Prevalence of snoring and facial profile type, malocclusion class and dental arch morphology among snorer and nonsnorer university population

Gassan H. Al-Madani, Saeed M. Banabilh and Medhat M. El-Sakhawy[1]

ABSTRACT

Objectives: The objectives of this study were to determine the prevalence of snoring in an adult male university population, and to test the null hypothesis that there is no difference in facial profile shape, malocclusion type, or palatal morphology among snorer and nonsnorer.

Materials and Methods: Berlin questionnaire was given to 840 students and employees aged 18–45 years (24 ± 40). Both snorers and nonsnorers were assessed for the facial profile type, malocclusion type, and palatal morphology. Chi-square and Student's *t*-test were used to compare the difference between the two groups.

Results: The prevalence of snoring was 16.28%. The most frequent findings among snorer were straight profiles (52.0%), Class I malocclusion (74.7%), and V palatal shape (16.0%), respectively. The Chi-square test revealed a significant difference in terms of V-shaped palatal morphology ($P < 0.05$); higher neck circumference (NC) ($P < 0.007$); upper arch length was significantly shorter ($P < 0.038$); and the inter-first upper premolar distance was significantly narrower ($P < 0.013$).

Conclusion: The null hypothesis is rejected. Snoring in our university population is associated with V-shape palatal morphology, increased NC and decrease in the upper arch length, and inter-first upper premolar distance.

Key words: Adult, dental arch, facial profile, malocclusion, orthodontic, snoring

INTRODUCTION

Snoring is not a benign symptom. It is associated with an increased risk of hypertension, cardiac arrhythmias, and mortality.[1] Snoring is defined as a sound produced when an individual breaths during sleep due to the turbulence of air passing through the partially obstructed airway. It is considered as one of the most common clinical symptoms of obstructive sleep apnea (OSA).[2] Snoring may result in excessive daytime sleepiness, loss of concentration, and psychological disturbances that may eventually cause deterioration of the patient life quality unless treated.[1] The estimations of snoring prevalence ranged between 16% and 89% of the general population. This wide range is due to the differences in the populations studied, study design, investigations performed, ethnic group, age, and sex of the subjects.[1-6] Snoring is potentially related to the increase in the body mass index (BMI), cigarette consumption, ethnic differences, infections, and hypertension.[7-9] Nocturnal polysomnography is considered the best tool to investigate whether snoring is a health risk.

Department of Orthodontic Dentistry, School of Dental Sciences, University of Science and Technology, Sana'a, Republic of Yemen, [1]Department of Orthodontic Dentistry, School of Dentistry, Tanta University, Tanta, Egypt

Address for correspondence: Dr. Saeed M Banabilh, Department of Orthodontic and Pedodontic, Board Member of Qassim Dental Research Center, College of Dentistry, Qassim University, Buraidah 51412, P.O. Box 6700, Saudi Arabia.
E-mail: banabilh23@gmail.com

Access this article online	
Quick Response Code:	Website: www.jorthodsci.org
	DOI: 10.4103/2278-0203.173424

How to cite this article: Al-Madani GH, Banabilh SM, El-Sakhawy MM. Prevalence of snoring and facial profile type, malocclusion class and dental arch morphology among snorer and nonsnorer university population. J Orthodont Sci 2015;4:108-12.

However, it is not widely available and expensive to be used as a screening tool, as it is mostly available only in specialized sleep clinics. Therefore, the use of questionnaires like Berlin questionnaire become a simple and effective method of screening for snoring and risk of OSA.[3] In addition, many craniofacial features and malocclusions were reported to be associated with snoring. For example; narrow airway at the level of the soft palate and oropharynx, more inferiorly positioned hyoid bone, more protruding maxilla, anterior-posterior discrepancy of maxilla and mandible, Class II malocclusion, increase in over-jet, reduced overbite, narrower upper, and shorter lower dental arch and crowding in the mandibular arch.[10-13] According to literature, snoring was associated with OSA, and the characteristics were complicated with other dentofacial risk features such as facial profile, malocclusion classification, and dental arch morphology. For instance, Stellzig-Eisenhauer and Meyer-Marcotty (2010) reported a significant difference between patients with retrognathism and pragmatism in respect to the transverse dimension of the nasopharynx.[14]

However, de Freitas *et al*., found no correlation between obstructions of the upper airway and the frequency of malocclusions.[15] This reflects the discrepancy between the influence of the facial profile, malocclusion classification, and dental arch morphology on airway measurements. Therefore, the aim of this study was to test the null hypothesis that there is no morphological difference in facial profile, malocclusion class, and dental arch morphology in adult Yemenis male with and without snoring. Rejection of the null hypothesis might improve our understanding of the influence of snoring on the surrounding dentofacial structures.

