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Impact of Nasal Septum Deviation on Maxillomandibular Morphology and Nasal Volume: A Retrospective Computed Tomography Study

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Research Article

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ABSTRACT

Objectives: This study aimed to investigate the association between nasal septum deviation (NSD) and the development of maxillomandibular structures and nasal morphology.

Materials and Methods: Computed tomography (CT) scans of 337 patients (mean age: 34.9 ± 10.95 years) were analyzed to assess the realtionship between NSD, transverse maxillary/mandibulary dimensions, and nasal volume. Measurements included 4 maxillary and 1 mandibular landmarks: Anterior nasal spina-posterior nasal spina (ANS-PNS) length, maxillary width, maxillary height (distance from Mx-Mx line to orbital floors), maxillary depth (distance from the first molar cemento-enamel junction to nasal floor), mandibular width (the distance between the outermost points of mandibular left and right first permanent molar). NSD presence was classified using Mladina's system. Student's t-test compared measurements based on NSD presence, while ANOVA assessed differences among NSD types. Statistical significance was set at $p < 0.05$.

Results: Among participants, 44 (13.1%) had no nasal septal deviation (NSD). The prevalence of NSD types was as follows: Type I (21.1%), Type II (10.7%), Type III (16.6%), Type IV (7.4%), Type V (10.1%), Type VI (14.8%), and Type VII (6.2%). Comparison between patients with and without NSD showed no statistically significant differences in ANS-PNS distance, maxillary width, maxillary height, maxillary nasal base height, or mandibular molar width ($p > 0.05$). Males exhibited significantly larger craniofacial parameters and nasal volume than females. Maxillary width in patients aged 16 and older was significantly smaller than the value reported by Ricketts ($p < 0.05$). Nasal volume increased in the presence of NSD ($p = 0.01$).

Conclusions: While NSD is a common condition, its impact on maxillomandibular development remains uncertain. However, its presence is associated with an increase in nasal volume. Further research incorporating larger sample sizes, advanced volumetric analyses, and functional assessments is essential to comprehensively evaluate the relationship between NSD and maxillomandibular morphology.

Keywords: Nasal septum, maxilla, mandible, nasal obstruction, cone-beam computed tomography.

Nazal Septum Deviasyonunun Maksillomandibüler Morfoloji ve Nazal Hacim Üzerine Etkisi: Retrospektif Bilgisayarlı Tomografi Çalışması

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ÖZET

Amaç: Bu çalışmanın amacı, nazal septum deviasyonu (NSD) ile maksillomandibular ve nazal gelişim arasındaki ilişkiyi araştırmaktır.

Gereç ve Yöntemler: Çalışmada, 337 hastanın (ortalama yaş: 34,9 ± 10,95 yıl) paranazal bilgisayarlı tomografi (BT) görüntüleri kullanılarak NSD ile maksiller/mandibular transvers parametreler ve nazal hacim arasındaki ilişki analiz edilmiştir. Ölçümler 4 maksiller ve 1 mandibular anatomik noktayı içermektedir: Anterior nazal spina-posterior nazal spina (ANS-PNS) uzunluğu, maksiller genişlik, maksiller yükseklik (Mx-Mx hattından orbitaların tabanına olan mesafe), maksiller derinlik (birinci molar bölgesindeki sement-mine birleşiminden nazal tabana olan mesafe) ve mandibular genişlik (sol ve sağ mandibular birinci moların en dış noktaları arasındaki mesafe). NSD varlığına göre ölçümleri karşılaştırmak için Student's t-testi uygulanmıştır. Farklı NSD tiplerine bağlı parametre farklılıkları ANOVA testi ile değerlendirilmiştir. İstatistiksel anlamlılık seviyesi olarak $p < 0,05$ kabul edilmiştir.

