

## Long-term effectiveness of projection control suture in rhinoplasty\*

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### SUMMARY

*The aim of this study is to report the long-term effectiveness of septocolumellar projection control suture (PCS). Fourteen cases underwent rhinoplasty including projection control suture have been included into the study. The long-term effectiveness of PCS is investigated on patients' early and late postoperative photographs. Mean durations between operation and early and late postoperative photographic documentations were  $1.28 \pm 06$  (range 1-3) and  $23.27 \pm 7.84$  (range 12-48) months, respectively. The measurement of the nasal tip projection by using Goode and Byrd-Hobar techniques were accomplished on the lateral view photographs. The Scion Image software program was utilized for numerical analysis. There was no statistically significant change in nasal tip projection on early and late postoperative periods. The Goode and Byrd-Hobar ratios were measured as 0.584 and 0.572 in preoperative photographs. There were statistical significant differences between the preoperative and postoperative results ( $p = 0.001$  for Goode and  $p = 0.0001$  for Byrd-Hobar). The mean Goode's ratio was  $0.614 \pm 0.035$  in the early postoperative period, and  $0.616 \pm 0.035$  in the late postoperative period. The mean Byrd-Hobar's ratio was  $0.673 \pm 0.037$  in the early postoperative period, and  $0.668 \pm 0.039$  in the late postoperative period ( $p = 0.336$  for Goode,  $p = 0.374$  for Byrd-Hobar). There was no projection loss in any of our cases after a two years follow-up period. According to these preliminary results on a limited number of patients, PCS seems to be a reliable and effective surgical method to create the desired nasal tip projection for a long time.*

*Key words: nasal tip, projection control suture, rhinoplasty, septocolumellar suture, tip projection*

### INTRODUCTION

The nose is the most prominent and elegant organ of the mid-face. The nose should be natural in appearance with symmetry and appropriate length, projection and rotation. An ideal nose is balanced with curvilinear contours from brows to the nasal tip, drawing attention away from the nose and toward the eyes and other facial features<sup>(1)</sup>. Lack of this balance may cause an unnatural nasal look that draws attention to the nose rather than the eyes<sup>(1)</sup>. The tip of the nose has its own characteristics such as projection, rotation, volume, form and definition. Tip projection is one of the most considerable characteristics of the nose. There have been many nasal tip surgical techniques described to modify the shape and position of the nasal tip cartilages by suturing, scoring, morselizing, dividing cartilages, or a combination of them<sup>(2)</sup>. The evolution of the rhinoplasty has developed from destructive techniques to conservative, protective and augmentation techniques in recent decades<sup>(3)</sup>. Suture techniques have eliminated the need for excessive excision, transection and scoring of tip cartilages to modify their shapes<sup>(4)</sup>. Scoring techniques have become much less necessary and

resection techniques have been largely limited to cephalic resection of the lower lateral cartilage to reduce the tip bulbosity<sup>(4)</sup>. The philosophy of the modern nasal tip surgery is based on placement of sutures to reshape and reposition of various nasal tip components.

Control of the nasal tip projection is one of the most important components of aesthetic rhinoplasty. During balancing the projection of the tip, the surgeon must consider not only the nasal dorsum, but also other facial proportions, primarily the upper lip length and facial plane, including the chin position<sup>(5)</sup>. At the end of the operation, the nasal tip is positioned according to the cartilaginous dorsum and the facial plane. Because of the complex nasal tip dynamics, nasal tip projection alterations may affect tip rotation and length. There are numerous suture techniques that have been proposed to modify the shape, form and the position of the tip cartilages. The projection control suture (PCS) is a fixation suture between the medial crura of the lower lateral cartilages and the caudal septum to adjust the tip projection. This is the first suture described for nasal tip

surgery; Jacques Joseph named it as orthopedic suture in 1931<sup>(6)</sup>. Although suture terms as septocolumellar and medial crural anchor were used to define this suture in the literature, as it controls the nasal tip projection; the term projection control suture was preferred by Tebbetts<sup>(2)</sup>.

Since there were no data available concerning the surgical results of PCS obtained with objective methods, this study aimed to assess the long-term effectiveness of PCS in 14 cases by using objective measurement techniques.

**METHODS**

*Patients*

Fourteen cases (7 women, 7 men) underwent rhinoplasty and were included in this study. All rhinoplasty operations were performed by the author. Since all cases had insufficient tip projection and an open technique was the author’s preferred surgical approach, this technique was used in all cases. The PCS was used to adjust the tip projection in all cases. The age of patients ranged from 18 to 34 (mean 24.2) years old. The mean follow-up period was  $26.85 \pm 10.77$  (range 12-50) months. The long-term effectiveness of PCS was investigated on patients early and late postoperative photographs. Mean durations between operation and early and late postoperative photographic documentations were  $1.28 \pm 06$  (range 1-3) and  $23.27 \pm 7.84$  (range 12-48) months, respectively.

