Section A -Research paper

Nasal Tip Augmentation Techniques: Review Article

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Article History: Received: 20.06.2023 **Revised:**09.07.2023 **Accepted:** 19.07.2023

Abstract:

Most of the rhinoplasty performed is to raise the nasal bridge and the nasal tip. However, what cannot be overlooked in tip plasty is that it is hard to obtain satisfactory results by merely increasing the height of the nasal tip. For successful tip plasty, not only the height of the nose tip is raised, but to achieve a natural and beautiful nose, the shape, width, and position of the nasal tip must be adequately maintained or changed. Therefore, the suture technique and the cartilage graft, which are the two most commonly used tools in nasal tip surgery, should be appropriately applied.

Keywords: Nasal Tip, Augmentation, Technique**.**

DOI: 10.53555/ecb/2023.12.1139

Introduction:

Rhinoplasty is a surgical procedure utilized to alter and reconstruct nasal structures for cosmetic and functional purposes. Many patients opt for functional rhinoplasty due to narrow nasal passages, a deviated septum from natural development or trauma, or nasal turbinates causing infection or obstruction. In addition, some patients undergo revision rhinoplasty for congenital defects such as craniosynostosis or cleft lip and palate. On the other hand, patients often seek cosmetic rhinoplasty for aesthetic purposes such as an enlarged dorsal hump, asymmetrical nostrils, or to address a deviated septum. Furthermore, in 2020 it was projected that 352,555 cosmetic rhinoplasties were conducted in the United States by board-certified plastic surgeons, making it the most common plastic surgery procedure conducted (**1**).

Types:

Open and closed are the two main techniques to perform rhinoplasty. Although both approaches alter bone and cartilage, differences arise with mechanisms by which nasal structures are accessed. Open rhinoplasty relies on two incisions within the nostrils in addition to a

transcolumellar incision across the columella to connect the two internal incisions (**2**).

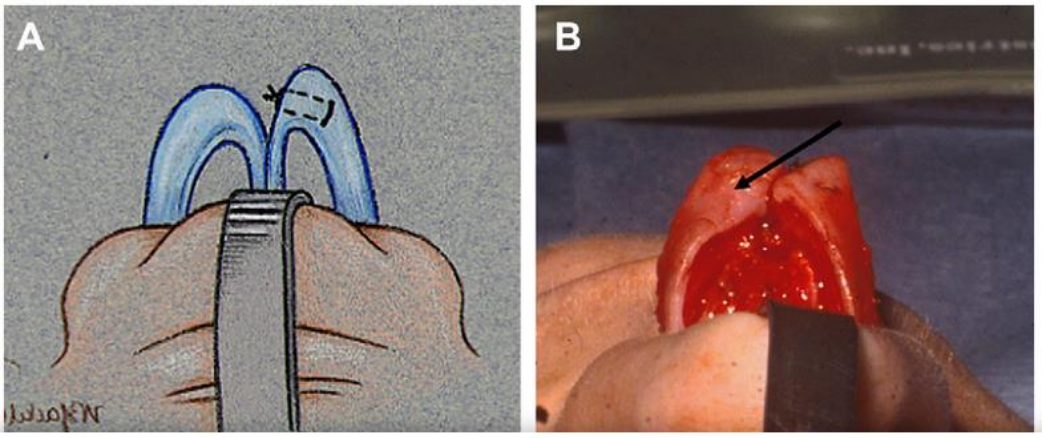

Figure (1): The traditional transdomal suture narrows the tip and on occasion is added to the hemi-transdomal suture if additional narrowing of the dome is needed (**3**).

The transcolumellar incision, which allows surgeons to lift the skin of the nose to visualize the relevant anatomy, differentiates between an open and closed rhinoplasty. Open rhinoplasty offers several advantages for patients. By exposing the underlying nasal anatomy, surgeons are better able to fully examine nasal asymmetry or abnormalities in structures, leading to increased precision. However, some studies have reported that open rhinoplasty may lead to scar formation due to the transcolumellar incision. In addition, there are reports of increased swelling, potentially leading to surgical errors and a need for reoperation. All in all, open rhinoplasty has shown to be advantageous for patients requiring correction from a prior rhinoplasty, dorsal hump removal, and those who require significant changes to the size and shape of their nose (**4**).