Bulgular: Toplam 44 hastada (%13,1) NSD saptanmamıştır. Mladina sınıflamasına göre NSD tiplerinin dağılımı şu şekilde bulunmuştur: Tip I (%21,1), Tip II (%10,7), Tip III (%16,6), Tip IV (%7,4), Tip V (%10,1), Tip VI (%14,8) ve Tip VII (%6,2). NSD bulunan ve bulunmayan hastalar karşılaştırıldığında, ANS-PNS mesafesi, maksiller genişlik, maksiller yükseklik, maksiller nazal taban yüksekliği ve mandibular molar genişlik açısından istatistiksel olarak anlamlı bir fark saptanmamıştır ($p > 0,05$). Erkek hastalarda, kadınlara kıyasla kraniyofasiyal parametreler ve toplam nazal hacim anlamlı derecede daha büyük bulunmuştur. 16 yaş ve üzeri hastalarda maksiller genişlik, Ricketts tarafından bildirilen değerlerden daha küçük bulunmuştur. NSD varlığında nazal hacimde artış gözlenmiştir ($p = 0.01$)

Sonuçlar: NSD yaygın bir durum olmakla birlikte, kraniyofasiyal gelişim üzerindeki etkisi belirsizliğini korumaktadır. NSD, maksiller ve mandibular temel boyutları anlamlı şekilde değiştirmemekle birlikte, nazal hacimde artışla ilişkilidir. NSD ve maksillomandibular morfoloji arasındaki ilişkiyi kapsamlı bir şekilde değerlendirebilmek için daha geniş örneklem grupları, ileri hacim analizleri ve fonksiyonel değerlendirmeler içeren ek çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Nazal septum, maksilla, mandibula, nazal tıkanıklık, konik ışınlı bilgisayarlı tomografi.

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Introduction

The nasal septum serves as the partition that splits the nasal cavity into two halves, playing a crucial role in both the nose structural integrity and the regulation of airflow. Any deviation in this structure, whether due to bone or cartilage, is known as a nasal septal deviation (NSD)[1] and present in more than half of the population.[2–4] NSD can be present at birth or develop later due to various factors. Notably, trauma during birth is often cited as a primary cause, and injuries sustained during childhood, particularly from contact sports, significantly increase the risk of developing NSD.

According to the functional matrix theory, obstruction of the nasal and ororespiratory airways can influence the growth direction of the facial skeleton.[5,6] A deviated nasal septum along with upper airway obstruction such as nasal-sinus pathologies or hypertrophy of Waldeyer's lymphatic ring, often leads to mouth breathing. This alters the balance of forces exerted by the lips, cheeks, and tongue, potentially resulting in morphological changes and growth modifications in the craniofacial complex.[5,7] Consequently, NSD obstructing normal airflow, might impact maxillary volume and relatively mandibular position and dimensions.

Research findings highlight a compelling link between NSD existence/narrower maxillary intermolar width[8] and posterior NSD/deep palate.[9] However, conflicting reports challenge this notion, indicating no significant relationship between NSD and transverse maxillary deficiencies.[10]

There are lots of classification of NSD which defines the obstruction severity and the septal morphology. The Mladina classification is one of validated methods that categorizes deformities into seven types based on their anatomical characteristics.[11] This classification is widely used in ear, nose, throat (ENT) and rhinology to assess nasal obstruction and guide surgical interventions. Despite the presence of various NSD types, their influence on craniofacial dimensions appeared to be limited. The null hypothesis posits that (H_0) NSD has no association with changes in maxillomandibular dimensions and NSD does not affect nasal volume. This study aimed to evaluate the distribution of different types of NSD and their potential impact on nasal volume and maxillary and mandibular development parameters.

