Dorsal Augmentation with Septal Cartilage

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ABSTRACT

Deficiency of nasal dorsal projection may be inherent or acquired. Repair is most commonly performed with an onlay graft. When nasal septal cartilage is available, it is the author's preferred source for graft material. It is important to realize that dorsal augmentation is an operation performed for aesthetic not functional reasons. As such, patients understandably scrutinize their postoperative result, and attention to detail in all aspects of the surgery is critical in achieving a favorable outcome. The author's technique for using septal cartilage for dorsal augmentation is presented. Specific considerations include patient selection and analysis, graft harvesting, preparation, and placement, donor-site care, and recipient site preparation and postoperative care.

KEYWORDS: Rhinoplasty, augmentation, septum, graft

As with any rhinoplasty procedure, accurate preoperative analysis is critical to a successful outcome. Patients with deficiency of the nasal dorsal appear washed out on frontal view, making their eyes seem wide set. On lateral view, the nose has a scooped appearance. This can be particularly distressing in patients who should have a strong nasal profile (i.e., tall, otherwise strong facial features, male). Specific measurements concerning proper dorsal projection are beyond the scope of this article, however, an accurate assessment of the dimensions for augmentation is critical and greatly affects the selection and fabrication of the donor graft.

TECHNIQUE

Dorsal augmentation with septal cartilage may be performed under intravenous sedation or general anesthesia. The surface area outline for the dorsal onlay graft is marked on the patient prior to any injection. Deficiencies of the nasal dorsum can encompass the entire subunit or be confined to specific areas within the subunit. The graft design, both in outline and thickness, is therefore dictated by the specific needs of the case. The final augmented

result, however, should yield a dorsal subunit as described by Burget and Menick,¹ a gentle highlighted ridge extending from the radix to the supratip blending naturally with the sidewalls of the nose. Placing a single light source oriented 45 degrees above the nose aids in visualizing the proper outline. The author favors using a Devon skin marker (no. 160-R; The Ludlow Company Chicopee, MA) that has been sharpened to a finer point using a no. 15 blade. After the outline for the graft has been made, the marking is sealed on the skin by applying pressure with a dry surgical sponge. This ensures that the mark does not rub off or "bleed" during the case. The dimensions for the graft thickness should already be established preoperatively.

Patients are given perioperative antibiotics. No controlled randomized studies have shown antibiotics to be necessary, however, the use of antibiotics is viewed as judicious if cartilage grafting is done or if a foreign body is to be placed in the nose (i.e., nasal packing, septal splints). Cottonoid pledgets containing 4 mL of 4% cocaine are placed into the nose. After pharmacologic effect, the nasal septum and dorsum are injected with 1% lidocaine with 1:100,000 epinephrine, using a

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3-cc syringe. Larger syringes do not offer as much control of injection pressure. Fine control of injection pressure aids in hydrodissection. Accurate hydrodissection (i.e., subperichondrial/subperiosteal) aids in hemostasis, as well as establishing the proper surgical plane.

The septal cartilage is accessed via a hemitransfixion incision with dissection around the caudal margin of the quadrangular cartilage. Both sides of the mucoperichondrium are raised. To start the dissection in the proper mucoperichondrial plane, the author uses a no. 15 blade to make hash marks (i.e., tick-tack-toe grid pattern) down to bare cartilage, the dissection is expanded using a sharp angled McCollough elevator (no. 93-0408; Boss Instruments, Hermitage TN). Staying in the proper surgical plane is critical for hemostasis and preventing unilateral fenestra or even through and through perforations. The entire quadrangular cartilage is exposed. So that the inferior portion of the quadrangular cartilage can be visualized and harvested, it is helpful to raise the flaps beyond the border with the maxillary crest. The larger angled Woodson elevator (no. 70-3052; Boss Instruments) is ideal for this maneuver. Cartilage is harvested in a manner similar to Freer's classically described "submucous resection."² This maneuver is performed with a Freer "D" knife (no. 93-0725; Boss Instruments). Enough quadrangular cartilage (i.e., the "L" strut) must be left behind so as not to compromise nasal support. Figure 1 illustrates the "L" strut of anterior caudal nasal septum (pictured in striped pattern), which must be preserved to prevent loss of nasal support. The area of septum that attaches to the upper lateral cartilages should also be preserved. Generally, the "L" strut measures 1.0 to 1.5 cm, however, the amount of

