Nasal Hump Treatment With Cartilaginous Push-Down and Preservation of the Bony Cap

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Abstract

Background: Classic nasal hump reduction based on partial resection of the cartilage and bones in the nose may lead to dorsum deformities such as an inverted-V deformity, irregularities, and an open roof. Techniques that preserve the nasal dorsum (namely the push-down and let-down) avoid these problems, but may not always be indicated for very large, broad, or deviated noses, whereas cartilaginous push-down is also indicated for large and deviated humps. Because only the cartilaginous portion of the hump is preserved in the cartilaginous push-down, a rough area may remain where the bony portion is resected.

Objectives: The aim of this study was to develop a variation of the cartilaginous push-down technique which includes a bony cap to preserve the smoothness of the keystone area during nasal hump treatment.

Methods: Forty-eight consecutive patients with indication for nasal hump treatment who underwent cartilaginous push-down procedures with bony cap preservation between August 2018 and October 2019 were studied.

Results: We observed related complications in 2 patients (4.2%); in 1 patient (2.1%) the bony cap was lost during the rasping of the nasal bones and the surgery was altered to utilize only the cartilaginous push-down. Another patient (2.1%) experienced a mild hump recurrence during the early weeks following the procedure. All of the remaining patients had their nasal humps treated adequately.

Conclusions: The nasal hump was adequately corrected in most of the study patients (95.8%). Preserving the bony cap while performing the cartilaginous push-down may prevent complications related to the osseous resection of the keystone area.

Level of Evidence: 4

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Classic nasal hump reduction is based on partial resection of the bones and cartilage in the nose, as described more than a century ago by Joseph. The cartilaginous portion of the hump is a single unit comprised of the 2 upper lateral cartilages (ULCs) and the septal cartilage. These 3 components fuse in their cephalic portions into a shape...
resembling the letter M, a form that is unique in human anatomy. During hump reduction in classic rhinoplasty, this structure is resected into 3 pieces, which is the main cause of irregularities, shadows, and pinching in the long term. Moreover, the angle and relation between the septal cartilage and the ULCs is reduced, which may compromise the function of the internal nasal valve.

To avoid these problems, various authors have described methods that preserve the integrity of the dorsum during nasal hump treatment. Three main approaches that preserve the dorsum are currently used in rhinoplasty: the push-down described by Cottle; the let-down techniques described by Huizing and Drumheller (modifications of Cottle’s method involving an osseous wedge resection); and the cartilaginous push-down described by Ishida. The first 2 lower the hump as a whole, preserving the integrity of the dorsum and the keystone transition area. The main indications for these approaches are small humps, little or no nasal deviations, and a thin nose shape. Large, angled, deviated, or broad humps can be treated with these techniques, but present additional difficulties as described by Cottle and Drumheller.

The treatment described by Ishida preserves the cartilage. This technique was initially used only in thin, small to moderate humps with minimal or no deviations. However, once the anatomy of the keystone area was fully understood, the main indications for the cartilaginous preservation technique changed to include large and/or deviated humps.

The nasal hump is a unique structure with osseous and cartilaginous components. The main structure is the septal nasal cartilage, comprised of the ULCs and the posterior septal cartilage, which are fused in the midline to form an M shape. This structure is responsible for the spring action which opens the internal valve. Fusion of the ULCs and the septal cartilage has been shown to occur at 4 months’ gestation.

The cephalic portion of the ULC (lateral process of the septal cartilage) is overlapped 4 to 9 mm by the nasal bones. Where it meets the perpendicular plate of the ethmoid bone, the septal cartilage extends cephalically 8 to 10 mm (50%-60%) under these overlying nasal bones (Figure 1). The ULC adheres strongly to the nasal bones, and this adhesion is stronger towards the midline. The lateral borders of the ULC do not extend to the pyriform aperture, and are connected to the malar bones by fibrous connective tissue.

There are various advantages to keeping the cartilaginous dorsum intact, namely preserving the middle third of nose width, the dorsal aesthetic lines, and the internal nasal valve. On the other hand, this procedure can create a small open area where the overlying nasal bone was removed and the underlying cartilage is not intact; irregularities and fibrous tissue may develop in this small area. In order to broaden the spectrum of the cartilaginous push-down technique and avoid these problems, we propose preserving the bone-cartilage connection (bony cap) in the upper keystone area during dorsum reduction.

METHODS
Forty-eight consecutive patients with indication for nasal hump treatment underwent cartilaginous push-down procedures with bony cap preservation. Patients who had previously undergone hump treatment were excluded.
This study was conducted between August 2018 and October 2019. This study was approved by the Committee of Ethics for Analysis in Projects of Research of the Faculty of Medicine of the University of São Paulo and all patients give written informed consent.