On the other hand, closed rhinoplasty minimizes external scarring and requires less time to perform the procedure in comparison to open rhinoplasty. In addition, studies have determined that the recovery period for closed rhinoplasty is significantly less than that of open rhinoplasty. However, closed rhinoplasty offers limited surgical access and visibility, making it difficult to perform precise modifications and potentially increasing the risk of complications. Closed rhinoplasty has seen popularity in patients looking to undergo minor revisions to the size and shape of their nose or those who require minimal nasal bridge modifications (**5**).

Regardless of the chosen method, there are several common risks associated with rhinoplasty such as swelling, skin discoloration, and periorbital hematomas. Some studies have indicated that impairments in olfactory sensation have occurred in patients, with sensation returning within a few days postoperatively. A few patients have been found to experience temporary rhinitis leading to nasal discharge, rhinitis sicca, and issues with breathing that are relieved with the use of topical agents. Lastly, infections occur very rarely and are seen in patients who have had an extensive history of nasal trauma or prior nasopulmonary infections (**6**).

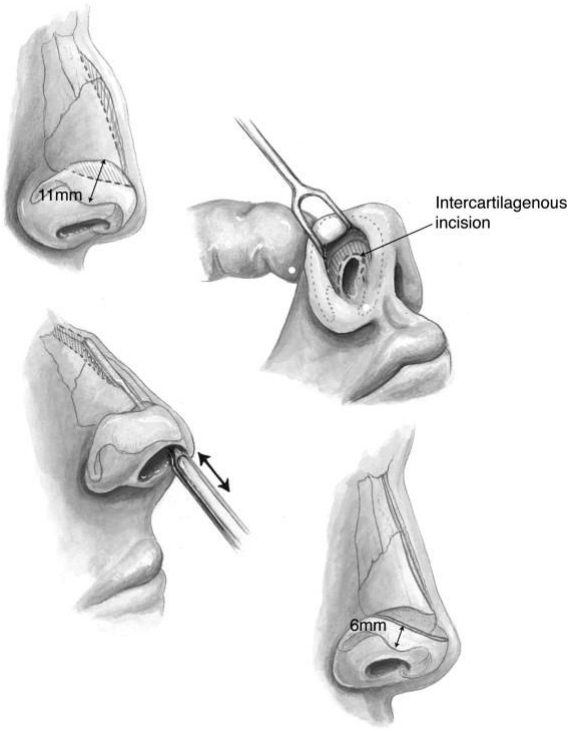

Fig (2): Closed rhinoplasty (**1**).

In the last two decades both open rhinoplasty and closed rhinoplasty have evolved tremendously with the incorporation of different cartilage grafts, sutures, and advancements in surgical technology (**1**)

Nasal tip surgery

Nasal tip surgery is generally recognized as the most complex portion of rhinoplasty, and tip irregularities are a common cause of revision rhinoplasty. The three-dimensional structural anatomy of the nasal tip is complex; the interrelationship between these structures determines the ultimate form and function of the nasal tip. As a result, alteration of one structure in the tip will often lead to change in other portions of the nasal tip (**7**).

The universal goal of nasal tip surgery is to create a stable, symmetric, and aesthetically projected and rotated nasal tip that is triangular at base view and harmonious with the rest without causing functional impairment. A plethora of techniques for nasal tip surgery have been described by scores of surgeons over the years in an effort to clarify their concepts and promote the validity of their maneuvers. The resultant collage of techniques can confuse even the most experienced rhinoplasty surgeon. However, one concept that has stood the test of time is the tripod concept of nasal tip dynamics, as first proposed by Anderson(**8**).

