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Endoscopic septoplasty below the age of 17 years

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Abstract

Background The claim that septoplasty in children should not be done was raised in the early last century. Pediatric septoplasty is highly controversial. Some surgeons are concerned that early surgical intervention before age 17 can adversely affect the normal growth of the nose and face. On the contrary, there is evidence of significant dental, palatal, and facial abnormalities following traumatic damage to the septal cartilage. Therefore, surgical correction of the deviated nasal septum may be performed regardless of the patient's age. The recommendation of early surgery is based on the explanation that the earlier the correction of septal deviation, the better the outcome of developing normal breath and acceptable facial growth. This study evaluates the nasal and facial bony growth after endoscopic septoplasty for patients below the age of 17 years.

Methods This retrospective study reviewed 39 patients who underwent endoscopic septoplasty. The involved patients' age at surgery was below 17 years old. Postoperative evaluation was done for all patients subjectively using the visual analog scale (VAS) and objectively by endoscopic nose examination. The nasal and facial bony growth were evaluated using lateral cephalometry, which was carried out for each patient when they reached the age of 17.

Results Thirty-nine patients underwent endoscopic septoplasty. The median visual analog scale for nose block and headache significantly declined after the procedure significant differences were observed between patients and controls regarding the following parameters: palatal length, anterior skull base, mid-face protrusion, and mid-face length.

Conclusion Early endoscopic septoplasty below the age of 17 is a safe procedure and does not compromise the nasal or facial growth when indicated for patients with severe persistent nose block and poor quality of life.

Keywords Endoscopic septoplasty, Below the age of 17

Background

Early in the twentieth century, it was asserted that children should not undergo septoplasty. This claim was based on animal experimental studies and sporadic case reports performing destructive and aggressive septoplasty [1, 2]. Early treatment of deviated nasal septum has a lot of controversy among rhinologists. Some surgeons are concerned that early surgical intervention before the age of 17 can adversely affect the average growth of the nose and face. In addition, failure to correct a septal deformity might worsen the condition and increase the risk of sinusitis or facial asymmetry [3].

In contrast, there is growing evidence of significant dental, palatal, and facial abnormalities following traumatic damage to the septal cartilage. Therefore, surgical correction of the deviated nasal septum may be performed regardless of the patient's age if such a

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deformity causes severe nasal block and oral breathing [4, 5]. Although this controversy never ends, severe septal deviation is believed to result in nasal obstruction, leading to mouth breathing [6]. The prolonged mouth opening keeps the upper lip everted and the tongue lower, decreasing maxillofacial muscle tone and, subsequently, maxillary hypoplasia, micrognathia, retrognathia, and protrusion of upper incisors. This ends in malgrowth of the midfacial region [7].

The recommendation of early surgery is based on the explanation that the earlier the correction of septal deviation, the better the outcome of achieving normal breath and acceptable facial growth [8, 9]. The endoscope has become the treatment modality for correcting nasal septal deviation since it was first described by Lanza et al. [10]. Otorhinolaryngologists worldwide have shown steady popularity of the consensus in favor of endoscopic septoplasty compared to the traditional classic septoplasty [11]**.** Endoscopic septoplasty enables the surgeon to target the deviated part of the septum or spurs and remove them under direct visualization by performing an incision precisely over the spur, thus minimizing surgical trauma [12].

This study aimed to evaluate nasal and facial bony growth after endoscopic.

Methods

This retrospective study was conducted after approval of the medical ethical committee of Benha Faculty of Medicine, Benha University, Egypt. This study was conducted on 39 patients who met the inclusion criteria and underwent endoscopic septoplasty between 2017 and 2023. All patients had symptomatic deviated nasal septum, refractory to conservative medical treatment, with a history of nasal obstruction, facial pain, or headache. The age of the involved patients at the time of surgery ranged between 12 and 15.8 years old.

The exclusion criteria encompassed patients with other nasal-sinus pathology, craniofacial anomalies, or genetic syndromes affecting facial growth. Furthermore, patients who did not complete the follow-up, those with previous nasal surgery, and those beyond the target age group were excluded.

