

# Septal Crossbar Graft for the Correction of the Crooked Nose

Armando Bocchieri, M.D., and Michele Pascali, M.D.

Rome, Italy

Surgical management of the crooked nose still constitutes a problem that is difficult to solve because of the possibility of recurrence and the risk of weakening the supporting structures. The authors propose an innovative surgical technique for the correction of this deformity that takes into account both aspects of the problem. The technique combines septoplasty by means of staggered intracartilaginous incisions with the original positioning of a unilateral spreader graft. Once realignment of the deviated cartilages is achieved, this cartilaginous stent, referred to as a "crossbar graft," makes it possible to keep the mobilized axis firmly in the correct position over time. This graft is also quite effective from a functional point of view in restoring the correct angle of the internal nasal valve. Moreover, the technique allows for the harmonization of the aesthetic line from the eyebrow to the tip-defining point on the concave side with the same line on the other side. (*Plast. Reconstr. Surg.* 111: 629, 2003.)

*Crooked nose* is a general term used to denote all deformities in which the key element is deviation of the nasal pyramid with respect to the midline of the face. Distinctions are traditionally drawn between deviation in the upper (bony) and lower (cartilaginous) portions and combined (osteocartilaginous) deformity. With respect to the medial axis, the deviation can also be linear, C-shaped, or S-shaped. Correction of the crooked nose still presents a difficult problem and is a focal point for leading surgeons.<sup>1</sup> The surgical techniques normally used can prove to be unsuccessful as a result of either recurrence<sup>2</sup> or collapse of the excessively weakened nasal dorsum.<sup>3</sup> The purpose of this article is to describe an easily performed surgical technique designed to maintain a previously crooked nasal pyramid on the correct linear axis.

## METHODS

### *Review of Technique*

The correction of septal deviation constitutes a key element in surgical management of the crooked nose, and numerous techniques of achieving it have been described. A review of the literature suggests that three surgical procedures are primarily used: realignment by means of septoplasty, extracorporeal reshaping and replacement of the septum, and camouflage of aesthetic deformities.

The first procedure includes the "swinging door" technique proposed by Metzenbaum<sup>4</sup> and its subsequent modification by Seltzer.<sup>5</sup> Transfixion incision, lateral mucoperichondrial incision, and degloving on the convex side are followed first by the vertical resection of a strip of cartilage and then by an incision along the nasal floor. The septal cartilage is thus completely mobilized and can be moved back to a medial position (as in a door) and anchored to the columella.

The technique originally developed by Goldman<sup>6</sup> involves two parallel vertical infracartilaginous incisions and the creation of two mobile cartilaginous compartments that, being freed at the bottom, can be repositioned on the midline. To avoid the removal of large portions of deviated cartilage, authors such as Maliniac,<sup>7</sup> Becker,<sup>8</sup> Converse et al.,<sup>9</sup> and Rees<sup>10</sup> prefer the use of multiple weakening incisions to suppress tension and produce straightening. Being concerned with the stability of mobilized and repositioned pieces over time, authors such as Converse,<sup>11</sup> Ponti,<sup>12</sup> and Wexler<sup>13</sup> have



suggested that the severed upper lateral cartilage should be sutured to the new septum. Lawson and Reind<sup>14</sup> advocated a series of vertical full-thickness incisions through the concave side of the septum, leaving the mucoperichondrium adherent on the convex side and preserving the lower attachment to the maxillary crest as much as possible. Seeking to avoid any break in cartilaginous continuity, authors such as Barsky et al.,<sup>15</sup> Pollet,<sup>16</sup> Gomulinski,<sup>17</sup> Aiach and Levignac,<sup>18</sup> Trenité,<sup>19</sup> and Micheli-Pellegrini<sup>20,21</sup> prefer to perform incisions on the pattern referred to by French-speaking authors as *quinconce* and by English-speaking authors as *staggered* or *gore pattern*, without degloving the mucoperichondrial lining on one side. The spiral incision used by Jost<sup>22</sup> to free the septum from intrinsic forces in all directions is analogous in conception.

Numerous authors have advocated the removal, reshaping, and reinsertion of the septum or portions thereof. These include Peer,<sup>23</sup> who suggested the complete removal of the deviated part of the septum, leaving only the dorsal part intact, and the subsequent caudal regrafting of a supporting strip. Elsbach<sup>24</sup> modified this technique to leave a medial vertical pillar between the nasal dorsum and floor. A supporting element is again regrafted in the caudal portion of the septum.

Galloway and Fomon<sup>25</sup> described removing the quadrilateral cartilage completely, remodeling it, reinserting it between the two leaves of mucoperichondrium, and anchoring it in a pocket created in the columella. Many subsequent authors, such as Converse,<sup>11</sup> Cottle et al.,<sup>26</sup> Ponti,<sup>12,27</sup> Rees,<sup>28</sup> and Sulsenti and Palma,<sup>29</sup> adopt the same technique of removing the septum for remodeling and then reinserting and anchoring it between the mucoperichondrial leaves with transfixion stitches. Gubish<sup>30</sup> removes the septum completely, then sections and sutures some of its components to obtain a straight configuration and grafts a perpendicular plate of fenestrated ethmoid bone as a splint before reinsertion.

Sheen<sup>31</sup> and Constantian<sup>32</sup> proposed camouflage techniques for the correction of nasal deformity and to preserve the supporting structure to the greatest possible extent. For noses that resist complete and perfect realignment, Tardy<sup>33</sup> uses cartilage grafts to camouflage minimal asymmetries and deviations as long as the airways have already been corrected. Toriumi and Ries<sup>34</sup> suggested an innovative method that

involves positioning a planoconvex spreader graft<sup>35</sup> on the concave side, both to restore respiratory function and to harmonize the aesthetic line from the eyebrow to the nasal tip. In larger C-shaped deformities, Toriumi uses ethmoid bone stenting grafts to straighten the deformed anterior (dorsal) segment of the L-shaped septal strut after cross-hatching it. Guyuron,<sup>36</sup> after anteroposterior scoring of the concave side of the L-strut, uses spreader grafts anteriorly on one side or bilaterally and extramucosal stents posteriorly to guide cartilage memory. Rohrich<sup>1</sup> also adopts the unilateral spreader graft technique, stressing its importance in the correction of high dorsal septal deviations. Byrd<sup>2</sup> places a septal extension graft in the spreader graft position on the concave side, thus also making it possible to control tip projection, rotation, and shape.

