The Cottle Method and Modifications in Preservation Rhinoplasty

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KEYWORDS

• Preservation rhinoplasty • Cottle rhinoplasty technique • Endonasal rhinoplasty • Rhinocontouring • Endonasal spreader graft

KEY POINTS

- The term "preservation rhinoplasty" has gained much popularity in recent years but is not a new operative technique and has been used by generations of rhinoplasty surgeons.
- We review relevant history of the "Cottle Rhinoplasty technique" to highlight the long-standing existence and dependability of this technique.
- We highlight a number of modifications we incorporate into the operation which are helpful in advancing Cottle's original push-down/let-down.
- The described modifications are borrowed from structural rhinoplasty, and allow us to achieve more predictable results.

INTRODUCTION

Dorsal reduction is a key component in esthetic rhinoplasty and often reflects the patient's primary cosmetic desire. The most common technique to lower the nasal dorsum involves the direct resection of dorsal nasal cartilage and bone "from above," a technique we ascribe to Jacques Joseph and term the "Joseph dorsal reduction technique." Since the Joseph dorsal reduction requires resection and therefore disruption of the tissues immediately underneath the dorsal nasal skin, it also requires the subsequent meticulous reconstruction of dorsal cartilage and bone to create beautiful smooth dorsal esthetic lines and functional nasal capacity. This reconstruction of the dorsal elements, including the upper lateral cartilages and their intimate association with the dorsal septum and the nasal bones, can at times be challenging and may often be a limiting factor in the success of a rhinoplasty—revision rhinoplasty may stem from dorsal irregularities, open roof deformity, and nasal breathing problems associated with a poorly reconstructed nasal dorsum. This represents a fundamental risk of the Joseph technique, and the Cottle technique represents a reaction to these Joseph technique shortcomings. Of course, despite the challenges of dorsal reconstruction required in a Joseph rhinoplasty, surgical technique innovations and attention to detail have enabled surgeons to achieve outstanding results with Joseph rhinoplasty.

Although the Joseph dorsal reduction technique has been the dominant rhinoplasty technique worldwide from the mid-twentieth century until today, throughout the decades and generations, there have always been devotees of the "Cottle

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Technique"—pockets of surgeons throughout the world who have enthusiastically dedicated their successful careers to the Cottle rhinoplasty technique. Maurice Cottle, though he did not invent the concept of "dorsal preservation rhinoplasty," gave the "push-down" and "let-down" operations broad awareness and popularized the techniques that involve lowering the dorsal height by resecting a portion of the ventral septal cartilage and impacting the nasal bones. The Cottle technique offers the opportunity to reduce the nasal dorsum without deconstructing and then reconstructing the native nasal dorsum. The upper lateral cartilage attachments to the septum and nasal bones, and the keystone area itself, are all left intact, minimizing any direct manipulation of the dorsal structures and eliminating the need to reconstruct the middle and upper nasal thirds. This bypasses many of the risks inherent in the Joseph rhinoplasty techniques, allowing for the naturally existing dorsal structures to remain intact.

Among the Cottle devotees who practiced Cottle rhinoplasty throughout their careers and who interacted directly with and collaborated directly with Maurice Cottle are 2 dominant figures in the field of rhinoplasty and rhinology who transmitted the techniques to their students—Dr Fausto Lopez Infante, MD, who was a leader among Mexican rhinoplasty surgeons and teachers and who practiced at the Spanish Hospital in Mexico City, and Professor Eugene Barton Kern, MD, who is a leader among North American rhinoplasty and rhinology surgeons and teachers who practiced and taught at the Mayo Clinic in Rochester Minnesota. These 2 world-famous surgeons and educators are responsible for transmitting Cottle's technique to generations of rhinoplasty surgeons through publications, the teaching of residents, and instructing in worldwide didactic and cadaver courses, including teaching the 2 authors of this article. Of special note, Fausto Lopex Ulloa is the son of Fausto Lopez Infante and was partnered in practice with his father before the untimely death of "Big Fausto." In this publication, we describe the essential operation as it was transmitted to us, and we introduce some modifications that we have developed to help improve upon the original surgical technique's consistency and precision.

