Oblique Turnover Flap for Repositioning and Flattening of the Lateral Crura: A Novel Technique to Manage Cephalic Malposition of Lower Lateral Cartilage

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Abstract

Malposition of the lower lateral cartilage (LLC) is a relatively common anatomical variation, described as any displacement of the lateral crura from the usual parallel direction with the nostril rims. Cephalic malpositioned LLC has the following characteristics: abnormal axes of the lateral crura, bulbous and broad nasal tip, parenthesis deformity, long alar creases, alar wall hollows, nostril deformities, and incompetence of the external valve. Numerous techniques were founded to correct this aesthetic and functional unpleasant variation, although all of them have some limitations. The authors described and evaluated the efficacy of the oblique turnover flap (OTOF) technique in the management of cephalic malposition of LLC (CMLLC). The advantages of this technique are: it does not need any additional grafting; it is quick and safe to perform; it has stable results. In the present study, 24 primary rhinoplasties using OTOF technique were performed between January 2014 and September 2016. There were 21 females (87.5%) and 3 males (12.5%), with age ranging from 23 to 46 years. The mean follow-up period was 12.1 months (range: 8–28 months). All patients were treated by the senior author (A.G.) in the RinoIstanbul Clinic. Three parameters were measured and compared pre- and postoperatively, using a t-test and a p value criteria of 0.05. The difference was found to be statistically significant: the angle between the central axis of the lateral crura and the septum on each side, satisfaction scale rating of the patients’ nasal tip appearance and the satisfaction scale rating of patients’ nose breathing. The angle of the central axis of lateral cruras to the midline significantly increased, the mean satisfactory scale ratings of nasal tip appearance and breathing quality were also significantly improved. OTOF is a quick, useful, efficient technique for repositioning and flattening of the lateral cruras of CMLLC with a good, predictable, and stable long-term results in our hands if used on right candidates.

Keywords
► cephalic malposition of lower lateral cartilage
► oblique turnover flap
► nasal tip contouring
► bulbous tip
► rhinoplasty

Cephalic malposition of lower lateral cartilage (CMLLC) is one of the most common objects of aesthetic and functional rhinoplasty. Constantian wrote in his article that 68% of his primary rhinoplasty cases had lateral crural malpositioning.1 To diagnose CMLLC the surgeon has to observe several parameters that were described by Sheen: malposition is “any displacement of the lateral crura from the usual parallel alignment with the nostril rims,” that can be presented as abnormal axes of the lateral crura, bulbous, and broad nasal tip, parenthesis deformity, long alar creases, which extend to the nostril rims, alar wall hollows, alar retraction, nostril deformities, and incompetence of the external valve.2 Daniel measured the
distance from the midnostril point on the alar rim back to the caudal border of the lateral crura and indicated that any distance greater than 7 mm would be considered alar malposition.\(^3\) In the study, Daniel et al noticed that 17.5% of their patients had a midnostril distance of 8 to 9 mm. It let them recommend surgeons, instead of the usual infracartilaginous incision, to consider making a rim incision 2 mm back from the nostril rim (this type of incision we used on our patients) to insert an alar structure rim graft at the time of closure.\(^4\)

One more characteristic of CMLLC has been described: the lateral crural central axis positioned \(\leq 30\) degrees from the septum and oriented toward the same side medial eye canthus. A normally (orthotopic) positioned lateral crura located \(\geq 45\) degrees from midline and oriented toward the ipsilateral lateral eye canthus.\(^5\) We used the mentioned criteria to compare the position of LLC pre- and postoperatively. The authors of previous studies have suggested numerous techniques to correct malposition of LLC.\(^6\)–\(^14\) Gunter and Friedman described repositioning of the LLCs caudally with lateral crural strut graft,\(^6\) others introduced composite grafts,\(^7\) alar rim grafts,\(^14\) and repositioning.\(^8\) The stair-step technique was defined by Boccieri and Raimondi,\(^9\) and it was modified by Ercan et al by adding lateral crural rim graft.\(^11\) Also the alar rim flap and repositioned lateral crural flap techniques were proposed.\(^12\)–\(^13\) All of the techniques mentioned earlier have a definite role in modern rhinoplasty surgery and, when selected appropriately, commonly lead to desired surgical outcomes. However, there are certain limitations to each of the aforementioned techniques. During all times the surgeons are trying to improve their techniques to make them easier and quicker, resulting in good, predictable, and stable outcomes, without using additional materials (such as grafts). To our knowledge, there were no studies done up to date introducing turning the cephalic part of the lateral cruras over the caudal part in an oblique way as a flap, which leads to repositioning and flattening of the lateral crura at the same time, without using grafts. In the present study, we introduced and evaluated the efficiency of oblique turnover flap (OTOF) technique for repositioning and flattening of the lateral crura of CMLLC. The cosmetic and functional results are discussed and compared with the previous studies, the advantages and limitations of this method are shown.