### *Surgical Technique*

Essentially, the operative procedure associates a septoplasty by means of creating staggered incisions with the placement of a unilateral spreader graft on the concave side (Fig. 1). This aim is achieved by using either an endonasal or an external approach. In the first case, a transfixion incision is made in connection with bilateral intercartilaginous incisions; in the second case, inverted V-shaped columellar and marginal incisions are used. In the most severely deviated nose, an open approach is preferred to provide better exposure of the nasal dorsum and easier maneuverability of the graft.

At the beginning, subperichondrial degloving is followed by removal of the septal cartilaginous and bony segments where the deviation is located. The base of the caudal septum is fully detached from the nasal spine and the maxillary crest and is repositioned in the midline. In addition to dorsal skeletonization, extramucosal separation of the upper lateral cartilages from the dorsal septum is undertaken to eliminate the extrinsic deforming forces that act on this structure.

In any case, a large L-shaped caudal and dorsal septal segment measuring at least 15 mm in width is preserved. This portion of cartilage remains solidly attached to the mucoperichondrium of the convex side that was not degloved previously. The straightening of this L-shaped structure is performed on the concave side by creating staggered intracartilagi-



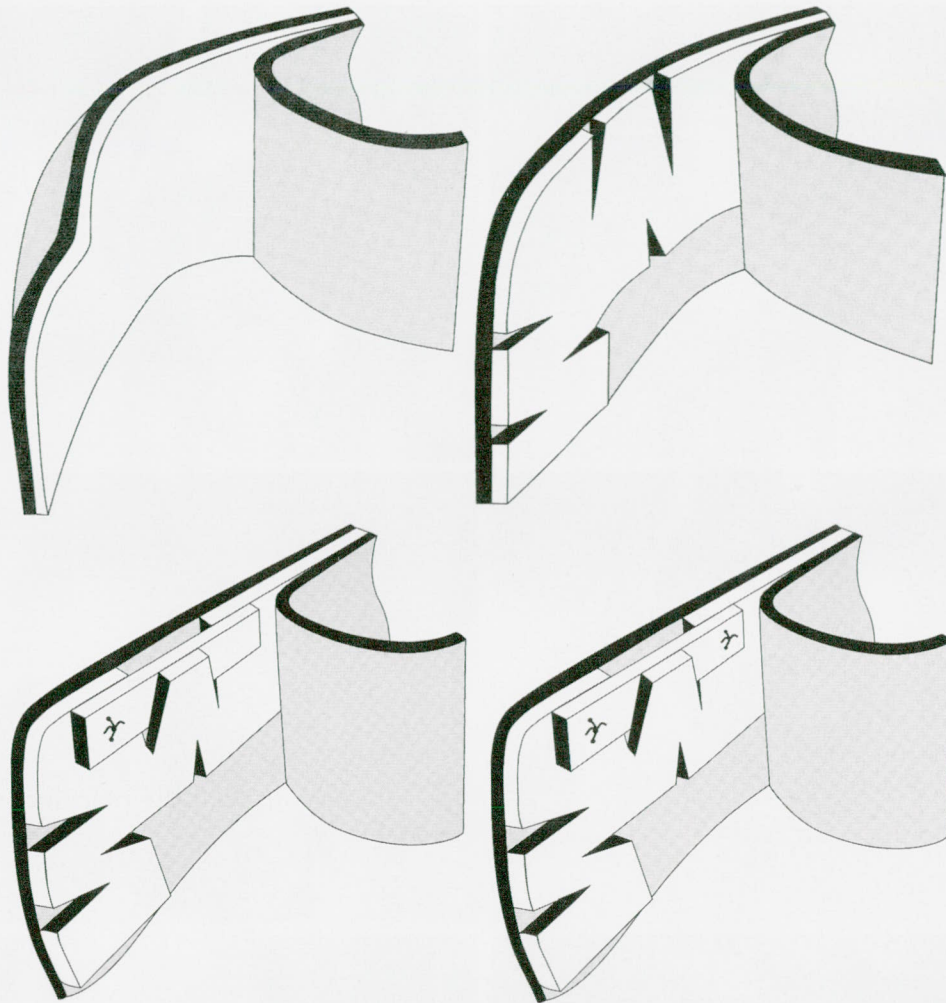


FIG. 1. (Above, left) Preoperative curvature of the septum. (Above, right) Pattern of the staggered incisions. (Below, left) Septal crossbar graft fitted between two septal vertical intracartilaginous incisions (closed approach). (Below, right) Additional posterior suture (open approach).

nous incisions at critical locations<sup>17</sup> (Fig. 2, above, left).

The cuts are made to full thickness through the cartilage into the areas of greatest concavity. Their direction is vertical in the dorsal septal strut and horizontal in the caudal strut. The pattern is a series of three parallel incisions, with each series being made up of one pair of incisions on the external side of the L-shaped strut and one staggered central incision on the internal side. Two series of three incisions are generally sufficient to obtain good mobilization of the septum: one series is created on the dorsal strut and another is made on the caudal strut. In any case, the anatomic continuity of the L-shaped septal strut is never interrupted, and a cartilaginous bridge is always maintained among all of the incisions.