Hodges et al. (9) important yet simple concept has aided thousands of rhinoplasty surgeons in understanding nasal tip dynamics and achieving improved results. It defines the conjoined

medial crura as one leg of a tripod and each of the lateral crura as the other legs. The lengths of these legs can be altered to change the position of the tip. In the past 20 years, a striking revolution has occurred in the fine points of analysis and technique, guided by surgeons devoted to tissue reorientation and augmentation rather than resection, individualization of technique rather than a lock-step approach, and atraumatic tissue dissection in proper nasal cleavage planes. Shaping the nasal tip by scoring, morselization, resection, or transection of the alar cartilages (destructive techniques) disrupts the structural integrity of the alar archs sacrificing support and introducing variables surgeons cannot control.

When alternative non destructive techniques as sutures are available and equally effective, a decision to use destructive technique is a flawed decision because it introduces additional uncontrolled variables that increase risks of secondary deformities. Over the decades, suture techniques were introduced intermittently, but to a limited extent. It was not until the early 80s that there was a surge in suture techniques to control tip shape (**10**).

Daniel and Regnault, (11) popularized a dome control suture for the open approach. J. Tebbetts more than anyone else at the time, suggested a change in approach to cartilage control by suggesting non destructive techniques. A number of suture techniques to control virtually every part of the nasal tip complex became available.

Because suture techniques are intended to change the shape of tip cartilages, the assumption is that there is cartilage of sufficient size and integrity to permit the application of suture techniques. When cartilage is missing or extraordinarily weak, grafting is necessary. Tip grafts, columellar struts, spreader grafts, and lateral crural struts will not lose their significant roles in rhinoplasty simply because suture techniques are available (**12**).

Nasal tip augmentation

Autogenous cartilage grafts can be used effectively and safely in augmenting nasal tip projection in Asians. The choice of technique for augmenting nasal tip projection depended on the degree of the tip support and the amount of the tip augmentation required (**13**).

Reshaping the existing lower lateral cartilage using suture techniques such as dome binding sutures and lateral crural steal technique was employed in only small numbers, and this was used more frequently to complement the tip grafts. Structural onlay grafts employing cap grafts or a long shield graft coupled with buttress grafts were the main workhorse when the patients had moderate tip support and needed minimal to moderate augmentation of the tip (**14**).

For effective increase of the tip projection with onlay grafts, the tip grafts need a firm platform to sit on. Often a columellar strut was used to add strength to the nasal tip support in patients with weak lower lateral cartilages. The septal cartilage in Asians is usually thin, and shield grafts sculpted from the septal cartilage can easily bend or rotate cephalically with pressure exerted from the overlying thick skin soft tissue envelope (SSTE) (**15**).

This can make the nose look short and over-rotated. Buttress grafts placed behind the shield graft can prevent this cephalic rotation while achieving the desired amount of projection. One drawback of this technique is that tip grafts usually augment only the infratip lobule segment of the tip. The septal extension graft was efficiently used when the tip support was poor and/or when there was a need for major tip augmentation. It provides a firm foundation upon which the lower lateral cartilages can be repositioned, simultaneously altering projection, rotation, and nasal length (**16**).

It can be performed unilaterally or bilaterally and it can be sculpted, depending on the desired changes of the tip. Care should be taken to bevel or thin this portion of the graft overlapping the septal cartilage, since nasal obstruction can occur postoperatively due to increased thickness in this area. If the caudal septum is deviated, it is important to straighten it first so that the extended portion of the graft lies in the aesthetic midline. Occasionally, the septal extension graft is used to batten and straighten the deviated caudal septum and to augment the tip projection simultaneously (**17**).

The caudal septum to which the septal extension graft is fixed must be stable and strong enough to withstand the pressure exerted by the thick overlying SSTE characteristic of the Asian nose and predictably maintain projection. One preventive measure in addition to fixation of the caudal septum to the anterior nasal spine is adding strength to the caudal septum with batten grafts or extended spreader grafts (**18**).