*Measurement techniques*

The Scion Image (Beta 4.02 Win version) software program was utilized for numerical analysis of the nasal tip projection. This method was utilized in other rhinoplasty studies before<sup>(3,7)</sup>. The measurements of the nasal tip projection by using Goode and Byrd-Hobar techniques (Figure 1) were accomplished on the lateral view photographs. The author performed all measurements. In repeated measurements of distances, most consistent values were accepted to prevent inter-measurement variability. The assessor was not blind during the assessment of the preoperative and postoperative photos.

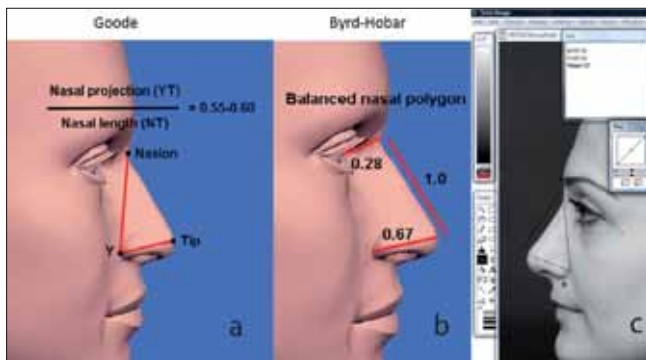


Figure 1. The projection of nasal tip is investigated by Goode (a), and Byrd-Hobar (b) techniques on early and late period postoperative profile photographs (courtesy of Fazil Apaydin, MD, Professor, Turkey. Rhinobase). Measurement of an example case with Scion Image (c).

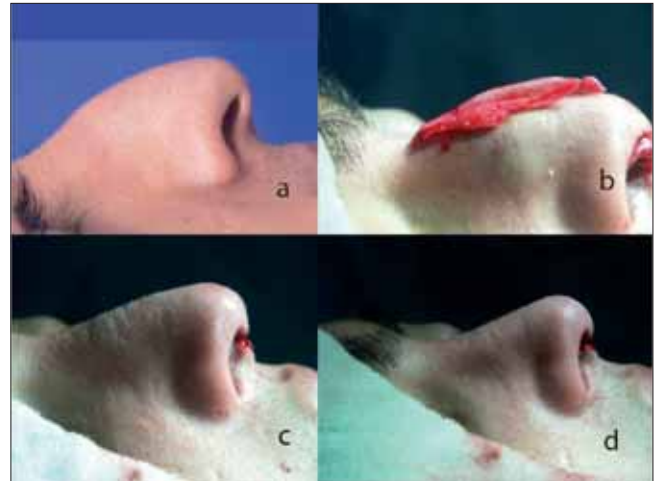


Figure 2. In a case with a tension nose (a), after a moderate amount of hump removal (b) and classical tip approach including columellar strut graft and bilateral lateral crural steal sutures, the desired relationship between the nasal dorsum and nasal tip cannot be achieved (c). By using the PCS, additional projection is obtained (d).

*Rationale and surgical technique*

At the end of the operation, after completing the typical sequences of open technique rhinoplasty, if satisfactory tip projection cannot be provided with the conventional techniques applied to nasal tip such as columellar strut graft, transdomal or lateral crural steal sutures and interdomal sutures, then the PCS might be indicated to provide appropriate tip projection as an alternative to onlay tip grafts (Figure 2). After a complete transfixion incision, a 3/0 permanent (Prolene®, Ethicon LTD) suture is passed from the septum superiorly. Then, a needle is passed through the lateral paracolumellar skin, columellar complex (both medial crura and columellar strut) and opposite paracolumellar skin inferiorly according to the septal suture. The nasal tip complex is projected according to the nasal dorsum by tightening the suture gradually (Figure 3). The more superior the suture is passed to the septum, the more nasal tip projection is obtained.

*Statistical methods*

The Statistical Package for Social Sciences version 13.0 was used for statistical analysis. Results were given as means ± standard deviation (SD). The Shapiro-Wilk test was used to analyze whether these ratios showed normal distribution or not. Since the ratios showed normal distribution, the paired t-test was used for the comparison of early and late period ratios.