A small portion of dorsal cartilage 5 to 10 mm in length between two vertical parallel infracartilaginous incisions performed at the point of greatest concavity is detached from the mucoperichondrial lining of the convex side and mobilized toward the concave side (Fig. 2, above, right). A segment of cartilage previously harvested from the posterior-inferior septal region is cut into a rectangular shape measuring 3 to 6 mm in height, 1.5 to 2.5 cm in length, and 1 to 3 mm in thickness. This cartilage is then inserted through the mobilized portion of dorsal cartilage and affixed to the caudal septum as a spreader graft with one 5-0 Vicryl mattress suture (Fig. 2, center). Thus, the anterior stability of this splint graft is ensured by the suture, and its posterior stability is ensured by the joint with the laterally mobilized portion of dorsal septum (Fig. 2, below,



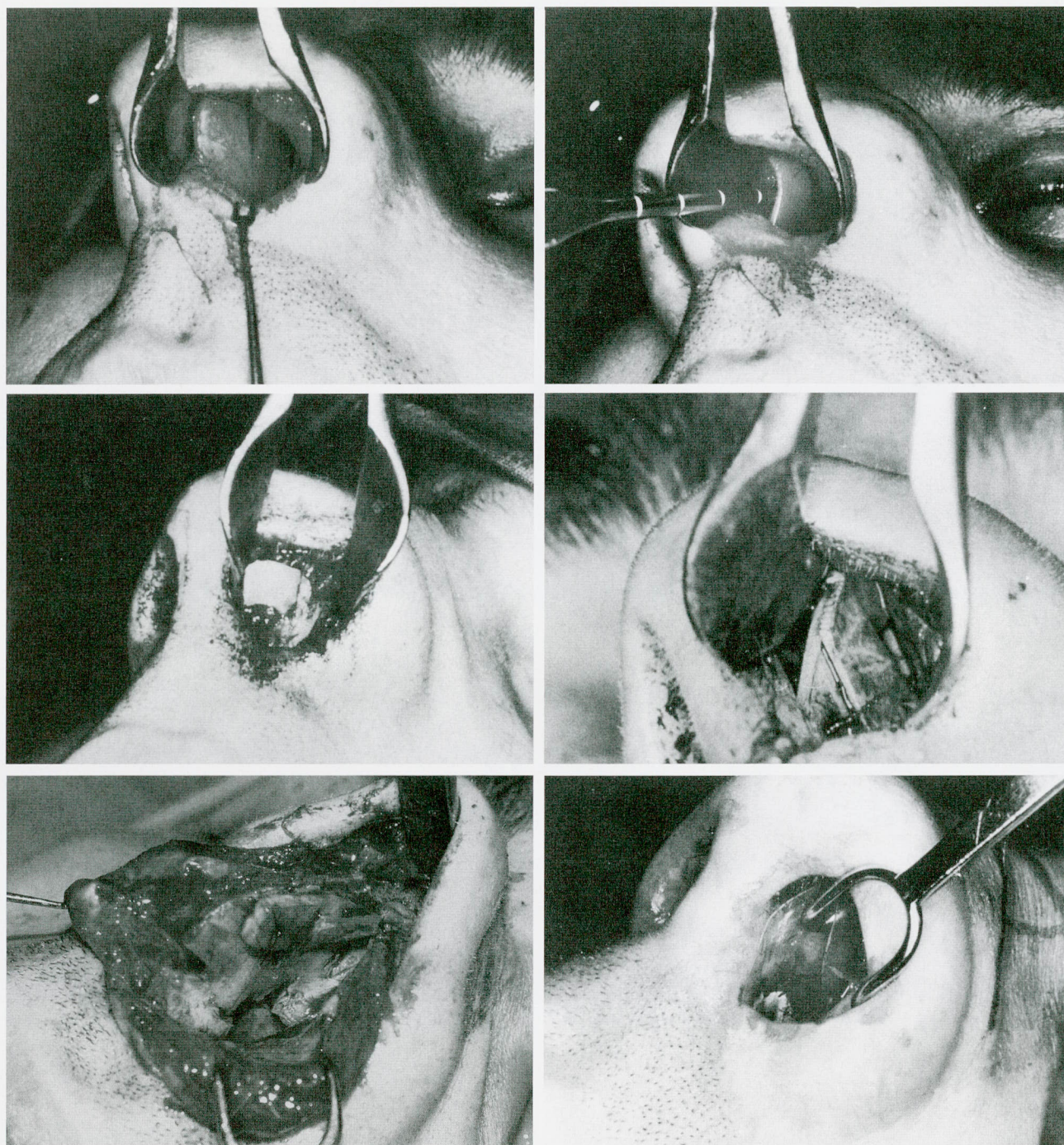


FIG. 2. (Above, left) Intraoperative photograph showing the staggered incisions. (Above, right) Degloving and mobilization of a septal dorsal segment between two vertical intracartilaginous incisions. (Center, left) Gradual insertion of the septal crossbar graft. (Center, right) Septal crossbar graft secured as a spreader graft with a single mattress suture on the concave side (closed approach). (Below, left) Septal crossbar graft straightening the septum and overpowers the intrinsic forces of the cartilaginous memory (open approach). (Below, right) Endonasal positioning of the splint.

left). Moreover, in the open approach, additional posterior suturing between the graft and the dorsal septum behind its mobilized portion can also be performed (Fig. 1, below, right). A continuous quilting suture of 4-0 catgut secures the mucoperichondrium to the residual

septum and eliminates the dead space, thus preventing the formation of hematoma. If deviation of the bony pyramid is present, medial and lateral micro-osteotomies for medial repositioning are performed before septal repair. In some cases, double lateral micro-osteoto-



mies are required to align a markedly crooked nose with asymmetric and unequal bony sidewalls.

