

## “Pisa Tower Concept”: a new paradigm in crooked nose treatment

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## ABSTRACT

### **Background:**

The primary element of a crooked nose is a midline deviation of the nasal pyramid. To date, no surgical strategies have been described as compatible with dorsal preservation philosophy.

The dorsal preservation technique differs from the Joseph structured rhinoplasty because it preserves both the keystone area (K-area) and the continuity of the cartilaginous vault.

Authors want to focus on the versatility of dorsal preservation technique even for the deviated nose, introducing the “Pisa Tower Concept”.

### **Methods:**

From January 2015 to June 2019, 280 patients with a crooked nose diagnosis underwent primary septorhinoplasty with dorsal preservation through an asymmetric bony wedge resection, with the lowering of the bony pyramid onto the frontal process of the maxilla “let down” osteotomy (LDO), according to “Pisa Tower Concept”.

Inclusion criteria were a pre-operative CT exam (Fig. 1), a nasal axis deviation and a complete photographic exam pre-operative, and a 1-year follow-up, at least.

### **Results:**

In our study, the mean nasal axis deviation was  $7.62^\circ$  preoperatively and  $1.15^\circ$  postoperatively ( $P < .05$ ). Of the 84 patients, 47 (55,95%) were very satisfied, 33 (39,28%) were satisfied, and 4 (4,76%) were unsatisfied with surgical results and required revision surgery.

### **Conclusions:**

Authors’ opinion is that the association of Swinging Door Septoplasty with the Pisa Tower concept can be a valid alternative to other techniques working with structured rhinoplasty philosophy in patients with Crooked nose.

Although this is only a preliminary study, the least use of spreaders graft and less aggressive reconstructive methods look very promising.

## Introduction

The crooked nose deformity is one of the most challenging practices for the rhinoplasty surgeons. The crooked nose is arched or deformed in both the horizontal and vertical plane and the tip is frequently twisted <sup>1</sup>.

There are various possible etiological processes for crooked nose deformities, including trauma and congenital and iatrogenic factors, although nasal trauma is the most common.

In a crooked nose, upper lateral and lower lateral cartilages, bony nasal dorsum, septum, nasal spine, soft tissues, and ligaments may be involved and each may contribute to these deformities <sup>3</sup>.

Although various nasal osteotomy techniques have been used for the correction of nasal bone deformities (including medial osteotomy and lateral osteotomy) in Joseph's structured rhinoplasty, to date, **only Özücer and Çam<sup>1</sup> described dorsal preservation principles for correction of I-shaped crookedness.**

The dorsal preservation technique differs from the Joseph structure rhinoplasty because **it** preserves both the keystone area (K-area) and the continuity of the cartilaginous vault.

Authors want to focus on the versatility of dorsal preservation technique even in deviated nose introducing the, so called, "Pisa Tower Concept", based on an asymmetric bony wedge resection, with lowering of the bony pyramid onto the frontal process of the maxilla ("let down" osteotomy - LDO)<sup>4</sup>.

## Materials & Methods

A retrospective analysis was performed on the Authors' medical records of patients with crooked nose diagnosis **who** underwent primary septorhinoplasty with Pisa Tower Concept from January 2015 to June 2019.

The Authors performed all surgical procedures in their private practice at MySelf and Assunzione in Rome.

All patients provided written informed consent.

Inclusion criteria were a pre-operative CT exam, a nasal axis deviation and a complete photographic exam pre-operative and 1-year follow-up, at least.

Nasal axis was measured from digital photographs of each patient at the preoperative visit and the final postoperative visit.

To determine the nasal axis deviation, the midpoint between the 2 medial canthi was determined. One line was drawn from this mid-point to the central tip defining point, and another line was drawn perpendicular to the intercanthal line. The nasal axis deviation corresponded to the angle between these lines<sup>5</sup>.

Furthermore, the linear distance, ~~between~~ between the Rhinion-point (**the point at the lower end of the median suture joining the nasal bones**) and the pyriform aperture (the base of the Webster triangle) was measured preoperatively and post-operatively directly on the CT exam.