Figure 1 The "L" strut of the anterior caudal septum, pictured in vertical stripe, should be preserved, and the posterior septum can be harvested for graft material.

"L" strut cartilage necessary to provide good support can vary greatly depending on the strength, thickness, and dimensions of the nasal septum and other nasal tissues (i.e., upper lateral cartilages, lower lateral cartilages, nasal bones, etc.). Nonsupportive quadrangular cartilage, pictured posterior to the dotted vertical line, can be harvested freely. Obviously, one should be confident that enough septal cartilage is preserved to provide good support. After all, the patient is undergoing dorsal augmentation; nothing should be done to compromise that goal.

After the cartilage is harvested, any significant bony septal deviations are corrected and the hemitransfixion incision is closed with absorbable 4-0 chromic gut suture on a P-3 needle (no. 1654; Ethicon, Somerville, NJ).

Septal splints are fashioned from sterilized plastic milk containers (Fig. 2A). The containers are cut into sections that are gas sterilized (Fig. 2B). Intraoperatively, the sterilized sections are cut into splints to fit the individual patient (Fig. 2C). Septal splints are used primarily to provide gentle compression of the mucoperichondrial flaps over a large surface area, thus preventing septal hematoma. For this to occur, it is crucial that the suture securing the splints spans the majority of the length of the splints. If the securing suture spans only a short distance, the splints are primarily spacers and do not provide much compression. A tonsil tenaculum (no. 95-2020; Boss Instruments) aids in this maneuver by holding the splints in the proper position while the suture is placed (Fig. 2D). A 3-0 Prolene (Ethicon, Somerville, NJ) on a FS-2 needle (no. 8665; Ethicon) is used. It is a strong enough suture to hold the splints in place. The needle is strong enough to pass through the splints; yet the needle is small enough to be retrieved easily from the posterior nose after passing through the splints. The posterior throw of the securing suture is made more easily if the needle is loaded parallel to the needle driver rather than the traditional perpendicular orientation.

In addition to preventing hematoma formation, septal splints provide a physical protective barrier during the healing process. Septal splints also keep the underlying mucosa moist and free of crusts. The septal splints are left in place for 1 week. No septal quilting suture is used.

Nasal packing called Rapid Rhinos (no. RR400; ArthroCare UK LTD, Glenfield Leicestershire UK) is placed on each side of the nose. The nasal packing is not used to prevent septal hematoma, the septal splints see to that; rather, the packing is used to absorb the postoperative nasal drainage. The Rapid Rhinos consist of a foam core covered with a wicking mesh material that by design forms a gel and allows the packs to be removed without discomfort. The packs are removed the day after surgery.

Figure 2 (A) Septal splints are made from plastic milk containers. (B) The containers are cut into sections and sterilized. (C) The sections are cut into splints intraoperatively, sized for each patient. (D) A tonsil tenaculum holds the septal splints in position while the securing suture is placed.

Once the septal cartilage is harvested, it must be manipulated to match the required augmentation needs. Cutting, shaving, and beveling of the cartilage are performed with a fresh no. 15 blade under magnification. Beveling of the margins of the dorsal graft is important as sharp edges will result in a noticeable artificial appearance. This is especially important in thin-skinned patients.