Any aesthetic correction of the dorsum must always be performed before insertion of the crossbar graft. In contrast, reshaping of the tip, when necessary, is preferably performed after correction and reconstruction of the L-shaped septal strut. The caudal margins of the upper lateral cartilages are sutured to the nasal septum near the anterior septal angle with 5-0 Vicryl suture, and the incisions are closed in a standard fashion. Then the mucosal septal flaps can be compressed by placing bilateral intranasal splints (Guastella-Mantovani septal valve splint; Invotec International, Inc., Jacksonville, Fla.) on both sides of the septum for 8 to 10 days<sup>37</sup> (Fig. 2, *below, right*). An intranasal pack is inserted and can be removed the day after the operation.

#### RESULTS

Thirty patients (18 men and 12 women) with crooked noses underwent primary rhinoplasty with the use of the crossbar graft technique. No substantial dorsal humps were removed. In some cases, a slight dorsal resection was performed to harmonize the profile. Patients' ages ranged from 20 to 46 years (average age, 30 years). The follow-up period ranged from 16 to 28 months (median follow-up, 22 months). All patients subjectively reported resolution of nasal obstruction. Objective assessment of the outcome by clinical inspection revealed evidence of improvement of nasal deformities in all patients. One man who had an operation early in the series developed a slight upward posterior displacement of the graft. Perhaps this complication was caused by an insufficient vertical length of the dorsal posterior incision. This displacement was perceived more by touching the nose than by visibility to the eye, however, and the patient refused revision. Preoperative and postoperative photographs obtained in two representative cases illustrate dorsum straightening and nasal symmetry with the use of the crossbar graft on the concave side (Figs. 3 through 6).

#### DISCUSSION

Examination of the operative results and long-term follow-up described in the literature shows that the problem of deviation of the upper nasal pyramid has an optimal solution in performing upper marginal resections of the

septum, staggered osteotomies, and double osteotomies. To the contrary, lower and combined deviations often lead to recurrence at various levels, even when the operation is performed by accomplished surgeons. The cartilage of the septum often has "a mind of its own" and can resist even the most dedicated and corrective maneuvers that the surgeon can devise.<sup>10</sup> According to the degree of deformity, measures of a more or less radical nature have been used to correct septal deviation involving luxation, subperichondrial resections, relaxing incisions, and the removal of dislocated bony fragments or crests.

It is now known that even in cases in which major subperichondrial resections are performed, it is still necessary to retain a cartilaginous L-shaped strut as a support for the middle and lower thirds of the nasal pyramid. This major axis of support is subjected to the intrinsic, residual, postoperative forces of traction and dislocation determined by the elastic memory of the cartilage. The same axis is also acted on by extrinsic deforming forces that result from the attachment of upper lateral cartilages. These forces can be eliminated by performing extramucosal separation of the latter from the septum.

In any case, the crooked nose involves anatomic deformities of the upper lateral cartilages that can prove difficult to solve. Any excess in length or twisting can be corrected by conservative resection of their caudal segment. It is a far more difficult matter to ensure the symmetry of upper lateral cartilages that present outward bowing on the convex side and inward bowing toward the deviation on the concave side.

Surgical techniques in which cartilage grafts are laid on the upper lateral cartilage on the concave side can provide a brilliant solution to the aesthetic problem but can prove to be ineffective in functional terms. On the concave side, depression of the upper lateral cartilage in fact leads to stenosis of the internal nasal valve that is in no way affected by the dorsal onlay graft. It proves more effective to use a unilateral spreader graft, which not only provides lateral shifting of the upper lateral cartilage on the concave side, thus making it symmetrical to the convex side, but also reestablishes the correct angle of the internal nasal valve. Moreover, the spreader graft also serves to strengthen the septal L-shaped strut.

