Quantitative Comparison Between Microperforating Osteotomies and Continuous Lateral Osteotomies in Rhinoplasty

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Objective: To determine the difference in nasal bone narrowing between 2 techniques: the low lateral intranasal perforating osteotomy technique and the low lateral continuous osteotomy technique.

Methods: A retrospective analysis of preoperative and postoperative photographs to determine the changes of the dorsal width of the nose (width of plateau of the nose, or dorsal nasal highlight) and the ventral width (junction of the flattened surface of the maxilla and the ascending nasal process of the maxilla).

Results: Twenty patients underwent continuous osteotomies, and 40 underwent intranasal perforating osteotomies. The continuous osteotomy technique had a preoperative to postoperative decrease in the ventral width of 7.0% ($P < .01$). The perforating osteotomy technique had a decrease in the ventral width of 3.6% ($P < .001$). Neither technique resulted in a statistically significant change in dorsal width ($P < .25$). There was no significant difference in ventral and dorsal narrowing when comparing continuous osteotomies to perforating.

Conclusions: Both the continuous and perforating osteotomy technique resulted in a decrease in the ventral nasal bone width. No statistical difference was found between continuous and perforating osteotomy techniques in the amount of nasal bone narrowing ($P < .25$).

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Lateral osteotomies are used in rhinoplasty to narrow the nasal bones, close the open roof deformity after hump removal, and achieve symmetry of an asymmetrical framework. The 2 basic techniques for performing lateral osteotomies are continuous and perforating. The continuous lateral osteotomy creates a single fracture along the lateral portion of the nasal process of the maxilla and nasal bones. The perforating osteotomy creates a series of postage stamp–type perforations along the same line as the continuous osteotomy that are connected by digital in-fracture to mobilize the nasal bones.

The anatomy of the nasal bones has been likened to a pyramidal frustum, or a truncated pyramid.[1] **Figure 1** A shows the geometric design of a pyramidal frustum. Based on this geometric parallel, 2 basic widths of the nasal bones can be ascertained: dorsal and ventral widths. Dorsal width is the distance between the lateral aspects of the dorsum of the nose at its widest point (Wt), just before the bones curve toward the face. This is also known as the dorsal nasal highlight on frontal photographs. Ventral width is the distance between the points at which the flattened surface of the maxilla meets the ascending nasal process of the maxilla (Wb). Figure 1B depicts a pyramidal frustum on a patient's photograph.

Several studies have compared continuous vs perforating osteotomy techniques with regard to postoperative bruising and ecchymosis. Gryskiewicz and Gryskiewicz[2] demonstrated that internal perforating osteotomies with a 2.0-mm straight osteotome significantly reduced postoperative swelling and ecchymosis compared with continuous lateral osteotomies with a 4.0-mm guarded osteotome. Perforating internal osteotomies gave better results than the transcutaneous perforating technique with regard to postoperative swelling and bruising. Likewise, Tardy and Denneny[3] showed that a perforating osteotomy performed with a 2.0-mm osteotome reduced tissue disruption and bleeding compared with continuous osteotomies. In a study using endoscopic evaluation of cadaveric nasal mucosa, Rohrich et al[4] showed that the perforating technique produced fewer mucosal tears than the continuous technique. Eleven percent of the perforated osteoto-

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mies resulted in mucosal tears as opposed to 74% of the continuous osteotomies ($P < .001$).

Few studies have attempted to quantify the effects of osteotomies on nasal narrowing. Recently, Kortbus et al[5] examined the effects of continuous osteotomies on ventral and dorsal nasal widths. They found statistically significant changes in the ventral width without any change in dorsal width. The maintenance of the dorsal width was attributed by the authors to all cases being reduction rhinoplasties requiring closure of open roof deformities.

We compared the narrowing achieved by continuous and perforating osteotomies based on quantified measurable photographic changes of ventral and dorsal nasal widths.

METHODS

An institutional review board–approved retrospective analysis of the senior author's (M.C.) rhinoplasty database took place from May 2000 to December 2006. The senior author (M.C.) was the surgeon for all patients included in the study. All patients had a minimum of 6 months of postoperative follow-up.

Two consecutive groups of patients were analyzed. Group 1 consisted of 20 consecutive patients who received rhinoplasty from 2000 to 2003 with isolated lateral continuous osteotomies. Group 2 consisted of the following 40 consecutive patients from 2003 to 2005 who received isolated lateral perforating osteotomies. All patients examined in both groups required removal of dorsal humps and subsequent osteotomies to narrow the nasal bones.