**RESULTS**

No complication occurred during the postoperative follow-up period. The Goode and Byrd-Hobar ratios were measured as 0.584 and 0.572 in preoperative photographs, respectively. There were statistical significant differences between the preoperative and postoperative results ( $p = 0.001$  for Goode ratio and  $p = 0.0001$  for Byrd-Hobar ratio). A mean YT/NT ratio

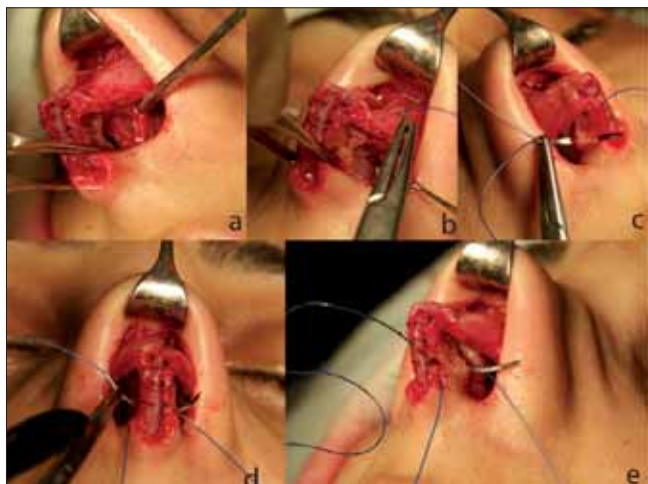


Figure 3. After final tip procedures, in case of unsatisfactory tip projection, PCS is applied. After a complete transfixion incision (a), a 3/0 permanent (Prolene<sup>®</sup>, Ethicon LTD) suture is passed from the septum superiorly (b). A needle is passed through the lateral paracolumellar skin (c), columellar complex (both medial crura and columellar strut) (d) and opposite paracolumellar skin (e) inferiorly according to a septal suture. The nasal tip complex is projected according to nasal dorsum by tying the suture.

was obtained as  $0.614 \pm 0.035$  (range 0.56-0.66) in the early postoperative period, and  $0.616 \pm 0.035$  (range 0.56 - 0.66) in the late postoperative period. A mean YT/NL ratio was obtained as  $0.673 \pm 0.037$  (range 0.60 - 0.72) in the early postoperative period, and  $0.668 \pm 0.039$  (range 0.59 - 0.72) in the late postoperative period. No statistical significant differences were determined between the early and late postoperative ratios ( $p = 0.336$  for YT/NT,  $p = 0.374$  for YT/NL). There was no statistical significant change in measurements of nasal tip projection on early and late postoperative photographs by utilizing Goode, and Byrd-Hobar techniques.



Figure 4. Preoperative and 27 months postoperative lateral view photographs. Additional tip projection is obtained by PCS in an example case with a tension nose. Since additional tip projection is obtained, there was no need to overreduction of the nasal dorsum to achieve a balanced nasal dorsum and tip relationship in cases with a tension nose.

Surgical results of example cases are given in Figures 4-6.

## DISCUSSION

In a typical rhinoplasty operation, creation of a narrower and more defined nasal tip is desired<sup>(1)</sup>. When performing rhinoplasty, managing the frontal view and 3-dimensional tip contouring is much more complex than the 2-dimensional profile alignment. This explains why many rhinoplasty patients have an acceptable profile but look unnatural or deformed on the frontal view<sup>(1)</sup>. A detailed comprehension of the 3-dimensional nasal anatomy is essential for accurate understanding of the nasal deformity and its correction<sup>(3)</sup>.

Resection, transection, morselization, scoring, suturing and grafting are major surgical techniques for the tip refinement in rhinoplasty. The first four techniques disrupt the structural integrity and support mechanisms of the nasal tip, primarily the lower lateral cartilage resistance. The compromised structural integrity of the nasal tip cannot resist to postoperative wound contracture and related complications. These aforementioned techniques have completely irreversible effects on structural integrity of the nasal tip. Visible tip grafts have also their own disadvantages, such as potential postoperative tip irregularities due to translocation of the graft and margin visibility. Onlay tip grafts can be visible during the time course of the wound healing process. In primary or secondary rhinoplasty, visible onlay grafts placed subcutaneously in the nasal tip have potential complications such as malposition, displacement, warping, resorption, visible irregularities, extrusion, infection, soft-tissue deformation and soft tissue atrophy<sup>(2)</sup>. Tip asymmetry due to graft malposition, displacement and visible marked edges of the graft is the major disadvantage of onlay tip grafts. Revision rates due to complications of onlay tip grafts can be as high as 18% even in the most expert hands<sup>(2)</sup>.

