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Lateral Crura Control in Nasal Tip Plasty: Cephalic Oblique Domal Suture, 7X Suture and ANSA Banner

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Abstract

For many years the nasal tip has been the main task for rhinoplasty surgeons, who have developed many surgical strategies to refine its complex anatomy and obtain a durable aesthetic and functional result over time. We present a surgical sequence where new techniques are introduced based on the elliptical vestibular ring. The goal is to conservatively control the two arms of this ring, with limited cartilage resections, new configuration of the cartilaginous framework using sutures and the use of a minimal amount of cartilage for grafting. We aim to achieve elegant and functional longstanding tips without the stigma of a "frozen nose". We present our technical sequence, with some innovations, to treat the lower lateral crura anatomical variations obtaining a flat structure and the use of an Anterior Nasal Septal Angle (ANSA) extension graft that gives support to the lateral crura tensioning, gives projection, and avoids the rigid tip side effect of the septal extension grafts. The cephalic oblique domal suture and the 7X suture control the lateral crura anatomy, and the ANSA Banner gives it support. These techniques will be explained in detail in the following paragraphs of this article.

Keywords: Elliptical vestibular ring; Lateral crura control; Cephalic oblique dome suture; 7X suture; ANSA banner

Introduction

The nasal tip is probably the richest chapter in rhinoplasty procedures book. Its anatomical variations, compound anatomy, its relationship with the middle third of the nose and lip, and how these tissues behave post-surgically as well as many other factors that are involved in creating a pleasing and functional tip are responsible for that.

Jack Sheen was one of the main contributors to this subject since the mid 70's and has helped us understand this complex anatomy. It was he who described the ideal tip shape as 2 equilateral geodesic triangles with a common base formed by a line connecting both domes, among other characteristics [1].

Toriumi in 2006 [2] introduced the concept of nasal tip contour as a series of surface highlights and shadows created by underlying anatomical high and low points. He described that a favorable nasal tip contour has a horizontal orientation with a shadow in the supratip area that continues into the supra-alar regions. There is a smooth transition between different subunits without a clear line of demarcation. The nasal tip will have highlights and shadows in specific areas depending on the underlying tip structure that we should preserve or modify, depending on each case, which will give a natural and pleasing non-operated look.

In 2012, Çakir [3-5] introduced the concept of polygons for analyzing the aesthetic lines and volumes of the nose, based on drawings and sculptures that he developed throughout his career as a Rhinoplasty surgeon. These geometric distributions of the fundamental structure of the nose will have an important effect on the nasal external appearance, achieving a combination of shadows and highlights, with very good aesthetic results.

Apart from these authors, plenty of articles have been published by many surgeons regarding the management of special areas of the tip.

Understanding the domal segment was the main focus on developing tip plasty techniques. The Lateral Crura (LC) was mainly seen as a structure to be reduced cephalically, sometimes dramatically,

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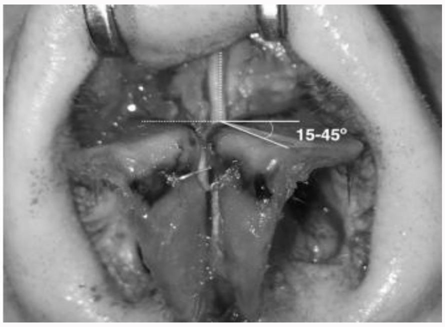

Image 1: LC Short Axis Angle. The angle formed by the lateral crus surface and the horizontal plane (perpendicular to the septum) should ideally be in between 15° and 45°.

in order to rotate, reduce volume and refine the tip. Such maneuvers have the tendency of creating unsatisfactory outcomes, such as ala retractions, pinched tips, supratip fullness, irregularities and external valve impairment. It is clear today that the LC work represents a fundamental and delicate step in tip plasty.

In an aesthetic tip, the caudal margin of the lateral crus lies close to the same level as the cephalic margin [2,6]. In addition, the caudal margin of the dome should be positioned above the cephalic margin of the dome [2].

The inversion of the caudal border promotes a reduction of the alar rim support which leads to a break of continuous light from the tip to the alar lobule, creating an unattractive appearance of an isolated tip. Functionally, the external valve can be compromised.

Lateral Crura Axis

As described by Johnson et al. [7], the lateral crus has a vertical (short, cephalic to caudal) axis and horizontal (long, medial to lateral) axis. Ideally the angle between the LC surface and the septum should be in between 105° and 135°. If we make a perpendicular line to the septum (horizontal plane) we are looking for a 15° to 45° angle with the LC surface. We prefer using the horizontal plane since it is more intuitive during surgery. In this article we will call it the Short Axis Angle (Image 1).

Lateral Crura Intrinsic Anatomy

The ideal LC anatomy shows convexity next to the domal segment and flatness or a slight concavity lateral to it. The shape of the cartilage was classified by Zelnik et al. [8] in 1979 and by Rollin et al. [6] in 2014 based on convexity and concavity. The first one, identified 5 variations in the anatomy of the LC of the alar cartilages with some occasional asymmetries between the two sides, and the second group described some anatomic variation based on the long axis, from medial to lateral. These anatomic variations create difficulties in remodeling the LC into a desirable flat format. Gruber et al. [9] demonstrated the effectiveness of the horizontal mattress suture neutralizing convexities of the LC. These sutures can be used in any convex/concave surface. The turn-in flap technique also contributes to correcting these deformities by opposing concavity against concavity or convexity against convexity helping to create a flat structure and minimally increase its thickness, without causing functional impairment, and with the consequent strengthening of the LC arm. However, by itself, this is not entirely effective because the opposing cartilage flaps have neither the same size nor the same resilience, but by increasing thickness it will support bigger forces when remodeling sutures are applied. This combination has shown to be a powerful tool when indicated.

