

Prevalence of Nasal Septum Deviation Using Cone-Beam Computed Tomography: A Cross-Sectional Study

Abstract

Background and Aim: Nasal septum deviation (NSD) increases the chance of nasal obstruction, sinusitis, and upper airway and middle ear infections and can affect vocal cord activity, beauty, and breathing. The present study investigated the prevalence of NSD and its relation to gender, age, and history of trauma using cone-beam computed tomography (CBCT). **Subjects and Methods:** This cross-sectional study was performed on the data from CBCT examinations of 386 patients referred to two oral and maxillofacial radiology centers in Tehran, Iran, from January 2016 to January 2017. The presence of NSD and its type according to the Mladina's classification were evaluated. The effect of age, gender, and history of trauma on the prevalence of NSD was considered using a logistic regression. **Results:** 86.6% (confidence interval = 0.81, 0.91) of the patients showed NSD. The prevalence was 19.4% type 1, 6.2% type 2, 20.7% type 3, 5.4% type 4, 4.4% type 5, 0.3% type 6, and 30.3% with type 7. The logistic regression indicated that the chance of deviation of nasal septum increased with age and every 10-year increase in age increased the odds of septal deviation by 0.32 ($P < 0.001$ and odds ratio = 1.032). Gender ($P = 0.094$) and history of trauma ($P = 0.79$) had no effects on the chance of deviation of nasal septum. **Conclusion:** This study showed that the frequency of NSD was 86.6%, with type 7 being the most common type, followed by type 3 and 1. NSD showed no association with trauma and gender, and the increase in age increases the chance of NSD.

Keywords: Cone-beam computed tomography, Mladina's classification, Nasal septum deviation

Introduction

Nasal septum deviation (NSD) has revealed a wide range of prevalence. It may either be congenital or acquired and may involve cartilaginous or osseous part.^[1] NSD increases the chance of nasal obstruction and can affect vocal cord activity, appearance, and breathing.^[2,3] In addition, nasal obstruction and postnasal discharge are also associated with NSD. NSD can consequently change facial skeletal morphology and therefore puts a patient at the risk of mouth breathing. Nasal septum deformation may lead to headache due to inflammation of the paranasal sinuses and may cause difficulty in breathing or even anosmia.^[4,5]

According to previous researches, the prevalence of NSD is 0.93%–55% among different age groups of human beings. Further, different classifications were applied in these studies.^[4] A recent international study indicated that the

prevalence of NSD is approximately 90% in adults.^[6]

There are several methods in NSD classification. Mladina *et al.* introduced a classification including seven different types of NSD according to the horizontal and vertical characteristics of nasal septum.^[5-7]

Up to 50% of nasal deformities need rhinoplasty or septoplasty.^[8,9] The best management of NSD in rhinoplasty is based on an accurate preoperative diagnosis of the nasal deformity, both by clinical and radiographic examinations, such as rhinoscopy, endoscopy, multislice computed tomography (CT), and magnetic resonance imaging. CT scan is a standard imaging technique for precise view of the nasal cavity and paranasal sinuses.^[10-12]

Despite the fact that preoperative CT scan of the nasal cavity can be recommended in case of NSDs, CT has high radiation dose and cannot be used routinely due to its high cost.^[11] In the last decade, cone-beam CT (CBCT) has been widely

Mahkameh Moshfeghi, Bahareh Abedian¹, Mitra Ghazizadeh Ahsaie, Farzam Tajdini²

Department of Oral and Maxillofacial Radiology, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, ¹DDS, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, ²Department of Oral and Maxillofacial Radiology, School of Dentistry, North Khorasan University of Medical Sciences, Bojnurd, Iran

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Address for correspondence:

Dr. Mitra Ghazizadeh Ahsaie, DDS, MPH, Resident, Department of Oral and Maxillofacial Radiology, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran. E-mail: mitraghazizadeh@gmail.com

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used in the field of oral and maxillofacial radiology, due to its high image resolution, low radiation dose, and low costs. The median effective dose for CBCT varies between 50 μ Sv and maximum 120 μ Sv (depending on the field of view size), which is much lower than the effective dose from maxillofacial CT (650 μ Sv) or head CT (2 mSv).^[12] Although CBCT lacks the ability to demonstrate soft tissue, it is frequently used in the evaluation of sinus and nasal anatomy and pathology.^[13] CBCT is an accepted diagnostic tool for paranasal sinus assessment and is ordered widely by general dentists, oral and maxillofacial surgeons, and otolaryngologists.^[14,15]

According to previous studies, NSD prevalence is in close relation to genetics and environmental factors. According to Al-Rawi *et al.*, NSD is a wide spread and common problem among individuals from the Middle East.^[16] Due to different reports on the prevalence of NSD, the effect of genetics on it, and the absence of accurate national statistics in this field in Iran, the present study was conducted to investigate the prevalence of NSD, using the Mladina's classification, and its relation to gender, age, and history of trauma in an Iranian sample.