The cartilaginous push-down approach to nasal hump treatment is based on preserving and repositioning the septal cartilage as a single unit, without disrupting the M-shaped connection between the ULCs (lateral process) and the posterior septal cartilage. Using an open or closed approach, the nasal dorsum is undermined in a sub-superficial musculoaponeurotic system plane and the posterior septum is undermined in a sub-perichondral plane on both sides. The undermining extends to the perpendicular plate of the ethmoid bone, and a strip of septal cartilage is resected parallel to the dorsum. This resection should occur on the more deviated portion of the septal cartilage; most deviations tend to occur at the base of the septal cartilage, near the palatal crest. When septal deviation is absent or minimal, the preferred spot for resection is approximately 3 to 4 mm below the dorsum (Figure 2). The high septal strip preserves the caudal portion of the}

**Figure 2.** (A) Low septal strip resection, mostly used in low septal deviations and nasal deviations. (B) Mid-septal strip resection, when septal deviation is minimal or absent, facilitates stitching between upper and lower portions of the septum when necessary. (C) High septal strip resection, which leaves the caudal portion of the septal cartilage untouched.
septal cartilage, which may come in handy when treating difficult nasal tips.

The ULCs are freed from the nasal bones with a Freer dissector. Because this cartilage extends up to 9 mm under the nasal bones and is much softer than these overlying structures, special caution is required. The ULCs should be split from the nasal bones starting close to the keystone area, and the lateral extent of this dissection defines how far the dorsum will be lowered. The septal cartilage is then completely detached from the perpendicular plate of the ethmoid to mobilize the hump (Figure 3, Video 1).

Two osteotomies are performed on the nasal bones in the keystone; they begin just short of the widest point in the middle third of the nose (dorsal aesthetic lines) and converge to the midline at roughly 50% to 60% of the extent of the nasal bones (Figure 4). This bony cap in the keystone area will be lowered together with the cartilaginous portion of the hump.

The bony cap should not be extended past the midpoint of the nasal bones for 2 reasons: to avoid the thicker portion of the nasal bones; and to reduce the need for ethmoid osteotomies.

The lateral length of dissection between the ULCs and the osseous pyriform aperture determines how far the dorsum will be lowered; nasal deviations can be corrected without lowering the dorsum, if needed. The ULCs are released incrementally from midline to lateral; the more we advance the dissection, the more the cartilaginous dorsum is lowered. The remaining attachments of the ULCs and the nasal bones, the fibrous connective tissue that includes the sesamoids and the lateral osteotomies, stabilize and secure the middle third of the nose. The tip cartilages remain independent from the middle third of the nose.

The bony cap in larger noses just needs to be cut narrower; even in larger noses it articulates with the cartilage, straightening the osteocartilaginous transition. The residual lateral bony hump is then rasped to the desired level. The lateral osteotomies bring the bones closer to the midline and help stabilize the cartilaginous hump in place (Figures 5 and 6).

Surgery on the remaining tip is carried out according to the surgeon’s preference. Gauze splinting is left in place for 24 hours as the inner dressing, and the cast is removed after 6 to 7 days. The specific postoperative restrictions for this procedure are no different from usual rhinoplasty.

**RESULTS**

Forty-eight patients were operated. Ten were male and 38 female, and ages ranged from 15 to 51 years old (median age, 27.6 years). In 46 patients, rhinoplasty was the primary procedure. Six surgeries were closed and 42 utilized an open approach. Nasal humps were considered small in 17 patients, medium in 24, and large in 7. Sixteen patients had nasal deviations. Twenty-nine patients underwent low cartilaginous septal strip resection, whereas the remaining 19 patients had high septal strip resection. Lateral osteotomies were performed in 40 patients, and 8 received both lateral and medial osteotomies (Figures 7-9). The mean follow-up was 8.5 months (range, 6-14 months).

We observed related complications in 2 patients (4.2%); in 1 patient (2.1%) the bony cap was lost during the rasping of the nasal bones and the surgery was altered to utilize only the cartilaginous push-down. Another patient (2.1%) experienced a mild hump recurrence during the early
weeks following the procedure. All of the remaining patients had their nasal humps treated adequately.

**DISCUSSION**

Nasal hump treatment with preservation of the dorsum goes back to 1914 when Lothrop reported performing wedge resections on lateral osteotomies alongside transverse osteotomy at the nasion. In 1954 Cottle described a push-down technique with a low septal strip, septal disarticulation from the ethmoid bone, and ethmoid wedge resection. In the 1970s Huizing and Drumheller described let-down techniques which were variations on Cottle's push-down involving wedge resections on lateral osteotomies to better adapt the nasal pyramid. Gola published a high septal strip excision technique in the 1990s, followed by Saban et al in 2006, whose technique involved resecting a strip of septal cartilage and ethmoid bone as close as possible to the dorsum, which allows lowering of the dorsum into the newly created space. Today, there are three main approaches to septal resection: Cottle, with low septal-high ethmoid resection; Saban-Gola, with a high

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Figure 4. (A) Red lines on the nasal bones showing the path of the osteotomies. (B) Osteotomy with a small chisel. (C) Bony cap (red triangle) being lowered with the cartilaginous nasal dorsum.
septal-ethmoid strip; and Ishida, with septal strip resection involving only cartilage.8,18,19

Although the push-down and let-down techniques preserve the integrity of the nasal dorsum and the keystone area, broad, large, or deviated humps present certain limitations to these “en bloc” treatments, sometimes requiring additional procedures to adequately lower and straighten the nasal hump.19 Very large bony humps may be difficult to adapt, creating bony gaps, especially on the nasal bridge. Nasal humps with a large angle between the bony and the cartilaginous portions may also require additional procedures for proper lowering.