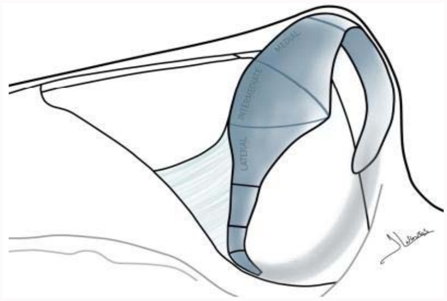

Figure 1: Lateral crura segments and vestibule ring. The medial segment starts at the domal junction and goes lateral to an imaginary line that intersects the turning point and the medial limit of the longitudinal scroll ligament; the lateral segment is limited laterally by the LC–AC junction and medially by an imaginary line intersecting the turning point and the lateral limit of the scroll; the intermediate segment, triangular, with the apex at the turning point and the base represented by the scroll ligament stays in between the medial and lateral segments. The fourth segment is represented by the AC. The AC does not attach to the pyriform aperture; an elliptical ring around the vestibule is anatomically defined by the ULC, the AC and connective tissue at the nasal sill (grey inferior semi-circle).

The wide, under projected, and ptotic nasal tip, described by Davis [10] as the Compound Tip Deformity (CTD) is also frequently exacerbated by pronounced convex cupping (i.e., bulbosity) of the LC, in both axis, which not only adds to lobular width but also dramatically increases supratip fullness.

Vestibular Ring

The Accessory Cartilages (AC) run lateral to the Lower Lateral Cartilages (LLC) and turn medially, in between mucosa and SMAS, without attaching to the pyriform aperture. A connective tissue continues towards the anterior nasal spine, enclosing a ring with the Medial Crura (MC) [6] (Figure 1).

This concept gives us another perspective regarding tip malposition, first introduced by Sheen [11] in 1978, as any displacement of the caudal border of the LC from its parallel alignment with the nostril rim. Constantian in 1993 [12] described the LC long axis cephalization as an orientation towards the medial canthus instead of ideally towards the lateral canthus. Following this concept, the angle formed by the long axis (a line passing the midpoint of the LC) and the midline should ideally be 30° or greater [13].

An angle inferior to 30° will be found in the LC cephalic malposition. A reflex to this concept was the development of alar transposition techniques [14].

If we assume the vestibular ring concept, this cephalization corresponds to an undesired configuration of the surface anatomy of both LC axis, with a consequent non-ideal wide elliptical ring format. The wider the elliptical ring the more LC cephalization and supratip fullness we observe. In fact, the lateral aspect of the ring has its origin (domal region) and termination (AC next to pyriform aperture) in a constant position. It is the arch in between these 2 points that may assume a variable configuration. By narrowing the ellipse and making the domes supporting the rest of the tip complex we can achieve dramatic modifications. We follow this concept to develop our surgical philosophy (Image 2).

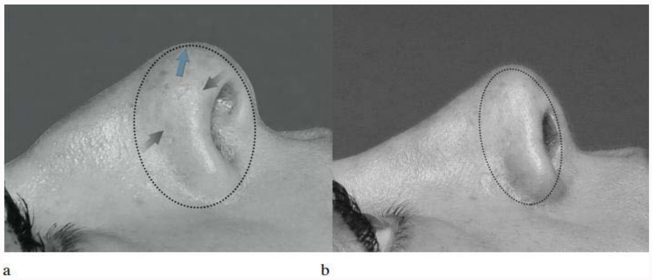

Image 2: The vestibular ring. Pre and post op pictures of the same patient (see case study 1). In the pre-op we observe a wide elliptical ring with consequent alar malposition (alar retraction) and bulbosity, hanging columella and lack of domal definition. By bringing the two arms of the ring closer, a narrower ellipse was achieved with the correction of the defects.

Lateral Crura and Accessory Cartilage Segments

Three segments of the LC will be considered in this article: The medial, the intermediate and the lateral segments (Figure 1). The AC (variable in number, from 1 to 4, also called minor alar cartilages) represent themselves as the most lateral and posterior segment, a fragile and narrow one. The constant junction between the LC and AC is the weakest point of the nasal lateral wall cartilaginous framework, with direct impact in the airway, especially when it buckles into the vestibular area. It is often represented in the external surface by a supra-alar dimple. This anatomy can be seen in nonoperated noses but can also be created in tip surgery, due to a lack of tension of a large posteriorly displaced LC with the consequent fold in of the LC-AC joint.

The two posterior segments (the LC lateral segment and the AC segment) have a considerably variable anatomy, in shape and in their individual sizes, even if globally it is approximately constant. Routinely, during surgical dissection these two lateral segments are not exposed. The laterals limits of a regular dissection stops at or immediately lateral to the turning point caudally and does not expose more the lateral limit of the upper lateral cartilage cephalically.

Considering this observation, the main tip maneuvers will be applied with direct observation of the anterior segments but not the posterior ones. The nasal pyramid full degloving facilitates the surgical work and also gives extra analytical information, what makes it our routine approach.