Subjects and Methods

Ethical approval

This cross-sectional study was approved in the Research Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.RIDS.REC.1395.226).

Sample size

The study was performed on the data extracted from CBCT examinations of 386 patients referred to two oral and maxillofacial radiology centers in Tehran, Iran (one located in the north and one located in the west), from January 2016 to January 2017.

Inclusion criteria

The CBCT scans containing nasal septum inside the field of view. Images were mostly taken for non-NSD purposes, such as implant placement, examination of maxillary arch, and dentition for tooth extraction or sinuses.

Exclusion criteria

Patients who had pathologic lesions, syndromes such as cleft palate, and previous history of nose surgery were excluded from this study.

CBCT scans were captured with Newtom VGi (Verona, Italy, maximum KVP of 100 and variable field of view) and Newtom Giano (Verona, Italy, maximum KVP of 90 and variable field of view). The evaluation of bony part of the nasal septum was performed by two calibrated oral and maxillofacial radiologists using NNT Software (Version No. 8, Verona, Italy). If there were doubts on the NSD classification, a third expert oral and maxillofacial

radiologist suggested the type. The evaluation was conducted through scrolling in continuous coronal sections of each CBCT from anterior nasal spine to posterior nasal spine, and NSD type was registered based on the most prominent view observed within coronal cuts.

The nasal septum was evaluated on the basis of CBCT scans, and the presence or absence of NSD and its type according to the Mladina's classification were evaluated [Figure 1].^[6] In addition, a questionnaire survey regarding possible causes of deformation such as trauma was performed. Further, the effects of age, sex, and history of trauma on the prevalence of NSD were considered using a logistic regression.

Results

A total of 386 CBCT of the patients with a mean age of 42.55 ± 23.26 years were investigated in this study, 86.6% (confidence interval [CI] = 0.81, 0.91) of which had NSD. The prevalence of NSD were 19.4% type 1, 6.2% type 2, 20.7% type 3, 5.4% type 4, 4.4% type 5, 0.3% type 6 and 30.3% type 7 [Table 1]. Figure 2 shows a normal septum without any deviation in the coronal view of CBCT. Figures 3-8 show coronal CBCT scan of the patients with different types of NSD.

History of trauma

Three hundred and thirty-eight (87%) patients reported no history of previous trauma, with a mean age of 43 years, in which 294 (87%) had NSD and 44 (13%) did not have NSD. Forty-eight (13%) patients mentioned a history of trauma, with a mean age of 34, in which 41 (85.4%) had NSD [Table 2].

Gender

Within 213 female patients, 34 (16%) had no NSD and 179 (84%) had NSD. Among 173 male patients, 17 (9.8%) had no NSD and 156 (90.2%) had NSD. No significant relation was found between gender and NSD ($P = 0.08$).

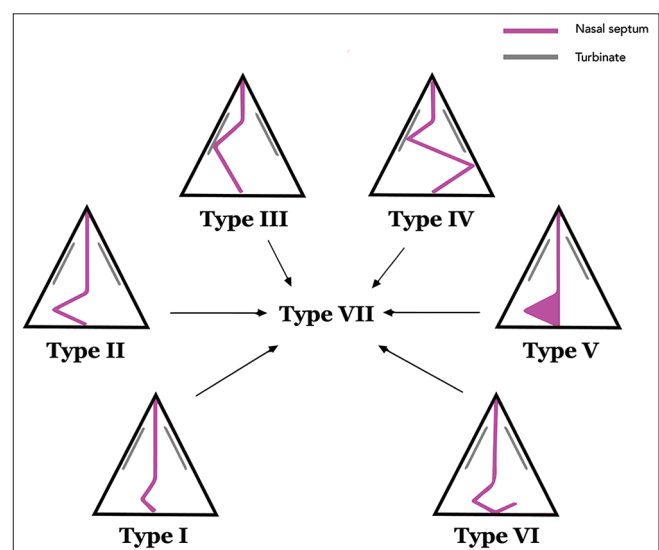


Figure 1: Mladina's classification for nasal septum deviation^[6]