**Methods**

In the present study, we examined 80 patients with CMLLC, 24 of them were selected to undergo an OTOF technique additionally to other rhinoplasty components, such as dorsal hump reduction, osteotomies, septrhplasty, tip modifying techniques, and so on. There were 21 females (87.5%) and 3 males (12.5%), with age ranging from 23 to 46 years. The mean follow-up period was 12.1 months (range: 8–28 months). All 24 patients were treated by the senior author (A.G.) in the Rinolstanbul Clinic in the period from January 2014 to September 2016. They were selected based on their preoperative standard photographs, preoperative examination, and intraoperative finding, as will be explained later on. According to our standard procedure of examination, we are taking pre- and postoperative photographs (1 week, 3, 12, and 24 months after the surgery) using Nikon D60 digital SLR camera in focal distance of 1 m in frontal, lateral, three-quarter and base views, with and without para flash. Para flash technique lets us evaluate better dorsal aesthetic line, while single flash shows better tip cartilaginous margins and details of the base of the nose (Fig. 1). The patients did not have any significant asymmetry or malformations of the alar cartilage. For rating patients’ nose breathing quality and their satisfaction with the appearance of their nasal tip, they were provided with a visual analog scale (VAS) before and after the surgery (VAS; scored from 0 to 10, in which 0 was the worst and 10 is the best possible outcome). VAS questionnaire was given to patients before and after surgery for statistical analysis; paired sample t-tests were performed on each pair. The \(p\) value for each comparison was calculated using SPSS version 21 (IBM Corporation); \(p < 0.05\) was considered to be statistically significant for all comparisons.\(^13\) The pre- and postoperative scores were compared. Intraoperatively we evaluated the condition of lateral crura of LLC and the angle between the central axis of the lateral cruras and the septum on each side, in each case, the angle was measured before applying OTOF technique and immediately after by using the protractor (Fig. 2a, b), the difference between these two angles was calculated, it showed the angle of lateral cruras repositioning, and the results were compared. The indications for OTOF technique in all patients were (beside their wish to reduce the size of nasal tip that was too wide or too bulbous, and difficult nose breathing) as follows: the lateral crura should be strong enough, not less than 10 mm wide, convex or straight, patient’s skin should be normal or thick not to show the flap. The exclusion criteria in our study were: alar pinching, the width of lateral cruras less than 10 mm, weak lateral crura and thin skin; because OTOF technique was not applicable in those cases. The process was explained to all patients, who signed an informed consent afterward.