The LC medial segment has a direct response to the domal sutures. Depending on the anatomy, the intermediate and lateral segments may not suffer the desired effect only by these sutures. In fact, the work on the lateral segments anatomy is often of dramatic importance for the aesthetic and functional results and is, not infrequently, neglected.

Lateral crura tensioning concept. The fragility of the lower nasal sidewall is mainly due to lack of a supportive structure and the lack of tension of an eventual large LC. Giving support by adding structure or remodeling the existent one and giving tension seem to be the logical solutions.

Rick Davis introduced a powerful concept, the Lateral Crura Tensioning (LCT) [10]. It is the combination of a Lateral Crura Steal (LCS) [15,16] with a Septal Extension Graft [10,17-20] (SEG), which creates a "sturdy and stationary platform to allow precise positioning and suspension of the tip cartilage complex". In addition to cosmetic benefits of the traditional LCS, LCT improves lower nasal sidewall tone and increases the threshold for dynamic nasal valve collapse by preserving the lateral crus and the nasal scroll and by stretching and tensioning the lateral crus [10]. It is a really effective technique to achieve tip symmetry, tip contour, and restore posterior nasal sidewall patency, which favors function in a structured conservative way, without grafting or repositioning of the LC.

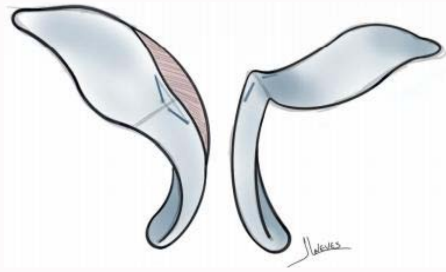

Figure 2: Cephalic Oblique Domal Suture: The suture will be placed in the cephalic third of the LC and IC. Two oblique lines will be designed lateral and medial to the new dome with the entry point 1 mm to 2 mm below the new domal line starting from medial to lateral. Then the suture runs over the surface around 4 mm to 5 mm oblique to the long axis towards the LC cephalic margin till it reenters as close as possible to the cartilage´s cephalic border; it crosses the IC at the same level. The knot is placed in the medial surface of the IC.

The SEG will act as the support to the tip, with direct sutures to the new domes thus supporting the lateral wall tensioning, and the support to the MC in a Tongue-And-Groove fashion (TIG). The TIG21 maneuver is probably the most powerful one supporting the tip. However, it has a side effect of creating a frozen tip, and because of that we prefer to use a SEG limited to the Anterior Nasal Septal Angle (ANSA) that also supports the tip but leaves the MC and consequently all the columella region free.

Surgical Technique

The aim of this paper is to show structured tip plasty with the use of minimal cartilage grafts, regarding number and size. We aim to produce a long-standing pleasant and functional nasal tip in an open approach rhinoplasty.

To show the effectiveness of a single technique (a stitch, a graft or other) as part of a complex surgical sequence is not an easy task, which can lead to biased interpretations. Therefore, we will describe our sequence, discussing indications and goals.

Defining the lower lateral cartilage new architecture

This is a crucial moment of analysis. The tip position is determined, and the rest of the process will follow this tridimensional decision. We design the length and width of the LC considering the desired dome position. This point will work as the anterior vertex of the elliptical vestibular ring. We stand at the head of the patient and create traction of the two LLC with two forceps to achieve better symmetry. The new caudal and cephalic domal point are marked, and since we are creating tension forward in the LC we lateralize the new domes (a generous LCS); on some occasions up to 10 mm. Having defined the domal points we mark the new domes. A cephalic line, from the Intermediate Crus (IC) to the LC is marked taking into consideration that: the domes should have 4 mm to 5 mm, the intermediate segment of the LC should have 7 mm to 9 mm, which means that aggressive reductions must be avoided [6] in order to prevent lobular pinching,

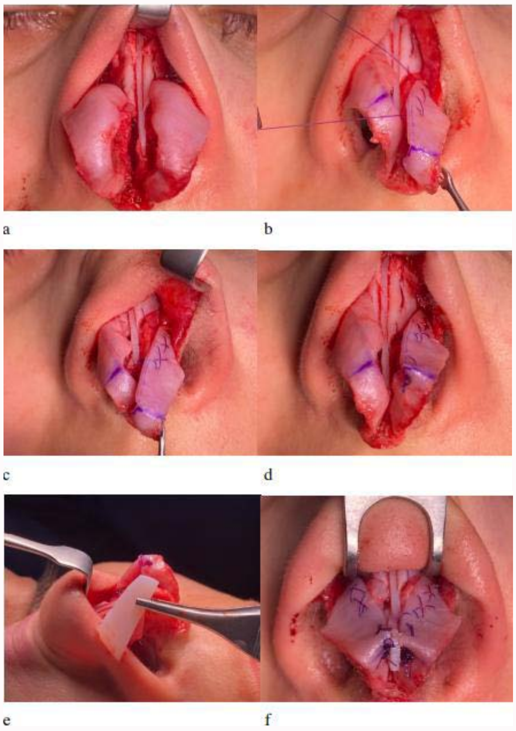

Image 3: Surgical sequence: a) The Bulbous tip, LC crura with convex long axis and cephalic convexity of the short axis. b) the new LLC anatomy was designed. LCS and turn-in flap (right crus); the 7 creation of the suture at the LC. c) The 7X suture finalized with X appearance on the LC surface. d) left dome after the cephalic oblique suture. e) Defining the ANSA banner orientation. f) interdomal – ANSA banner suture stabilizing the tip. Note this suture follows the domal suture path. The LC is flat with the correct short axis orientation, the new LC medial segment is slightly concave meeting the dome, the LC caudal margins are everted and the caudal domal points are diverging.

alar retraction, asymmetries and irregularities, hyper-rotation and loss of tip support and an eventual valve collapse (Figure 2, Image 3b). The circumstantial cephalic excess will be trimmed or occasionally used to create a turn in flap. When indicated, the reduction of the LC in the short axis permits rotation and adjustment of the ideal Short Axis Angle.

