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Original Article

The Relation Between the Distance of Hard Palate and Tongue with Nasal Septal Deviation

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Abstract

Background: This study aimed to determine the distance between the hard palate and the tongue and its relationship with Nasal Septal Deviation (NSD).

Methods: This descriptive-analytical study was conducted on patients aged 18 to 60 years referred to the ENT clinic of Milad and Masih Daneshvari Hospitals. Patients were also divided into two groups (patients with and without NSD). Coronal CT scan was taken in all patients in the same position. In this regard, these pictures were taken vertically from the highest point of the hard palate to the tongue, the transverse distance between the two upper third molars of the upper jaw, and the ratio of these two distances.

Results: The mean age of patients with and without NSD was 35.8212.49±, and 33.9912.78± years old (p=0.66). The distance of hard palate to tongue in patients with and without NSD was 13.05±4.52, and 12.26±4.68 *mm*, respectively (p=0.32). The intermolar distance in these patients was 34.2±3.50, and 34.40±3.31 *mm* (p=0.78), respectively. This ratio in the two groups was 0.380.13±, and 0.340.11±, respectively (p=0.16).

Conclusion: According to these findings, no significant difference was observed between the patients with and without NSD regarding the distance between the hard palate and tongue, intermolar distance, and its ratio, but the distance of hard palate to tongue, and the ratio in the patients with NSD was slightly higher than patients without NSD. Further studies using coronal CT scan in larger samples are needed to clarify the role of the distance of hard palate and the tongue in NSD.

Keywords: Coronal CT scan, Distance, Hard palate, Nasal septal deviation, Tongue

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Introduction

Nasal septum plays a key role in regulating nasal airflow. Polyposis (1,2) is in the medial wall of the nasal cavity and is extended from the roof to the floor of the nasal cavity (3). Nasal Septal Deviation (NSD) is observed in 20-31% of the population and severe deviation is noted as a contributing factor for sinusitis (4).

NSD can occur in the intrauterine period, birth or after birth (5,6). On the other hand, minor nasal trauma and microfracture which are occurred during the intrauterine period, delivery, or growth period may lead to chondrocyte growth (5). Generally, it is divided into 6 types, including type 1: septal crest, type 2: cartilaginous deviated nose, type 3: high septal crest deviation, type 4: caudally inclined septum, type 5: septal crest and type 6: caudally inclined septum (7,8).

NSD causes inequality in the nasal passages, leading one side becomes narrow and the other becomes wide (9,10). NSD may cause osteomeatal obstruction or interfere with proper airflow (11). Moreover, the reduction of volume between the two sides increases the air pressure and the shear stress of its wall on the mucosa of the narrow side (12). It is expected that septoplasty reverses these changes *via* eliminating the obstruction and equalizing the volume of the nasal cavity bilaterally, leading the reduction in speed of the airflow due to the increase in area and volume (9).

Mandibular and maxillary are affected by environmental and genetic factors which influence the response of cells to the stimuli. In addition, soft tissue forces play a significant role during mandibular-maxillary growth and may affect the establishment of jaw relation, but the degree of its influence on the final form is still a debate (13).

Vieira *et al* reported no significant differences between the nasal and mouth-breathing regarding palatal height, and intermolar width, before and after tonsillectomy (14); however, there was no comprehensive study considering the relation of the distance between the hard palate and the tongue with NSD; therefore, this study was aimed at determining the distance between the hard palate and the tongue in coronal CT scan and its relationship with NSD.

Materials and Methods

This descriptive study was conducted on 148 patients aged 18 to 60 years referred to and underwent CT scan of paranasal sinuses for nasal obstruction in the ENT clinic of Milad and Masih Daneshvari Hospitals. All patients underwent ENT examination and orthodontic evaluation. Patients were also divided into two groups (patients with NSD and without NSD). After receiving the Ethical code, patients who had previously undergone sinus surgery or had polyposis, sinusitis, sinus tumor, all oral cavity tumors, history of oral cavity surgery, and a hard palate and tongue lesion were excluded from the study.