HISTORY

The concepts of reducing the nasal dorsum "from below" as Cottle advocated versus "from above" as Joseph advocated are not new. The originators of these techniques are not Joseph or Cottle themselves, but these 2 giants, who are among the progenitors of modern-day rhinoplasty, popularized the techniques. The 2 divergent schools which developed, the Joseph school and the Cottle school, each emerged worldwide with a devoted following at a time of tremendous growth in rhinoplasty popularity and these 2 schools remain alive today. An outstanding and elegant historical description of the push down and let down procedures is provided by Professor Eugene Kern in an article entitled "History of Dorsal Preservation Surgery" and forms the foundation for this historical summary section. In 1887, John Orlando Roe was the first to publish on cosmetic nasal surgery involving the nasal tip[1,2] and in 1891, he published on the subcutaneous approach to dorsal reduction.[3] In 1898 and 1904, Jacques Joseph described dorsal reduction by reducing the osseocartilaginous nasal dorsum from above, and it is based on these descriptions that we attribute much of what we know about Joseph rhinoplasty today, as his works had a far and wide reach and popularity.[1,4] In 1899, JL Goodale from Boston Massachusetts published "A new method for operative correction of exaggerated Roman nose"[5] in which he first describes the operation that has become known as preservation rhinoplasty today—in his description Goodale resected the septal cartilage with 2 scissor cuts (including septal mucosa) and he transected the nasal bones at the nasomaxillary groove with a saw followed by a gentle tap on the dorsal nasal bones to depress them downward. Goodale's description, in general terms, is most like the "push-down" operation. In 1914, Lothrop performed the first "let-down" operation utilizing the Lothrop bone punch (rongeur) for resection of a wedge of bone from the frontal process of the maxilla or nasal bones adjacent to the frontal process of the maxilla.[6] In the technical description of by Lothrop's, he describes elevating the mucoperichondrium flaps on either side of the nose widely and resecting a high portion of septal cartilage and perpendicular plate of ethmoid, resecting a bone wedge from the nasal bone/frontal process of maxilla region with a new instrument he describes in the article, followed by release of the fronto-nasal suture with a narrow straight chisel to "let-down" the upper portion of the septum so that it lies in continuity with the lower cut edge of the septal cartilage. In 1926, Pierre Sebileau and Leon Durfourmentel published in French on the "Surgical Correction of Congenital and Acquired Deformities of the Nasal Pyramid" in which they describe resection of a portion of the frontal process of the maxilla and a lower septal cartilage strip to reduce the dorsal profile while keeping the keystone area and osseocartilage dorsum intact.[1] In 1954, Maurice Cottle published in English on the "push-down" technique and would promote the operation for the next few decades, influencing

many students and developing a significant following among surgeons strongly committed to this surgical approach. Though the concepts of the technique were published before Maurice Cottle's 1954 publication, the term "Cottle rhinoplasty" persists today due to the worldwide influence Maurice Cottle had on surgeons committed to the technique. Cottle and his disciples advocated for the "push-down" throughout their careers, through lectures, teaching in courses, and publishing several articles. Cottle championed the concept of the push-down rhinoplasty technique in which the dorsum is displaced downward rather than resected as a safe method to reduce the height of the nasal dorsum.[4,7,8]

TECHNIQUE DESCRIPTION

The Cottle rhinoplasty technique provides for a minimalist approach to the nasal dorsum. In combination with establishing excellent rapport with the patient ahead of surgery, this minimalist approach helps insure a high degree of patient satisfaction.[9] Maurice Cottle taught that "as the septum goes so goes the nose," placing the septum as the most important determinant of nasal shape, and the Cottle rhinoplasty technique models this concept. The basic Cottle technique is detailed as follows, and has been described in greater detail by us previously.[10]

Local anesthetic infiltration is achieved with approximately 10 mL of 1% lidocaine with 1:100,000 epinephrine into the nasion, intercartilaginous area, pyriform aperture, membranous septum, infraorbital region, columellar base region, supraorbital region, and transfixion incision site. This amount of local anesthetic distributed so widely around the face and nose provides adequate block and vasoconstriction without distorting the form of the nasal tissues which would make precision surgery difficult to accomplish. Most commonly, bilateral intercartilaginous and complete transfixion incisions are made which allows excellent visualization of the nasal septum and the osseocartilaginous pyramid. Tip refinement may be undertaken, however, the surgeon sees fit, as the Cottle technique refers to management of the nasal dorsum only. In the vast majority of patients, we prefer the traditional endonasal approach for "push-down" and "let-down" operations, as we believe this stays true to the concept of minimizing surgical invasiveness and risks.

