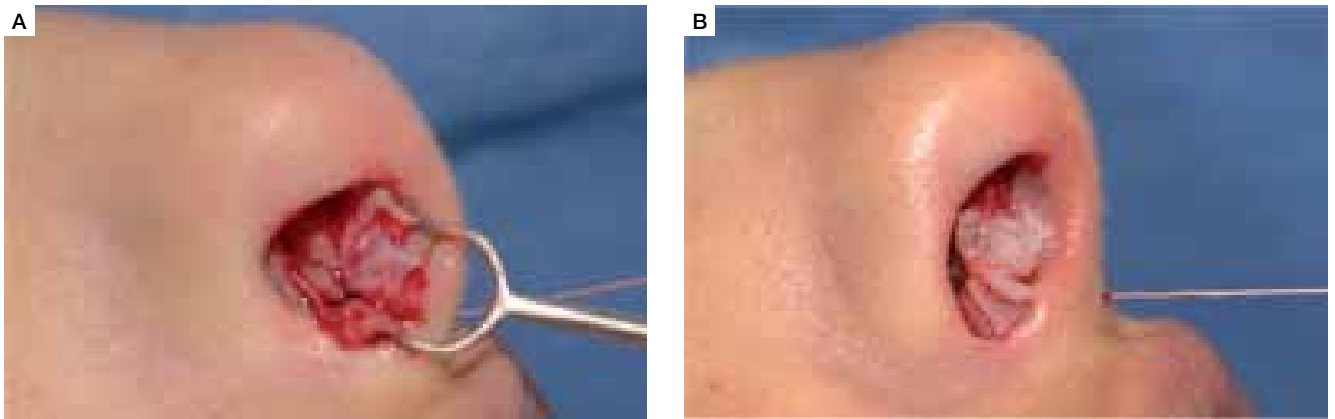


Fig. 4. The pre-spinal graft. The cartilage fragments are transpassed with a single transcutaneous reabsorbable suture (“pearl necklace”) (A); the suture is pulled to guide the graft through the hemitransfixion incision into the pre-spinal pocket (B).

grafts are useful to attain a smoother nasal dorsum and avoid any irregularity of the nasal surface. A strip of (weakened and moulded as needed) cartilage is inserted on the bony-cartilage dorsum after raising the dorsal skin with Aufricht elevator. In case of graft pocket exact size (in relation to graft dimension), the pocket itself will keep the dorsal graft in place with no need for further fixation. However, it can be useful to immobilize the graft with transcutaneous needles until nasal taping is completed (Figs. 5a, b). In case of a wider skin dissection, the dorsal graft can be inserted and maintained in place by transcutaneous sutures⁴. In our experience, we find it easier to insert the cartilage graft within a “gelfoam sandwich”: the gelfoam will maintain the graft in place in the first healing days and will dissolve completely later on¹⁶.

Among dorsal grafts, we would like to underline the importance of the “radix graft” used to “fill in” (making it flatter) the naso-frontal angle¹⁷. The use of a “radix graft” should be planned preoperatively in case of a “too much defined” (deep) naso-frontal angle, whose correction may lead to an excessive hump removal in the attempt to adapt the dorsal height to the naso-frontal angle. In such a case, the result would be represented by an unnatural saddle profile with a hyperprojected tip (Figs. 6a, b). A “radix graft” (moulded

and morcelized as needed), eventually wrapped in temporalis fascia, is inserted and pulled in place with a transcutaneous “guide” suture (Figures 6c,d). Special attention should be paid to avoid rough or rigid grafts, which may cause irregularities or protrusion under the skin.

Columellar strut

In 1932 Eitner, in his masterpiece “Kosmetische operationen”, described a graft inserted between the middle crura to support tip projection in bulbous or fatty skin noses¹⁸. In 1944, Daley proposed a mattress suture to stabilize this graft in place¹⁹. Finally, in 1977 Baum confirmed the indications of this graft in fatty skin noses and bulbous tips (“to force ends of lateral crura to project upward simultaneously”), in order to avoid the loss of tip projection along time¹⁰. Nowadays, this still remains the main indication of columellar strut in “closed” rhinoplasty.