Materials and Methods

This retrospective study was conducted in accordance with the Ethics Committee of the Biruni University (Istanbul, Turkey, Number: 2020/43-26). Given that this investigation was a retrospective analysis of radiographic records, formal informed consent was neither sought nor required in accordance with applicable ethical and institutional guidelines. Based on the identified NSD types, the optimal sample size to best represent the population at 85% power and a 0.05 significance level was calculated as 118. From a total of 1200 paranasal CT scans provided by Biruni University Hospital, 337 met the selection criteria, comprising 168 (49.9%) female and 169 (50.1%) male subjects. All images were captured using a Siemens SOMATOM Scope VC30 model CT scanner (Siemens Healthineers, Erlangen, Germany) with an exposure of 130 kV and 70 mAs. The minimum field of view was set at 140 mm in diameter and 100 mm in height, providing a sufficiently large window to visualize all anatomical structures required for measurement. The inclusion criteria consisted of CT scans from individuals over 16 years old, with no distortion or good condition, ensuring clear visualization of the nasal septum and maxillomandibular landmarks. Patients with a history of functional endoscopic sinus surgery were not excluded. Scans were excluded if they showed pathologies affecting the walls of the maxillary sinuses. Patients with missing teeth, fixed prostheses, a history of facial or cranial trauma, nasal bone fractures, prior septal surgery (septoplasty), or congenital craniofacial deformities were excluded.

After the scan, reconstructions were performed, generating two slices of 1.5 mm thickness in axial and coronal planes. The initial and final reconstructions of the CT images were carried out using the NNT viewer software version 17.2 (NewTom, Imola, Italy). The device's radiation settings were automatically adjusted, and all data were recorded using the MicroDicom (MicroDicom Ltd.,Sofia, Bulgaria) software. To assess the reproducibility and reliability of the measured variables, both intra-examiner and inter-examiner calibration were conducted. An intraclass correlation coefficient (ICC) was used to compare the examiners' measurements against reference standards, ensuring a strength of agreement exceeding 0.75. Also, method error was assessed using the Dahlberg formula.[12] All measurements were performed by two experienced and calibrated professionals (E.K. and Y.S), with any discrepancies resolved by an ENT specialist (Y.S).

NSD types were classified using sagittal and frontal sections according to Mladina et al.'s classification, which categorizes septal deviations into seven types: four involving vertical deformities, two characterized by horizontal deformities, and one presenting atypical deformities, as follows:

Type I is characterized by a vertical ridge that does not extend to the nasal dorsum. In contrast, Type II involves a vertical ridge that reaches the nasal dorsum. Type III features a vertical ridge located in a deeper region, whereas Type IV affects both the anterior and deeper portions of the vertical ridge. Type V presents as a horizontal deformity on one side of the nose, with the opposite side remaining flat. Type VI is marked by bilateral septal involvement, where one side is dislocated while the other is deviated. Lastly, Type VII represents a combination of two or more of these deviation types.[11]

Anterior nasal spine-posterior nasal spine (ANS-PNS) length, maxillary width (Mx-Mx), maxillary height (the distance between the Mx-Mx line and a line connecting the orbital floors) maxillary depth (the distance between the cemento-enamel junction line of the first molar region and the nasal floor on both sides), mandibular molar width (the distance between the outermost points of mandibular left and right first permanent molar) were measured (Figure 1).