The technique proposed here combines sep-



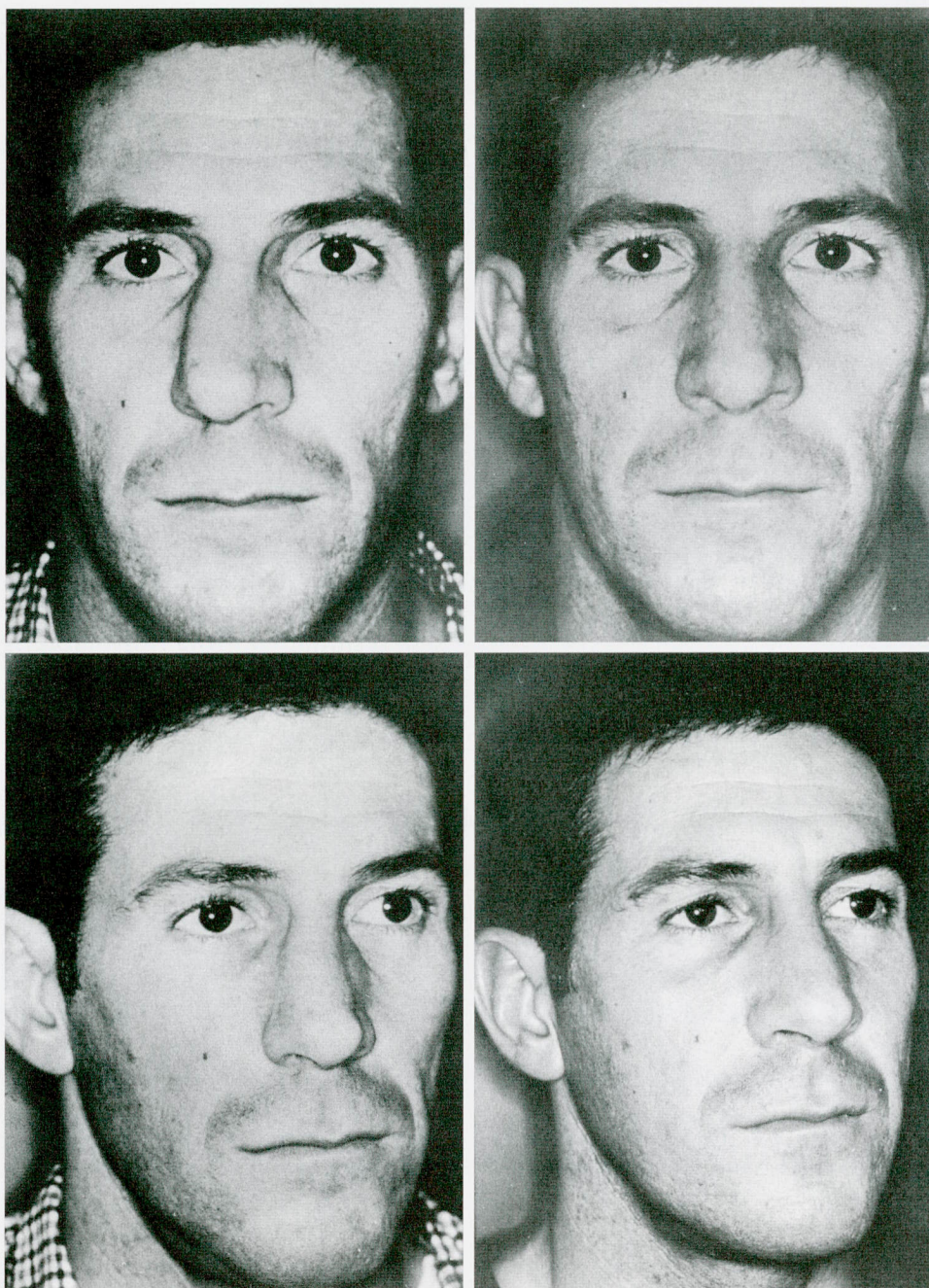


FIG. 3. Case 1: Correction of crooked nose using the septal crossbar graft technique. (Left) Preoperative views. (Right) Postoperative views.

toplasty by means of staggered incisions with a cartilaginous graft secured in the same way as does a spreader graft. The staggered incisions permit adequate realignment of the deviated cartilage while maintaining anatomic continuity and valid structural support. The risk of recurrence does, however, remain, owing to the presence of "elastic memory" of the cartilage, which tends to bring the septum back to its original position.<sup>15,38</sup> It therefore becomes

necessary to ensure that the mobilized axis of the nasal pyramid is kept firmly in the correct position over time. To this end, a grafted stent of septal cartilage is used to counter the forces of dislocation and traction.

The particular originality of the technique lies in the way the graft is positioned along the dorsal septum through the creation of an anatomic stable and functionally efficient joint. The crossbar graft serves to counter intrinsic



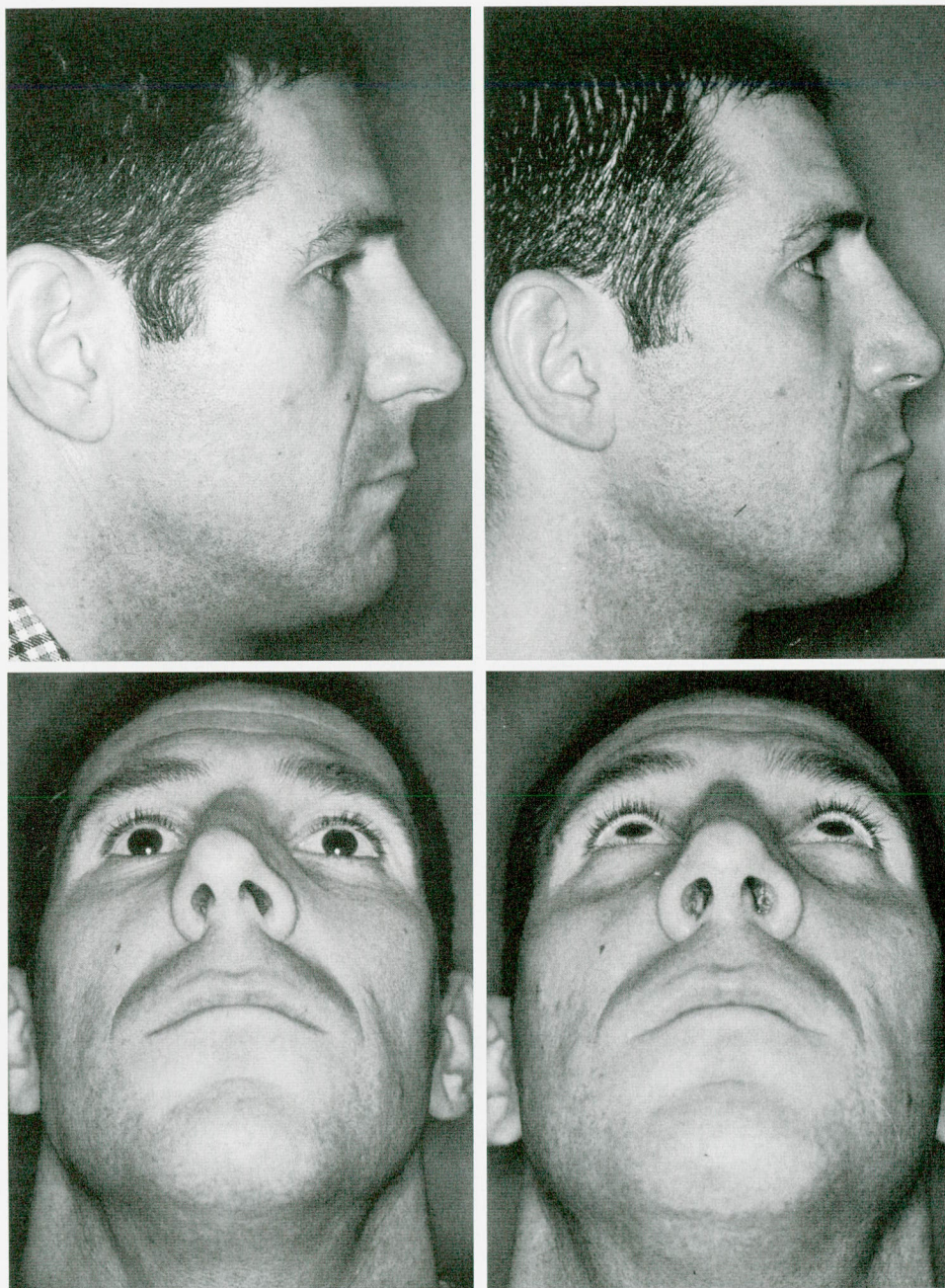


FIG. 4. Case 1: Correction of crooked nose using the septal crossbar graft technique. (Left) Preoperative views. (Right) Postoperative views.