All surgeries were performed in NMC Royal Hospital, Abu Dhabi, United Arab Emirates. The study relied on data extracted from the patient files and reports. Preoperatively, patients underwent a comprehensive ENT examination and routine nasal endoscopic examination to determine the severity and location of the deviated septum and whether it was cartilaginous or bony. Additionally, CT imaging of the nose and paranasal sinus was carried out to confirm the diagnosis and to exclude any associated hidden paranasal sinus pathology.

Written consent was obtained from each patient's sponsor preoperatively. For all cases, correction of nasal septal deviation was done via an endoscopic approach.

All patients had regular follow-up visits weekly for the first month postoperatively and twice for the next month, then twice annually until they completed the age of 17.

Two months postoperatively, all patients were evaluated subjectively using the visual analog scale (VAS). Each patient was asked to give a score out of 10 (0 is the worst and 10 is best) for nasal block, facial pain, and headache. The data were recorded and analyzed for each symptom before and after surgery. Objectively in the same visit, patients were assessed by endoscopic nose examination for adhesion, deviation recurrence, or septal perforation. After this period, each patient had a follow-up visit every 6 months.

For each patient, when reaching the age of 17 years, a lateral cephalometry was done for radiological evaluation of the facial bony growth. The cephalogram of each patient was studied and analyzed by a radiologist, who selected five standard anatomical bony landmarks. These five points are illustrated in Fig. 1. Point (S) is the midpoint of the sella floor, point (N) is the nasion, point (ANS) is the anterior nasal spine, point (PNS) is the posterior nasal spine, and point (A) is the most concave point of the maxilla. For assessment of the facial bony growth, five linear measurements between these radiological points in millimeters were obtained from each

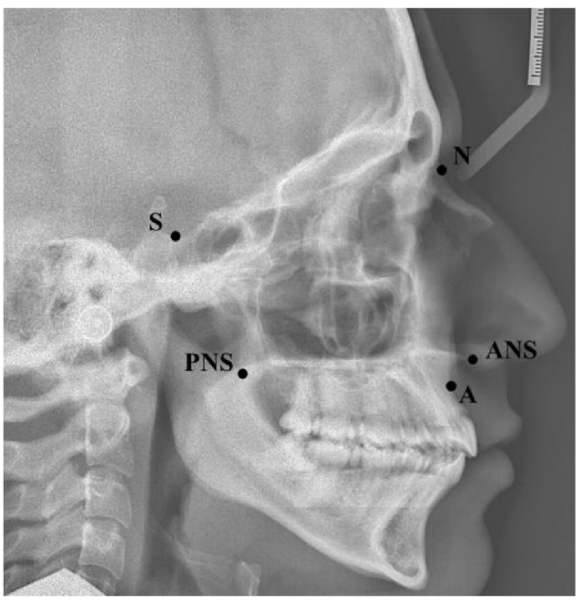

Fig. 1 Cephalometric standard anatomical bony landmarks. S is the midpoint of the sella floor, N is the nasion, ANS is the anterior nasal spine, PNS is the posterior nasal spin, and point A is the most concave point of the maxilla

cephalogram (Fig. 2) as follows: (1) anterior skull base, linear measurement between (S) and (N); (2) mid-face protrusion, linear measurement between (S) and (ANS); (3) palatal length, linear measurement between (ANS) and (PNS); (4) mid-face length, linear measurement between (N) and (ANS); and (5) anterior facial height, linear measurement between (N) and (A).

Twenty cephalograms were obtained from routinely imaged cases before starting orthodontic treatment at the orthodontic clinic. The selected images were of patients above 18 years old with no history of nasal surgery or other craniofacial anomalies. The same five linear measurements used in the study patients were recorded and used as a control group. The collected data of operated patients were compared to that of the control group to evaluate the facial bony growth objectively.

Statistical methods

The whole collected clinical data were obtained and saved. Data analysis was done using SPSS version 28 (IBM, Armonk, New York, USA). The normality of quantitative data was assessed using the Shapiro–Wilk test and data visualization methods. Means with standard deviations or medians with ranges were used to summarize quantitative data. Categorical data were expressed as numbers and percentages. The visual analog scale was compared before and after the procedure using Wilcoxon's signed ranks test. Growth parameters were compared between the patients and controls using the independent *t* test. All statistical tests were two-sided. *P* values less than 0.05 were considered significant.