Age

In this study, the patient’s age varied between 5 and 96 years with a mean age of 42.22 ± 23.26 . The mean age of the patients with NSD was significantly higher than

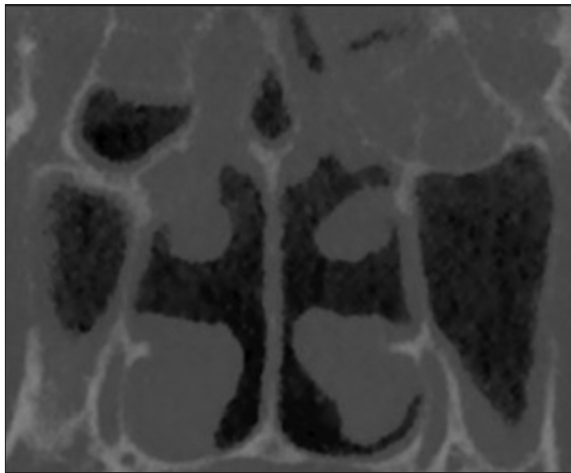


Figure 2: Normal nasal septum with no deviation

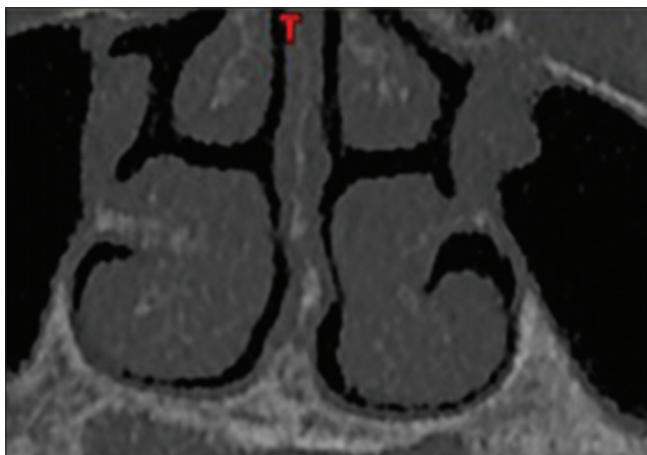


Figure 3: Coronal cone-beam computed tomography of the patient demonstrates type 1 nasal septum deviation

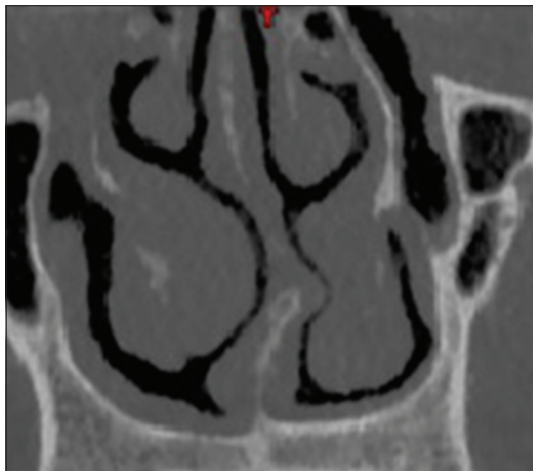


Figure 4: Coronal cone-beam computed tomography of the patient demonstrates type 2 nasal septum deviation

patients without NSD as patients with NSD had a mean age of 43.95 years and patients with no NSD had a mean age of 33.37 ($P < 0.001$) years and a positive relation was detected between age and NSD.

By the logistic regression, to investigate the effect of gender, age, and history of trauma on NSD, it was observed that the chance of deviation of nasal septum increased with age and every 10-year increase in age increases the odds of septal deviation by 0.032 ($P < 0.001$ and odds ratio [OR] = 1.032). Gender and history of trauma showed no effect on the chance of having deviation of the nasal septum ($P = 0.094$, $P = 0.79$ respectively) [Table 3].