In contrast, the cartilaginous push-down method described by Ishida et al6 can treat large, deviated, and/or strongly angled humps. Septal deviation is also corrected as part of the hump treatment. Ferreira et al20 recently presented a similar approach based on a spare roof technique, involving a cartilaginous push-down with a high cartilaginous septal strip. Both techniques included removal of the bony hump, which creates a rough area despite the preserved cartilage underneath. This area immediately above the keystone may develop irregularities or even a small open roof in the upper third of the nose.

The cartilaginous push-down technique with preservation of the bony cap addresses these problems. By preserving the bony cap, the integrity and smoothness of the keystone area are maintained, along with the broad array of indications for cartilaginous push-down. Finally, the bony cap does not impede lateral and medial osteotomies, allowing the bony pyramid to be narrowed when necessary.

The middle third of the cartilaginous vault plays an important role in nose aesthetics and function. This single cartilaginous structure, formed from the fusion of the ULCS and the septal cartilage, is responsible for the shape and support of the middle third of the nose.30 By preserving the connection between these cartilaginous processes during

Figure 5. (A) Rasping the nasal bones after lowering the cartilaginous hump with the bony cap. (B) Lateral osteotomies to adjust the nasal bones to the bony cap and stabilize the cartilaginous dorsum.

Video 1. Watch now at http://academic.oup.com/asj/article-lookup/doi/10.1093/asj/sjaa061
hump treatment, the internal nasal valve is maintained, and its function can even be improved if necessary. Release of the keystone region corrects the nasal hump and deviations, and middle third deviation can be fixed without changing hump shape if desired. Treating the cartilaginous portion of the hump isolated from the bony portion permits straightening of the middle third of the nose, whereas deviation of the upper third is treated with regular osteotomies. There is no need to lower the dorsum if this is not desired, which may be especially important in patients who wish to retain the ethnic characteristics of their noses. In these cases, the ULCs should not be released from the nasal bones in order to maintain dorsum height.

One main concern when treating the keystone area is nasal collapse. The integrity of the connection between the ULCs and the septal cartilage stabilizes this structure, and the height of the hump can be controlled by incremental undermining of the ULCs from the nasal bones. As more of the ULCs is detached, the hump is reduced further. The most common complication observed after cartilaginous push-down is hump recurrence. This most often results from insufficient detachment of the septal cartilage from the

Figure 6. (A) Marking the location of the bony cap on a 26-year-old female patient. (B) Nasal dorsum. (C) Bony cap after isolation from the nasal bones. (D) Perfectly adjusted bony cap after rasping and lateral osteotomies.
Figure 7. (A, C, E) Preoperative and (B, D, F) 13-month postoperative photographs of a 27-year-old female patient with mild nasal deviation; small hump treated with low septal strip cartilaginous push-down with bony cap.
Figure 8. (A, C, E) Preoperative and (B, D, F) 14-month postoperative photographs of a 25-year-old male patient with medium nasal hump treated with high septal strip cartilaginous push-down with bony cap.
nasal bones (lateral process) or from the ethmoid plate (posterior process). This is easily corrected by revising and expanding the dissection between the cartilaginous septum and the ethmoid plate and the ULCs from the nasal bones.

Figure 9. (A, C, E) Preoperative and (B, D, F) 12-month postoperative photographs of a 24-year-old male patient with large hump and mild deviation treated with low septal strip cartilaginous push-down with bony cap.

Approaches that preserve the anatomy have several advantages over classic hump treatment; internal valve function is preserved, along with the smoothness of the dorsum and its aesthetic lines. The cartilaginous push-down
broadens indications for preservation techniques, permitting treatment of larger, deviated, and/or highly angled humps. Adding the bony cap to the cartilaginous push-down preserves the external portion of the keystone area, thus adding a smooth osteocartilaginous transition similar to the push-down and let-down techniques.

In this study, patients with nasal humps were satisfactorily treated with cartilaginous push-down and bony cap preservation, but further studies are needed with larger samples and longer follow-ups to verify efficiency and complications.

CONCLUSIONS

In this study, the nasal hump was adequately corrected in most patients (95.8%). Preserving the bony cap while performing the cartilaginous push-down may prevent complications related to the osseous resection of the keystone area.

The cartilaginous push-down broadens the indications for preservation techniques, treating large, deviated, and/or strongly angled humps and preserving internal valve function. The preservation of the bony cap additionally creates smoothness of the keystone area during nasal hump treatment.

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