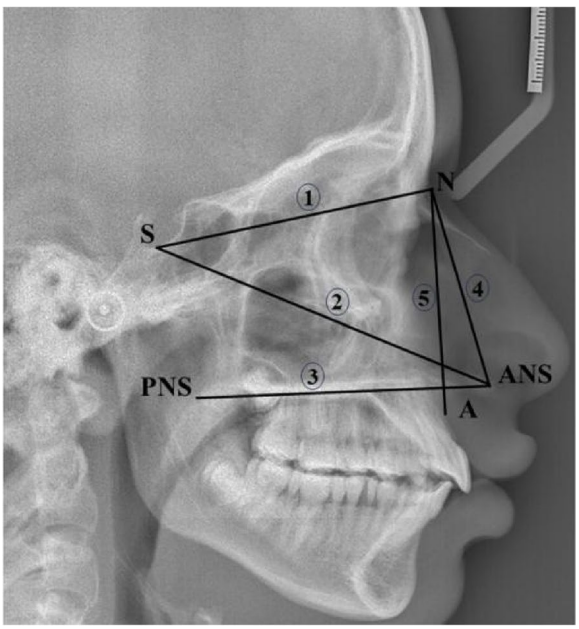

Fig. 2 Cephalometric lines for assessment of facial bony growth. (1) Anterior skull base between (S) and (N). (2) Mid-face protrusion between (S) and (ANS). (3) Palatal length between (ANS) and (PNS). (4) Mid-face length between (N) and (ANS). (5) Anterior facial height between (N) and (A)

Results

Demographics

Thirty-nine patients underwent endoscopic septoplasty. The mean age of the studied patients was 14.2 ± 1.1. Approximately three-quarters (76.9%) were males, and one-quarter (23.1%) were females.

Clinical findings

As shown in Table 1, the median visual analog scale for nose block significantly declined after the procedure (median = 1) compared to before the procedure (median = 9) ($P < 0.001$). Additionally, the median visual analog scale for headache significantly declined after the procedure (median = 1) compared to before the procedure (median = 6) ($P < 0.001$) (Fig. 3).

Growth parameters

For evaluation of facial bony growth, the statistical analysis of data obtained from cephalograms of both groups was carried out. Radiological linear measurements included (1) anterior skull base, (2) mid-face protrusion, (3) palatal length, (4) mid-face length, and (5) Anterior facial height.

Analyzed data showed that no significant differences were observed between patients and controls regarding the following parameters: palatal length PNS-ANS ($P = 0.226$), anterior skull base S–N ($P = 0.378$), mid-face protrusion S-ANS ($P = 0.527$), and mid-face length N-ANS ($P = 0.246$). Only anterior facial height N-B revealed a statistically significant difference between both groups ($P = 0.02$). However, this statistical difference seemed to be of no clinical importance as no patient complained of abnormal facial features (Table 2, Fig. 4). The clinical and radiological outcomes confirm

Table 1 VAS for nose block and headache before and after the procedure

	Median (range)	*P* value
Nose block		
Before	9 (7–10)	**< 0.001***
After	1 (0–3)	
Headache		
Before	6 (0–10)	**< 0.001***
After	1 (0–5)	

* Significant *P* value

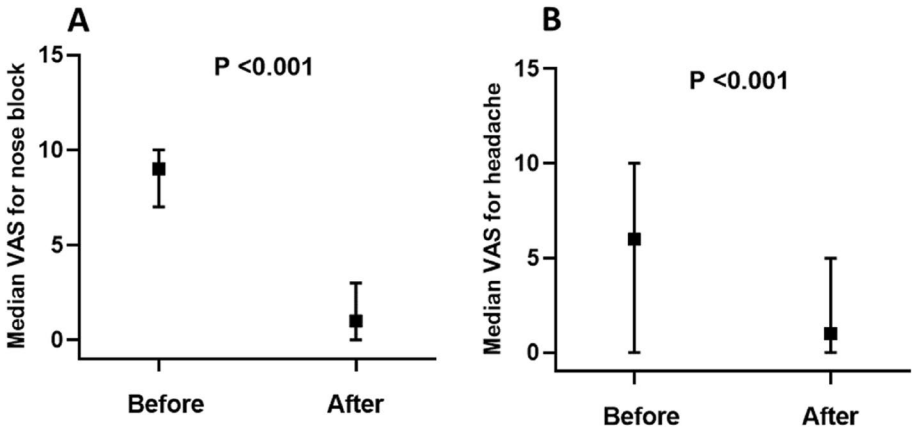

Fig. 3 Visual analog scale for **a** nose block and **b** headache before and after the procedure