Another advantage of the septal extension graft is that it makes the augmented nasal tip look natural, especially on the basal and lateral views. Typically not all of the three components of tip projection (ie, premaxillary, columellar, and infratip) are projected in tip augmentation. Stacking layers of thick onlay grafts or using long shield grafts on the tip only augments the infratip lobular component, which can cause an unnatural look on the basal and lateral view. To achieve a naturallooking tip after a significant increase in tip projection, all three components must be augmented simultaneously (**19**).

The septal extension graft proved to be a versatile technique that can be used to restore firm tip support and augment at least the two components of the nasal tip simultaneously in patients who need major augmentation. When the septal extension graft is applied, the nasal tip tends to become hard, and even though it softens with time it can be a source of postoperative complaint (**20**).

Several of patients had this complaint during the early postoperative period, but the complaints decreased as the tip became softer and more compliant. The cephalic resection was reserved for those cases with bulbous tip needing volume reduction for the tip refinement. Unlike in southeastern Asians such as Malays and Filipinos, alar flaring and wide alar base are not common in Koreans (**14**).

Often with increase in the tip projection, the preoperative flaring can be improved, obviating

the need for alar base resection. The high rate of an open approach can be attributed to the high demand for major tip augmentation (**21**).

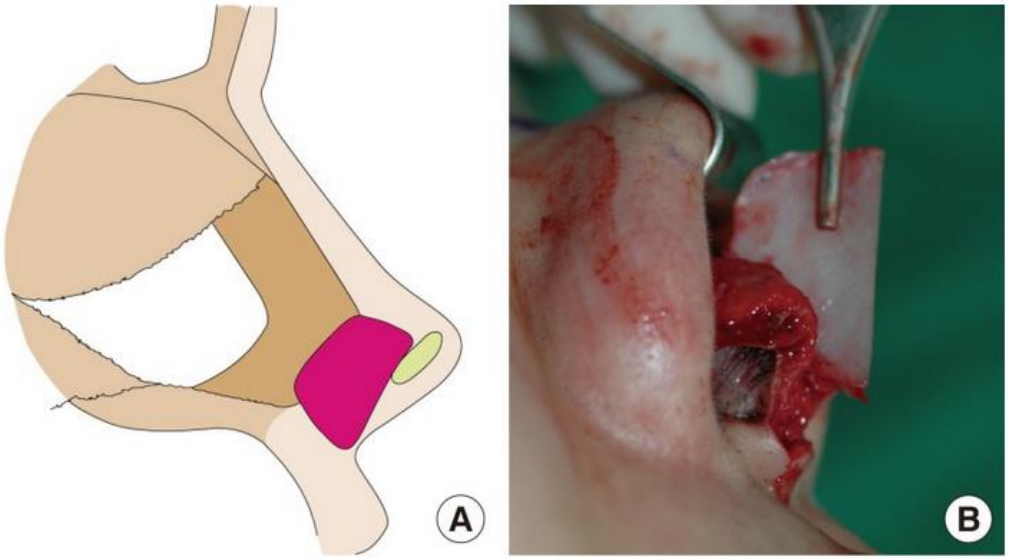

Figure (3): Type III septal extension graft (A) Schematic diagram and (B) photograph of type III septal extension graft. To blunt the nasolabial angle, the thicker part of the harvested septal cartilage should be placed frontward (**22**).

Erol's technique

Cartilage grafting remains an essential tool in primary or secondary rhinoplasty and nasal reconstruction, although it is not free of complications. At 1 to 2 years after surgery, carved or crushed cartilage grafts may become perceptible through nasal skin after the resolution of tissue edema (**23**).