The philosophy and use of columellar strut in “open” rhinoplasty is different from its use in an “endonasal” approach: Daniel reports using this graft in 99% of his surgeries¹³. We believe this represents one of the major differences between the two approaches. We agree with Tebbetts on the possibility to attain tip projection, in most cases, with the “simple” reshaping-suturing of nasal tip

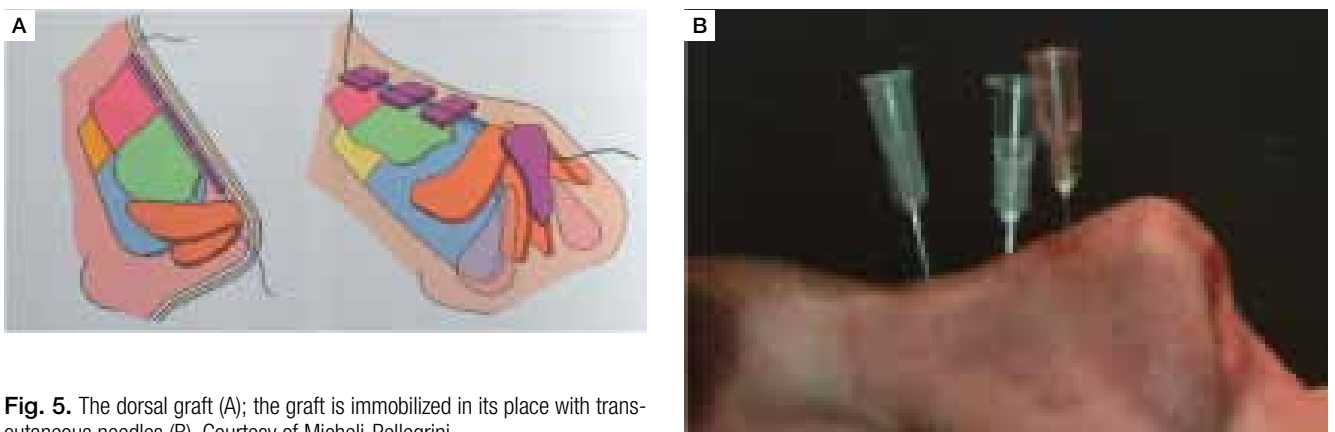


Fig. 5. The dorsal graft (A); the graft is immobilized in its place with transcutaneous needles (B). Courtesy of Micheli-Pellegrini.