Table 2 Growth parameters in patients and control groups

	Patients ($n=39$)	Controls ($n=20$)	*P* value
Palatal length PNS-ANS (mm)	62.5 ± 2.5	63.4 ± 2.2	0.226
Anterior skull base S–N (mm)	64.1 ± 2.8	63.5 ± 2.1	0.378
Mid-face protrusion S-ANS (mm)	80.4 ± 3	80.9 ± 2.5	0.527
Mid-face length N-ANS (mm)	46.9 ± 1.2	47.3 ± 1.1	0.236
Anterior facial height N-A (mm)	53.5 ± 1.6	54.6 ± 1.7	**0.02***

* Significant *P* value; *PNS* posterior nasal spine, *ANS* anterior nasal spine, *S* sella turcica, *N* nasion

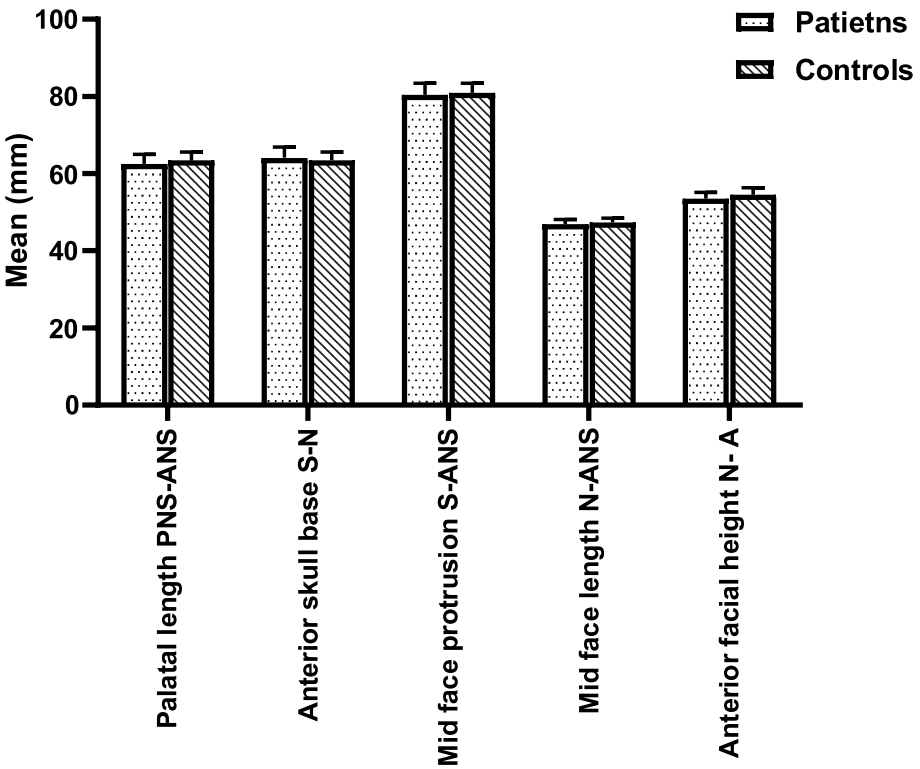

Fig. 4 Growth parameters in patients and control groups

that endoscopic septoplasty if indicated below the age of 17 years does not compromise the nasal or facial growth.

Discussion

The cartilaginous-deviated septum should only be corrected in pediatric age without compromising facial growth. This can be achieved by unilaterally elevating the mucosal flap while preserving the nasal floor mucosa, which should not be elevated to avoid incisive nerve injury. The corrections should be targeted to the deviated part with limited excisions. Separation of the dorsal cartilaginous septum from the perpendicular plate should be sidestepped due to the significance of this area for the full growth of the nasal septum [4].