Coronal CT scan was taken from all patients in the same position. In this regard, these pictures were taken vertically from the highest point of the hard palate to the tongue, the transverse distance between the two upper third molars of the upper jaw, and the ratio of these two distances. These distances were measured using Marco packs software in terms of millimeter (*mm*).

Statistical analysis

Data were entered to SPSS, version 19. The variables of Hard palate to tongue distance, and ratio did not have normal distribution. Using the test one-sample Kolmogorov-Smirnov Normal Test, their P-value values were less than 0.001, and as a result, they did not have a normal distribution. Therefore, Mann-Whitney test was utilized to compare them in two types of intervention. In the case of the intermolar distance variable, the p-value was 0.2, and as a result, it had a normal distribution, and the t-test was used to compare the variable in the groups. p-value <0.05 was assumed significant.

Ethical considerations

This study was approved by Ethical Committee of Shahid Beheshti University of Medical Sciences (number: IR.SBMU.NRITLD.REC.1400.124).

Results

In the current study, the mean age of patients in the two groups (without and with NSD) was 33.99±12.78, and 35.82±12.49 years old, respectively (p=0.66). The frequency of patients in the two groups in terms of gender is shown in table 1.

As shown in t able 1, there was no significant difference between the two groups in terms of gender (p>0.05).

Table 1. The frequency of patients in the two groups in terms of gender

Gender	Deviation		p-value
	Without NSD (control group)	NSD	
Men	27 (37)	37 (49.3)	0.130
Women	46 (63)	38 (50.7)	0.130

Table 2. The comparison of the two groups in terms of the distance of hard palate to tongue

NSD type	Hard palate to tongue distance Mean±SD	p-value
Without NSD (control group)	12.26±4.68	0.323
With NSD	13.05±4.52	0.323
Total	12.60±4.63	0.323

NSD: Nasal Septal Deviation.

Table 3. The comparison of the two groups in terms of intermolar distance

NSD type	InterIntermolar distance Mean ± SD (*mm*)	p-value
Without NSD (control group)	34.40±3.31	0.784
With NSD	34.2±3.50	0.784

NSD: Nasal septal deviation.

Table 4. The relation between the ratio and the type of NSD

NSD type	Ratio	p-value
Without NSD	0.34±0.11	0.167
With NSD	0.38±0.13	0.167
Total	0.36±0.12	0.167

NSD: Nasal septal deviation.

Table 5. The classification of patients in terms of the hard palate to tongue distance

Category	With NSD	Without NSD	Total
Less than 10 *mm*	26	25	51
10-15 *mm*	21	38	59
15-25 *mm*	26	10	36
More than 25 *mm*	1	2	3

NSD: Nasal septal deviation.

Table 6. The frequency of the type of deviation

Type of deviation	1	2	3	4	5	6
frequency	7	14	4	22	13	15

The comparison of the two groups (patients with and without NSD) in terms of the distance of hard palate to tongue is shown in table 2.

As shown in table 2, no significant difference was seen between the two groups in terms of the distance of hard palate to tongue (p>0.05). The comparison of the two groups (patients with and without NSD) regarding intermolar distance is shown in table 3.

As demonstrated in table 3, no significant difference was observed between the two groups regarding intermolar distance (p>0.05). The comparison of the two groups in terms of the ratio of the distance of hard palate to the tongue/intermolar distance is shown in table 4.

As shown in table 4, no significant difference was seen between the two groups considering the ratio of the distance of hard palate to the tongue/intermolar distance (p>0.05).

Table 5 shows the classification of patients in terms of the hard palate to tongue distance.

In majority of the patients, the distance of hard palate to tongue was 10-15 *mm* (Table 5).

Figure 1 shows the diagram of the distance between hard palate and the tongue versus the type of deviation. The frequency of type of deviation is shown in table 6 and figure 2.