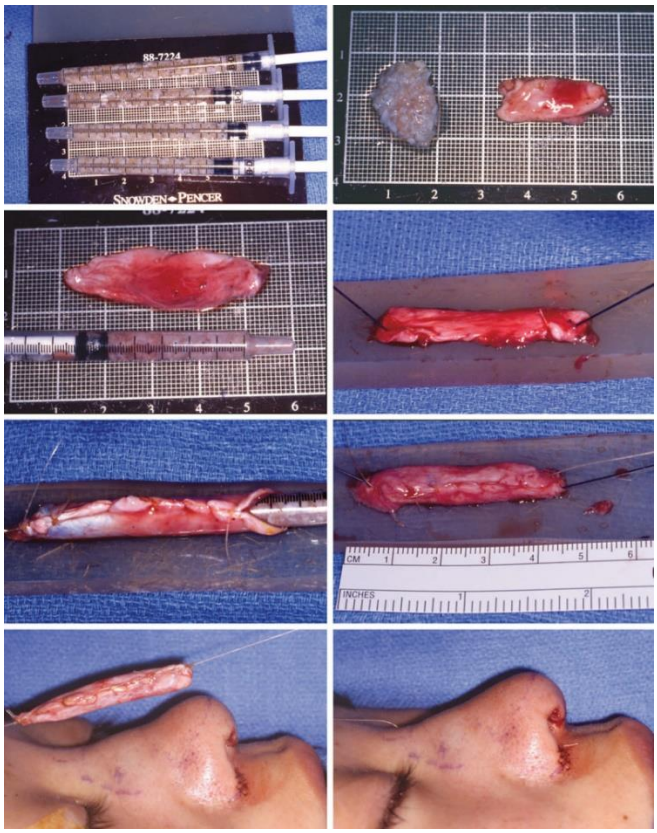

Figure (4): Diced cartilage covered with fascia. (**27**).

This technique can be used with either the endonasal or open approach. Generally, the endonasal approach was used. Harvested cartilage from septal, alar, conchal, and (in some secondary rhinoplasty cases) costal origins is diced in pieces of 0.5 to 1 mm using a no. 11 blad. One cubic centimeter of parenteral blood is obtained and gradually added to the cartilage mass to create coherence. The configuration of the amount of cartilage needed is carefully estimated, and one should begin with small amounts of cartilage (**25**).

The mass obtained by dicing can be augmented by adding more cartilage pieces. This fine-textured cartilage mass is then wrapped in Surgicel to obtain a cylindrical form (Fig. 5c) and moistened with antibiotic (rifamycin). The Surgicel-wrapped diced cartilage is molded with the fingers into a suitable form (Fig. 5d) and inserted under the dorsal nasal skin, into the nasal tip, or into the lateral sidewall (Fig. 5e) (**26**).

At this point in the technique, a slight overcorrection is desirable. During insertion of the shaped cartilage mass, care must be taken to maintain its integrity. After insertion and mucosal closure are accomplished, the graft can be externally molded in the same way as plasticine, as in a "Turkish Delight". The nose is then taped and dressed as usual. After removal of the plaster cast 7 days postoperatively, the graft can be easily reshaped by molding with the fingers if needed. Such reshaping is possible for 21 days postoperatively, albeit with increasing difficulty (**27**).

Figure (5): (Above, left) Preoperative frontal view of the patient showing external deviation, asymmetry, and broad tip. (Above, second from left) Postoperative view after 7 years. There were no nasal dorsal irregularities upon inspection or palpation and no recurrence of external deviation. (Above, second from right) Preoperative view from below. (Above, right) Seven years postoperatively. (Below, left) Preoperative right lateral view. (Below, second from left) Postoperative right lateral view after 7 years. (Below, second from right) Preoperative left lateral view. (Below, right) Postoperative left lateral view after 7 years (**28**).