The caudal edge of the upper lateral cartilage (ULC) is identified as is the cephalic edge of the lower lateral cartilage (LLC), and an intercartilaginous or transcartilaginous incision is made, along with a hemi-transfixion incision at the caudal septal border, with a No. 15 blade. The subperichondral and subperiosteal nasal septal flap is elevated on both sides of the septum, from the anterior septal edge to the posterior vomer and from the nasal floor to the dorsum. In one modification we use, we at times place a spreader graft under the upper lateral cartilages for nasal valve improvement, in which case rather than elevating the mucoperichondrial flap all the way to the dorsal aspect of the septum we would leave some mucosa attached to the septum (approximately 7 mm) in the region immediately under the upper lateral cartilages, so that a precise tunnel can be created for placement of spreader grafts endonasally.[11] If there is any obstructive septal deviation, it may be addressed as it would be during routine septoplasty for airway improvement. Complete disarticulation of the ventral cartilaginous septum from the maxillary crest and the posterior cartilaginous septum from the perpendicular plate and vomer is performed to allow for septal straightening and airway improvement. The septum is an essential component of Cottle rhinoplasty as we aim to provide optimal nasal function and airway patency. Next, we may proceed with standard "Cottle Push-Down surgery" in which case we perform lateral osteotomies in a high-low-high or low-low-high fashion, bringing the osteotome along the desired path to the nasal dorsum at the root of the nose in the region we want to be the deepest point of the nasal profile. Next the classis Cottle technique incorporates a transverse root oseteotomy percutaneously with a 2-mm osteotome to free the nasal bones from the frontal bone and this lower the dorsal height by impacting the nasal bones to a new position that lies deep to the level of the face of the maxilla and pyriform aperture. Among patients with relatively wide nasal bony bases and in patients who require less than approximately 4 mm of dorsal bone reduction, we can perform the push down as described. Among patients who have relatively narrow bony nasal bases, or who have more than 4 mm of reduction to undergo, we would resect a boney wedge from the frontal process of the maxilla or the nasal bones themselves from the point immediately above the head of the inferior turbinate extending a variable amount along the naso-facial junction until enough is removed that the cut edges of the nasal bones can be easily "let-down" to come in contact with the maxillary bone at the pyriform aperture. This procedure that has just been described is termed the "let-down procedure" for reducing the nasal dorsum height. To remove the wedge of bone, we were taught to use a bone rongeur which is straddled on either side of the nasal bone/frontal process

of the maxilla and squeezed to then cut and remove the necessary wedge of bone. To achieve this wedge resection, a 4-mm vertical incision is made along the nasal sidewall at the level of the pyriform aperture just above the insertion of the head of the inferior turbinate. Periosteum along the intended pathway of the lateral osteotomy is elevated along the internal and external aspects of the frontal process of maxilla and nasal bones. A 3-mm Lempert forceps or rongeur is introduced into the subperiosteal tunnel, and the bony wedge is resected from the bony pyramid. It may be necessary to remove bilateral wedges as well as asymmetrical wedges of bone if there is a crooked nose with crooked and asymmetrical bones present. One must be careful to remove enough bone to allow the dorsum to easily be lowered, but not too much bone to result in a saddle nose deformity. A modification we have introduced is using the piezo ultrasonic bone cutting device to incrementally and gradually remove the wedge of bone rather than removal of the wedge with a rongeur in one single swipe of the instrument. There is a greater sense of safety in the gradual reduction of the bone through incremental shaving, providing us with more precise control over how much bone is removed and insuring we do not accidently remove too much. This also allows us to tailor the amount removed on one side versus the other side to create better symmetry in the case of a crooked or tilted nose associated with asymmetrical nasal bones. In addition, if there is a crooked nose due to bony asymmetry, we resect more bone from the longer, more horizontal nasal bone to create improved symmetry and to straighten the crooked nose, and we have found this technique to be extremely useful in managing the crooked nose.[12]

An additional modification we have incorporated into the traditional endonasal Cottle technique involves using the piezo ultrasonic bone cutting tool to contour the nasal bones—if there is one concave and one convex nasal bone, or generally if there is a poor esthetic transition between the dorsum and sidewalls, rather than introducing multiple osteotomies and destabilizing the nasal bones with these multiple osteotomies, we contour the nasal bones along the convex nasal bony sidewall with sequential passes of the piezo device to create more symmetric concave nasal sidewalls bilaterally. This may also be achieved with a cutting bur and has been described previously[13] as rhinocontouring, but to our knowledge it has not been described in endonasal Cottle rhinoplasty.