Most surgeons agree that two main growing areas should not be injured during septoplasty surgery; sphenodorsal and sphenospinal areas [13]. Hence, in this study, endoscopic septoplasty was used to minimize trauma to these critical areas, which are essential for nasal and facial growth.

In agreement with our study, Kahveci et al. [14] stated that VAS is a highly effective method to evaluate the outcomes of septoplasty in improving nose obstruction symptoms. Postoperative CT PNS was used as an additional objective tool for their study, which was not included in our research. They found a strong correlation between the VAS score and the postoperative CT results.

Can et al. [15] concluded that pediatric septoplasty is a successful surgery. They agreed that the surgical procedure should be conservative and limited to the pathological deviated part of the nasal septum. However, they did not use the endoscope in their surgeries. They believed that proper evaluation of the outcome after pediatric septoplasty should include acoustic rhinometry as an objective way for surgical success.

Calvo-Henríquez et al. [13] stated that septoplasty may be indicated, regardless of the patient's age, for those suffering from persistent nose block and mouth breathing caused by marked septal deviation. They recommended early septoplasty in children rather than waiting until adolescence because during this period, the rapid development phase happens, and the deviated nasal septum may exert traction on normal adjacent cartilages, resulting in worsening nasal morphology and inappropriate facial growth. Additionally, the authors emphasized that no internationally standardized method for measuring facial growth exists. Variable methods were used for facial growth measurements in different studies.

Van der Heijden et al. [16] concluded that the nose reaches 98% of its complete growth at 15.8 years for girls and 16.9 years for boys. The included patients in our study were selected accordingly, and the final evaluation was carried out when the patient was 17 years old.

They believed that the nasal growth could be evaluated using five measures: (1) nasal bridge length from nasion to pronasal, (2) nasal protrusion from subnasal to pronasal, (3) nasal height from nasion to subnasal, (4) palatal length from the anterior nasal spine (ANS) to posterior nasal spine (PNS), and (5) midfacial protrusion from Sella (S) to anterior nasal spine (ANS).

Similarly, in this study, we employed five linear measurements. Two were similar to those used by Van der Heijden et al.; palatal length and mid-face protrusion. However, three were different; mid-face length from the nasion (N) to the anterior nasal spine (ANS), anterior skull base length from (S) to (N), and anterior facial height from nasion (N) to point (A).

A study by Costa et al. [17] included 27 patients who underwent Metzenbaum septoplasty. Their ages were less than or equal to 14 years at the time of surgery and at least 16 years at the time of the clinical and radiological assessment. Two patients underwent adenoidectomy, and three underwent adenotonsillectomy and inferior turbinates submucosal cauterization before the septoplasty surgery.

The clinical outcome of their study was evaluated subjectively by asking the patients about their satisfaction with nasal patency and shape. Out of the 27 cases, 16 underwent objective assessment by postoperative cephalometry. They used four measurements. Three of which were the same as linear measurements used in the current study; palatal length and midface length and protrusion. In addition, they included angular measurement for measuring midface protrusion, which is the angle between the sella, nasion, and the most concave point of the maxilla. Furthermore, they used anthropometric measurements of the face, which we did not implement in our study.

Cephalometric results in the current study were similar to their results. Most cases showed cephalometric measurements within the normal range. Concerning palatal length, 13 out of 16 measures (81.25%) were normal, and eight out of 16 (50%) were optimal. Regarding cephalometric linear and angular facial protrusion and length of the middle 1/3 of the face, 14 out of 16 (87.5%) were normal, and 9 out of 16 (56.25%) and 7 out of 16 (43.75%) of facial protrusion and length of the middle third, respectively, were optimal.

They concluded that pediatric septoplasty of caudal septal deviations by the Metzembaum approach is safe and does not impact normal facial growth as long as the vital growth areas are preserved [17].

A retrospective study was conducted on 28 pediatric septoplasty patients. Septoplasty only or septorhinoplasty was performed either via open or closed approach depending on the severity of the deviation and the

associated nasal deformity. Auxiliary procedures, such as columellar strut, spreader graft placement, or inferior turbinate reduction, were performed as indicated. The postoperative 1-month outcome was based on a subjective evaluation only. They used sinus and nasal-specific quality of life surveys (SN-5) and visual analog scales (VAS).