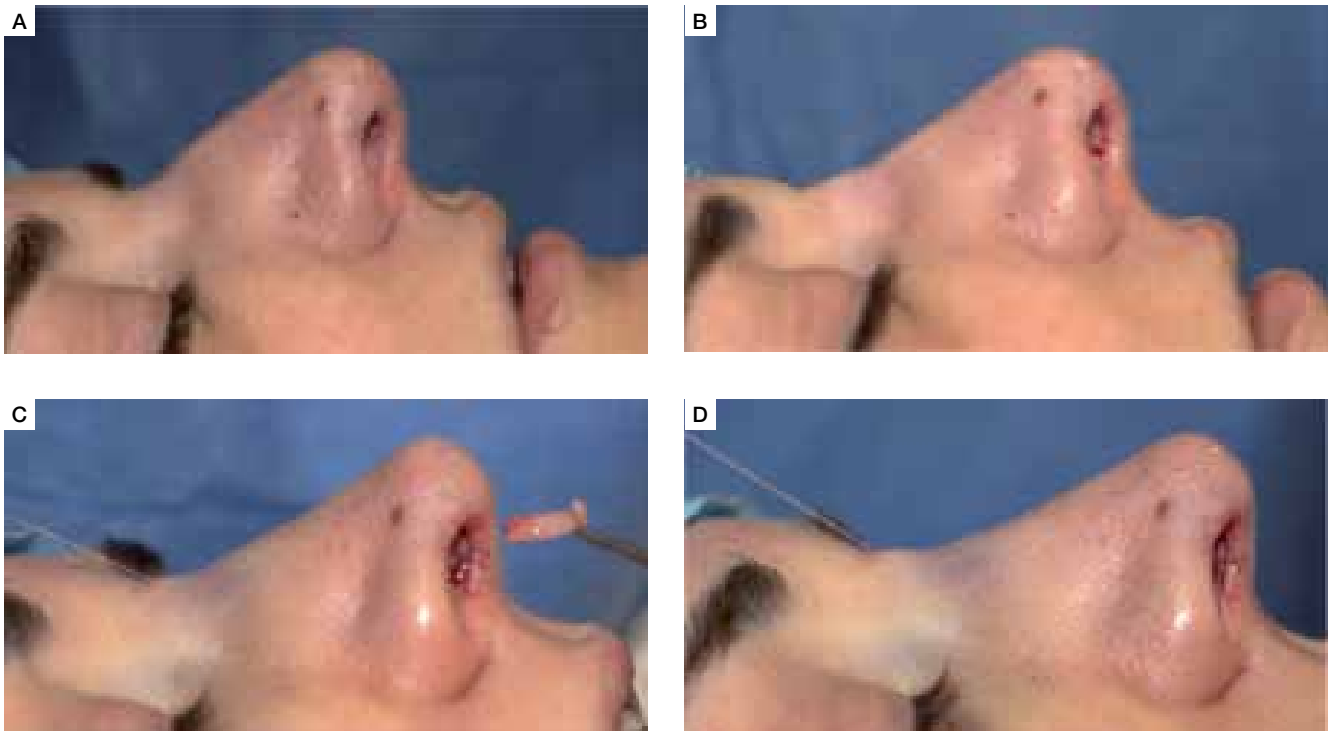


Fig. 6. The radix graft. Nasal hump with a deep naso-frontal angle (A); apparent reduction of the hump severity after placement of a “radix graft” (B); the transcutaneous suture is pulled to guide the graft in place (C); the graft is stabilized in place (D).

cartilaginous structures². Moreover, we believe that septal caudal edge acts as a pillar and represents a valid support for tip projection in most primary rhinoplasties. However, the loss of tip support secondary to columellar incision makes it necessary to place a columellar strut in almost all “open” rhinoplasties to avoid tip deprojection over time.

We use a columellar strut in all cases of hypoprojected tip, such as the so-called “binderian” nose, where a long columellar strut is needed to modify the severe lack of tip projection typical of those noses. In our experience, a columellar strut is also used to enhance tip rotation (in agreement with the principles of Anderson’s “tripod theory”)²⁰.

As to strut insertion in “closed” rhinoplasty, the graft can be placed either in an intercrural “exact size” pocket through a columellar marginal incision, or by suturing it between the middle crura after the delivery of inferior lateral cartilages. The preservation of columellar skin integrity helps to insert and maintain the position of the graft (Fig. 7).

Lateral crural strut graft and alar rim graft

The lateral crural strut graft and the alar rim graft are used for a better definition of nasal tip contour and alae in primary rhinoplasties. In secondary rhinoplasties, they are used as a support/recovery of weakened/depleted inferior lateral cartilages secondary to excessive resections during previous surgeries^{21 22}. We will not focus on such grafts, since their use is similar in both “closed” and “open” approaches.

Spreader graft

In 1984, Sheen⁸ described the spreader graft for the first time in his article “A method of reconstructing the roof of the middle nasal vault following rhinoplasty” as a way to correct the “narrow nose syndrome”. As to spreader graft indications, he added: “specifically, noses with short bones, thin skin, weak cartilage, ...predictably, these noses will be too narrow following resection of the roof”. This still remains, together with the narrowing/collapse of the internal nasal valve, the major indication for use of a spreader graft. In our experience, we used spreader grafts



Fig. 7. The “columellar strut” is fixed to the middle crura with reabsorbable suture.