If necessary, more than one piece of septal cartilage can be combined to meet either the thickness and/or the length requirements for augmentation. This is illustrated by the case pictured in Figs. 3 and 4. The patient is

a 31-year-old woman who wishes a higher nasal dorsum. She is pictured preoperatively and 1 year postoperatively (Fig. 3). Two pieces of septal cartilage are joined together to have enough length and thickness for the dorsal graft (Fig. 4). Although the patient is pleased with the result, close inspection of the postoperative frontal view shows a visible highlight along the right edge of the dorsal graft. This can be prevented with more precise shaving of the graft. When combining cartilage pieces, the author prefers a 6-0 polydioxanone (PDS) on a P1 needle (no. Z489; Ethicon) to make simple mattress stitches. Larger needles can cause unnecessary trauma to

Figure 3 (A) Preoperative. (B) One year postoperative. (C) Preoperative. (D) One year postoperative.

Figure 4 (A) Two septal cartilage pieces are joined to fashion the dorsal graft. (B) The dorsal graft pictured externally.

the graft. Rarely are more than three stitches necessary. Unlike what is pictured in Fig. 4A, it is preferable to place the knot for the stitches on the undersurface of the graft.

If the harvested septal cartilage cannot provide enough material for the required graft, auricular cartilage is harvested and the two used in combination. This is illustrated by a recent case pictured in Figs. 5 and 6. The patient is a 37-year-old Asian-American woman who wishes a strong profile and more tip projection. The patient is shown preoperatively and 2 months postoperatively (Fig. 5). Auricular and septal cartilage is combined to form the dorsal graft (Fig. 6A). Auricular cartilage is also used to fashion a tip graft (Fig. 6B).

Access for placing the dorsal graft is dictated by the needs of the case; however, a unilateral intercartilaginous incision is the preferred approach. For a right-handed surgeon, a right intercartilaginous incision is easier for graft insertion.

The "precise pocket" that is outlined on the skin at the start of the operation is dissected to receive the graft. Sharp dissection with a no. 15 blade is used throughout. The plane of dissection should be as close to the nasal bony/cartilaginous skeleton as possible. This exploits to advantage an avascular plane and results in maximum soft tissue coverage for the dorsal graft. The precise pocket should result in a tight fit for the dorsal

graft. A tight fit lessens the chances of graft migration and provides a natural tamponade to reduce bleeding. Once the precise pocket is been made, its dimensions are confirmed by inserting a Cottle elevator (no. 93-0480; Boss Instruments).

The graft is inserted with bayonet forceps (no. 93-1010; Boss Instruments). Pressure is applied to the lateral borders of the graft with one's thumb and index finger; tension on the graft is released from the bayonet forceps; and the bayonet forceps are withdrawn. The intercartilaginous incision is closed with 4-0 chromic gut suture on a P-2 needle (no. 1659; Ethicon). In the vast majority of cases, the graft is now in an accurate and stable position.

Occasionally, other maneuvers are necessary to position and/or secure the graft. The author has used two methods: guide sutures and transcutaneous sutures.

Guide sutures are illustrated by the case pictured in Figs. 7 and 8. The patient is a 41-year-old African-American man who at the time of consultation is 12 months status post septorhinoplasty by another surgeon. The septorhinoplasty included alar base reductions and placement of an alloplastic dorsal implant made from Medpor (Porex Industries, Fairburn, GA). At consultation, the patient believes that his nasal dorsum is too high and that his nose is slightly crooked on frontal

Figure 5 (A) Preoperative. (B) Two months postoperative. (C) Preoperative. (D) Two months postoperative.