Cephalic oblique dome suture

The domal creation suture is determinant for the final result. The main goal is to evert the caudal margin of the LC and elevate the caudal point of the new dome position [22]. The suture will be placed in the cephalic third of the LC and IC. The entry point is 1 mm to 2 mm below the new domal line at the junction of the medial third with the intermediate third of the medial surface of the IC. It will exit at the same level in the outer surface of the LC. The suture now runs at the surface around 4 mm to 5 mm oblique to the long axis towards the LC cephalic margin till it reenters as close as possible to the cartilage's cephalic border. It crosses the IC at the same level. The knot is placed in the medial surface of the IC (Figure 2). When the knot is tight the cephalic margins of the LC and IC become closer and leave the rest of the dome completely free. We can observe the elevation of the caudal border of the LC medial segment and the creation of a smooth concavity at the surface. The domal caudal point is also elevated.

If needed, we add one or two hemitransdomal sutures, as described by Dosanjh et al. [23] to increase this effect, and, due to the LCS we increased the intrinsic tension of the LC with consequent

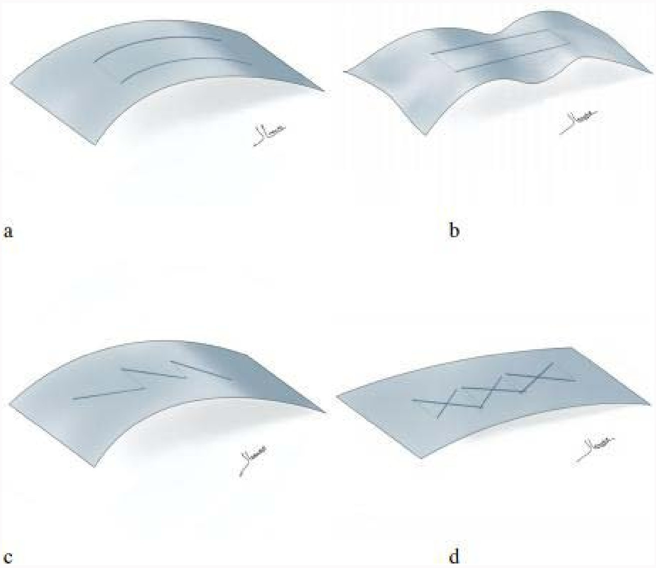

Figure 3: The 7X suture. Based on the horizontal mattress suture and how it affects cartilage surfaces (Gruber), we developed the 7X suture. In overly convex LC a strategy to get a flat surface must be decided. In larger distances, the horizontal mattress suture does not accurately control the curvatures, and sometimes creates a concavity in between the sutures long axis entrances and forms or increases the convexity of the short axis. To avoid this we split the forces into 3 or 4 points. The first passage creates a figure of 7, the second one an X, can deliver a flat surface with great accuracy.

stretching of the four cartilaginous segments. Nevertheless, and, because we have performed a generous lateral steal, the domes fall slightly lateral and posterior, which makes it obligatory to reposition it in the proper previously defined dome position.

7X lateral crura suture

As already described, the two lateral segments (the lateral segment of the LC and the AC segment) are often not directly addressed during tip plasty. When facing favorable anatomy (LC axis, intrinsic curvatures, LC-AC joint position) performing maneuvers in the anterior segments is usually sufficient. However, on some occasions less favorable anatomy may represent a real challenge, in controlling LC bulging and symmetry, controlling the supra-alar region and protecting the inner nasal valve. It is valid for most patients in cosmetic surgery that present overly wide nasal tips, and very often with asymmetries. As already described, the LC malposition concept led to the development of LC transposition techniques, usually with the support of grafts (struts and battens), which are in fact powerful and effective maneuvers. However, we prefer to see the problem as an undesired LC surface or/and LC-AC junction anatomy and an unfavorable vestibular ring curvature (wide ellipse), and try to correct the defect with conservative measures remodeling the cartilage surfaces and stretching the lateral component of the ring (narrowing the ellipse) bringing it to a more caudal position (correcting alar malposition), before considering more aggressive ones.

In convex LC surface, remodeling the dome region with sutures may lead to undesired side effects. Mispositioned domal sutures (mainly if no tension on the cartilage is created) may bring the two lateral segments medially and eventually posteriorly and collapse the LC-AC junction. It leads to obvious functional and aesthetic consequences. It is imperative then to also correct the anatomy of this region. By promoting the LCS and LCT we solve a great number of these issues but in marked convexities we may need to address the lateral segments structure, once the cephalic oblique domal sutures (or other domal suture) are not expected to correct these segments' anatomy. This is the same with severe concavities or irregular surfaces.

