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Outcomes of Surgical Correction of Crooked Nose Deformity: An Objective Method of Assessment

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Abstract

Background: Management of crooked nose deformity is considered one of the most challenging and difficult procedures in plastic surgery. For proper management of such condition, a thorough pre and intraoperative analysis of all nasal structures should be done.

Objective: The aim of this study is to report the significant benefits from using the Auto CAD program in measurement of angles of nasal deviation before surgery and its role in assessment of the postoperative surgical results.

Patients and Methods: The study was done on 28 patients with crooked nose deformity: Which were divided into two groups, I-type, which included 15 patients, and C-type, which included 13 patients. Deviation angles were measured by Auto CAD program on frontal views before and at least 3 months after the operation. Surgery was done through an open approach under general anesthesia.

Results: Very good results were achieved for both type of crooked noses ($p<0.05$). Better results were achieved with the I-type crooked nose deformity than those of the C-type deformity, but still with insignificant difference. Statistics showed that 66.7% and 53.8% of the patients with crooked noses, I type and C type respectively had good or excellent postoperative results.

Conclusion: We believe that using of the AutoCAD program is a very helpful and accurate method for preoperative assessment of angles of deviation and postoperative assessment of the degree of correction. We think that it can be helpful also measurement of nasofrontal, nasolabial, and nasofacial angles. In addition, it can help in nasal length and alar base width.

Key Words: *Crooked nose – Rhinoplasty.*

Disclosure: No disclosure.

Introduction

Crooked, twisted, deviated or scoliotic nose can be defined as any condition causing nasal deviation from the mid-vertical line of the face **[1]**. The commonest etiology of this deformity is blunt nasal trauma with neglected or improper reduction of nasal fractures. In addition, nasal deviation may be idiopathic or congenital in nature **[2]**. There are two main deforming forces controlling the problem of crooked nose deformity, intrinsic and extrinsic forces. Such forces act mainly on the nasal bone and cartilage, which represent the two main structural components of the nose. Intrinsic forces involve fracture or injury of the quadrangular cartilage, nasal septum, vomer or the perpendicular plate of the ethmoid. Extrinsic forces represent any tractional or pushing forces like abnormal position of upper or lower lateral cartilages, deviation of nasal bone or scar contraction **[3]**.

Any association of such forces may cause unequaled forces on the nasal septum causing septal deviation, which finally ends with crooked nose deformity.

Regarding the type of nasal deviation, there are four different types mentioned in the literature:

A- Cartilaginous type: In this type there is no deviation affecting the nasal bone but it involves only less than 2/3 of the cartilaginous structures of the nose.

B- Linear type: In some articles it is also named (I-shaped deviation). In this type the nasal axis deviation takes a linear shape and it is directed to one side.

C- C shaped: It is the most common type of deviation and commonly it occurs due to nasal septal fracture. The vertical nasal axis in this deformity is C-shaped.

D- S-shaped: It seems to be the most complicated type of nasal deformity. In such type, the nasal pyramid has different deviations and angulations **[4]**.

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For correction of crooked nasal deformity, meticulous preoperative assessment of the type of nasal deviation and analysis of the responsible components of such deformity (bony or cartilaginous or both) is very important. Therefore, adequate release of all intrinsic and extrinsic forces that cause nasal deviation is the main step to gain a straight nose.

The goal of our study was to discuss and show the significant benefits regarding the use of the Auto CAD program in measurement of angles of nasal deviation before surgery and its role in assessment of the postoperative surgical results. Such method allows us to achieve objective rather than subjective assessment of our results.

Patients and Methods

A- *Patients:*

The study was done between January 2024 and June 2024 in Plastic and Reconstructive Surgery Department, Beni-Suef University. The study included 28 patients (20 men and 8 women) presented by crooked nasal deformity. The patients were classified as, I-type, which included 15 patients and C-type, which included 13 patients. Patients who complained from S-shaped deformity were excluded from this research due to the low measurement reliability in such type of deformities.

Inclusion criteria:

Patients who complain from crooked nose (I or C type) aiming to improve functional or esthetic problems.

Exclusion criteria:

- Patients younger than 18 years old.
- In cooperative patients who refused charring in the study.
- Patients who have associated medical co-morbidities like cardiac, renal or hebetic insufficiency or suffering from coagulation problems.

Patient counseling and consent:

The research ethics committee, Faculty of Medicine, Beni-Suef University, approved the study.