Discussion

Nasal septal deviation plays an important role in nasal obstruction symptoms, appearance of the nose, and breathing. NSD may be associated with headaches and

Table 1: Prevalence and frequency of nasal septum deviation in patients according to Mladina’s classification

	Frequency (%)
Type	
1	75 (19.4)
2	24 (6.2)
3	80 (20.7)
4	21 (5.4)
5	17 (4.4)
6	1 (0.3)
7	117 (30.3)
Total	335 (86.8)
Normal	51 (13.2)
Total	386 (100)

Table 2: Nasal septum deviation and history of previous trauma

Trauma history	NSD (%)		Total (%)
	Yes	No	
Yes	41 (85.4)	7 (14.6)	48 (100)
No	294 (87)	44 (13)	338 (100)
Total	335 (86.8)	51 (13.2)	

NSD: Nasal septum deviation

Table 3: The effect of gender, age, and history of trauma on nasal septum deviation

	OR	95%CI for OR	P
Trauma history			
Yes	1.13	0.47-2.72	0.79
No	1		
Sex			
Male	1.72	0.91-3.23	0.09
Female	1		
Age	1.03	1.01-1.05	<0.001*

OR: Odds ratio; CI: Confidence interval; *significant

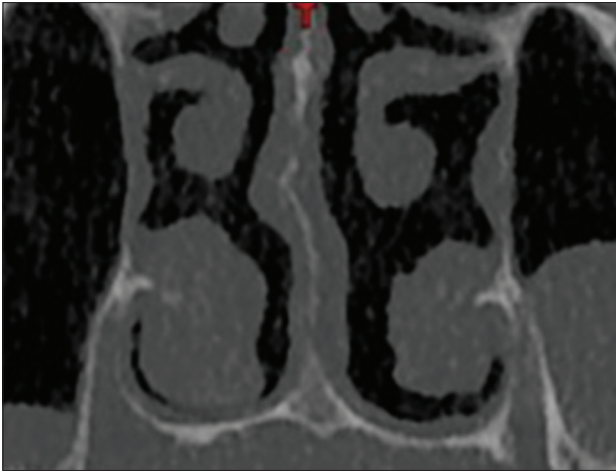


Figure 5: Coronal cone-beam computed tomography of the patient demonstrates type 3 nasal septum deviation

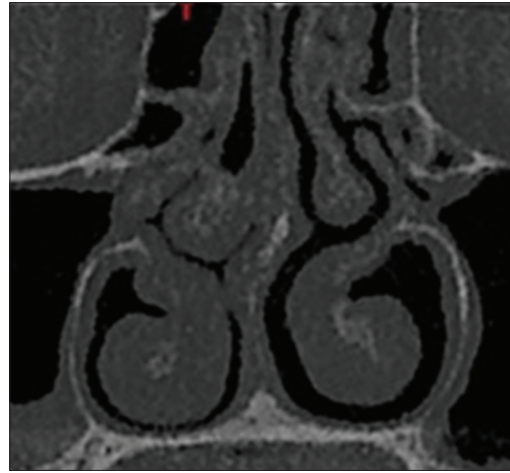


Figure 6: Coronal cone-beam computed tomography of the patient demonstrates type 4 nasal septum deviation

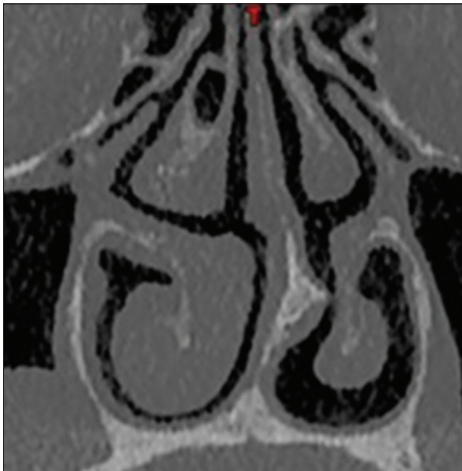


Figure 7: Coronal cone-beam computed tomography of the patient demonstrates type 5 nasal septum deviation

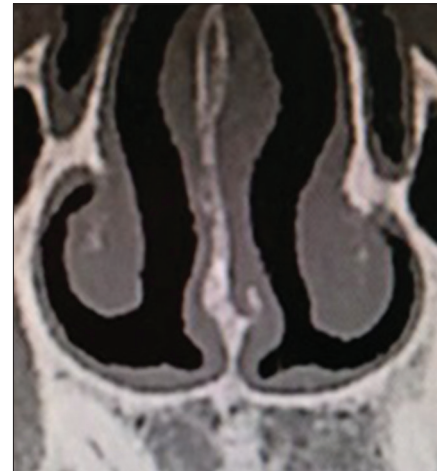


Figure 8: Coronal cone-beam computed tomography of the patient demonstrates type 6 nasal septum deviation

impairment dysosmia.^[4,5] In some studies, an association between NSD and presence of concha bullosa is recommended^[17,18] however, in the study of Smith *et al.*, no relation was detected.^[11]