We have already mentioned the effectiveness of Grubber's sutures to correct convex cartilage surfaces. The long arms of the suture will be placed over the convex surface so it can become flat or concave, while the short arms will stay over the concave surface. We must avoid creating any relevant distortion with the suture short arms that in fact can increase concavity. We used this concept to develop our suture, the 7X suture (Figure 3).

The horizontal mattress suture may present 2 problems. 1) The two suture passages in the concave surface will increase the concavity, that is why we should reduce their length as much as possible, and then create two short arms. In bulbous tips, where the two axis are convex, by placing a Gruber's suture to flatten the long axis we can increase the outer surface convexity of the short axis. 2) When a larger cartilage surface needs to be controlled, the use of a longer suture can distort the anatomy. As an example, in a bulbous tip, with convexity in both axis, when placing a larger mattress suture over the long axis it is difficult to determine the strength of the suture to get a flat surface, sometimes ending up with a non-desirable concave surface in between the 2 suture entrances of the longer arms. We can perform several mattress sutures (isolated or continuous [24]) but we may still encounter some of these problems. At the short axis we can see an impairment of the convexity since the short arms act at the concave surface (Figure 3a, 3b).

One solution to solve this suture weakness is by splitting the distance into 3 or 4 segments and crossing the sutures so no distortion will be created in any axis. Since we aim to have a strong and flat LC, we often perform the turn-in flap maneuver before we run the 7X suture. The goal of the turn-in flap (apart from opposing convexity against convexity or concavity against concavity helping to flatten the cartilage) is to have a thicker unit of cartilage to support the forces of the suture better, and mainly at the intermediate segment.

The entry point of the suture will be at the inner surface of the LC intermediate segment. The LC anterior segment is defined by the domal sutures, as already described. It runs slightly oblique to the long axis towards lateral for 3 mm to 5 mm over the outer surface. The suture again goes to the inner surface of the LC. We pass the suture to the outer surface around 1 mm to 2 mm (not bigger to avoid short axis distortions) from the previous exit in a perpendicular fashion regarding the same axis. These 2 suture lines, the outer oblique and inner perpendicular form a 7-figure. We repeat this movement till we achieve the desired level of the LC lateral. On some occasions we include the first AC. Around 3 to 4 figures of 7's are created (Figure 3c). We start the way back repeating the same concept. The outer oblique suture lines will cross and create an X-figure. The inner perpendicular suture lines will remain parallel to themselves. By placing this suture, we can create a flat segment of the cartilage regarding the long axis with great accuracy without compromising the short one. The X shape in fact flattens both axis. In cases of concave LC, the X will be seen at the inner surface and the two parallel lines at the outer surface. In cases of irregular surfaces (convex, concave) the concept must be adapted. The same when both axis are compromised. It is a very flexible suture that can be used in several circumstances (Image 3).

We use the 7X sutures in more delicate conditions of the LC, specifically in overly wide tips and considerable irregular LC surfaces (Image 4), where the rest of the maneuvers do not work properly. In the vast majority of cases we anticipate the need of this step; however we can decide to perform the suture at any stage of the surgery.

Image 4: Severe LC deformity. The LC surface was remodeled with the 7X concept (and a previous turn-in flap). A small batten graft was placed over the right LC-AC junction. The LC tensioning was supported by an ANSA banner.

ANSA banner

The next step is to stabilize the tip on the previously defined tridimensional tip point. In fact, it was the first decision we took during the tip plasty. As mentioned before, we will stabilize the tip on a SEG to bring the lateralized domes forward and create LC tension, but we prefer to use a partial SEG; the ANSA banner. Banner because conceptually it works as a long strip of cartilage bearing the whole tip structure in a projected position. The partial SEGs are historically being used for many purposes, and specifically the anterior septal angle extension graft [10,17-20].

To prevent postoperative progressive descent of the nasal tip and to construct a permanent nasal tip, Byrd et al. [17] proposed the construction of a rigid skeletal connection between the septum and nasal tip cartilages. They published a series of 20 patients who were at risk of losing the nasal tip projection. Nasal tip stiffness and thickening of the septum in the nasal valve area where the major drawbacks of the paired SEG. In the years following many have published modifications of this SEG with very good results regarding the projection, but with the inability to solve the lack of tip mobility.

We use the ANSA banner to support the LCT and avoid frozen tips as much as possible. It is a trapezoid structure, 10 mm to 15 mm long and 3 mm to 5 mm at the anterior aspect and 5 mm to 8 mm at the posterior aspect, which makes it a low cartilage consumer. Shape and size can be adapted to the available donor cartilage always taking into consideration that the graft is strong enough to resist to forces of retrodisplacement, over-rotation or deprojection, depending on the orientation we give it.

The banner orientation is probably the most important detail of the concept. Following simple engineering principles, a moment of a force (torque) is a measure of the tendency of the force to rotate the body upon which it acts, which is dependent on the distance and the force itself.

In other words, it is the tendency of an applied force to spin an object around an axis, a principle that represents what happens in the nasal tip. If the force is perpendicular to the distance, we achieve the highest moment of force, which makes the object rotate. But if the vector of the force acts at the same vector of the distance the moment of force is 0 Nm, which means there will be no rotational movement (Figure 4).