Discussion

NSD is associated with nasal obstruction, including lower concha hypertrophies, concha bullosa, and nasal polyposis (1,2). Due to the high incidence of NSD in our country (5,15) and no comprehensive study regarding the distance between hard palate to the tongue in patients with NSD, we assessed the distance between the hard palate and the tongue and our proposed category was as following (less than 10 *mm*, 10-15 *mm*, 15-25 *mm*, and more than 25 *mm*) and observed that in the majority of patients, the distance of hard palate to tongue was 10-15 *mm*. Moreover, we observed that the distance of hard palate to tongue had no effect on NSD type, but Akbay *et al* revealed an association between NSD and palatal height using CT scan in adult patients (16). The difference between Akbay *et al*'s study and our study was that we evaluated the distance between the hard palate and the tongue, while Akbay *et al* measured palatal height. D'Ascanio L *et al* reported that upper anterior facial height, and total anterior facial height were significantly higher in patients with NSD than nasal-breathing (control) (17). But Vieira *et al* also reported that there were no significant difference between patients with nasal-breathing and mouth-breathing in

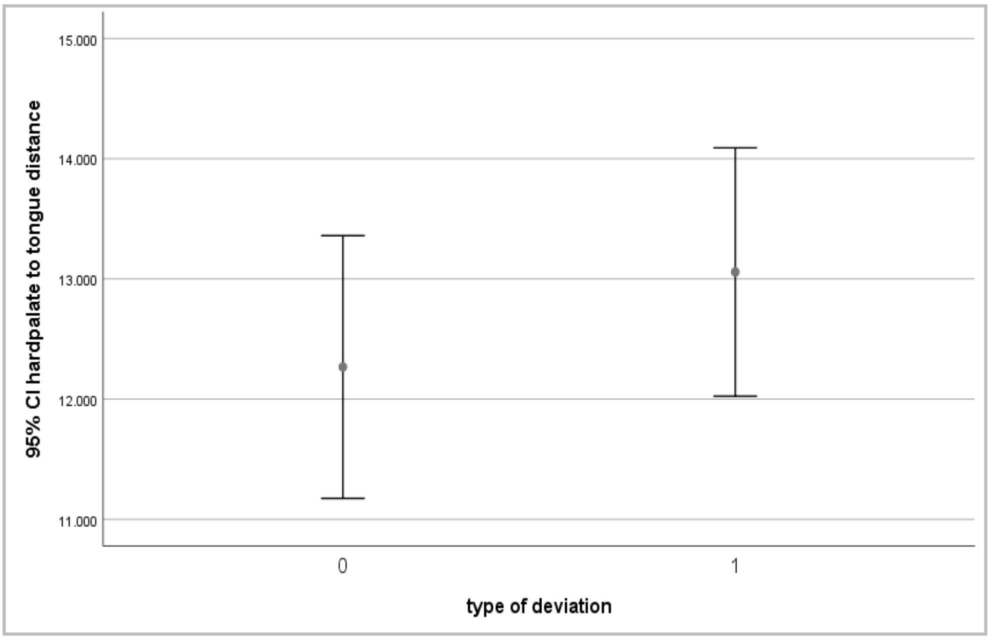

Figure 1. Diagram of the distance between hard palate and the tongue versus the type of deviation.

terms of palatal height before or after tonsillectomy (14). Kajan *et al* evaluated the effect of septal deviation on the depth of posterior palatal arch and observed that the mean deviated septal length in patients with NSD and control group was 5.62±2.37, and 0.000±000, respectively, indicating higher depth of posterior palatal in the patients with NSD than the control group (3).

Awuapara *et al* evaluated the nasal septum and depth of palatal arch using CT scan and observed no statistically significant relation between the deviation of the nasal septum and the depth of the posterior palatal arch in both genders (18). The difference between our study and Awuapara' study was that in Awuapara' study, the depth of palatal arch was measured, while in our study, the length between the hard palate and the tongue was measured. Conley *et al* reported that arch angle measurements were more important than the length measurements for palate differences (19).