**Surgical Technique**

All patients underwent open septrhplasty with radio-frequency of inferior turbinates by the senior author (A.G.);
although the technique can be used with a closed approach. After intubation and sterile preparation were done, patients were decongested using oxymetazoline-soaked pledgets. Local injectable anesthesia, using 1% lidocaine with epinephrine 1:100,000, was performed in a standard fashion. Before making the initial incision, we wait for the mandatory time period till patient’s blood pressure is not higher than 90 to 80 mm Hg. In our experience, this small trick significantly decreases bleeding during the surgery. Standard inverted V-incision was made across the columella using a #11 blade. Sharp curved scissors were used to make bilateral marginal incisions 2 mm back from nostril rim, which were then connected to the marginal extension of the columellar incision. Sharp dissection with a converse scissor was made; it preserved the subdermal plexus to the delicate skin of the columella, tip, and soft tissue triangles. Sharp dissection helps to maximize vascularity and avoid excessive swelling, which can be caused by broad spreading and tearing of the tissue with blunt dissection. Three-point retraction by one assistant with sharp two prong hooks was used for better observation. Identification of the LLCs was followed by exposure of the cartilaginous dorsum. A Joseph periosteal elevator was used to dissect the periosteum from the nasal bones in an extended way, which allowed us to use piezoelectric instruments for the bony job. Bilateral mucoperichondrial septal flaps were elevated exposing the septal cartilage. Then septrplasty with lateral retraction of the LLCs and identification of the anterior septal angle was done. For avoiding destabilization of the keystone area, the harvesting of septal cartilage was postponed until the work on the upper third of the nose has been completed. Next, the bony dorsal contour and the middle vault were managed, based on the desired final tip position. If required, dorsal refinements and osteotomies were done using the piezoelectric method described by Gerbault et al.\textsuperscript{15} After septrplasty, spreader grafting, etc., the tip plasty began. We marked the turning line along the lateral crura 45 degrees to the upper septum margin with a surgical marking pen on one side and made stamp maneuver for contralateral LLC, by squeezing their anterior surfaces to each other, so we could be sure that these lines were symmetric (\textsuperscript{Fig. 3}). For repositioning of the lateral crura, we had to dissect the vestibular skin from the undersurface. First hydro dissection was done with 1% lidocaine with 1:100,000 epinephrine (the bevel of the needle was placed flat against the undersurface of the cartilage) to avoid the tears in the vestibular lining. Blunt dissection was performed just until the future turning line; we kept remaining lateral crura attached to the vestibular skin to preserve its natural stability. The dissection was done on the plane keeping perichondrium attached to the cartilage on both sides. Once the lateral cruras of the LLCs were partially free from skin, not a complete cut, but a slight incision by 15 blade scalpel under the lateral cruras was done according to the previously drawn line, the anterior surface of the cartilage and its perichondrium were preserved (\textsuperscript{Fig. 4}). A 1 to 2 mm complete cut incision was made to decrease the tension at the medial and lateral ends of the

\textsuperscript{Fig. 2} Measurement of the cephalic malpositioned lateral cruras angle from the midline before (a) and immediately after (b) oblique turnover flap technique.

\textsuperscript{Fig. 3} Marking turning line of the flap: 45 degrees to the midline.
cartilage. By turning the cephalic part of the lateral cruras over the caudal part as a flap, the convex cartilage was reshaped by its tension, and the lateral cruras were straightened (Fig. 5a, b). The contra force of two convex turned over parts of LLC makes it straight and strong by itself. OTOF was fixed to the caudal part of the cartilage with three 5.0 rapid vicryl stitches, placed close to the caudal edge of the flap, through the vestibular skin, by using one Adson–Brown forceps to immobilize the cartilage. In this way, the flap was secure fixed by sutures (Fig. 6a, b). Uncut vessels give blood supply to the flap that makes it more capable of surviving and providing the support to remaining lateral crura. After OTOF technique was performed, the surgeon was checking the sufficiency of the lateral wall. If the flap was large, and the “dead space” was created by turning it over, we were covering it with a small triangle shape graft harvested from the nasal septum and fixed through the vestibular skin with one 6.0 PDS stitch (Ethicon Inc.) (Fig. 7). After that, we managed the projection and rotation of tip, if it was needed. The vestibular skin was also dissected on the level of the tip, and lateral or medial crural steal maneuver was applied. Columellar strut graft was placed, and medial crura of the LLCs were fixed to it in all patients. Then interdomal and cranial tip sutures, described by Kovacevic and Wurm, were applied in all cases. After everything was done with the nose skeleton, we redraped the skin envelope, evaluating if the
additional grafts were needed or not. If alar rim insufficiency existed, small alar rim graft was put in without any fixation. Bilateral mucoperichondrial flaps were raised. The closure was begun with a single 6.0 PDS suture in the midline for more symmetrical matching of skin envelope edges. Interrupted 6.0 nylon sutures were used to close and slightly evert the inverted V columnella incision. The incision was further reapprographed with additional 6.0 rapid vicryl interrupted simple sutures. The marginal incisions were closed with 6.0 rapid vicryl sutures in an interrupted fashion watching the nostril margin closely. The septum was closed by reapproximating the mucoperichondrial flaps with a 5.0 rapid vicryl plain suture in a running mattress fashion. The nose was then taped, splinted, and a cast was applied in a routine fashion. Antibiotic ointment was applied to all incisions and a "moustache" dressing was done.