B- *Pre-operative assessment:*

- Proper history taking and physical examination including assessment of position, symmetry and shape of bony and cartilaginous structure of the nose. In addition, endoscopic nasal examination was done.
- Radiological assessment: Computerized tomography (CT) paranasal: Coronal, axial and 3D cuts. It was done to all patients preoperatively. Radiodiagnosis consultant did proper analysis. It can give us detailed data about:
  - Bony structure of the nose: Length, shape, symmetry and any defect of nasal bone.
  - Nasal septum: Any deviation, residual hematoma.
  - Nasal turbinates: Any hypertrophy of the inferior turbinates.

Photography:

Standard photographs of the face, including the frontal, oblique, lateral and basal views, were taken preoperatively and three months postoperatively. The frontal views were processed by AutoCAD program to assess the degree of correction of nasal deviation, so in this study, we present only the frontal view photographs that show the actual difference and change in nasal shape.

Measurement of deviation angles:

In this study, we used an image-processing program (Autodesk AutoCAD 2018) to measure the degree of nasal deviation on frontal views.

Regarding the C-shaped crooked nose, measurement the angles of deviation was done as follows. Vertical midline extends from the glabella (G) to the upper lip midpoint (L) with marking of the nasion (N) and the center of the nasal tip (T) on this vertical midline. The last point is the point of maximum convexity (C). The angle between the NC and TC represents the angle of deviation of the C type crooked nose (Fig. 1).

Regarding the I-type or linear shaped crooked nose, we measured the angles of deviation as follows. Vertical midline taken from the glabella (G) to the upper lip midpoint (L) with marking of the nasion (N) on the same line. The last point is the most prominent point of the nasal tip (T). The angle between the NL and NT lines is considered the angle of deviation (Fig. 2).

We measured the angles of deviation before and 3 months after surgery. The best angular value for C-type crooked nose deformity was considered to be 180º while it should be 0º in I-type crooked nose deformity.

Surgical technique:

We believe that open rhinoplasty under general anaesthesia is mandatory for correction of crooked nose deformity. Open approach allows good visualization of the nasal anatomic structures with a better access to cartilaginous and bony structures of the nose.

(A) (B) (C)

Fig. (1): Showing the method of measurement of angle of deviation for C-type crooked noses. (A): Without marking, (B): After marking (the angle between NC and TC lines represents the angle of deviation and in this case it equals 1230, (C): CT paranasal (axial cut).

(A) (B) (C)

Fig. (2): Showing the method measurement of angle of deviation for I -type crooked noses. (A): Without marking, (B): After marking (the angle between TN and LN lines represents the angle of deviation and in this case it equals 7º), (C) CT paranasal (axial cut).

The main concept for correction of crooked nose deformity is freeing or straightening of any deviated or angulated structure regardless the nature or the cause of the deformity.

After adequate exposure of all nasal structures, we divided the operation into 3 main components:

A- *Releasing of any deviated structure, which involves:*

1- *Release of the cartilaginous structures (LLC, ULC, Nasal septum):*

- Adequate release of the LLC from the ULC at the level of the scroll area, which may needs trimming of the cephalic part of the LLC.

- Adequate release of the ULC from nasal septum. In such step, meticulous subperichondrial dissection on both sides of the septum was done until separation of the ULC from the quadrangular cartilage. In cases with overdeveloped or markedly deviated ULC, we should not do over resection of the ULC but rather we can do auto augmentation (or auto spreader flaps) to dilate the internal nasal valve.

- Dorsal hump reduction: The bony part of the dorsal hump is usually reduced either by rasping or by osteotomy and then followed by reduction of the cartilaginous hump if needed.

- Septoplasty: It is considered one of the main steps in correction of crooked nose deformity and a corner stone procedure for improving nasal airflow. Meticulous dissection on both sides of the nasal septum was done with resection of any deviated part. In addition, if there was fractured or deviated anterior nasal spine, it should be adequately released

from the caudal part of the septum which may needs caudal septal cartilaginous trimming. Finally, septal cartilage grafts for any purposes can be harvested with preservation of at least 1cm from the dorsal and caudal edges of the septum.

2- *Correction of deviated nasal bone by osteotomies:*

Adequate and precise nasal bone osteotomy is a very important step in correction of nasal bone deviation. For management of crooked nose deformity we cannot depend on green sticked perforations but rather we need complete osteotomies to ensure adequate mobilization and freeing of deviated nasal bones. In this research, many types of osteotomies were performed according to need like medial oblique, paramedian vertical or lateral osteotomies.