280 patients with crooked nose diagnosis underwent primary septorhinoplasty with dorsal preservation and correction of the front view by using the "Pisa Tower Concept". Among these, 233 patients were treated by **a** closed approach performed by the first Author (VF), while the others 47 patients underwent primary open rhinoplasty by another author (TM).

Nasal axis deviation and pre- and post-operative measurements were analyzed with SPSS Statistics for Windows (version 17.0, SPSS Inc, Chicago, IL), and the paired sample T-test was applied to ascertain the significance.

Patients were asked to complete an anonymous in-office questionnaire at a 1-year follow-up. The questionnaire addressed patient satisfaction (unsatisfied with the result, satisfied, or very satisfied) with the final shape of their nasal tip.

### Surgical Technique

All the operations were performed either **via** general or local anesthesia with sedation and through an endonasal / open approach by the same surgeons (V.F e TM.).

The first step consists of a 'swinging door' septoplasty, as described by Wright <sup>6</sup>.

The cartilaginous septum is dissected from its base, from posterior to anterior at the chondro-osseous junction, and from the vomer bone, from the base until the dorsal nasal region, with a sharp end of the elevator (Figure 1).

The septal flap is mobilized and can be displaced to approach to the posterior septum. A 5/0 polydioxanone suture (PDS) was used to fix the quadrangular cartilage flap to the anterior nasal spine. After the septoplasty, the quadrangular cartilage is left attached to the cartilaginous vault and is free from perpendicular plate influence.

Second step consists in performing transverse and radix osteotomies, endonasally with a Tastan-Cakir convex saws or percutaneously with a 2mm osteotome.

For the bony vault, Authors applied the Pisa Tower concept consisting of an asymmetric let down/push down in order to obtain dorsal preservation. A bony wedge was excised from the ascending maxillary process to obtain greater impaction on the longer side compared to the shorter, based on pre-operative measurements (Figure 2).

The amount of bone to be resected laterally is valuated and planned pre-operatively taking into account the amount of hump to be reduced and the level of the deviation to be corrected. The final goal is to obtain two lateral bony walls of equal length. The average bone resected was 9 mm, range: 3-14 mm)

Rongeur is the ideal instrument to perform a bony wedge resection after a wide internal periosteal dissection (Figure 2).

The Authors, removing the bony wedge, avoid internal nasal valve narrowing during the nasal impaction because the nasal wall will not slide in toward the inferior turbinate head.

The treatment on the shorter side depends on the amount of nose reduction expected: if minimal, then a Push down operation (PDO) is necessary because this side acts as a pivot point; in case of major nose reduction a minimal LDO may be necessary because a simple PDO will not be enough to allow a correct impaction.

In combination with swinging door septoplasty, it is possible to correct very difficult crooked nose without the need for an extracorporeal septoplasty. The association with the swinging door septoplasty allows to free the quadrangular cartilage (QC) flap from the perpendicular plate of the ethmoid (PPE) and this allows for the repositioning of a total bony cartilaginous vault (Video 1) (Figure 3).

## Results

In our study, the average age of the patients was 24.5 years (range, 17-54 years). Of the 280 patients, 192 were women and 88 were men.

The mean nasal axis deviation was  $7.62^\circ$  (range  $4.6^\circ$ -  $10.8^\circ$ , SD:  $\pm 1.65$ ) preoperatively and  $1.15^\circ$  (range:  $0.2^\circ$ - $2.9^\circ$  SD:  $\pm 0.61$ ) postoperatively ( $P < 0.05$ ). The mean R-Webster linear distance on the longer side was 29,6 mm (range: 21-43 mm, SD:  $\pm 5,0$ ) preoperatively and 22.7 mm (range: 17-34 mm, SD:  $\pm 3,9$ ) post-operatively ( $P < 0.05$ ), whilst considering the shorter side, the same measure resulted 23.4 mm (range: 18-33 mm, SD:  $\pm 3,7$ ) preoperatively and 22,3 mm (range: 17-32 mm, SD:  $\pm 3,5$ ) post-operatively ( $P > 0,05$ ).

The mean follow-up was 18 months (range, 12- 28 months).

Of the 84 patients, 47 (55,95%) were very satisfied, 33 (39,28%) were satisfied, and 4 (4,76%) were unsatisfied with surgical results and required revision surgery.