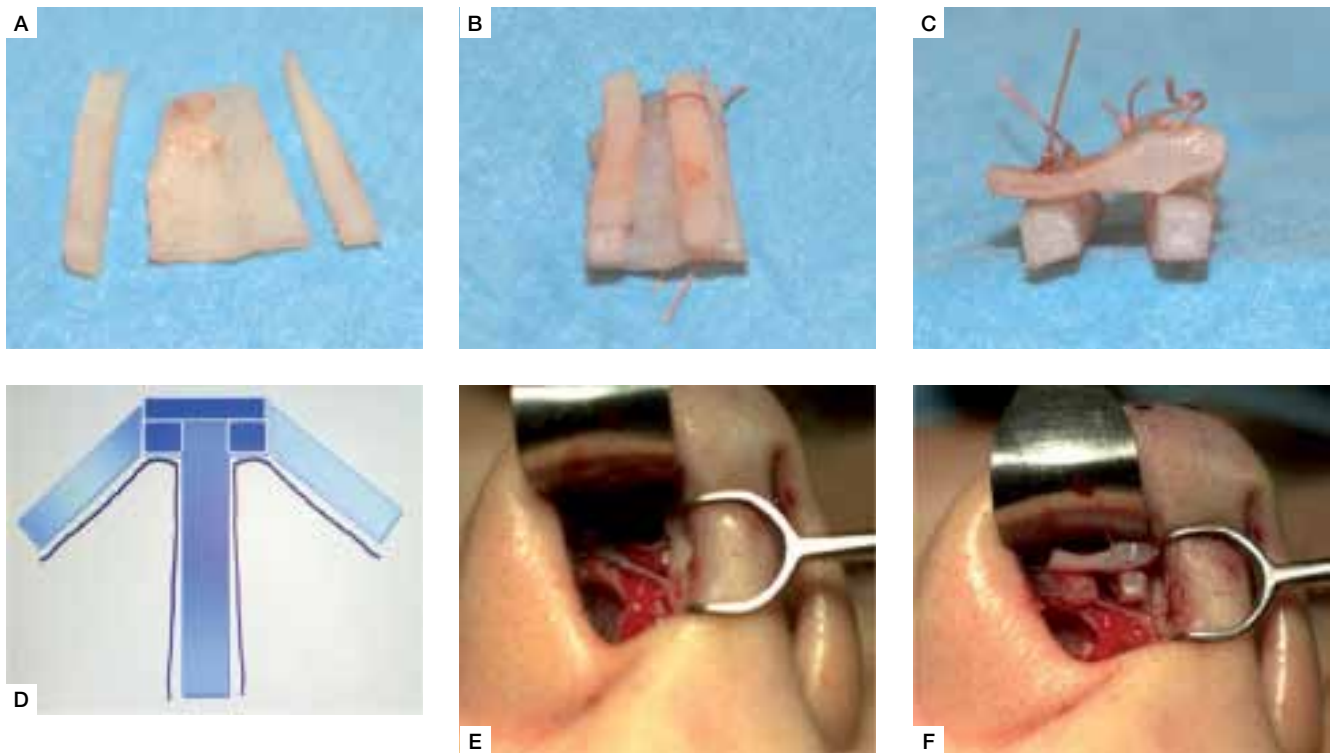


Fig. 8. The "rail spreader". The trapezoid cartilage base and two cartilage strips (A); the graft is composed with reabsorbable suture (B); the 3-dimension "rail-spreader" (C); drawing of "rail-spreader" position (D); the extramucosal approach: notice the upper edge of the septum and upper lateral cartilages creating two tunnel pockets for graft placement (E); the "rail-graft" is inserted (F).