B- *Structural nasal support:*

Separation of the septum from the deviating forces with resection of the deviated septal parts seems to be not enough for straightening of the septum.

To ensure adequate and permanent straightening of the deviated septum, there are two common techniques:

1- Cartilage scoring and suturing method like the Mustardé suture.
2- Supporting grafts like bilateral spreader or extended spreader grafts, columellar strut graft.

At the end of the surgery, we apply internal nasal packs that are commonly removed after 48 hours. External nasal supporting splint was performed and removed after 2-3 weeks.

Postoperative evaluation:

1- Assessment of the degree of correction of nasal deviation by measurement and comparison of the surgical results with ideal angular values. This was done by processing of the frontal view photos by the AutoCAD program preoperatively and 3 months postoperative.
2- Evaluation of patient satisfaction about the esthetic outcomes.

Results

This study involved 28 patients (20 men and 8 women) presented by crooked nasal deformity (classified as I-type, which included 15 patients and C type, which included 13 patients). We compare the pre and postoperative data to obtain an objective assessment of the degree of correction in each type of nasal deviation.

Statistical analysis:

The Student's *t*-test was used for analysis of the differences between pre and postoperative angular values. The chi-square test was used to test the differences between the two groups. The *p*-value was considered statistically significant if less than 0.05.

Table (1): Surgical results rated by comparison with ideal angular values.

Success rate	Correction (%)
Unsuccessful	<50
Acceptable	50–69
Good	70–89
Excellent	90–100

Table (2): Deviation angle measurement before and after surgery.

	Preoperative mean (°)	Min–Max (°)	Postoperative mean (°)	Min–Max (°)
I-shaped deformity	7.5±2.3	4.2 –13	1.8±1.06	0– 4.2
C-shaped deformity	145.8±10.22	108–162	165.9±7.33	155–180

Table (3): Results according to success categories.

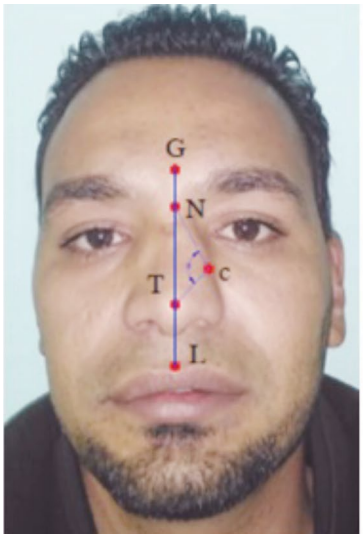
	I-shaped n (%)	C-shaped n (%)
Total	15	13
Unsuccessful	1 (6.6)	3 (23.07)
Acceptable	4 (26.7)	3 (23.07)
Good	4 (26.7)	3 (23.07)
Excellent	6 (40)	4 (30.8)

Table (4): Patient satisfaction rate.

	I-shaped n (%)	C-shaped n (%)
Total	15	13
Well satisfied	11 (73.4)	9 (69.2)
Moderately satisfied	3 (20)	2 (15.4)
Not satisfied	1 (6.6)	2 (15.4)

Regarding the interpretation between the patient satisfaction and deviation angle measurement by the Auto CAD program, we have just one patient in Type I crooked nose appeared to be not satisfied. We found that his angle of deviation was 120 preoperatively to be 4.20 postoperatively. On the other hand, we have two patients in Type C crooked nose who appeared to be not satisfied. We found that the angle of deviation was 1080 preoperatively to be 1550 postoperatively in one of them and 1100 preoperatively to be 1600 postoperatively in the other patient.

Clinical Cases

(A) 