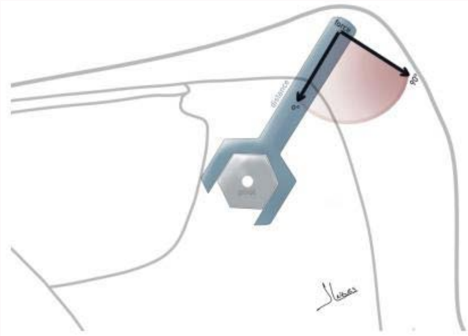

Figure 4: The moment of a force. The moment of force depends on the distance and force applied. It represents the capacity to rotate an object around a pivotal point. If the force is perpendicular to the distance (90º) we achieve maximum rotation. If the force is performed in the same vector of distance (0º) the moment of the force is 0, and there is no movement. It is fundamental to choose the ANSA banner angle that must follow the LC long axis vector.

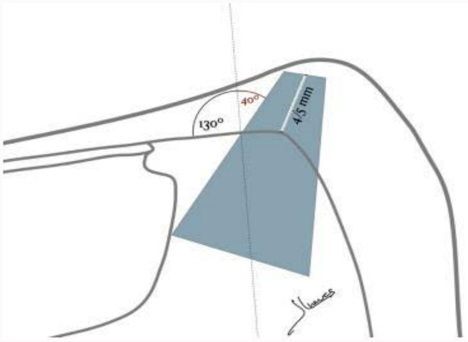

Figure 5: The ANSA banner. Following the information given by the moment of force we plan the ideal angle of the banner. Our preferred angle is 130º with the anterior border of the septum (or 40º if we consider a perpendicular line to the anterior border of the septum). The projection of the graft must be 4 mm to 5 mm on average, to achieve our aesthetic ideals.

We follow that rule to place our extension graft avoiding future rotations (specifically over rotation of the tip secondary to the LCS and tensioning). This is exactly what we are looking for in our banner´s central axis orientation. It must align with the force vector that is represented by the anterior to posterior traction that the LC provoke in their long axis. By placing these two axis together we are creating a moment of force of 0 Nm, meaning there is no rotational forces.

Practically, we create an angle with the anterior septal border of 130° (115° to 145°) to facilitate calculating at the surgical table, 40° (25° to 55°) with a perpendicular line to the anterior septal border in the sagittal plane. If we imagine the patient is standing still, the axis of the banner will be on the horizontal plane, as well as the horizontal (long) axis of the LC (Figure 5).

Once have the correct angle, we are dependent now on the stabilization of the ANSA banner to the septum to avoid lineal retro (posterior) displacement. We use 5.0 PDS and make several passages, in a mattress suture fashion. To prevent long-term displacements, we finalize it with a 5.0 Prolene suture. The two cartilages will stand side by side. We need to analyze the best way to place the graft, including which side of the septum, in order to avoid the lateralization of the graft, which is also stabilized in the midline with the help of the mattress sutures. In our aesthetic concept, the ideal length of the extensor over the septal border is 4 mm to 5 mm but this is, of course, artist dependent. We usually suture it with a longer free arm (6 mm, 7 mm) so we can carve it for precise remodeling at the end of the process (Figure 5 and Image 3e).

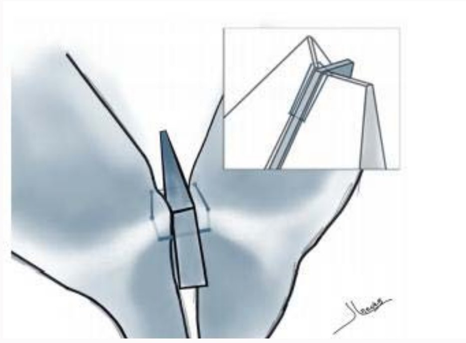

Figure 6: Suturing the new domes to the ANSA banner. The suture follows the rule of the cephalic oblique domal suture in order to elevate the caudal margin of the LLC. This is an interdomal suture with the inclusion of the extension graft.

Having the ANSA banner stabilized in the septum it is now time to anchor the new tip, by performing an interdomal suture that includes the banner (Figure 6). We will follow the same orientation of previously performed domes cephalic oblique suture. The 6 points sequence is as follows: 1) first through the graft at the level of the domes; 2) the first entry point of the domal suture, 1 mm from the domes from medial to outer surface; 3) the second point of the domal suture, 5 mm below, at the cephalic border of the LC; 4) through the extensor at the level of the previous passage; 5) the contralateral LC cephalic border, keeping the same level; 6) the domal point of the contralateral dome, from lateral to medial. The knot is tight in between the domes and the Ansa banner (Video 1). An additional suture (circular or 8-figure) is passed including both domes for stabilization. With this approach the domal caudal points diverge while the cephalic ones are in close contact in a symmetric and very stable fashion. The caudal border of the LC is everted. The lateral crura tension is then created.

Columellar strut and medial crura overlap

Having the domes ideal positioned with the proper shape and having the LC with the ideal short angle and the adequate long axis form and tension, we now need to address the MC and columella complex. Almost constantly, we use a columellar strut. It has a role in giving tip support but mainly avoiding columella retractions. Anteriorly, we leave a gap between the anterior aspect of the ANSA banner and the strut to permit free columella movements (Image 5 and Video 2). It works as a functional joint, and this is the main reason we try to avoid "full" extensors and not to create frozen tips. This articulation allows lateral mobilization of the columella and posterior to anterior (projection) movements. The whole complex (LC tensioning, ANSA banner, columellar strut and medial SMAS repositioning) supports the tip in a stable tridimensional position, avoiding future tip ptosis. It seems to be the ideal scenario in tip surgery.