Exclusion criteria included patients who had undergone previous rhinoplasty, patients who had received medial or intermediate osteotomies, patients with deviated noses, and those who did not have dorsal hump reduction.

Preoperative and postoperative photographs were taken using a Canon digital camera with a 100-mm Ultrasonic lens (model EOS D30; Canon USA Inc, Lake Success, New York) in a standardized fashion by a single photographer (M.C.). Two-point indirect bounced flash lighting was used for all photography.

Photographic analysis took place in a blinded manner. The ventral and dorsal widths were measured on frontal view. The dorsal width (width of the plateau of the nose, or dorsal nasal highlight) was measured at the widest point of the nasal dorsum. The ventral width was measured as the distance between the points at which the flattened surface of the maxilla meets the ascending nasal process of the maxilla Figure 1C depicts these measurements on a patient's frontal photograph. As a means to compare preoperative and postoperative photographs, the interpupillary distance was used as a fixed distance to create a multiplier.

Measurements were recorded with the use of the measuring tool in Adobe Photoshop software (version 7.0; Adobe Systems Inc, San Jose, California). A paired *t* test was used to analyze the difference between the preoperative and postoperative values of the dorsal and ventral widths for each of the 2 groups. To compare narrowing achieved between group 1 and group 2, a Wilcoxon signed rank test was used.

For the continuous osteotomy technique used in group 1, the senior surgeon (M.C.) used the same technique for all 20 patients. First, a 27-gauge needle is used to inject lidocaine, 1%, with 1:100 000 epinephrine, buffered 9:1 with sodium bicarbonate. The needle is inserted intranasally, and the periosteum external and internal to the bony pyriform aperture is injected, beginning at a level just superior to the lateral attachment of the anterior head of the inferior turbinate. Ten minutes are allowed for vasoconstriction. A 3-mm incision is made transversely at this point, and the periosteum is elevated in a narrow tunnel with a Joseph elevator to protect it from being cut by the guarded osteotome. A 4-mm curved guarded osteotome is inserted into the incision, perpendicular to the bony rim of the ascending process of the maxilla. The guard is palpated transcutaneously and is used as a guide for the trajectory of the osteotome. The osteotome is tapped toward the face of the maxilla with a mallet in a high-to-low direction until it reaches the nasofacial groove. It is then turned cephalad to cut the ascending process of the maxilla from the body of the maxilla in a low-to-high direction. Once it reaches the level of the nasal bones, near the medial canthus, it is directed anteriorly, to cut the nasal bone from the nasal process of the frontal bone. The bony nasal sidewall is then infractured with digital pressure. Medial osteotomies are not routinely performed in reduction rhinoplasties. In the patients included in this study, none required medial osteotomies, and none were performed.

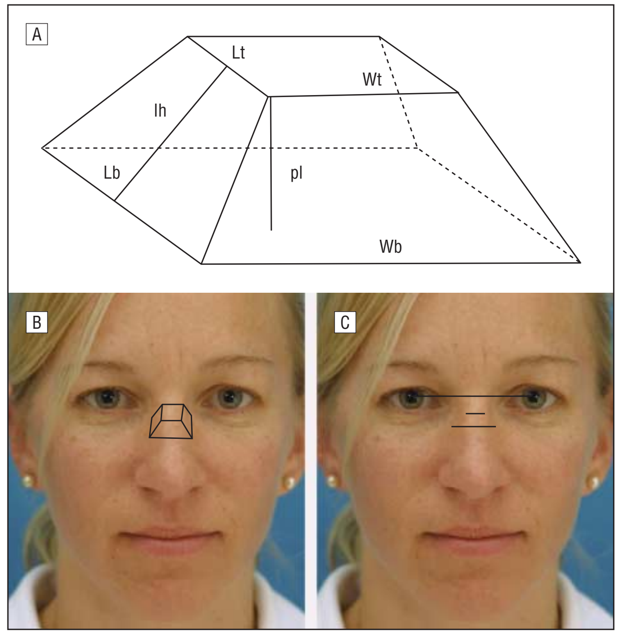

Figure 1. The pyramidal frustum. A, Lt indicates dorsal height; Lb, ventral length; p1, overall height; lh, slant height; Wt, dorsal width; and Wb, ventral width. B, A geometric design of a pyramidal frustum on a frontal photograph. C, The top line is the line demarcating the interpupillary distance. The middle line is the measurement of the dorsal width. The bottom line depicts the ventral width.