A thorough evaluation of the nasal septum is an essential part in the preoperative surgical planning.^[3,4] Dentists and otolaryngologists are better able to identify nasal septum anatomy and abnormalities due to the widespread use of CBCT.^[7,8]

The results of this study showed that the frequency of NSD was 86.6% (CI = 0.81,0.91), with type 7 being the most common type, followed by types 3, 1, 5, 2, 4, and 6. In the study of Mladina *et al.*, the prevalence of NSD was 89.25% and type 3 had the highest prevalence.^[6] In the study of Salihoglu *et al.*, almost half of the patients had NSD although their method of classification was different from Mladina's classification.^[19] Grey *et al.* showed the prevalence of NSD to be 79%.^[20] In the study of Yildirim and Okur the prevalence of NSD was 34.9% and the most frequent type was type 1.^[4]

In this study, patients who had previous history of trauma had more NSD, although this result was not statistically significant ($P > 0.05$). Min *et al.* showed positive correlation between trauma history and NSD.^[21] Further, Teul *et al.* indicated that the NSD prevalence was higher in patients with previous trauma history.^[22] Patients who reported trauma history were younger. It can be presumed that older patients may not remember their history of trauma.

Various studies have claimed an age-related increase in NSD, which is consistent with our results.^[6,8] In this study, it was observed that the chance of NSD increased with age and every 10-year increase in age increased the odds of septal deviation by 0.32 ($P < 0.001$ and OR = 1.032).

In the study of Yildirim and Okur, the prevalence of NSD in preschool children, primary schoolchildren, and middle school teenagers was 16.5%, 38.7%, and 39.9% respectively.^[4] In addition, Zielnik-Jurkiewicz *et al.* also indicated higher prevalence of NSD in older patients.^[9] In another study, Gray *et al.* showed that most nasal disorders

Table 4: Comparison of prevalence of nasal septum deviation in different races (%)

Type of NSD	Europe ^[6]	Warsaw ^[23]	Zagreb ^[24]	Korea ^[25]	Szczecin ^[22]	Tehran (Iran)
Type 1	16.2	9.66	14.7	11.36	10.3	19.4
Type 2	16.4	1.61	6.8	4.90	4.2	6.2
Type 3	20.4	8.28	1.4	1.62	12.4	20.7
Type 4	8.7	2.99	0.2	1.82	3.15	5.4
Type 5	14	11.95	2.9	1.57	9.2	4.4
Type 6	9.4	1.61	2.6	0.73	1.3	0.3
Type 7	4.1	3.22	0.2	1.18	2.7	30.3

NSD: Nasal septum deviation

increased by nose growth which may indicate the increase of NSD with aging.^[20] Subarić and Mladina conducted a study to evaluate the prevalence of nasal septum deformities and its type in children and adolescents. They indicated higher rate of type 1 and type 2 deformities in the youngest age group (2–6 years). In the adolescent group, the results indicated higher prevalence of type 3, 4, 5, and 6.^[23]

The results of this study showed higher prevalence of NSD in males compared to females, although this difference was not statistically significant. In the study of Mladina *et al.*, straight septum was detected in 15.4% of females and 7.5% of males.^[6] Yildirim and Okur and Smith *et al.* showed no statistical difference between the two genders.^[4,10,11] The study of Min *et al.* and Zielnik-Jurkiewicz *et al.* showed higher prevalence of NSD in males rather than females.^[9,20] Teul *et al.* also indicated that perpendicular septum was seen more in women than men.^[21] This difference may be the result of higher physical activity done by men or their higher risk for trauma.

Table 4 indicates the prevalence of different types of NSD according to the Mladina's classification in various global regions.^[6,22-25]

The most common type of NSD were: type 3 in Europe,^[6] type 5 in Warsaw,^[22] type 1 in Zagreb,^[23] type 1 in Korea,^[25] and type 3 in Szczecin.^[22] The difference in results may be due to differences in ethnicity, age groups, sample size, and method of evaluation.

This study focused on the NSD type in the bony part of nasal septum, as the anterior cartilaginous part of the nasal septum may also have deviation, further studies may emphasize on the prevalence of NSD in this segment of the nasal cavity.

Conclusion

NSD is a common malformation of the human nasal cavity. We conclude that the prevalence of NSD was 86.6% and type 7 of NSD is most frequently observed. NSD's incidence increased with age and was seen more in male than female although no significant difference was detected between the two genders. NSD showed no association with trauma.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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