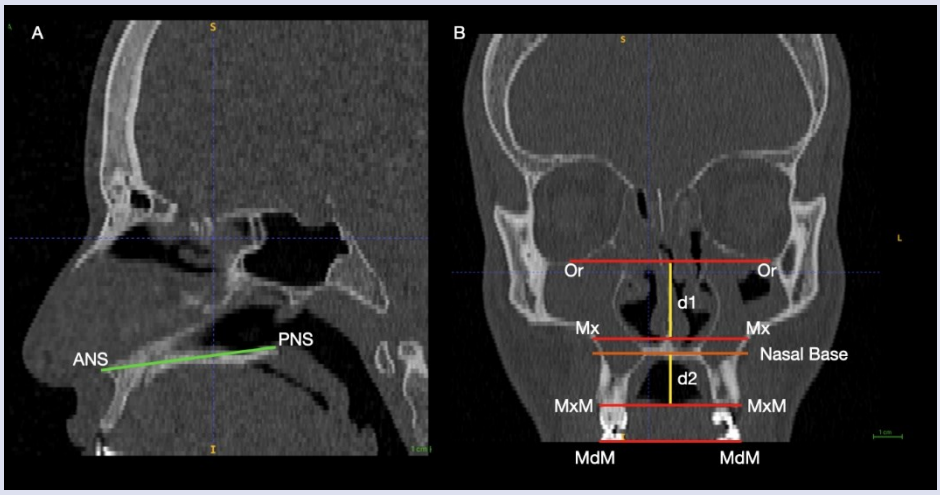

Figure 1. ***A.*** *ANS-PNS length (green line).* ***B.*** *Maxillary Width (Mx-Mx), Maxillary Height (d1) (The distance between the Mx-Mx line and a line connecting the orbital floors), Maxillary Depth (d2) (The distance between the cemento-enamel junction line of the first molar region and the nasal floor on both sides), Mandibular molar width (MdM-MdM) were measured.*

The volume of the nasal cavity was calculated by a radiology specialist (Z.O.) using specific predetermined landmarks to delineate the nasal cavity, while excluding the paranasal sinuses. The images were transferred to ITK-SNAP, a three-dimensional volumetric analysis software (Penn Image Computing and Science Laboratory (PICSL), University of Pennsylvania and the Scientific Computing and Imaging Institute (SCI), University of Utah). The analysis was performed using sagittal, coronal, and axial sections of the images. In this method, the midsagittal section was divided into 24 sections, each 0.4 mm thick. A manual segmentation tool was employed to mark the boundaries of the nasal cavity within these sections, from the anterior to the posterior portion of the sagittal section. The anterior border was the line connecting point nasion (N) to the ANS. The posterior limit was marked by a line connecting the inferior border of the sphenoid sinus (IBS) to the PNS. The inferior limit extended from the ANS to the PNS, while the superior limit was manually marked with a line that extended anteriorly to point N and posteriorly to the IBS, ensuring the exclusion of the paranasal sinuses, namely the sphenoid, ethmoid, and maxillary sinus. The cavity volume was measured in mm^3 by the program (Fig. 2). Some measurements could not be obtained due to image artifacts and were therefore excluded from the descriptive statistical analysis, in accordance with standard procedure.

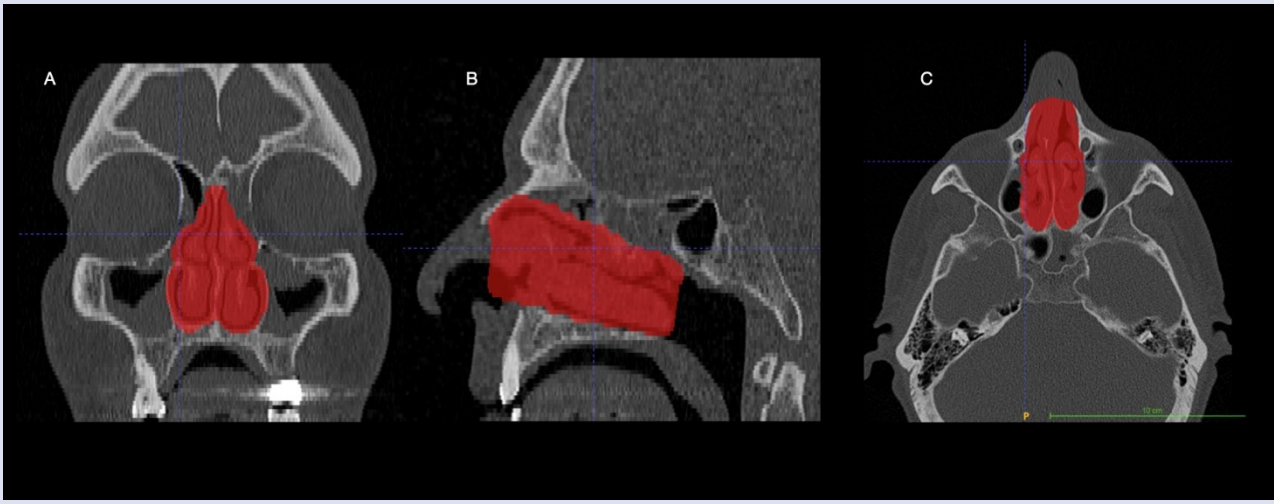

Figure 2. Boundaries of the nasal cavity.