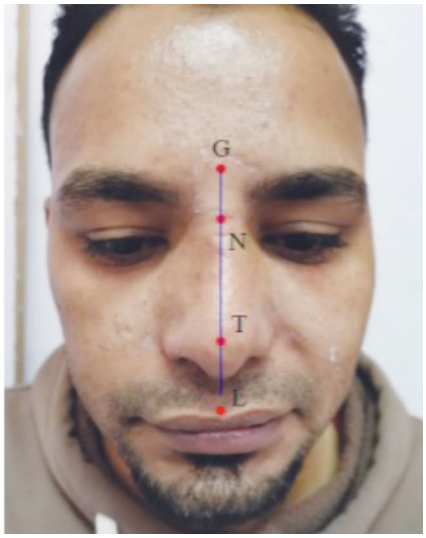
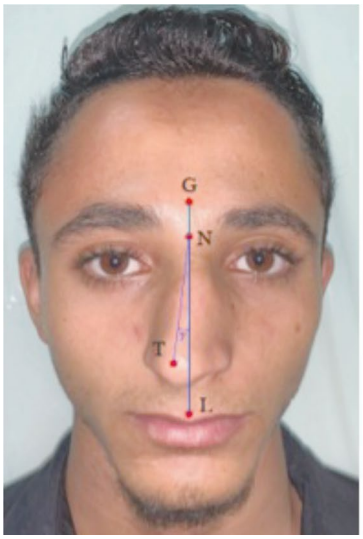
(B) 

Fig. (3): Preoperative (3A) and 3 months postoperative (3B) frontal views of patient with C shaped crooked nose.

(A) 

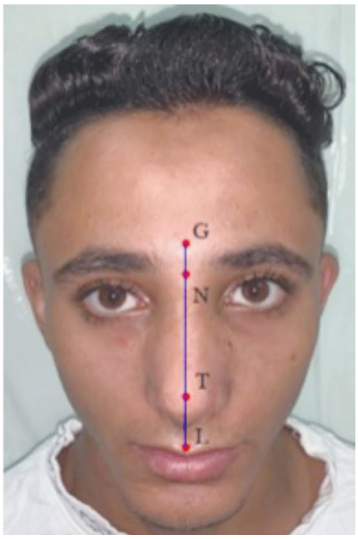
(B) 

Fig. (4): Preoperative (4A) and 3 months postoperative (4B) frontal views of patient with I shaped crooked nose.

Discussion

Surgical correction of a crooked nose deformity represents one of the most challenging subjects in plastic surgery. The main target in management of such deformity is to obtain a good aesthetic and an adequate functional outcome, so making an appropriate surgical plan is very important to achieve good results. Such plan depends on meticulous pre and intraoperative assessment. In addition, we need proper analysis of any deviating force (intrinsic or extrinsic) **[5]**.

Nasal septal position is considered the main factor controlling the position of the nose. "As the septum goes, so goes the nose" indicates the significant role of nasal septal correction for correction of nasal deviation **[6]**.

In our research, we manage two common types of crooked nose deformity, I-type and C-type. The I- type crooked nose arises from straight but malpositioned quadrilateral septal cartilage, on the other hand the C-shaped crooked nose arises from the asymmetric and deviated nasal septal quadrilateral cartilage **[7]**.

In the literature, many techniques have been used to correct crooked nose deformity, but to our knowledge, few researches reported their results in an objective manner or investigated their quantitative postoperative results **[8,9]**.

Ellis and Gilbert classified crooked nose as angulation at the rhinion or angulation at the nasion and they mentioned that a straight nose was obtained for 75% of angulations at the rhinion and for 90% of angulations at the nasion. Actually, they did not describe any objective method for the evaluation of their results **[10]**.

Ozturan et al., classified the crooked noses as C-shaped and I-shaped and they used a protractor for measurement of angles of deviation. They reported good or excellent results for 58% of the cases **[11]**, while in our study we achieved good or excellent results in 66.7% for I-type crooked noses and 53.8% for C-type crooked noses.

Okur et al., reported their results regarding management of 27 patients of C and I-shaped crooked nose. They found the mean angles of deviation is 1470 preoperatively and 167o postoperatively in cases of C type crooked nose while in I type crooked nose it was 7,6° pre-operatively and 1,9° postoperatively **[12]**.

In our study, we found that the mean preoperative angle of deviation regarding C type crooked nose was 145.8±10.22 to be 165.9±7.33 postoperatively while in I type crooked nose cases it was 7.5±2.3 preoperatively to be 1.8±1.06 postoperatively.

Conclusion:

We believe that using of the AutoCAD program is a very helpful and accurate method for preoperative assessment of angles of deviation and postoperative assessment of the degree of correction. We think that it can be helpful also for measurement of nasofrontal, nasolabial, and nasofacial angles. In addition, it can help in measuring of nasal length and allar base width.

This research has some limitations like short-term follow-up period with a few number of patients. Further studies with a larger number of patients and a longer period of postoperative follow up would lead to better and more accurate results.

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