Impact of Oral Maxillofacial Morphological Changes on Snoring: An Empirical Comparative Study

Dr. Buddha Syam Deepthi[1], Dr. M. Srinivasa Raju[2], Dr. Lakshmisasi Poluri[3], Dr. Sahithi Ram Vatram[4], Dr. Bhanuteja Pallagani[5], Dr. Vyshnavi Durga Gandi[6]

[1]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India (Corresponding Author)
[2]HOD & Professor, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India
[3]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India
[4]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India
[5]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India
[6]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India

Abstract

Introduction: Snoring is a prevalent condition that greatly affects public health. Snoring refers to the noise generated when a person breathes while asleep, caused by the airflow disruption through a partially blocked airway. It is seen as a prevalent clinical indicator of obstructive sleep apnea (OSA). Abnormalities in the facial skeleton may play a role in the development of obstructive sleep apnea (OSA), impacting both hard and soft tissues. Numerous studies have examined how inter-dental width and palatal shape influence the onset of OSA in developing patients. Previous research agrees that children with a narrow or high-arched hard palate are more likely to develop OSA. Significant deviation of the septum (SD) can result in substantial nasal obstruction, which may lead to sleep apnea. **Aim:** This study aims to assess the association between the shape of the maxillary arch, deep palatal vault, and nasal septal deviation in snoring patients. **Methodology:** A total of 40 patients (20 snoring, 20 non-snoring) are included in the study. Maxillary arch shape, depth of palatal vault and nasal septal deviation are evaluated in all patients and are compared between snoring and non-snoring groups. **Results and Conclusion:** A V-shaped palate is exclusively found in snoring patients (100%), whereas a U-shaped palate is more common in non-snoring patients (57.1%) with statistical significant difference. Mean depth of palate and nasal septal deviation shows no statistically significant difference between snoring and non-snoring groups.

Keywords: Oral Maxillofacial Morphological Changes, Snoring, Obstructive Sleep Apnea, Dental Crowding, Malocclusion Nasal Septal Deviation

Introduction

Snoring, defined as the noise produced during sleep due to airflow disruption, is commonly recognized as an early sign of obstructive sleep apnea (OSA)—a disorder linked to a constricted and collapsible pharynx[1,2]. The mechanisms underlying OSA are complex and multifactorial, with several anatomical factors affecting upper airway size during sleep[3]. Abnormalities in facial skeletal structure, such as high-arched hard palates and nasal septal deviation, have been implicated in OSA development[,5,6]. Existing studies indicate that children with high-arched palates are predisposed to OSA, often presenting dental crowding or malocclusion[7]. Significant deviation of the nasal septum can result in substantial nasal obstruction, potentially leading to sleep-disordered breathing and OSA[4,5]. Obstructive sleep apnea contributes to substantial public health issues, emphasizing the importance of understanding the morphological factors associated with snoring and its consequences[1].

Aim

This study aims to assess the association between maxillary arch shape, deep palatal vault, and nasal septal deviation with snoring in adult patients

Inclusion Criteria

- Age: 25 to 60 years

- Group I: Non-snorers with no history of snoring or respiratory disorders
- Group II: Snorers with a history of snoring.

Exclusion Criteria

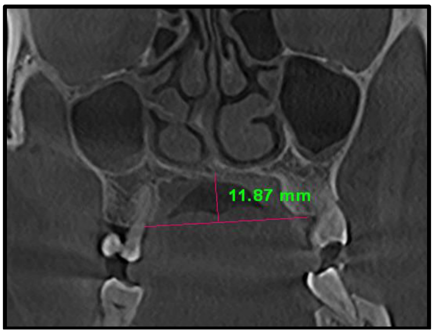
- History of radiotherapy
- Orthognathic surgery
- Previous orthodontic treatment
- Surgeries causing pharyngeal constriction.

Methodology

This study is conducted in the outpatient department of oral medicine and radiology, St. Joseph Dental College and Hospital. The study received approval from the Institutional Ethical Committee of St. Joseph Dental College and Hospital. [IEC PROTOCOL NUMBER: SJDC/CEC/OMR/2025/009] A total of 40 patients (20 snoring, 20 non-snoring) are included in the study. All the CBCT scans are taken using Rainbow CBCT machine (Dentium co. Ltd. South Korea). CBCT scans imported to digital imaging and communications in medicine format (Di Com) and analysed in rainbow viewer (software version 1.1.0)

Palatal Vault Depth

- An imaginary horizontal line is drawn at the alveolar crest level at the first molar region.
- The vertical distance from the deepest point on the palatal vault to the horizontal contact line is measured in coronal section.

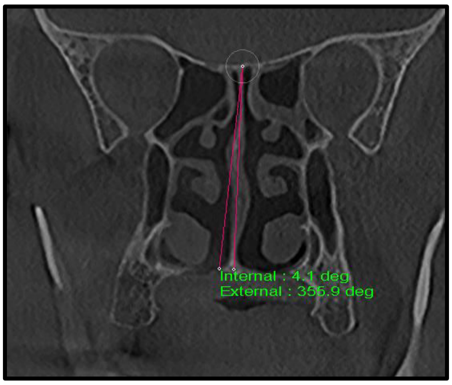


Maxillary Arch Shape

- Shape of maxillary arch is determined clinically into U and V shapes

Nasal Septal Deviation

- Measured by drawing a line from crista galli to maxillary crest and another line to the maximum deviation of nasal septum.