Statistical analyses were conducted using IBM SPSS 25.0 (IBM Corp., Armonk, New York, USA). Levene's test confirmed homogeneity of all parameters, allowing the use of parametric tests. Student's t-test was applied to compare measurements based on NSD presence. The differences of the parameters depending on different NSD

types were evaluated with the ANOVA test. A significance level of $p < 0.05$ was adopted. To assess method error, repeated measurements were performed on 20 randomly selected patients one month apart and analyzed using paired t-test and Dahlberg formula confirming the repeatability of all measurements without significant error.

Results

86% of the population was shown to have NSD. In 44 patients (13.1%), no NSD was detected. According to the classification by Mladina et al.'s, the distribution of NSD types among the patients was as follows: Type I in 71 patients (21.1%), Type II in 36 patients (10.7%), Type III in 56 patients (16.6%), Type IV in 25 patients (7.4%), Type V in 34 patients (10.1%), Type VI in 50 patients (14.8%), and Type VII in 21 patients (6.2%). In female, type 1 was the most common and type 7 the least common NSD, while in male, type 1 was the most common and type 4 the least common. The rate of not having NSD was almost equal in women and men (Table 1).

Table 1. The distribution of the NSD types

The Type of Nasal Septum Deviation	Gender	n	Total	%	Total %
No	Female	21	44	6.23	13.1
	Male	23		6.87	
Type 1	Female	36	71	10.42	21.1
	Male	35		10.68	
Type 2	Female	21	36	6.25	10.7
	Male	15		4.45	
Type 3	Female	31	56	7.41	16.6
	Male	25		9.19	
Type 4	Female	14	25	4.15	7.41
	Male	11		3.26	
Type 5	Female	19	34	5.63	10.08
	Male	15		4.45	
Type 6	Female	22	50	6.52	14.83
	Male	28		8.31	
Type 7	Female	4	21	1.18	6.23
	Male	17		5.05	
Total			337	100	

The findings showed that ANS-PNS distance, maxillary width, maxillary height, maxillary nasal base height, and mandibular width did not significantly vary across NSD types ($p > 0.05$).

When two groups were compared according to the presence or absence of NSD, no statistically significant difference was found in ANS-PNS distance ($p = 0.14$), maxillary width ($p = 0.67$), maxillary height ($p = 0.95$), maxillary nasal base height ($p = 0.43$), or mandibular width (MdM-MdM) ($p = 0.48$). Although nasal volume did not show statistically significant difference between NSD type, the presence of NSD increased nasal volume ($p = 0.01$) (Table 3). When compared according to the sex, all measured parameters were found significantly larger in males than in females (Table 4).

Method error was assessed using the Dahlberg formula. The measurement error values were 0.096 mm for nasal volume, 0.73 mm for ANS–PNS, 0.167 mm for maxillary width, 0.204 mm for maxillary height, 0.107 mm for maxillary nasal floor, and 0.139 mm for mandibular width, indicating good to excellent reliability for most variables and moderate reliability for ANS–PNS.