**Results**

All 24 patients included in this study were available for postoperative photography and follow-up. Figs. 8 and 9 show selected patients from the study to highlight their preoperative view and postoperative changes. After rhinoplasty, applying OTOF technique, all patients indicated that their aesthetic and functional results were satisfactory. Three parameters were compared: (1) The angle between the central axis of the lateral crura and the septum on each side: preoperatively, the mean angle was 28.84 ± 3.25 degrees on the right and 28.25 ± 3.21 degrees on the left side, respectively; these increased to 48.64 ± 4.24 degrees and 48.23 ± 4.20 degrees, respectively, after the procedure (p < 0.05). The mean angle of repositioning was 20.52 ± 5.63 degrees. These results show that cephalic malposition of lateral cruras has been changed significantly. All patients had harmonious aesthetic tip counteracting after the surgery. (2) Mean patient-rated VAS scores for satisfaction with nasal tip appearance were 3.87 ± 1.78 preoperatively, compared with 8.25 ± 1.15 postoperatively (p < 0.05). (3) Mean patient-rated VAS scores for satisfaction with the quality of nose breathing were 6.75 ± 2.45 preoperatively, compared with 8.85 ± 1.10 postoperatively (p < 0.05). External valve collapse during deep breathing and alar retraction were successfully treated in all patients.

**Discussion**

Oblique turnover flap technique was introduced in this article as a result of the necessity of finding a new easy and safe method for managing CMLLC, which is a quite common anatomic variation that shows itself in parentheses-shaped tip deformity, bulbous nasal tip and other aesthetic and functional unpleasant manifestations. Our technique can be explained as a modification of turnover flap for concave lateral crura described by Janis et al; we obliquely used this technique to correct CMLLC, which was never published before to our knowledge. Tellioglu et al described and Apaydin modified the technique, in which they made cephalic trimming of concave lateral crura and turned it into a pocket created under the remaining lateral crus to reinforce it. The lateral crura “sandwich" support and suspension helped to prevent and widen stenosis of the internal valve angle. Unfortunately, this technique cannot correct CMLLC. Numerous techniques were suggested to

**Fig. 8** Preoperative (a–d) and postoperative (b–h) pictures of the patient.
correct CMLLC: the lateral crural strut graft (Gunter’s graft) is widely and successfully used from the time it was found till now; however, it has some unfavorable outcomes, such as visible or palpable grafts and others. Also in some patients, there is lack of septal cartilage for using as the graft material, so it becomes necessary to harvest it from other donor sites, such as ear or rib cartilage. To avoid these problems other techniques were developed to find the most useful. Gruber et al reported the intercartilaginous graft technique, which is a modification of the lateral crural strut graft. In this research, they noted that the cephalic end of the lateral crus should not be excised in the presence of alar retraction or potential alar retraction.21 Some authors suggested to resect the malpositioned lateral crus and replace it as a free graft in a more caudal position.3 Others have used an extra cartilage graft, placed caudally below the malpositioned lateral crus in the alar rim.4,14 However, when a rigid cartilage graft is placed along the alar rim, the ala may not adapt to the nasal muscles.8 Repositioned lateral crural flap technique of Mohhebbi et al does not impede fine movements of the posterior alar rim, because the repositioned lateral crura support only the anterior part of the alar rim, as in normal anatomy.13 This technique does not require extra cartilage graft material. In this method, the lateral crus was obliquely divided (probably it was better not to call it “flap” technique) at the point of maximum convexity at different distances from the dome and two segments were prepared. The anterior segment was transposed caudally for a normal anatomical position and fixed to the posterior segment in a more caudal position; transsection of the lateral crus was used to control the projection and rotation of the nasal tip. In that study was indicated that, for patients showing distinct cephalic malposition, alar retraction and external valve incompetence, a more distal rotation in the repositioning of the LLC leads to correction of cephalized crura and alar retraction without any need to place rim grafts. However, the authors recommend to perform it on patients with lower grades of cephalically positioned crura and moderate external valve incompetence.13 In the Z plasty of the lateral crus of CMLLC, described by Oktem et al, they used consistent cartilage division in the “Z” shape, so it resulted in successful correction of alar cartilage malposition with aesthetic and functional improvements.8 In 2008, Bocciere and Raimondi treated 22 patients with good results by using stair-step incision for dividing the lateral crus as anterior and posterior segments.9 They repositioned the anterior segment over the posterior segment to correct the parenthesis deformity of CMLLC. They combined repositioning of anterior segment with a sliding backward movement on the posterior segment to reach the desired degree of rotation and projection, as a lateral crural steal technique, in the noses with an overprojection and ptosis of the tip. However, this technique may cause iatrogenic lateral crural weakness because of lateral crura’s horizontal length diminution by half. Also, this technique does not affect any existing alar rim retraction. The authors trimmed the lower step of the anterior segment, although it pushes the alar rim caudally, which may correct alar rim retraction. Ercan et al modified this technique by placing the lateral crural strut graft into the pocket and it is subsequent fixating to the medial segment of the lateral crus to treat ala retraction same time with CMLLC.11 Kemalolu and Altiparmak described the alar rim flap technique to
correct functional problems by reinforcing the external valve; this procedure also yielded a favorable aesthetic shape of the alar rim. In this method, a \( \geq 6 \)-mm wide cephalic portion of the LLC was left intact, and the remaining caudal region of 2 to 3 mm was marked, then the distal end of the caudal region of the LLC was cut, elevated and pulled caudally as a flap. This area corresponds to the alar rim flap. Autogenous cartilage grafts were placed on the deep surface of the alar rim flap and fixed. The distal end of the alar rim flap was inserted into a pocket prepared from the lateral end of the marginal incision to the pyriform aperture. The main idea of the technique was to preserve a scroll area and to support the alar rim by graft. However, this technique may produce internal valve deficiencies in patients with a vertical axis of the LLC less than 6 mm.