Figure 6 (A) Auricular and septal cartilage are used to fashion the dorsal graft. (B) The dorsal graft and tip graft pictured externally.

view (C-shaped deformity). In addition, the patient complains of pain and occasional swelling in the dorsum of the nose. Figure 7 shows the patient before his initial surgery, at the time of consultation and 14 months after removal of the Medpor implant and placement of a multilayered dorsal graft consisting of both septal and auricular cartilage. The Medpor is removed piecemeal via an endonasal approach (Fig. 8A). The pocket for the new cartilage dorsal graft is understandably larger than ideal. Therefore, guide sutures fashioned from 4-0 chromic gut on a P-3 needle (no. 1654; Ethicon) are secured to the cartilage graft, one superiorly and one inferiorly; the needles are left attached (Fig. 8B). The needles are passed from the appropriate positions inside the pocket out through the skin (Fig. 8C). The needles are cut off leaving tags of suture that are taped to the skin for 1 week. At 1 week, the sutures are cut flush with the skin. Fourteen months after secondary surgery, the patient is pleased with his adjusted lower profile. He is not bothered with pain or swelling of the nose. His nose appears straight on frontal view.

Transcutaneous sutures can be placed in two ways. In one method, the suture starts external and passes through the skin, to the cartilage of the dorsal

graft, and then back out through the skin. The author favors a 6-0 Prolene on a P-1 needle (no. 8697; Ethicon). The P-1 needle is strong enough to perform the maneuver but relatively atraumatic to the cartilage graft. In the second method, the suture starts external and passes through the skin to deeper nasal structures on the borders of the skin pocket. The author favors a 5-0 Prolene on a P-3 needle (no. 8698; Ethicon). A stronger P-3 needle is used for this maneuver as the suture is placed deeper through the tissues. In both types of transcutaneous sutures, it is important to stabilize the graft in proper position with digital pressure while placing the sutures. Also in both types of transcutaneous suture, the Prolene may be secured at the skin around a small piece of Telfa (Tyco Healthcare, Mansfield, MA). This protects the skin against maceration.

In the majority of cases, where a truly precise pocket can and has been created, neither guide sutures nor transcutaneous sutures are usually necessary.

After the dorsal graft has been placed and its position and stability confirmed, no one is allowed to touch the patient's nose except the surgeon. This is a safeguard against the graft being moved. Mastisol adhesive (no. 0523; Ferndale Laboratories, Ferndale, MI) is

Figure 7 (A) Prior to initial surgery. (B) Prior to secondary surgery. (C) Fourteen months after secondary surgery. (D) Prior to initial surgery.

Figure 7 (Continued) (E) Prior to secondary surgery. (F) Fourteen months after secondary surgery.

applied. While it dries, the surgeon removes his gown and gloves and washes his hands. This makes manipulating Steri-Strips much easier. Steri-Strips (no. R1547; 3M Health Care, St. Paul, MN) are applied followed by an Aquaplast nasal cast (no. PS1693; WFR/Aquaplast Corporation, Wyckoff, NJ). Care is taken when applying the Steri-Strips and the nasal cast to use even pressure so as not to move the graft. The nasal cast is left in place for 1 week. When removing the nasal cast, no force should be applied that could result in moving the dorsal graft. Gently passing a Billeau ear loop (no. 90–1122; Boss Instruments) between the nasal skin and the Steri-Strips is the favored method for nasal cast removal (see Fig. 9).

The internal septal splints are also removed at 1 week postoperatively. The nose is sprayed with topical decongestant and anesthetic. The 3-0 Prolene suture is cut with a no. 15 blade against the plastic on the opposite side as the suture knot. The splints are then grasped and removed with Brown Adson forceps (no. 10–6500; Boss Instruments).

Patients are cautioned to avoid nasal trauma. Patients are allowed to start light exercise at 1 week postoperatively. Impact activity such as running can be eased into starting at 2 weeks postoperatively.

It should be mentioned that although the intercartilaginous approach is favored for placing a dorsal

graft, if an external septorhinoplasty approach is being performed for other reasons (i.e., major nasal tip work), the dorsal graft can be placed with this approach as well. However, care should be taken to limit nasal dorsal dissection to the outline of the precise pocket.