Table 2. Comparison of differences in measured parameters according to nasal septum types

	Nasal Septum	N	Mean	Sd. Deviation	F	p
ANS-PNS (mm)	No	44	46.06	4.08	0.631	0.73
	Type 1	68	46.14	7.02		
	Type 2	36	47.14	4.23		
	Type 3	54	46.74	4.71		
	Type 4	25	47.64	3.68		
	Type 5	34	46.83	4.60		
	Type 6	50	46.53	3.69		
	Type 7	21	47.92	3.57		
Maxillary width (mm)	No	41	62.37	6.72	0.763	0.619
	Type 1	65	62.15	9.08		
	Type 2	33	64.59	3.90		
	Type 3	51	61.87	9.88		
	Type 4	25	62.92	3.77		
	Type 5	33	62.41	4.27		
	Type 6	48	62.79	4.7		
	Type 7	20	64.69	3.81		
Maxillary height (mm)	No	41	26.61	5.22	0.521	0.819
	Type 1	64	25.86	6.27		

	Type 2	31	26.59	3.81		
	Type 3	51	26.47	5.09		
	Type 4	24	25.83	2.78		
	Type 5	32	26.15	3.31		
	Type 6	48	27.42	3.55		
	Type 7	19	26.44	3.92		
Maxillary depth (mm)	No	40	12.93	2.61	1.002	0.430
	Type 1	64	12.97	2.73		
	Type 2	32	13.64	2.94		
	Type 3	51	12.87	2.94		
	Type 4	25	13.24	2.43		
	Type 5	32	13.01	2.23		
	Type 6	48	13.16	2.45		
	Type 7	20	14.42	2.31		
Mandibular molar width (mm)	No	42	76.94	12.76	0.556	0.791
	Type 1	59	77.75	11.17		
	Type 2	32	76.48	14.54		
	Type 3	46	76.9	12.32		
	Type 4	24	78.58	4.25		
	Type 5	32	79.27	4.53		
	Type 6	44	79.52	5.02		
	Type 7	18	79.85	2.14		
Total Nasal Volume (mm^3)	No	46	5.41	0.93	1.05	0.390
	Type 1	69	5.73	0.84		
	Type 2	36	5.77	0.97		
	Type 3	55	5.72	1.01		
	Type 4	25	5.75	1.02		
	Type 5	34	5.76	1.02		
	Type 6	48	5.69	0.9		
	Type 7	21	6.05	1.07		

ANOVA test $p < 0.05$

Table 3. Comparison of differences in measured parameters depending on the presence or absence of deviation

Parameters	Deviation	N	Mean	SD	t	p
ANS-PNS (mm)	Yes	288	45.76	4.97	-1.46	0.14
	No	44	46.89	4.12		
Maxillary width (mm)	Yes	275	62.79	7.009	-0.41	0.67
	No	41	62.31	6.49		
Maxillary height (mm)	Yes	269	26.43	4.64	0.06	0.95
	No	41	26.47	5.03		
The distance between the base of the nose and the maxilla (mm)	Yes	272	13.21	2.68	-0.77	0.43
	No	40	12.87	2.38		
Mandibulary width (mm)	Yes	255	78.14	9.64	-0.69	0.48
	No	42	77.002	12.46		
Nasal Volume (mm^3)	Yes	292	5.734	0.95	-2.23	0.01
	No	44	5.41	0.94		

Student t test $p < 0.05$

Table 4. Student's t-test results on the differences in measurements by gender

Parameters	Gender	N	Mean	SD	t	p
ANS-PNS (mm)	Female	167	45.64	5.71	4.173	<0.001
	Male	165	47.81	3.49		
Maxillary width (mm)	Female	163	61.74	8.75	2.472	0.014
	Male	153	63.65	4.03		
Maxillary hight (mm)	Female	159	25.88	4.99	2.021	0.044
	Male	151	26.95	4.30		
The distance between the base of the nose and the maxilla (mm	Female	160	12.56	2.89	4.054	<0.001
	Male	152	13.74	2.19		
Mandibulary width	Female	155	76.03	11.98	3.387	0.001
	Male	142	79.90	7.16		
Total Nasal volume (mm^3)	Female	168	5.147	0.63	-13.21	<0.001
	Male	169	6.227	0.89		