and extrinsic dislocating forces in the same way as a door can be "barred" on the inside to prevent it from being opened externally. At the same time, the position of the graft between the dorsal septum and the upper lateral cartilages serves to expand and restore the nasal valve in the same way as does a spreader graft. The considerable thickness determined by the mobilized portion of the septum pushed sideways in addition to the crossbar graft avoids two

layers of cartilage having to be sutured together to construct a thicker spreader graft.

By virtue of its conformation, the Guastella-Mantovani septal valve splint contributes to the proper healing of the mucoperichondrial lining at the level of the internal nasal valve. Furthermore, the distorted conformation of the upper lateral cartilage on the concave side benefits greatly from the corrective outward pressure provided by the underlying graft. This



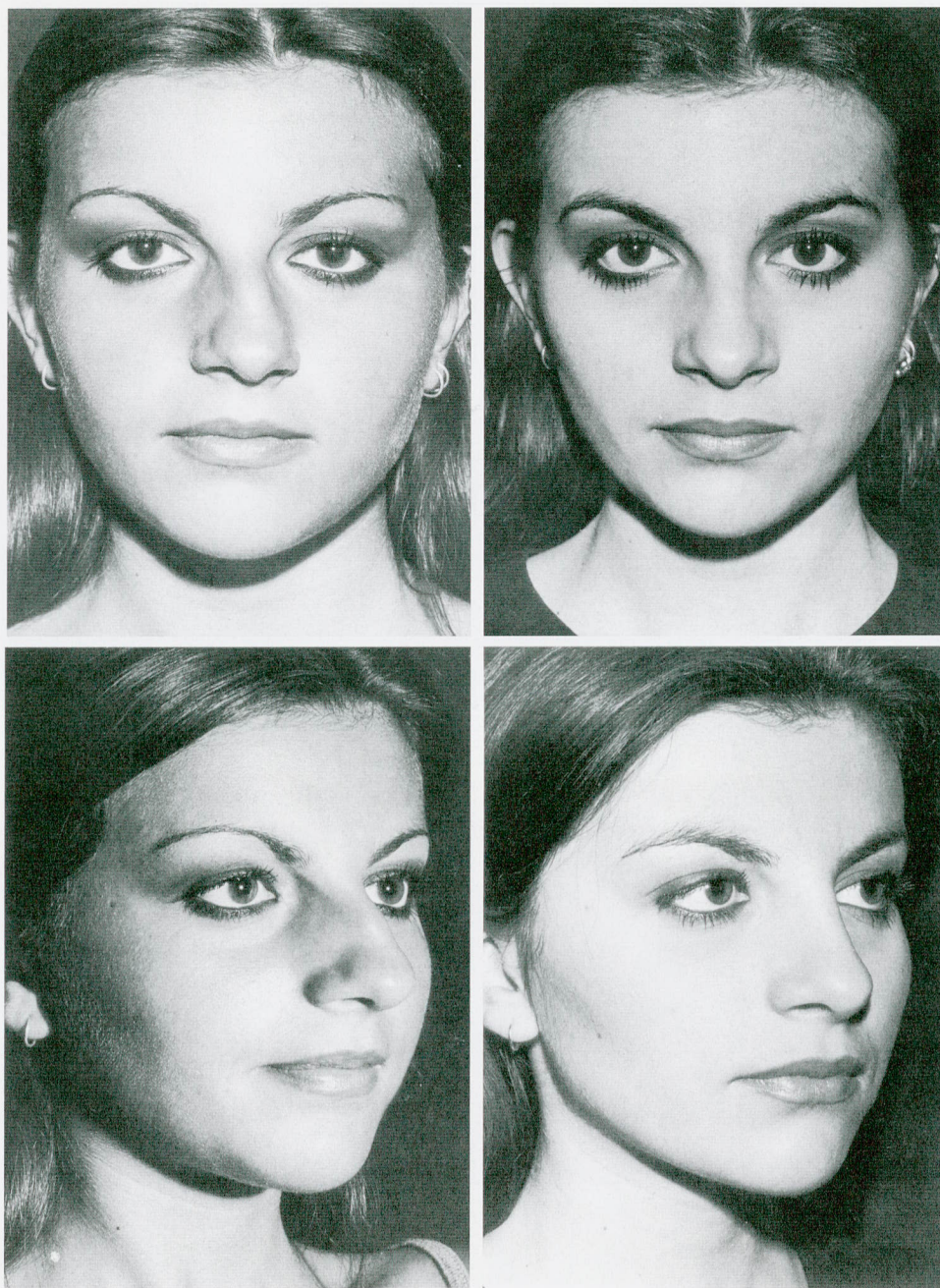


FIG. 5. Case 2: Correction of crooked nose using the septal crossbar graft technique. (*Left*) Preoperative views. (*Right*) Postoperative views.

camouflaging of the aesthetic line from the eyebrow to the tip-defining point on the concave side also reestablishes symmetry and harmony with the same line on the convex side.