DISCUSSION

Unfortunately, the ideal graft material for nasal surgery does not exist. The ideal graft material would be available in an unlimited supply, formed in infinite contours, be completely biocompatible, and require no morbidity to obtain. When septal cartilage is available, it is the author's first choice for graft material. Septal cartilage has several advantages. It is harvested in the same surgical field as the recipient site. It is biocompatible, with infection and resorption rates near zero, as evidenced in large reported series.^{3,4} Septal cartilage is easy to carve, and it does not warp over time. Unfortunately, septal cartilage is not always available in a large enough piece for dorsal augmentation. This may be due to loss of septal cartilage from prior surgery or trauma. Some patients inherently have a smaller amount (surface area and/or thickness) of septal cartilage. Unfortunately, ethnic groups who generally have a smaller amount of septal cartilage (Hispanic/Asian/African

Figure 8 (A) The Medpor implant is removed in pieces. (B) The multilayered cartilage graft with superior/inferior guide sutures. (C) The graft is in place and the guide sutures have been passed out through the skin.

Figure 9 A Billeau ear loop instrument, shown externally, can be passed under the nasal dressing for removal.

Americans) are often the population requesting dorsal augmentation. When septal cartilage is in short supply, the dorsal graft may be fashioned by combining more than one smaller pieces of septal cartilage or combining septal cartilage with auricular cartilage. All patients undergoing dorsal augmentation with the intention of using septal cartilage are also consented for the use of auricular cartilage.

Because of the inherent risk of infection and/or rejection, the author does not use alloplastic grafts in the nose. Each surgeon must address this issue for himself or herself. The debate over the use of alloplastic grafts in the nose has been going on for decades.⁵

Dorsal augmentation with septal cartilage has a long history. In 1901, Goodale reported subcutaneous placement of a septal cartilage autograft to repair a "median furrow" of the nose (i.e., dorsal deficiency).⁶ The operation was performed at Massachusetts General Hospital. Thru an endonasal approach in the left nasal vestibule, a precise pocket was created for a 2 cm by 7 mm cartilage graft from the patient's septum. At 3 months follow-up, the graft was stated to be surviving and in good position. Interestingly, this report predates by 1 year Freer's classic description of the submucous resection.²

Dorsal augmentation with septal cartilage is contraindicated in children.⁷ Midface growth may be affected in children by this type of septal manipulation. Auricular cartilage or rib cartilage is the favored donor source in this population.

Contraindications can also include systemic diseases that impair wound healing or affect the quality and/or quantity of donor cartilage: collagen vascular disease, rheumatic disease, lupus, polychondritis, and Wegener's granulomatosis.⁸

Complications from dorsal augmentation with septal cartilage should be few. Graft harvest site hematoma and infection rates, as with cartilage graft resorption and infection rates, should be near zero. Although infrequent, a more common complication is either a misplaced or displaced graft. Regardless of whether the graft malposition occurred during or after surgery, if it is noticeable, and the patient wishes, it should be repaired. The author has had little success in using nonsurgical, external, digital manipulation (performed by either the patient or the surgeon) postoperatively to reposition a graft. Concerning timing for the repair, enough postoperative edema should be gone so that when the graft is removed and repositioned, proper graft position can be accurately judged. Unlike during primary graft placement where guide sutures or transcutaneous sutures are rare, with secondary positioning, these adjuncts are the rule.

Grafts can also be noticeable due to poor design; visible graft edge is the common example. This situation should be rare but can be rectified with graft removal, carving, and replacement. Occasionally, a graft can be shaved in place without removal.

Obviously, the goal of a dorsal augmentation with septal cartilage is to create a nasal dorsum that looks natural. It is to be expected, however, that the nasal dorsum may not feel natural. All patients are counseled preoperatively that they may be able to palpate the outline their grafts. This is normal and expected.

Dorsal augmentation can be an extremely satisfying procedure for both the patient and the surgeon; however, given that this procedure is performed for aesthetic purposes, the bar is set high. Attention to detail in all aspects of the surgery is critical in achieving a favorable outcome.

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