Only four patients required revision surgery for hump recurrence. Two of these four were due to the incomplete deviation correction related to the learning curve time required to completely adhere to the new concepts. The remaining two were for minor tip revisions, thanks to the lower rate of dorsal irregularities related to this technique (rocker deformity or radix step can be present, but appreciable only on palpation and not aesthetically visible).

## Discussion

Crooked nose is one of the greatest challenges of septorhinoplasty.

Septal correction is essential for surgical success because the primary component of a crooked nose deformity is generally extreme septal deviation<sup>1</sup>.

Several septal in situ correction techniques are available, including scoring and thinning and use of sutures or battens of cartilage or bone for stabilization and maintenance of the septal correction<sup>7,8,9,10</sup>.

In situ septal correction techniques are relatively non-invasive and effective but residual cartilage memory may lead to surgical failure<sup>11</sup>.

Even regarding osteotomy, Literature has provided many techniques for deviated nose correction<sup>2,3,12</sup> but a unilateral spreader graft placement to the concave side of the deviation was suggested in most of the studies<sup>3,13,14</sup>.

This graft provides both functional improvement and aesthetic outcome, but it is unable to correct high deviations of the perpendicular plate of the ethmoid (PPE).

The Let Down operation (LDO) differs from the Joseph' structured rhinoplasty because it preserves both the keystone area (K-area) and the continuity of the cartilaginous vault, avoiding the narrowing of the internal nasal valve.

The concept of dorsal preservation in nasal surgery was first introduced by Goodale<sup>1</sup> in 1889 and Subsequently from Lothrop<sup>15</sup> in 1914.

To date, nose deviation seemed to be an exclusion criterion for the dorsal preservation technique, but Authors want to focus on the versatility of dorsal preservation technique even with crooked nose introducing the "Pisa Tower Concept".

Deviated nose anatomy has been compared with the famous Pisa Tower (Figure 4).

One side of the tower appeared longer: to straighten the tower, we should shorten the longer side.

So, through an asymmetric bony wedge resection with lowering of the bony pyramid onto the "longer" frontal process of the maxilla ("let down" osteotomy - LDO)<sup>4</sup>, both sides become of equal size and the nasal "Tower" can impact in the right position.

Authors' opinion is that Swinging Door Septoplasty and Pisa Tower can be valid alternatives to other techniques working with structured rhinoplasty philosophy in patients with Crooked nose.

## Conclusions

In conclusion, Authors described “Pisa Tower Concept” in preservation rhinoplasty to fix crooked nose.

The association of Swinging-door septoplasty with dorsal preservation and an asymmetric bony wedge resection with lowering of the bony pyramid onto the frontal process of the maxilla “let down” osteotomy (LDO) are the main advantage of this technique, making it unique.

## Conflict of interest

None of the authors has declared any conflict of interest (financial or non-financial) from being named as an author on the manuscript.

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## Captions to illustrations:

Figure 1 - 'Swinging door' septoplasty. The cartilaginous septum is dissected from its base, from posterior to anterior at the chondro-osseous junction, and from the vomer bone, from the base until the dorsal nasal region, with a sharp end of the elevator.

Generally, the cartilage junction with the bony vault is more cephalically placed than the K-area.

However, no cartilage is resected underneath the K-area.

Figure 2 - intraoperative technique for correcting nasal bone deviation through a dorsal preservation based on an asymmetric bony wedge resection with lowering of the bony pyramid onto the frontal process of the maxilla ("let down" osteotomy - LDO).

Figure 3 - Pre- and Post-operative Patient's photo. Correction of the nasal deviation through a dorsal preservation based on an asymmetric bony wedge resection with lowering of the bony pyramid onto the frontal process of the maxilla ("let down" osteotomy - LDO).

Figure 4 - Deviated nose clay model and the "Pisa Tower"

Video 1 - For the bony vault, Pisa Tower concept, consisting of an asymmetric let down/push down in order to obtain dorsal preservation, has been applied. A bony wedge was excised from the ascending maxillary process to obtain greater impaction on the longer side compared to the shorter, based on pre-operative measurements