#### CONCLUSIONS

The crooked nose is one of the most difficult surgical problems to solve in rhinoplasty. Careful examination of the literature clearly shows that no universally accepted solution to the

problem of the lateral deflection of the cartilaginous portion has yet been found. The surgical technique proposed here combines the advantages of septoplasty by means of creating staggered incisions with a cartilaginous graft of the spreader type. The simplicity of the procedure described, the use of autologous structures, and the long-term ability of the cartilaginous graft to counter the memory of the septal cartilage make this surgical technique a valid



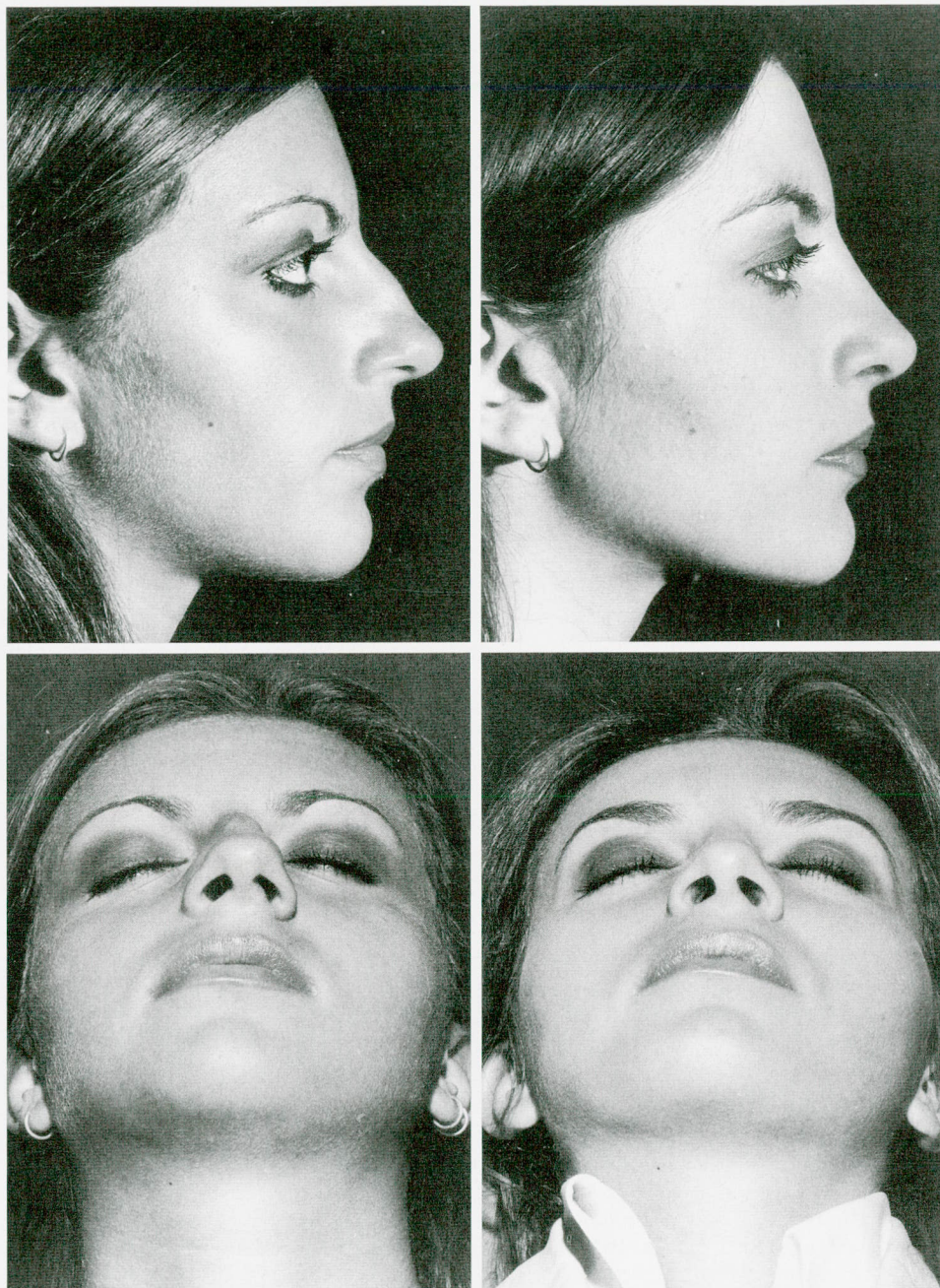


FIG. 6. Case 2: Correction of crooked nose using the septal crossbar graft technique. (Left) Preoperative views. (Right) Postoperative views.

tool for correction of the crooked nose. Further advantages are offered by the restored functionality of the nasal valve and the harmonizing of the aesthetic line from eyebrow to nasal tip through correction of the depression of the upper lateral cartilage on the concave side. A new surgical technique has been developed to treat crooked noses by means of positioning a unilateral spreader graft in an anatomic joint, which ensures the correct axis of the nasal pyramid over time.

Armando Boccieri, M.D.  
Via le U. Tupini 133  
I-00144 Rome, Italy  
[armando.boccieri@libero.it](mailto:armando.boccieri@libero.it)

#### REFERENCES

1. Rohrich, R. J. Rhinoplasty: Dorsal reduction and spreader graft. Presented at the 17th Annual Dallas Rhinoplasty Symposium, 2000. Pp. 153-166.
2. Byrd, H. S. The crooked nose: An algorithm for repair. Presented at the 17th Annual Dallas Rhinoplasty Symposium, 2000. Pp. 239-242.