In agreement with our results, they found a significant postoperative improvement in the overall score. However, this improvement was more remarkable in females than males, which was not observed in our study. They stated several limitations, including the retrospective design, the lack of a control group, the subjective assessment after septoplasty, which is not an accurate tool for this age group, and the lack of a standardized surgical approach or procedure across all patients [18].

Another retrospective study by Tasca et al. [7] was conducted on 44 Italian patients who had undergone surgery during their childhood by endonasal septoplasty. Anthropometric data analysis was used to detect facial or nasal growth retardation compared to the normative data of North American white subjects. There were no significant differences for all anthropometric measures compared to controls, except for the nasolabial angle; a significant difference between males and females was observed. There was a significant reduction in the nasolabial angle in females compared to controls ($P=0.04$), while this reduction in males was non-significant ($P=0.08$). The authors suggested that the surgical approach and technique might have influenced these measurements because they found that patients operated by extracorporeal septoplasty demonstrated a significant reduction in the nasolabial angle compared to those operated by conservative septoplasty. They concluded that endonasal septoplasty in children does not affect normal nasal or facial growth.

Martins et al. [19] conducted a longitudinal cohort study on 40 children who underwent endoscopic septoplasty, using the same operative technique in our research. They performed additional procedures, including submucosal inferior turbinate cauterization in 97.5% of the patients, adenotonsillectomy in 50%, and adenoidectomy in 42.5%. All patients were evaluated 10, 30, and 60 days postoperatively for nasal synechia, deviation recurrence, septal perforation, or infection. After this period, annual follow-up was done with a maximum of 7 years. The outcome of their study was not based on any objective tool; they only relied on clinical observation for any nasal or facial deformity. However, they concluded that early correction of nasal septal deviation is crucial to promote harmonious and appropriate craniofacial growth without nasal or facial deformities.

Numerous studies have described endoscopic septoplasty as a superior approach for deviated septum correction compared to conventional septoplasty [20–23]. Endoscopy provides the surgeon with a brilliant magnified view, allowing for precise localization, identification, and correction of the pathological deviation under direct visualization, which helps minimize the possible iatrogenic trauma. Endoscopic septoplasty significantly reduces the postoperative morbidity period due to the limited extent of flap dissection. Despite these advantages, there is a lack of studies emphasizing the use of endoscopic septoplasty in children. However, all patients in our study were operated on by endoscopic approach [20].

Conclusion

Endoscopic septoplasty is a meticulous conservative procedure targeting the pathological deviated part of the nasal septum and respecting the critical areas for facial growth. Based on our findings, we firmly believe that early endoscopic septoplasty, performed before age 17, is a safe and effective procedure that does not compromise the nasal or facial growth when indicated for patients experiencing severe persistent nasal blockage and poor quality of life. We recommend further prospective studies with a larger number of younger children undergoing septoplasty compared to non-operated controls to further validate and strengthen our findings.

Abbreviations

VAS	Visual analog scale
FESS	Functional Endoscopic Sinus Surgery
ENT	Ear, Nose, and Throat
CT	Computed tomography
S	Sella floor midpoint
N	Nasion
ANS	Anterior nasal spine
PNS	Posterior nasal spine
A	The most concave point of the maxilla
SN-5	Sinus and nasal-specific quality of life survey

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Authors' contributions

TA prepared and drafted the manuscript. SB reviewed and edited the material and the language of the research. AI performed the surgeries. DE interpreted the radiologic data of the research. AA prepared and drafted the statistical analysis of the research.

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Availability of data and materials

All clinical data and materials supporting this study are available upon request.

Declarations

Ethics approval and consent to participate

This retrospective study was conducted after approval of the medical ethical committee of Benha Faculty of Medicine, Benha University (REC-FOMBU), with

approval number (RC-19-7-2023) in compliance with the Helsinki Declaration of 1975 and its amendments.
Written informed consent was obtained from each patient's sponsor preoperatively for correction of nasal septal deviation.

Consent for publication
Written consent was obtained from each patient's sponsor for publication.

Competing interests
The authors declare that they have no competing interests.

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