Once the lateral osteotomies are performed in the case of the push-down, the bone contouring is completed in cases of bone concavity/convexity asymmetries, or the bony wedge is resected in the case of "let-down," the osteotomies are completed in a standard "high-low-high" lateral osteotomy approach, respecting Webster's triangle. Next, if a greenstick fracture did not adequately mobilize the nasal bones, which is another modification we prefer for enhanced stability of the nasal bones, a formal percutaneous transverse root osteotomy may be necessary and is accomplished with a 2-mm osteotome. In this fashion, the entire nasal pyramid is mobilized and may be repositioned lower and in the midline. Our preservation rhinoplasty push-down or let-down technique incorporates purposeful septal surgery as an indispensable step in deprojecting the dorsal height and in straightening the nose. After mobilizing the bony pyramid to the midline and straightening the septum, the remaining septum height determines the height of the dorsum. Trimming of the ventral septum is performed to adjust the dorsum height to the desired height and we then fix the residual septum to the maxillary crest and anterior nasal spine periosteum. The caudal septum is fixed to the anterior spine using a 3-0, 4-0, or 5-0 polydioxanone (PDS) suture in a figure of 8 design, or we have also sutured it extramucosally with 4-0 chromic suture to hold the newly repositioned septal flap. It should be noted that we have not faced significant postoperative loss of tip projection or columellar retraction because the caudal edge of the septum is anatomically adjusted and reinserted onto the nasal spine. Additionally, we reposition the tip lobular complex onto the repositioned caudal septum to control tip rotation and projection.

Before closure of the mucoperichondrial septal flaps, the nasal septal space is filled with residual fragments of septal cartilage and bone that were previously removed from the septal space, and quilting sutures are applied with 4-0 plain gut suture. Application of external nasal valve batten grafts may be incorporated as needed for weak external valve and tip support. Doyle splints are applied and secured with 4-0 prolene suture. A nasal cast is placed over the nasal dorsum and removed on day 6 or 7. Additional nasal tape dressing may be placed postoperatively as needed.

MODIFICATIONS DEFINED

Spreader Grafts

Spreader Grafts have been used with increased frequency ever since Jack Sheen introduced them 40 years ago.[14] The use of spreader grafts preservation rhinoplasty is a modification we have introduced years ago, and have been using the technique with great frequency.[11] One of the

authors incorporates endonasal spreader graft in nearly every dorsal preservation performed through the Cottle approach in which there is weakness of the upper lateral cartilage, nasal crookedness, or narrowing of the middle nasal third. As with other approaches to the nose, if the middle third is naturally narrowed as in tension nose deformity, or if there are inherently weak upper lateral cartilages causing a concavity along nasal sidewall in the middle nasal third, applications of spreader grafts help to widen the internal nasal valve angle and expand the breathing area through the valve. To ensure a stable airway and enhance structural support in the middle third of the nose and dorsum, we have found spreader grafts a very useful addition to the Cottle rhinoplasty approach.

Piezzo for Bone Wedge Resection

Resection of the wedge of bone from the junction of the nasal bones and frontal process of the maxilla can occur through several techniques. First, a double osteotomy using standard osteotomes to resect the intervening segment of nasal bone between the double osteotomy may be undertaken. Secondly, utilizing a rongeur to straddle and remove a segment of bone from the nasal bones/frontal process of maxilla junction may be used. Finally, the Piezzo may be used to either perform the double osteotomy or to shave the wedge out incrementally. The advantage to the Piezzo modification is that it allows the surgeon to sequentially and incrementally remove a layer of nasal bone/frontal process bone at a time so that over-resection may be avoided and fears of creating a saddle nose minimized. A wider incision and a wider field of dissection is required to introduce and visualize the piezo tip along the bony sidewall, but this offers a safe alternative for the beginning surgeon as they develop more comfort in resecting the bony wedge. The Piezzo may then also be used for completion of the lateral osteotomy and connecting it to the root of the nose or to the transverse osteotomy line as needed.

Piezzo for Rhinocontouring

The Cottle technique represents a way of reducing the nasal dorsum height, but additional techniques may be incorporated into the surgery depending on the needs of the patient. The concept of rhinocontouring of the nasal bones has been in practice for quite a number of years, and involves the simplest things such as rasping the bony nasal dorsum to lower the dorsal height or to reduce the appearance of rhinion horns at the junction of the dorsal upper lateral cartilages and bony nasal dorsum. Rhinocontouring may also be achieved with the Piezzo device, and it may be used for contouring the bony nasal sidewalls to create a thinning of the nose or a concavity along a nasal bone that might have previously been shaped as a convexity. By creating symmetry along the nasal bones without cutting or fracturing them, we are able to minimize the need for multiple osteotomies that may heal less predictably, offering greater safety and less variable outcomes.