In a typical sequence of open rhinoplasty operation, most of the major tip support mechanisms are destroyed. During the tip suturing and grafting, the nasal tip projection should be reestablished. There are plenty of suture techniques described for nasal tip positioning and reshaping. Suture techniques do not compromise the intrinsic tip support mechanisms and generally support them. Transdomal and interdomal sutures are placed for the tip projection, narrowing and unification. Columellar strut graft and the aforementioned sutures are workhorse techniques to establish nasal tip projection and rotation in open rhinoplasty technique. Transdomal and interdomal sutures and columellar strut graft shape and unify the medial, middle and lateral crura. Transdomal sutures bend inward the lateral crura to increase the convexity and emphasize the tip defining points. Lateral crural steal suture is a modification of transdomal suture, which increases the tip projection and rotation. In this technique, lateral crural length is transposed to increase the medial crural length by using mattress suture placed at the anterior portion of the lateral crura, lateral to the tip defining points. This suture is generally suc-





Figure 5. PCS is applied in an example case with underprojected tip. Tip projection is obtained by columellar strut graft, lateral crural steal suture and PCS. Also minimal hump reduction by rasping and unilateral spreader graft is applied to the left side of the middle nasal vault. Results were shown on photographs of preoperative and 26 months postoperative period (anteroposterior view, lateral view, oblique view and basal view).

successful in cases with droopy nose deformity arising from short medial crura and long lateral crura of lower lateral cartilages; otherwise this suture may cause an overrotated nose deformity. The more lateral placement of lateral crural steal suture, the more inadvertent tip overrotation can be possible.

The control of the nasal tip projection is one of the most important components of aesthetic rhinoplasty. Surgical correction of the underprojected tip can be obtained by preserving and/or restoring major and minor tip supports, reorienting the lower cartilages, and augmentation with cartilage grafts. Inadequate tip projection is one of the most common reasons of unfavorable or suboptimal rhinoplasty results<sup>(8)</sup>. At the end of the operation, the nasal tip is positioned according to nasal dorsum and facial plane. According to an anatomical model (Padgett Instruments, Kansas City, MO, USA) to illustrate the idealized and average-sized nasal measures, an ideal nasal tip height should be 6-8 mm above the nasal dorsum<sup>(4)</sup>. However, in patients with thicker skin, this difference between the dorsum and the tip can be up to 10 mm to obtain the desired profile. In a classical open approach rhinoplasty, because of destructed tip support mechanisms, columellar strut grafts are used to restore the tip support. Tip alignment is obtained by using the transdomal and interdomal sutures. Additional tip projection can be obtained by PCS and onlay tip grafts. Though the PCS is placed to increase or decrease the nasal tip projection<sup>(9,10)</sup>, in our hands, PCS is mainly utilized to increase the nasal tip projection, in cases that need additional projection despite classical techniques (Figures 4-6). If the suture is passed through the posterior portion of the medial crura and anterior portion of the caudal septum, the increased tip projection and cephalic rotation of the lower lateral cartilages are achieved<sup>(10)</sup>. Tebbetts emphasized the impressive potential of PCS for increasing or decreasing unified tip complex projection at least 3-4 mm without any other techniques<sup>(2)</sup>. A greater additional (5-6 mm) tip projection can be achieved by PCS (Figure 4). PCS may lead to widening of the interdomal distance if an interdomal suture is not placed. Placement of septocolumellar sutures to affix the medial crural and columellar strut complex to the caudal septum reconstitutes major tip support and can also provide tip projection. Anchore of the medial crura to the caudal septum, near the nasal spine results in decreased tip projection. Unsatisfactory projection despite routine tip procedures is the main indication for utilizing the septocolumellar PCS in our hands. Also PCS does not have the disadvantages of visible onlay tip grafts to contribute to the nasal tip projection.

By using PCS, the unified and symmetric tip complex can be projected or deprojected without distortion. The entire tip complex can be positioned as a unit relative to the nasal dorsum without disrupting the established relationships between the medial and lateral crura of the lower lateral cartilage by PCS<sup>(2)</sup>. In a primary rhinoplasty, this systematic approach achieves more precise and predictable tip projection control<sup>(9)</sup>. PCS can be used to increase or decrease the nasal tip, to rotate



Figure 6. PCS is applied in another example case with crooked nose deformity and underprojected tip. Tip projection is obtained by columellar strut graft, lateral crural steal suture and PCS. Asymmetric minimal hump reduction and medial oblique and lateral osteotomies were applied (anteroposterior view, lateral view, oblique view and basal view).