To achieve the desired thickness, the amount of the Surgicel-wrapped diced cartilage mass required for each case may vary. To cover the straight dorsum, 1-mm thickness of cartilage mass is sufficient. To augment a low dorsum, 2- to 8-mm thickness of diced cartilage is needed. One should estimate the temporary thickness added by Surgicel, which will be reabsorbed after 48 hours. In some cases, larger pieces of cartilage are saved (1) for use in the columella if elongation of the nasal skeleton or lengthening is required; (2) for support to advance the columella; (3) for control of the shape and definition of the lateral crus; (4) as a supporting graft for valvular incompetence; and (5) for banking. In this instance, to prevent later showing of the graft, the Surgicel-wrapped diced cartilage is placed around the carved costal cartilage and into the lateral sidewall (**27**).

Figure (6): (Above, left) Preoperative frontal view of the patient shows marked external deviation. (Above, second from left) Postoperative frontal view after 3 years shows a straight nose with no sign of recurrence of external deviation and no dorsal irregularities (camouflaged with Surgicel-wrapped diced cartilage). (Above, second from right) Preoperative view from below. (Above, right) Three-years postoperative view from below. (Below, left) Preoperative right lateral view. (Below, second from left) Postoperative right lateral view after 3 years. (Below, second from right) Preoperative left lateral view. (Below, right) Postoperative left lateral view after 3 years (**28**).

Daniel and Calvert techniques

Grafts are an integral part of modern rhinoplasty surgery, for both functional and aesthetic reasons. Septal and auricular cartilage are the principal donor sites, with rib cartilage increasingly used in secondary cases. Several of the problems that have been associated with cartilage grafts are donor-site morbidity, limited availability, visibility, warping, and longterm survival (**29**).

Diced cartilage offers a dramatic solution to many of these problems, as virtually all the excised cartilage pieces obtained during a standard rhinoplasty can be diced and used without harvesting additional material. Diced grafts are generally not visible, as they are 0.5 to 1.0 mm in size and wrapped in fascia when placed beneath thin skin (**30**).

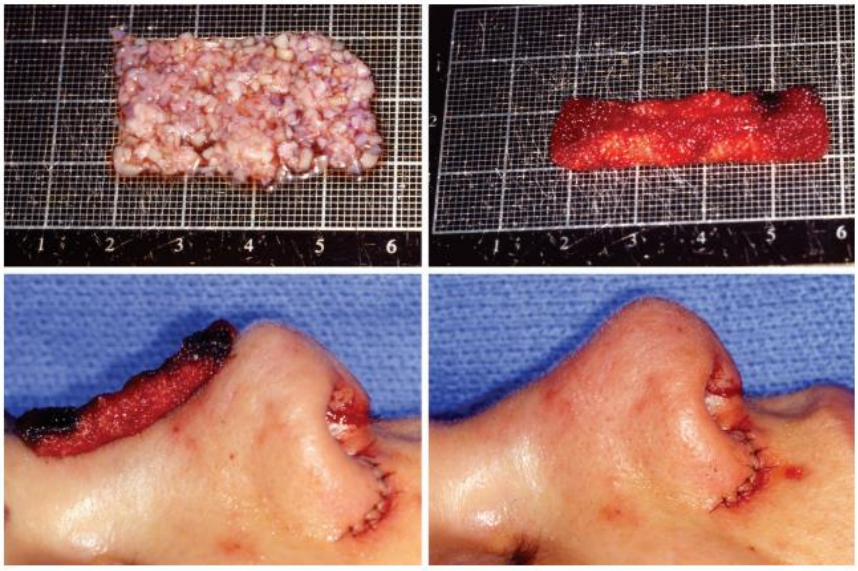

Figure (7): (Above) Diced cartilage prepared and then wrapped in Surgicel. (Below) The diced cartilage graft wrapped in Surgicel being inserted as a full-length dorsal graft for the patient (**31**).

The role of diced cartilage grafts in plastic surgery is fascinating. The viability of diced cartilage grafts was first demonstrated experimentally by Young in 1941 and clinically described by Peer in 1943. Subsequently, Peer conducted extensive research on molding diced cartilage into an ear framework. He implanted a vitallium mold filled with diced costal cartilage into the subcutaneous tissue of the abdomen (**30**).