Greenstick Fracture at the Radix/Root of the Nose

As we were taught the Cottle technique, we learned that a transverse root osteotomy is required to release the nasal bones to allow them to come down to a lower height more freely to effectively reduce the dorsal height. A single occurrence of a flailing nasal bone due to overaggressive osteotomies in which a step-off deformity at the root or a saddle deformity occurs is enough to encourage a surgeon to change their approach. We always try to avoid a complete transverse osteotomy separation of the nasal bones at the root of the nose/dorsum, and instead prefer to create a greenstick fracture at the root of the nose as part of the lateral osteotomy. The greenstick fracture is created after completion of the lateral osteotomies, and in most cases is produced with mild to moderate digital pressure after completion of the lateral osteotomy. In this way, better control is maintained at the root of the nose, preventing major step-deformity or saddling along the dorsum.

DISCUSSION

The Cottle techniques in dorsal preservation offer the surgeon an opportunity to reduce the nasal dorsal height without directly manipulating the bone, cartilage, and soft tissues and in so doing avoiding the risks inherent with deconstructing and reconstructing the nasal dorsum. While no technique is fail-proof, anything we can do to minimize the manipulation and destruction of tissue and of structural support will logically also reduce the risks of the operation and the variability of long-term healing. While philosophic discussions and disagreements about approaches and techniques are valuable processes that help shape our collective decisions toward improving the care of our patients, it is interesting to note that what ultimately emerges as the most popular concept of what is best may not actually reflect what is best—the arguments of Joseph versus Cottle which have a long history among our

predecessors has reemerged today, and there is room for both schools. It is also important to note that the technique an individual surgeon may choose is likely based on their personal experience and training, their comfort level, and the level of control they may need—structural rhinoplasty offers more control over the result on the table whereas Cottle rhinoplasty relies on developing an understanding of, and trust in, the anticipated wound healing process.

We have presented several modifications to the "original" Cottle "push-down/let-down" that we routinely rely upon to insure more predictable and stable long-term results. Incorporating other structural modifications into an operation to address the nasal tip, that are not related to the Cottle push-down/let-down that deals with dorsal preservation and therefore are not included in this publication, is also very important for long-term natural rhinoplasty results. The growing popularity of conservative and preservative approaches to nasal dorsal surgery, and the expansion of the concepts of minimalist surgery and augmenting structural support at the nasal tip, will help us provide our patients with better outcomes both esthetically and functionally. The future of rhinoplasty is very bright, given the trajectory we as a rhinoplasty surgeon community are on.

CLINICS CARE POINTS

- Preservation rhinoplasty has gained popularity over the past few years.
- The Cottle technique represents a long-standing approach to nasal contouring.
- Applying structural and contouring modifications to the original Cottle technique has enhanced our results.

DISCLOSURE

The authors have nothing to disclose.

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APPENDIX SUMMARY

Modification to the Original Cottle Push-Down and Let-Down Technique

Spreader Grafts: Spreader grafts help to widen the internal nasal valve as well as to stabilize the dorsal septum. We have incorporated spreader grafts to help reenforce the dorsal aspect of the L-strut and to widen the nasal valve area in Cottle's preservation rhinoplasty.

Piezzo Technology for Incremental Resection of Bone Wedge in Let-Down: Rather than removing a wedge of bone en-bloc or through double osteotomies, it provides a surgeon with greater control to incrementally shave the frontal process of maxilla or nasal bone down to create a gap for the nasal dorsum to "let-down" into, utilizing Piezzo technology. In this way, a surgeon can gradually remove bone and not fear creating a saddle nose due to over-resection of bony wedge.

Piezzo Technology for Contouring Nasal Bone Asymmetries and Convexities: Asymmetrical nasal

bones may be improved with asymmetrical osteotomies, multiple osteotomies, and other less common bone cutting techniques. A potentially more conservative approach to creating bony symmetry is to perform rhino-contouring during which the piezo or drill may be used to contour the nasal bones and frontal process of the maxilla to create improved nasal bone shape and symmetry. By contouring the bones, there is less healing variability as compared with osteotomies.

Asymmetrical Bone Wedge Resection for Twisted Nose. To straighten out crooked nasal bones that contribute to a crooked nose, the surgeon may resect wedges of bone of different widths on either side of the nose. This is like performing a double osteotomy on the side of the nose with longer bones, or the reduction of an asymmetrical dorsal hump when performing standard Joseph rhinoplasty.

Greenstick Fracture at the Radix/Root of the Nose: Rather than performing a transverse root osteotomy to free the nasal bones from the frontal skull in order to allow them to descend, we refer to perform a greenstick fracture of the root of the nose and find that in the vast majority of patients, this is all that is required to release the nasal bones and allow them to descend to a lower position and correct the dorsal prominence. Complete transverse osteotomy creates risks of step-off deformities as well as over-reduction of the dorsum due to loss of control of the bony nasal dorsum at the radix. The greenstick fracture allows us to maintain control.