In group 2, the same surgeon (M.C.) used the same perforating osteotomy technique for all 40 patients: The same injection technique as that described for continuous osteotomies is used. A small incision then is made into the nasal mucosa lateral to the pyriform rim with the point of a 2-mm osteotome. The 2-mm osteotome is seated onto the pyriform aperture perpendicular to the bone and then punched into the bone with a mallet. A series of punch osteotomies are made in a high-to-low-to-high fashion into the medial surface of the maxilla, in a trajectory similar to the one used for continuous osteotomies. No percutaneous osteotomy is required. Care is taken to punch only as deeply as is needed to cut the bone, minimizing injury to the underlying tightly adherent nasal mucosa. After the series of punches are created in the nasal sidewall, lateral digital pressure allows for infracture of the nasal bones.[6]

RESULTS

There were 20 patients in group 1 and 40 patients in group 2. In group 1, 16 were women and 4 were men. In group

Table. Analysis of the Difference in Dorsal Width (DW) and Ventral Width (VW) of Patients Who Underwent Continuous Lateral and Continuous Perforating Lateral Osteotomies

	Doral Width/IP Distance				Ventral Width/IP Distance			
Group	Preop DW/IP Distance	Postop DW/IP Distance	Difference	*P* Value	Preop VW/IP Distance	Postop VW/IP Distance	Difference	*P* Value
Continuous technique (group 1)[a]	0.15	0.14	0.01	.25	0.29	0.27	0.02	.01
Perforating technique (group 2)[b]	0.17	0.17	0.00	NA	0.39	0.37	0.14	.001

Abbreviations: IP, interpupillary; NA, not applicable; postop, postoperative; preop, preoperative.
[a]There was no difference in DW. However a statistically significant ($P < .05$) decrease in VW was achieved.
[b]Once again, there was no difference in DW. Similar to the continuous technique, a statistically significant ($P < .05$) decrease in VW was achieved. The difference in narrowing achieved between the continuous and perforating techniques was not statistically significant ($P < .31$).

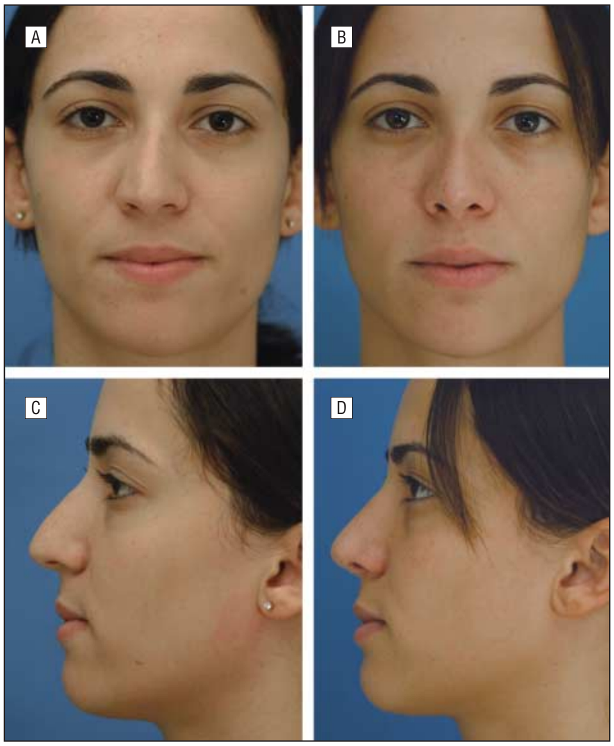

Figure 2. A patient who underwent microperforating lateral osteotomies by the senior author (M.C.). She also underwent dorsal hump removal and nasal tip contouring. Her measured dorsal width decreased by 2.23%, whereas her ventral width decreased by 5.93% with comparison to her preoperative photographs, taken at 12 months. A, Preoperative frontal view; B, postoperative frontal view; C, preoperative lateral view; D, postoperative lateral view. Lateral views are shown to demonstrate the amount of hump removed and lack of dorsal edema at time of photograph.

Figure 3. This patient underwent microperforating lateral osteotomies by the senior author (M.C.). Her dorsal width decreased by 1.53%, while her ventral width decreased by 3.7%. The osteotomies were also effective in improving her dorsal deviation. She also underwent a right spreader graft, dorsal hump reduction, and nasal tip contouring. A, Preoperative frontal view; B, postoperative frontal view; C, preoperative lateral view; D, postoperative lateral view. The postoperative photographs were taken at 8 months.