Student t test $p < 0.05$

Discussion

Three-dimensional images obtained through computed tomography (CT) are crucial for accurate diagnosis and reliable treatment planning.[13] Utilizing CT for diagnosing NSD and assessing its morphological parameter were demonstrated that these records are suitable for reproducibility and can be used to evaluate the severity of NSD.[14]

NSD can lead to nasal airway insufficiency and contribute to the development of mouth-breathing habits, similar to cases of adenoid vegetation.[5,6] Additionally, findings from several anthropometric studies suggest a relationship between NSD and facial development related malocclusions.[8,15] This manuscript emphasizes the type of NSD and its potential impacts on maxillomandibular development and nasal volume for the first time in the literature.

Although, nasal obstruction is one of the most common symptoms in patients with NSD[16], nasal obstruction is not stem from only NSD but also other anatomical and pathological conditions.[17] Although NSD is seen quite often, it is usually not severe enough to cause nasal obstruction. A study conducted in South Korea with 28912 adult participants found that the prevalence of NSD was 48.0%, while symptomatic NSD (cases presenting noticeable symptoms) accounted for 3.8%.[18] Mladina and other classification schemes were made just according to the shape of the nasal septum without clinical condition and the present study did not score nasal obstruction clinically.

The present findings indicated a high prevalence of NSD (86%), with Type I (21.1%) and Type VI (14.8%) being the most common forms, while Type IV (7.4%) and Type VII (6.2%) were the least frequent. In contrast, the referenced study[19] reported an even higher prevalence (92.7%), with Type 7 being the most frequent (34.2%), followed by Type 5 (26.2%) and Type 3 (23.6%). The highest obstruction score were observed in patients with Type 2 deviations. However, no significant correlation was found between obstruction scores and NSD type or angle.

In the present study, when compared the patients with and without NSD, non-significant changes in maxillomandibular complex is implying relatively the presence of NSD is not always a reason of airway obstruction and its influence on craniofacial dimensions appeared to be limited. This suggests that while NSD is a common anatomical variation, its presence alone may not have a major impact on maxillofacial development. These results contrast with some previous studies [8,16] that have suggested a relationship between septal deviation and alterations in maxillary growth. D'Ascanio et al.[8] reported that children with NSD exhibited increased lower and upper facial heights as well as larger gonial angles compared to nasal-breathing children of the same age. In their study using posteroanterior radiographs, Bektas et al.[20] compared transverse dentoskeletal measurements of 25 children diagnosed with NSD and 25 control individuals without NSD. In the NSD group, lateral orbital width, maxillary width, nasal width, and upper molar width were significantly lower than in the control group, while no significant difference was observed in mandibular width.[20] Despite differences in age groups, the present study aligns with the findings of Bektas et al., as no significant difference in mandibular width was observed between individuals with and without NSD. The findings of this study were consistent with a previous research[10], which reported no statistically significant differences in maxillary width between individuals with and without NSD. This reinforces the notion that NSD may not always directly contribute to altered breathing patterns, highlighting the need for further investigations with larger sample sizes, consideration of additional influencing factors, and the use of advanced diagnostic techniques.[21] The lack of significant differences in maxillomandibular dimension measurements in this study may be attributed to variations in NSD severity that cause obstruction, sample characteristics, or adaptive growth mechanisms in individuals with septal deviation. These differences highlight the variability in NSD distribution across populations and underscore the importance of considering both functional and structural implications in clinical assessments. In line with the present study, in previously mentioned studies [8,20], researchers have restricted their evaluation to NSD alone, overlooking nasal obstruction. Only a handful of studies have undertaken the more comprehensive approach of assessing both NSD and nasal obstruction simultaneously.[22,23]