in about 10% of our primary rhinoplasties, with a small increase of this percentage in secondary procedures. Differently, the supporters of "open" rhinoplasty report a more frequent use of spreader grafts. We prefer to limit the use of such graft only to selected cases, since we believe that a systematic use of spreader grafts may cause a substantial stiffening of the nose and loss of the natural elasticity of the cartilaginous pyramid that will remain substantially unmodified in the long term. Another limitation to the use of spreader grafts in our experience is represented by the higher complexity of graft positioning and suturing in "closed" rhinoplasty compared to a "transcolumellar" approach^{1 2 4 8}. In order to avoid such difficulties, we have developed and used an easily custom-made spreader graft, called the "rail spreader". The name is related to its shape, similar to railroad tracks. It is composed of a cartilage base (obtained from the nasal septum or the auricular concha) shaped as a trapezoid (its length and width are decided in relation to the defect to be corrected). Two strips of cartilage are moulded and sutured along the base lateral edges (Figs. 8a-c). The skin of the nasal dorsum is raised by Aufricht elevator to expose the cartilaginous dorsum: the upper lateral cartilages and the nasal septum are exposed trying to preserve the integrity on the nasal mucosa (as in the "extramucosal" approach) in order to create two tunnel pockets (one on each side of the nasal septum). The rail spreader is inserted with its base upwards by making the two rails slide cranially be-

tween the nasal septum and the upper lateral cartilages (Figs. 8d-f). Once in place, the graft does not need to be sutured, since the "railroad system" and the mucosal coverage will keep it in place. In case of a severe saddling of the nasal dorsum, it will be possible to increase graft thickness by adding several cartilage layers. In our experi-

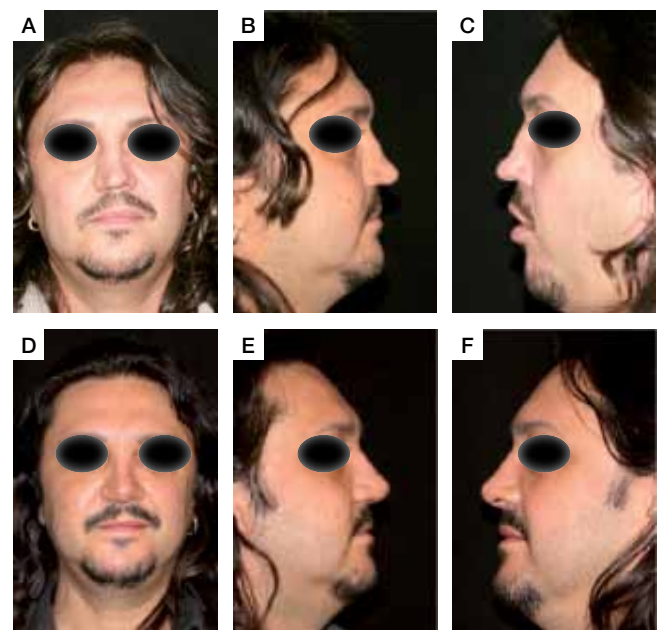


Fig. 9. Patient submitted to a revision rhinoplasty with our "rail-spreader" graft. Preoperative (A, B, C); postoperative (D, E, F) view.

ence, complete interruption of the internal mucosal layer does not prevent the use of the “rail spreader” since the nasal mucosa will naturally cover the graft with no additional risk of infection or internal valve synechia/stenosis (Figs. 9a-f).

Conclusions

The topic of grafts in rhinoplasty would undoubtedly require a more detailed and extended description, as confirmed by the immense number of textbooks and articles published on this subject. The aim of this chapter was only to show the validity of the “endonasal” approach as an up-to-date technique, proving the possibility of graft use in both “closed” and “open” rhinoplasty. In experienced hands, both techniques are valid and can achieve good results. However, we believe that for most primary rhinoplasties, the “endonasal” technique allows to obtain the result desired with a “more natural”, faster and less invasive approach. Furthermore, if a revision surgery is required, we believe that “endonasal” primary rhinoplasty (being less “deconstructing” than the “transcolumellar” approach) allows easier resolution of most problems during the secondary procedure.

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