2, 31 were woman and 9 were men. The minimum follow-up time after which postoperative photographs were analyzed was at 6 months after surgery. The follow-up photographs analyzed were taken an average of 9.6 months after surgery. The maximum follow-up time was 16.5 months.

In the 20 patients who underwent continuous lateral osteotomies with a 4.0-mm osteotome (group 1), there was a significant decrease from preoperative to postoperative ratios of ventral width to interpupillary distance (**Table**). The ratio decreased from 0.29 to 0.27 ($P < .01$), representing a 7% decrease. There was no significant difference between preoperative and postoperative values in the ratios of dorsal width to interpupillary distance (0.15 to 0.14, respectively; $P < .25$).

In the 40 patients who underwent perforating intranasal lateral osteotomies with a 2.0-mm osteotome (group 2), there was a significant decrease from preoperative to postoperative ratios of ventral width to interpupillary distance (Table). The ratio decreased from 0.39 preoperatively to 0.37 postoperatively ($P < .001$), representing a 3.6% decrease in ventral width. As with group 1, group 2 had no significant difference in the ratios of dorsal width to interpupillary distance between preoperative and postoperative measurements.

When the results of the change in widths using the 2 techniques were compared with each other using the Wilcoxon signed rank test, there was no significant difference in narrowing between the continuous and perforating osteotomies for both the dorsal ($P < .31$) and ventral ($P < .14$) measurements.

Figure 4. While microperforating lateral osteotomies (performed by the senior author [M.C.]) in this patient decreased her dorsal width by 5.45%, she had a negligible decrease in her ventral width (0.07%). She also had a left spreader graft, which may affect the appearance of the ventral width. However, it alleviated a concavity on the left nasal sidewall. A, Preoperative frontal view; B, postoperative frontal view; C, preoperative lateral view; D, postoperative lateral view. The postoperative photographs were taken at 12 months.

Figure 5. This patient underwent microperforating lateral osteotomies by the senior author (M.C.) and had dorsal width decrease of 2.46%, whereas she only had a ventral decrease of 2.05%. She also underwent maneuvers aimed at deprojection and rotation, which cannot be appreciated on these frontal images. A, Preoperative frontal view; B, postoperative frontal view; C, preoperative lateral view; D, postoperative lateral view. The postoperative photographs were taken at 9 months.

COMMENT

Both techniques resulted in statistically significant narrowing of the ventral width. Neither technique demonstrated a statistically significant difference in narrowing vs the other. In addition, neither technique resulted in significant dorsal width narrowing.

In reduction rhinoplasty, the dorsal hump is removed, which creates an open roof that widens the dorsal width. The nasal pyramid has been likened to a truncated pyramid. As one shortens the overall height of the pyramid by decreasing "pl," the width of the dorsum (Wt) increases (Figure 1A). Lateral osteotomies fracture the nasal bones so that they can be repositioned and narrowed, that is, they close the open roof. Owing to decrease in dorsal projection and the creation of the wider open roof, hump removal and subsequent osteotomy closure are thought to widen the dorsal width postoperatively. However, this study shows that regardless of technique, dorsal width remains narrow after lateral osteotomies. These results confirm the results of our earlier study (Kortbus et al[5]) that hump reductions do not necessarily lead to increases in dorsal width, something that had long been accepted as true. Indeed, it seems that regardless of osteotomy technique, reduction rhinoplasty can leave the dorsum narrow. **Figures 2**, **3**, **4**, **5**, **6**, **7**, and **8** show preoperative and postoperative photographs of patients who underwent perforating lateral osteotomies performed by the senior