In the current study, no significant difference was observed between the two groups regarding intermolar distance**.** Vieira *et al* evaluated the hard palate dimensions in NSD, and control group and observed no significant differences between patients with the nasal-breathing and mouth-breathing regarding intermolar width (14). The finding of the mentioned study was consistent with our study. D'Ascanio L *et al* evaluated the patients with NSD and nasal breathing (control) and observed that there was a significant difference between the two groups in terms of maxillary intermolar width (T6–T6). It is believed that children with NSD demonstrated dental and facial anomalies compared to nasal breathing (control) (17). The difference between our study and Ascanio' study was that we evaluated eighth tooth, while Ascanio *et al* assessed sixth tooth. Freitas *et al* and Ghasempour *et al* also revealed no significant difference between those with allergic rhinitis and those without any respiratory pathology in terms of intermolar width (20,21). Schwarz *et al* evaluated NSD following surgical orthodontic rapid maxillary expansion and revealed that surgical sectioning of the nasal septum to prevent septal deviation is not warranted (22).

Furthermore, no significant relation was seen between the ratio of the distance of hard palate to the tongue/intermolar distance with NSD type. No similar study was found in this regard. But Rafat *et al* assessed the morphology of maxilla in patients with

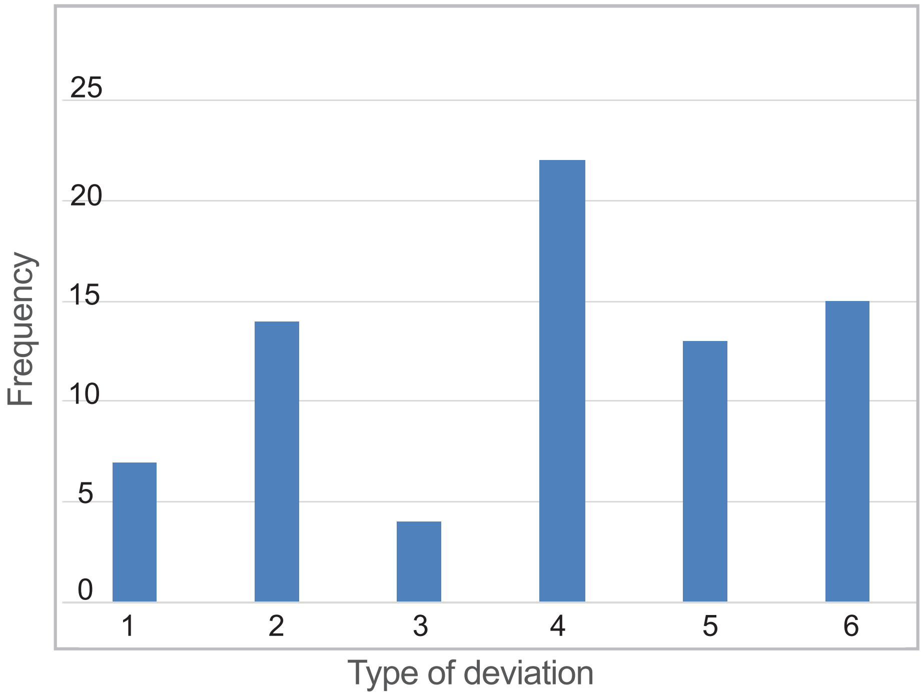

Figure 2. The frequency of the type of deviation.

impacted maxillary and observed that arch length/inter-molar width in palatal and normal groups in men were 74.216±5.142, and 74.958±5.08, respectively. Moreover, this ratio in women was 75.431±5.4, and 75.755±5.4, respectively, indicating no difference between NSD and control group regarding arch length/inter-molar width in both genders (23). The difference between the two studies was that arch length/intermolar was measured in Rafat's study instead of the distance between the hard palate and the tongue/intermolar (23).

Conclusion

According to these findings, no significant difference was observed between patients with and without NSD regarding the distance between the hard palate and tongue, intermolar distance, and its ratio, but the distance of hard palate to tongue, and the ratio in patients with NSD was slightly higher than patients without NSD. Further studies using coronal CT scan in larger samples are needed to clarify the role of the distance between the hard palate and the tongue in NSD.

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Conflict of Interest

There is no conflict of interest.

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