Conventional cephalic excision of the lateral crura can exaggerate both functional and aesthetic problems in the management of CMLLC. In our study there is a significant difference from all previously mentioned techniques: we are not dividing LLC, keeping anterior surface and perichondrium intact. Our technique does not require an extra cartilage graft material that may be limited in some septorhinoplasty operations, in which cartilage grafts, such as spreader graft, batten graft, columellar strut graft, tip graft, and cap graft, were used. Also, our technique does not break fine movement of nasal muscles that protect the function of the internal valve. In our method, we suggested to cut slightly posterior surface of the lateral cruras of the LLCs in oblique way, not a full cut, mostly scarring, as soon as they were partially free from skin. Then we turned the cephalic part of the lateral cruras over the caudal part as a flap, so the convex cartilage was reshaped and straightened by its own contra force. Flap was securely fixed to the caudal part of the cartilage with vicryl stitches, placed close to the caudal edge of the flap. The flap is more capable of surviving and providing the support to remaining lateral crura due to preserved vessels that give blood supply. We checked the sufficiency of the lateral wall after OTOF technique. If the “dead space” was created, we reconstructed the lateral wall by covering it with a small triangle shape graft, harvested from the nasal septum and fixed though the vestibular skin. Then, if it was needed, we managed the projection and rotation of tip with lateral or medial crural steal maneuver. In all patients, in order to give the nasal tip natural soft appearance, beside its stability, we placed columellar strut graft and fixed LLCs to it. Nowadays, tongue-in-groove technique is the most common method of stabilizing the tip structures, although it has such unfavorable outcome as the tip stiffness that makes almost all patients unhappy. The surgeons are trying to underestimate this problem and explain to patients that for good outcomes this technique is the must. However, the stiffness appears because of creating the compound that does not exist in the normal anatomy of the nose. That is why we are focusing on this problem and think that this way of tip fixation should be limited, although it is not the subject of this article. Afterwards interdomal and cranial tip sutures, described by Kovacevic, were applied in all cases. This technique helped us to rotate the caudal margin of lateral crus to create a better aesthetic contour of the tip. We redraped the skin envelope and evaluated if the additional grafts were needed or not, after finalizing our work with the nose skeleton. A small alar rim graft was put in without any fixation if the alar rim insufficiency existed.

Rhinoplasty is a complex, comprehensive operation that needs a lot of techniques and maneuvers to reach the goal of aesthetic and functional satisfaction of the nose appearance. Throughout history, the surgeons are trying their best to improve the techniques, making them more simple and useful on the way to the main goal.

**Conclusion**

As a result of our study, we can conclude that:

1. OTOF is a useful, quick, and safe technique for surgical treatment of patients with aesthetic and functional problems out of cephalic malposition of the LLC.
2. The advantages of this technique include the following: no division of the lateral crura of CMLLC; in one maneuver you can flatten and reposition the lateral crura; in most of the cases graft material is not needed; no disruption to alar muscle movement.
3. This technique should be used on patients with more than 10 mm wide, strong, cephalic malpositioned lateral crus of the lower lateral cartilage.
4. This technique is suitable for both open and close rhinoplasty. However, we used it just with an open approach.

**Disclosure**

There are no financial disclosures or conflict of interest to declare. All work was done with written patient consent and institutional review board clearance.

**Ethical Approval**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Appropriate consent was obtained for patients’ photographs in this study.

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