By 4 months, it was possible to transfer a rigid framework to the auricular region. Both Young and Peer described their histologic findings as showing survival of the diced cartilage with interspersed fibrous tissue resulting in a solid sheet of opaque cartilage-like material. Peer's initial work on using diced cartilage for cranioplasties was confirmed by Wilflingseder, who also found a solid cartilaginous mass following initial insertion of diced cartilage pieces. Perhaps the most surprising application of diced cartilage is in treatment of the collapsed nose associated with leprosy. Wintsch credits Tovey for detailing the procedure originated by Cockett in which diced cartilage is used to fill the posterior nasal cavity before insertion of a dorsal bone graft. The use of diced cartilage for correction of saddle nose deformity using a chondrojet injector was devised by De Kleine and is illustrated in Denecke and Meyer (**32**).

Interestingly, these editors state that "the method has been abandoned for building up the dorsum, but in reconstruction of the orbit, maxillae, etc. it has remained a practical method." No explanation is offered for its abandonment. Burian6 describes the use of diced cartilage grafts for facial and nasal reconstruction including specific surgical instruments for dicing and introducing the grafts. The question then becomes, why was diced cartilage abandoned for almost 50 years until Erol revitalized our interest? (**32**).

It is tempting to speculate that there may have been significant absorption of the grafts in the preantibiotic era of the 1930s to 1950s. Second, the introduction of Silastic implants and other "miracles of modern chemistry" including Supramid mesh, Mercel, Proplast, and others shifted attention away from autogenous material to allografts. The most intriguing aspect of this article is the dramatic contrast in the results reported by Erol and ourselves with the Turkish delight grafts (diced cartilage grafts wrapped in Surgicel). To try and solve this discrepancy, Dr. Erol kindly sent us samples of the Surgicel that he uses. In a personal communication with Johnson & Johnson, Inc., the sole manufacturer of Surgicel worldwide, it was determined that the Surgicel used in the United States and Turkey is manufactured at the same facility (**30**).

The packaging of Surgicel occurs at two separate facilities, both approved by the Food and Drug Administration and the Communauté Européene. Therefore, the Surgicel itself is not a variable in the results. Surgicel is oxidized regenerated cellulose. It is prepared by treating cotton with alkali and carbon disulfide, then passing it through an acid bath, followed by regenerating the cellulose into a pure chemical compound of the desired fiber size. The fibers are then oxidized and the material is purged of chemical by products by neutralization and washing. It is then spun and knitted into a fabric that can be used as an absorbable hemostatic agent. Initial clinical and experimental studies were conducted in the 1950s and early 1960s showing its efficacy as a hemostatic agent, but with some persistence of fibers at the site of implantation in clinical biopsy specimens. (**30**).

Clinically, why has Erol4 been able to achieve success in more than 2563 patients? In the majority of Erol's case studies, the grafts were used for a "camouflage" purpose to hide dorsal irregularities in primary rhinoplasty patients (**33**).

The grafts were used for "contour" and to produce a distinct change in the nasal profile. **Gryskiewicz, (34)** stressed the difference in using dorsal grafts for camouflage contour and the difference between short-term and long-term results.

Gryskiewicz, (34) observed partial absorption in a long-term result that Erol had published as demonstrating a successful outcome using a diced cartilage dorsal graft wrapped in Surgicel. Why would anyone perform a dorsal graft in 1850 primary rhinoplasties? Rate of dorsal augmentation in primary rhinoplasty is 4 percent, whereas Erol's appears to be virtually 100 percent. Certainly, overreduction followed by augmentation using the Skoog rhinoplasty technique cannot be the goal. Rather, the goal must be to fill the dead space above the closed open roof and give a rounder, more natural appearance to the nose.

Erol refers to his grafts as having a semisoft, smooth surface under the skin early on, but does not describe their longterm palpability. The graft remains distinctly palpable for up to 6 years, which is the longest follow-up available to us (**35**).

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