In ptotic tips, where typically the MC are foreshortened, the LCS elongates it creating the ideal balance with the LC, which in turn are shortened and tensioned. On some occasions, the MC become too long distorting the columella. If that happens, we create an overlap at the level of the columellar breakpoint.

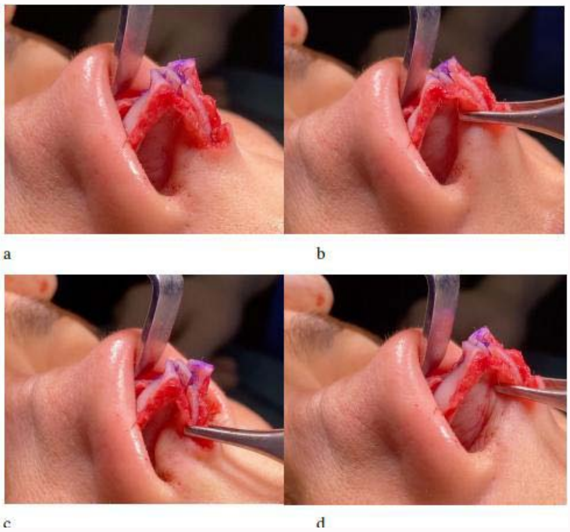

Image 5: ANSA banner and columellar strut. The two grafts are not connected. It permits the columella region to mobilize lateral and upwards avoiding the frozen tip. The banner supports the tip in pull-down movements (c). Pulling up (b) and lateralizing the columella (d).

Image 6: Ligaments repositioning: The vertical scroll ligament (1) and Pitanguy ligament (2), the deep medial SMAS, are repositioned. The superficial medial SMAS goes with the columellar cutaneous flap. ANSA banner (a) and columella strut (b).

Tip medial SMAS and vertical scroll ligament repositioning

Even if this is not the topic of this article, just a quick note on soft tissues. The tip medial SMAS [25,26] is transected at the level of the columella incision. The superficial SMAS often goes with the cutaneous flap, even if it can sometimes be dissected separately. The deep medial SMAS (also known as the Pitanguy ligament) is dissected and kept attached to the supratip soft tissues. The vertical scroll ligament is isolated and preserved.

At the end of the surgery, the ligaments are repositioned. First, we recreate the scroll area. We suture the vertical ligament in its proper place, in between the new cephalic border of the LC and the caudal border of the upper lateral cartilage with a 5.0 Vicryl (Image 6). This is an additional maneuver to avoid cephalic migration of the LC. The deep SAMS ligament is then sutured to its origin. It will pass below the dome sutures immediately over the anterior septal angle in the midline (lateral to the ANSA banner), simulating the normal anatomy where the ligament runs in between the domal ligament and the caudal border of the septum. These three ligaments repositioning create a supratip and lateral crease definition, and work as stabilization net reducing dead space. At last, the superficial ligament will be repositioned with the skin flap at the columella incision level.

Case Analysis

Case study 1

Patient with a nasal hump in a deviated nose. The tip is bulbous with a retracted ala and some degree of hanging columella, which represents a wide elliptical vestibular ring with no tip definition. The two LC axis are convex. The LC-AC junction has no buckling. We performed a segmental dorsal preservation approach, based on the Tetris concept [27] and a let-down technique. We used the Vestibular Ring concept to transform it into a narrow elliptical form. We reduced the septal caudal border to shorten the nose and setback the columella. As already mentioned, we prefer not to make the TIG, to avoid frozen tips, even if in this case it was an option. The domes were lateralized 5 mm and the LC cephalic border was trimmed to permit the new dome design with 5 mm width and facilitate tip rotation. An ANSA banner was sutured side to side with the septum, at the left side of it, with 4 mm projection. The cephalic oblique domal suture plus the interdomal stabilization sutures to the banner were performed. At this point the LC tension was created. The cartilage source for the banner was the trapezoid cartilage removed below the Tetris block. A strut was placed in between the two crura. The source for the strut was the caudal border trimming. It means that no septal cartilage was harvested. With these maneuvers we achieved the narrow elliptical vestibular ring with a consequent improvement of the defects previously described. Note that this surgery had a real preservation approach, from dorsum to tip till the septum that remained intact in all its basal portion, even though the tip is structured.

Case Study 1:

Case study 2

Patient with a childhood nasal trauma episode. She shows a saddle nose with a lack of support of the pre-maxilla. Asymmetric tip with considerable LC asymmetry. The bony dorsum was addressed with an ultrasonic device, with paramedian, intermediate and basal osteotomies plus sculpture of the dorsum. The middle third was reconstructed with a septoplasty and spreader grafts. In spite of the trauma and the appearance of saddle deformity, the quadrangular cartilage was a sufficient cartilage donor. Regarding the tip, the first effort was to find a symmetrical point for the new domes. After that the LC long axis was treated. A turn-in flap was produced until the lateral aspect of the LC intermediate segment. A 7X suture was performed. With the new defined domes and the redesigned LC we sutured it to the SEG. In this case it worked as a long ANSA banner since we needed to give support to the insufficient caudal septum. A complete SEG could have been used. The MC were supported with the columellar strut. The medial SMAS ligaments were repositioned. With these maneuvers we achieved a good symmetrical position of the tip and always keeping in mind the same concept; avoid frozen tips.