- Classified into four categories according to the degree of its deviation:
- Type I: <5°
- Type II: 5–10°
- Type III: 10–15°
- Type IV: >15°

Results

Table 1: Association between Shape of palatal vault and type of nasal septal deviation in snoring and non-snoring patients

			Snoring	Non-snoring	P value
Shape of palate	U	Count	15	20	0.047*
		% wi3thin shape	42.9%	57.1%	
	V	Count	5	0	
		% within shape	100.0%	0.0%	
Type of Nasal septal deviation	Type I	Count	1	5	0.256
		% within shape	16.7%	83.3%	
	Type II	Count	11	10	
		% within shape	54.5%	45.5%	
	Type III	Count	7	5	
		% within shape	58.3%	41.7%	
	Type IV	Count	1	0	
		% within shape	100%	0.0%	
Chi-square test *statistically significant					

Table 1 depicts the association between shape of palatal vault and type of nasal septal deviation in snoring and non-snoring patients. A V-shaped palate is exclusively found in snoring patients (100%), whereas a U-shaped palate is more common in non-snoring patients (57.1%). This reveals a significant relationship between palatal shape and snoring (p = 0.047). The association between the type of nasal septal deviation and snoring is not statistically significant (p = 0.256). The Type III deviation is more frequent in snoring patients (58.3%), and Type I deviation is more common in non-snorers (83.3%), while Type II nasal septal deviation was almost equally distributed between snoring (54.5%) and non-snoring (45.5%) patients. Type IV deviation is seen in snoring patients.

Table 2: Inter group Comparison of mean depth of palate and nasal septal deviation in snoring and non-snoring patients

		Mean	Std. Deviation	P value
Depth of palate	Snoring	13.0275	1.72560	0.499
	Non-snoring	13.4220	1.92088	
Nasal septal deviation	Snoring	9.0900	2.97620	0.191
	Non-snoring	7.7450	3.39682	

The mean depth of the palate is slightly lower in snoring patients (13.03 ± 1.73 mm) compared to non-snoring patients (13.42 ± 1.92 mm), but the difference is not statistically significant (p = 0.499). Similarly, the mean degree of nasal septal deviation is higher in snoring patients (9.09 ± 2.98 mm) than in non-snoring patients (7.75 ± 3.40 mm). However, this difference is also not statistically significant (p = 0.191). (Table 2)

Discussion

The results of this study support a significant relationship between oral-maxillofacial features, particularly palatal shape, and the prevalence of snoring[6]. The presence of a V-shaped palate was exclusively observed among snoring patients, echoing findings by Al Madani GH et al.[6], where individuals with V-shaped palates were more likely to demonstrate habitual snoring patterns. Anatomically, a V-shaped palate may reduce the oral cavity's volume and alter airflow dynamics during sleep, increasing the tendency for airway collapse, turbulence, and noise production. These conclusions are important clinically, as targeted interventions, such as orthodontic treatment or maxillary expansion, may be considered in patients identified with high-risk palatal morphology[6,7].

Palatal depth showed no statistically significant difference between snoring and non-snoring groups, which is consistent with reports by Seto BH et al.[8]. This suggests that the absolute depth of the palate, while anatomically notable, does not alone predispose adults to snoring. It is possible that other structural or dynamic variables, such as soft tissue hypertrophy or muscular collapsibility, play compensatory or dominant roles in airway obstruction and snoring pathogenesis[1,2]. Assessment of nasal septal deviation revealed no significant association between deviation type and snoring in this cohort, despite other studies indicating septal deviation as a risk factor for obstructive sleep apnea[4,5]. For example, Yeom SW et al.[5] reported a higher prevalence of OSA in populations with marked septal deviation, highlighting that the discrepancy may reflect differences in sample size, population-specific anatomical norms, or other confounding factors such as concurrent nasal or pharyngeal pathologies. Indu PS et al.[4], however, support the use of septal deviation as a radiographic marker for OSA risk, suggesting that imaging evaluation should remain a fundamental element of sleep disorder workup. The implications of these results are notable for dental, otolaryngological, and sleep medicine practitioners. Morphological assessment of maxillary shape—especially identification of a V-shaped palate—should be integrated into screening protocols for patients with snoring or sleep-disordered breathing, as early anatomical intervention might mitigate progression to obstructive sleep apnea[3,6]. Nevertheless, the lack of significant results for palatal depth and nasal septal deviation in snoring underscores the multifactorial nature of upper airway dynamics during sleep, involving not only static anatomies but also functional and neuromuscular factors[1,3,7]. Limitations of the present study include a relatively modest sample size and exclusion of soft tissue variables (e.g., tongue size, pharyngeal wall thickness), both of which could affect snoring propensity and should be addressed in future longitudinal investigations. Larger multicenter studies using standardized radiological criteria and functional airway assessments are necessary to conclusively determine the interplay between oral-maxillofacial morphological changes and snoring[1,7].

Conclusion

This empirical comparative study demonstrates that morphological features of the oral and maxillofacial region, particularly the presence of a V-shaped palatal arch, have a statistically significant association with snoring, while palatal depth and nasal septal deviation do not show significant correlations with snoring. The findings highlight the value of craniofacial assessment, especially maxillary arch evaluation, in identifying individuals at increased risk of habitual snoring and potentially obstructive sleep apnea. However, factors such as palatal depth and nasal septal deviationthough implicated in craniofacial developmentwere not statistically significant indicators in this group and may require further investigation with larger sample sizes. Early identification and intervention in high-risk palatal morphologies may contribute to improved preventative and therapeutic strategies for snoring and its associated morbidities.

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