One of this studies, higher grades of septal deviation that cause obstruction were found associated with increased facial asymmetry, reinforcing the role of nasal obstruction in craniofacial growth alterations.[22] In a five-year follow-up study,[23] examining the effects of transitioning from mouth breathing to nasal breathing after adenoidectomy, vertical facial dimensions were found to decrease, maxillary arch constriction was reduced, and the axial inclinations of maxillary and/or mandibular teeth improved. In a comparison of identical twins with varying septal deformities revealed that the cartilaginous nasal septum plays a key role in shaping nasal development and influencing the anteroposterior growth of the maxilla. Anterior septal deformities were found associated with underdeveloped cartilaginous noses and a reduced anteroposterior maxillary dimension. However, no significant correlation was observed with posterior septal deformities, suggesting they may be a natural part of midface development. In their study, they emphasized the importance of the link between nasal obstruction and reduced maxillary height.[24] Since obstruction was not clinically assessed in the present study, the findings can not be directly compared with those of the referenced investigations.

Contrary to the findings of the referenced study[14], which found a decrease in nasal cavity dimensions in NSD presence, the present results showed that the presence of NSD was associated with an increase in total nasal volume. This may be an adaptive mechanism, where the nasal airway expands to compensate for obstruction and maintain airflow efficiency. A study evaluating the relationship between NSD and nasal cavity area using

posteroanterior radiographs reported that nasal septum deviation was associated with a reduced nasal cavity and maxillary area.[25] However, the study was limited by its lack of three-dimensional assessment. Another study analyzing CT scans of NSD patients demonstrated that the deviated side exhibited significantly greater nasal bone length and thickness compared to the contralateral side, indicating localized bone remodeling linked to NSD—though these changes did not correlate with the deviation severity. NSD often leads to compensatory inferior turbinate hypertrophy—a clear adaptive or protective response.[26] Similarly, the present findings suggest that localized remodeling within the nasal cavity may have contributed to an increase in internal nasal volume.

When measurements were analyzed based on sex, all parameters were found to be significantly larger in males than in females. This aligns with existing literature on craniofacial growth, which consistently reports larger skeletal dimensions in males due to hormonal and genetic influences.[27] Another important observation was maxillary width in adults—regardless of sex—showed that the mean maxillary width in the study group (overall mean: 62.97 mm; 61.74 mm for women and 63.65 mm for men) was significantly narrower than the value reported by Ricketts (67.3 mm) ($p < 0.05$) (Table 2). In comparison with previously reported values for the Turkish population (63.81 ± 3.33 mm for women and 69.86 ± 4.30 mm for men), the present findings were also slightly narrower.[28] This discrepancy may be attributed to ethnic and genetic variations in craniofacial morphology, differences in sample size and age distribution, or methodological differences in measurement techniques. Additionally, environmental and functional factors such as nutrition, breathing patterns, and lifestyle could contribute to population-specific differences in maxillary width.

The present findings fail to reject the null hypothesis that NSD is unrelated to maxillomandibular measurements. However, the null hypothesis was rejected regarding nasal volume, as results showed a statistically significant increase in the NSD group.

A key limitation of this retrospective analysis is that current classification schemes fail to account for the various pathologies responsible for obstruction. To fully understand how obstruction—and other orthodontic or orthognathic abnormalities—influence the relationship between maxillomandibular dimensional changes and NSD, future studies can use the current gold-standard methods for assessing both obstruction and structural deviations. Also, evaluating conchas and internal airway volumes seperately is important. By evaluating NSD in a larger, clinically diverse population, researchers can dramatically enhance both the depth and validity of this field of study.

Conclusions

While NSD is a frequently observed condition, its role in craniofacial development remains inconclusive. The findings of this study suggest that, at least in this sample, NSD does not significantly alter key maxillary or mandibular parameters. Although, the presence of NSD increased nasal volume, NSD subtype has no effect on nasal airway volume. All measured parameters were found significantly larger in males than in females Further research with larger sample sizes, detailed volumetric analyses, and assessments of functional and clinical implications is necessary to fully understand the interplay between NSD and maxillomandibular morphology.

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Conflicts of Interest Statement

There are no financial/nonfinancial competing interests to declare.

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