Case Study 2:

Case study 3

Revision rhinoplasty. Apart from the dorsal defects, the tip was asymmetric, showing a considerable left alar rim retraction, deep supraalar creases with consequent breathing impairment. The columella was deviated. There was a supratip fullness due to a cephalic displacement of the LC. The septum was bent to the right. We started the approach with a septoplasty and the introduction of a spreader graft below the right nasal bone which was collapsed. Some sculpture with an ultrasonic device was performed. The septum was again a sufficient donor of cartilage for the grafts we projected. An LCS was performed and a cephalic trim was created at the LC medial segment only to design the width of the domes, and not to reduce the

Case Study 3:

LC short axis.

Like the previous cases we created LC tension supported by an ANSA banner, but in this case, because of a marked LC-AC buckling, we decided to structure it with two small struts fixated with a 7X suture. A columellar strut was also used. Some cartilage gel was used to smooth the infralobule region. The tip is more symmetric now, and the supratip fullness is not visible anymore once the LC is in its proper position. The alar retraction was corrected, and the functional issues were solved. We can still observe some supraalar dimple but as seen in the basal view it does not create any airway blockage.

Discussion

Tip plasty is probably the biggest challenge in rhinoplasty. Achieving a pleasant functional longstanding result is the goal of any sequence of techniques. The recognition of the LC anatomy variants leads to different diagnostic interpretations and consequently different surgical approaches. The concept of LC cephalization gives space to develop LC repositioning maneuvers. Toriumi [2] showed the effectiveness of these structured maneuvers achieving outstanding and longstanding results. However, these techniques have some drawbacks, as any disruptive maneuver, and they are technically demanding. We prefer the concept of the structural vestibular ring. The lateral aspect of this ring is situated in between two points, the domes and the AC at the pyriform aperture. We need to work on this arch and mold it to achieve its ideal form. We always start by using conservative measures as described and try to avoid more aggressive ones. Our efforts go mainly to the LC control: Long axis form and position, and the short axis angle, as the main concerns. The LCT described by Rick Davis inspired our work. However, and because conceptually we try to avoid the TIG (exceptions are revisions and severe ptotic tips) we use a concept where the tip is not frozen.

The ANSA banner and its proper orientation permit the application of forces of tensioning over the domal cephalic borders, with the moment of the force of 0 Nm, which confers great stability regarding rotation (specifically hyper rotation after the LCS), leaving the rest of the LLC free. The work at the medial crus will be independent of the ANSA banner, which avoids the frozen tip characteristics of the TIG maneuver. The articulation of the two grafts (ANSA banner and strut graft) permits a mobile columella with a stable tip (Video 2). On certain occasions, the lateral segments of the lateral wall must be addressed directly by giving new formats and sometimes structure. Even the LC intermediate segment may present distorted anatomy that does not respond entirely to dome sutures and LCT. The use of 7X sutures have the capacity to flat concave, convex or irregular surfaces with great efficacy. In cases of LC-CA joint buckling, the first AC can be included in the suture to flatten it.

Having the LC long axis flattened, and the LC tensioned, we create a straight line in between the two fixed points, tip and pyriform aperture. It means that a cephalically arched lateral aspect of the vestibular ring can be straightened and consequently be brought caudally and correct the alar rim malpositioning and tip bulbosity. By leaving the caudal margin of the domes and the LC everted, we create the continuous light from the tip to the alar lobule without a demarcation. In cosmetic surgery, the majority of patients need some tip rotation, meaning that at least the lobular segment of the MC must be placed more cephalic; in some patients the caudal septum is reduced. These two maneuvers, at the LC and MC, have the potential to transform a wide elliptical ring with no definition at the domes to a narrower vestibular ring with elegant domal and supratip areas (Image 2).

If the goals are not accomplished with these maneuvers, we may consider rim grafts, with our preference being the articulated rim graft [10,28] or repositioning maneuvers as already mentioned. Regarding tip symmetry, each maneuver has its important role. In order to avoid deviations, we do not put all the pressure in the ANSA banner. In fact, this graft gives fantastic stability to the tip, even in symmetry, but ideally the domal sutures and the reformatting 7X sutures should create symmetric LC arms.

Conclusion

The LC plays a fundamental role in tip surgery. Today it is clear that their length, resilience and orientation have an unavoidable impact both on aesthetics and function. Following the elliptical vestibular ring concept, some surgical strategies were shown to mold it conservatively.

The LCT not only achieves an elegant tip but also improves the nasal valve patency, and since we prefer to avoid the frozen effect of the TIG maneuver, we have shown how to use a small well oriented extension graft, the ANSA banner, with great efficacy. The way the new domes are created, and the two LC axis and surface are designed with the cephalic oblique domal sutures and the 7X sutures were also demonstrated. In fact, by controlling the two legs of the ring we can reposition the alar rim without needing LC transposition maneuvers in most cases.

The columellar arm is also controlled by this concept.

By leaving the MC independent from the extension graft and from the septal caudal border we produce a tip with interesting mobility. The lateral movements and the posterior to anterior movement (pulling up) of the columella are the most important ones in tip mobility. The only one that has limitations is the anterior to posterior movement (pulling down) that in fact is part of the goal of the surgery; longstanding tip support.

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Video Links Below:

Video 1:

https://youtu.be/CVO7d3MSheo

Video 2:

https://youtu.be/Ae1EnaNMcN4

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