3. Meyer, R. *Secondary and Functional Rhinoplasty: The Difficult Nose*. Orlando: Grune & Stratton, 1988. Pp. 139–146.
4. Metzenbaum, M. Replacement of the lower end of the dislocated septal cartilage versus submucous resection of the dislocated end of the septal cartilages. *Arch. Otolaryngol.* 9: 282, 1929.
5. Seltzer, A. P. The nasal septum: Plastic repair of the deviated septum, associated with a deflected tip. *Arch. Otolaryngol.* 40: 433, 1944.
6. Goldman, I. B. New technique in surgery of the deviated nasal septum. *Arch. Otolaryngol.* 64: 183, 1956.
7. Maliniac, J. W. Role of the septum in rhinoplasty. *Arch. Otolaryngol.* 48: 189, 1948.
8. Becker, O. J. Problems of septum in rhinoplastic surgery. *Arch. Otolaryngol.* 53: 622, 1951.
9. Converse, J. M., Holmes, E. M., and Huffman, W. C. The deviated nose and septum: A panel discussion. *Trans. Am. Acad. Ophthalmol. Otolaryngol.* 58: 741, 1954.
10. Rees, T. D. (Ed.). *Aesthetic Plastic Surgery*. Philadelphia: W. B. Saunders Co., 1980.
11. Converse, J. M. Corrective surgery of nasal deviations. *Arch. Otolaryngol.* 52: 671, 1950.
12. Ponti, L. Etiopatogenesi e diagnostica nei nasi devianti (note di tecnica operativa). *Clin. Otorinolaringoiatr.* 13: 83, 1961.
13. Wexler, M. R. Chirurgia ricostruttiva del naso lesionato. *Otorinolaringol. Clin.* 1: 128, 1976.
14. Lawson, W., and Reind, A. J. Correcting functional problems. *Facial Plast. Surg. Clin. North Am.* 2: 501, 1994.
15. Barsky, A. J., Sidney, K., and Simon, E. *Principles and Practice of Plastic Surgery*, 2nd Ed. New York: McGraw-Hill Book Company, 1964.
16. Pollet, J. Le point de vue du plasticien. *Cahiers d'O.R.L.* 6: 197, 1971.
17. Gomulinski, L. Morphological aspect of septal deformations: Their correction during complex rhinoplasties [in French]. *Ann. Chir. Plast.* 27: 343, 1982.
18. Aiach, G., and Levignac, J. *La Rhinoplastie Esthetique*. Paris: Masson, 1986.
19. Trenité, G. J. N. (Ed.). *Rhinoplasty: A Practical Guide to Functional and Aesthetic Surgery of the Nose*. New York: Kugler Publications, 1993.
20. Micheli Pellegrini, V. *Il Naso Torto*. Padua: La Garangola, 1985.
21. Micheli Pellegrini, V., and Ponti, L. *La Rinoplastica*. Fabriano, Arti Grafiche "Gentile," 1999. Pp. 163–178.
22. Jost, G., and Legent, F. The problem of the septum in corrective rhinoplasty [in French]. *Ann. Chir. Plast.* 12: 142, 1967.
23. Peer, L. A. An operation to repair lateral displacement of the lower border of the septal cartilage. *Arch. Otolaryngol.* 25: 475, 1937.
24. Elsbach, E. J. Cartilaginous septum in the reconstruction of the nose. A modified procedure. *Arch. Otolaryngol.* 44: 207, 1946.
25. Fomon, S., Syracuse, V. R., Bolotow, N., and Pullen, M. Plastic repair of the deflected nasal septum. *Arch. Otolaryngol.* 44: 141, 1946.
26. Cottle, M. H., Loring, R. M., Fischer, G. G., and Gaynon, I. E. The "maxilla-premaxilla" approach to extensive nasal septum surgery. *Arch. Otolaryngol.* 68: 301, 1958.
27. Ponti, L. Aesthetic problems in surgical technique of the nasal tip. In G. A. Sisson and E. M. Tardy (Eds.), *Plastic and Reconstructive Surgery of the Face and Neck: Proceedings of the Second International Symposium*, Vol. 1. New York: Grune & Stratton, 1972.
28. Rees, T. D. Surgical correction of the severely deviated nose by extramucosal excision of the osseocartilaginous septum and replacement as a free graft. *Plast. Reconstr. Surg.* 78: 320, 1986.
29. Sulsentì, G., and Palma, P. "Innesti e trapianti a livello del setto nasale." In: Fibbi A. "Innesti e trapianti nelle rinoseptoplastiche primarie e secondarie" XV Convegno Naz. Aggiorn. A.O.O.I. Maratea. Milano: Ed. Formenti, 1991. Pp. 91–110.
30. Gubisch, W. The extracorporeal septum plasty: A technique to correct difficult nasal deformities. *Plast. Reconstr. Surg.* 95: 672, 1995.
31. Sheen, J. H., and Sheen, A. P. *Aesthetic Rhinoplasty*, 2nd Ed. St. Louis: Mosby, 1987.
32. Constantian, M. B. An algorithm for correcting the asymmetrical nose. *Plast. Reconstr. Surg.* 83: 801, 1989.
33. Tardy, M. E. *Rinoplastica: Lo Stato dell'Arte*. Vol. II. Naples: Edises S.r.l., 1999.
34. Toriumi, D. M., and Ries, W. R. Innovative surgical management of the crooked nose. *Facial Plast. Clin. North Am.* 1: 63, 1993.
35. Sheen, J. H. Spreader graft: A method of reconstructing the roof of the middle nasal vault following rhinoplasty. *Plast. Reconstr. Surg.* 73: 230, 1984.
36. Guyuron, B., Uzzo, C. D., and Scull, H. A practical classification of septonasal deviation and an effective guide to septal surgery. *Plast. Reconstr. Surg.* 104: 2202, 1999.
37. Mantovani, M., Guastella, C., and Mazzola, R. F. The Guastella-Mantovani septal-valve splint: An intranasal biplanar and multivectorial orthopedic device. *Plast. Reconstr. Surg.* 106: 475, 2000.
38. Courtiss, E. H. Septorhinoplasty of the traumatically deformed nose. *Ann. Plast. Surg.* 1: 443, 1978.