the nasal tip and reduce the columellar show. Columellar show reduction can be an inadvertent effect of the suture in cases with normal columellar show. This suture is preferred in tension nose cases as the columellar show reduction possibility is lower than in other cases. Overgrowth in cartilaginous dorsum and a relatively underprojection of the nasal tip are seen in cases with a tension nose. The tension nose deformity is one of the indications to use PCS. The tension nose deformity may result in the phenomenon of an overprojected dorsum and a relatively underprojected nasal tip. This abnormality typically results in an acute nasolabial angle. In these cases, a moderate amount of dorsal reduction and use of PCS for additional projection to achieve natural appearance between the nasal dorsum and nasal tip prevent the excessive hump removal and relevant complications. Tezel and Numanoglu reported that the amount of nasal dorsal resection can be diminished by the increase of tip projection achieved by PCS<sup>(8)</sup>. This suture method also addresses the acute nasolabial angle deformity. Columellar retraction and suture loosening can be the complications of this technique. Columellar retraction due to this technique is not usual unless caudal septal shortening is not applied. We did not observe any tip projection loss due to PCS loosening in a follow-up period of over two years.

There are many techniques that can be used to assess the tip projection in relation to the upper lip, subnasale, alar-facial groove, or a line from the nasion or glabella<sup>(5)</sup>. In a method described by Goode, a line drawn from the alar-facial groove to the nasal tip (YT) measures 0.55-0.60 of the distance from the nasion to the alar-facial groove (NT). Several other methods have been described. Byrd-Hobar proposed that ideal tip projection (YT) is two thirds of the ideal nasal length (NL). Simons described nasal tip projection, measured from the subnasale to the tip-defining point, as equaling the length of the upper lip, which is measured from the subnasale to the vermilion border. Since the method depicted by Simons depends on upper lip length that may be variable, we did not use this method. The Goode and Byrd-Hobar techniques were used to analyze the nasal projection. Since all these techniques assessing nasal tip projection depend on ratios, there is no need to use a ruler during photography. Classical lateral profile photographs are suitable for measurements.

In the literature, there are few articles about the results of PCS. In a series of 235 rhinoplasties (220 primary, 15 secondary), Tebbetts reported that the need for visible onlay grafts were drastically reduced, being necessary in only 4 cases of the 220 primary rhinoplasty<sup>(2)</sup>. He followed his cases 1 to 7 years with no recurrence of deformity due to suture disruption and reported only two secondary procedures necessary for tip revision. The reasons of secondary procedures were blunt trauma and overtightened lateral crural spanning suture. Daniel reported a simplified, three stitches, open tip suture technique, including columellar strut suture, domal creation suture (transdomal suture) and domal equalization (interdomal suture) sutures<sup>(11)</sup>. When needed, a septocolumellar suture (PCS) was

added. He stated that he used this suture as refined by Tebbets for minor adjustments in a range of  $\pm 2$  mm. Though he reported potential complications related to three stitches, there were no data about the results of PCS. Gruber and Friedman described a four stitch (transdomal, interdomal, lateral crural mattress and columellar-septal sutures) algorithm for the correction of tip bulbosity<sup>(4)</sup>. In this series including 150 cases, they reported one low-grade nasal tip infection. However, they did not report data about maintaining the nasal tip projection. Though Tezel and Numanoglu stated that they have been using this suture in a total of 495 cases in closed approach rhinoplasty since 2000, they did not give any quantitative data<sup>(8)</sup>. They reported that their complication rates and need of open approach rhinoplasty were reduced significantly. They also, emphasized that after this technique, their amount of dorsal hump reduction was diminished like our observation.

This is the first study evaluating the long-term effectiveness of PCS by using objective measurement techniques on postoperative photographs. There was no projection loss in none of our cases that underwent rhinoplasty including PCS during a two years follow-up period. There were statistical significant differences between the preoperative and postoperative results ( $p = 0.001$  for Goode ratio and  $p = 0.0001$  for Byrd-Hobar ratio). Results of the Goode technique showed that tip projection was increased by rhinoplasty. The Byrd-Hobar measurements technique is related to nasal tip projection and nasal dorsal length. Since increased projection and decreased nasal dorsal length due to tip rotation were achieved by rhinoplasty operation, results of Byrd-Hobar technique showed a pronounced difference.

There was no statistical significant difference in measured results of techniques assessing the nasal tip projection such as Byrd-Hobar and Goode in early and late postoperative photographs. According to our preliminary results in a limited number of patients, PCS seems to be a reliable and effective surgical method to create the desired nasal tip projection for a long time. However, further and longer quantitative studies in larger series are needed to evaluate the effectiveness of this suture.

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