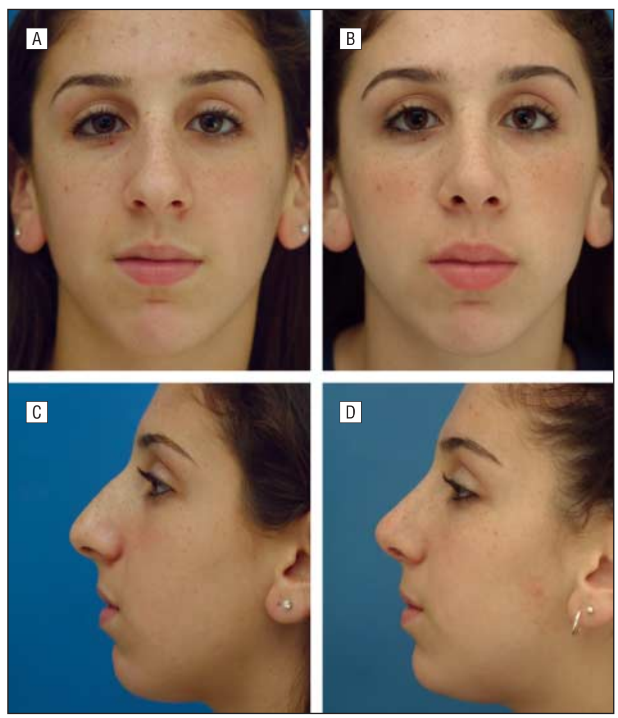

Figure 6. This patient underwent microperforating lateral osteotomies by the senior author (M.C.). She had a negligible decrease in dorsal width (0.08%), and her ventral width decreased by 2.1%. She also underwent dorsal hump reduction and tip contouring. A, Preoperative frontal view; B, postoperative frontal view; C, preoperative lateral view; D, postoperative lateral view. The postoperative photographs were taken at 11 months.

Figure 7. This patient underwent microperforating lateral osteotomies by the senior author (M.C.) and had similar decrease in dorsal width (1.02%) with comparison with ventral width (1.41%). She underwent dorsal hump reduction and nasal tip contouring as well. A, Preoperative frontal view; B, postoperative frontal view; C, preoperative lateral view; D, postoperative lateral view. The postoperative photographs were taken at 14 months.

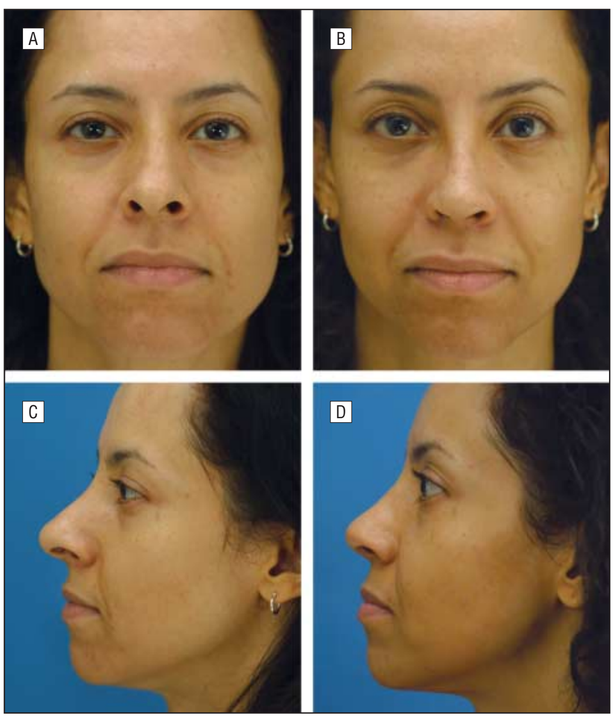

Figure 8. This patient underwent microperforating lateral osteotomies by the senior author (M.C.). While she had a minimal decrease in dorsal width (0.56%), the ventral width decreased by 4%. In addition, the surgery aimed to correct her overprojection, which cannot be appreciated in the frontal images. A, Preoperative frontal view; B, postoperative frontal view; C, preoperative lateral view; D, postoperative lateral view. The postoperative photographs were taken at 6 months.

surgeon (M.C.). Profile views are also shown to demonstrate how much hump was removed and the lack of existence of significant postoperative edema confounding measurements.

It is not surprising that both techniques yielded similar amounts of narrowing. Both techniques create controlled fractures of the nasal bones that allow for the desired amount of narrowing. Murakami and Larrabee[7] theorized further narrowing with perforating techniques owing to maintenance of soft tissues and periosteal envelope. However, our study suggests that the creation of complete fractures of the nasal bones, regardless of technique, may be the most important factor in nasal bone narrowing.

In conclusion, both continuous and perforating lateral osteotomies create statistically significant narrowing of the ventral nasal width. However, there was no statistically significant difference between the 2 techniques. In addition, neither technique created statistically significant change of the ventral width of the dorsum when compared with preoperative width. This confirms that lateral osteotomies can maintain the narrowness of the nasal dorsum despite hump reduction in reduction rhinoplasty.

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