MATERIALS AND METHODS

After the study was approved at the institutional level and informed consent was obtained, a cross-sectional study was carried out among male students and employees at the University of Science and Technology. For the prevalence study, the sample size was calculated using Power and Sample Size Software (5.2 MB version 2.1.31.) which indicated 840 subjects is required for this study. When the participants agreed to participate in the study, a consent form was given along with a set of the sleep behavior questionnaire (Berlin questionnaire). The inclusion criteria were: Age 18 and above, healthy individuals without any diseases or congenital abnormalities and the presence of at least six teeth in each maxillary and mandibular arch. The exclusion criteria were any psychological diseases, alcohol drinking, and craniofacial deformity. Each selected subject undergone clinical examination, upper and lower arch impression, and BMI calculation. Totally, 150 participants (75 snorers: 9 employees, 66 students) and (75 nonsnorers: 8 employees, 67 students) were able to complete their required records. For assessment of snoring, the Berlin questionnaire was used to assess snoring status.[16] The Arabic version of the questionnaires was adapted from a previous study.[17]

Each individual age, sex, height, and weight were recorded. BMI was calculated from the patient's height and weight in standard units (kg/m^2), and neck circumference (NC) was measured at the level of the thyroid cartilage. The facial profile was assessed by classifying the facial profile into convex, concave, and straight. Malocclusion was assessed according to Angle classification.[10] Assessment of arch morphology and palatal morphology were carried out as following: Arches were classified as constricted and nonconstricted. The dental arch constriction was defined as the presence of two or more maxillary posterior teeth in edge to edge cuspal relationship with their antagonists, or in a frank cross bite.[18] The palatal morphology divided into U-shaped (normal) and V-shaped (constricted).[10] Maxillary constriction was defined by the presence of all the following features: A narrow and high palatal vault; corresponding narrow arch form and unilateral or bilateral buccal tilting of the maxillary alveolar arches with posterior teeth in crossbite or edge to edge relationship with the lower teeth.[18] Assessment of dental cast parameters were completed by taken dental impression and fabricating a set of upper and lower models. Alginate impression material (Zhermack, Germany) mixed according to the manufacturer's instructions. The following measurements were recorded using digital calipers: Inter-canine distance; inter-premolar distance; intermolar distance; arch length; palatal cast depth.[18]

RESULTS

Out of 840 questionnaires distributed, 700 were returned (77 employees and 623 students); the response rate was 80%. A total of 114 snorers were identified (16.28%). Nine were employees (11.7%), and 105 were students (16.9%). Totally, 150 participants (75 snorers) and 75 nonsnorers were able to complete their required records and, therefore, were included in the comparison study. Table 1 shows the demographic profile of 150 subjects who were males with mean age of 24 ± 4 years, mean height of 167 ± 6 cm, mean weight of 63 ± 10 kg, mean BMI of 22.5 ± 3 kg/m^2, and mean NC 36 ± 2.6 cm.

Accordingly, the mean neck size was found to be significantly greater for the snorer group (36.6 ± 2.5) than nonsnorer group [35.4 ± 2.6; $P < 0.007$; Table 1]. Clinical examination shows that the most frequent finding among snorer groups when compared with the nonsnorer group were straight profiles (52.0%), Class I malocclusion (74.7%), and V palatal shape (16.0%), respectively [Table 2]. The Chi-square test revealed a significant difference among the V-shape palatal

Table 1: Clinical observation of snorers and non-snorers extra-oral variables

Variable	*n*=75		*P* value
	Snorers	Non-snorers	
Height (cm)	167.32±7.15	166.5±6.67	0.484
Weight (kg)	64.57±11.05	61.43±9.57	0.065
BMI (kg/m^2)	23.00±3.24	22.14±3.23	0.107
NC (cm)	36.59±2.55	35.42±2.65	0.007*

*Significant $P<0.05$. BMI – Body mass index; NC – Neck circumference

morphology ($P < 0.034$), but no significance was found in terms of the facial profiles; malocclusion class or arch morphology. These results are summarized in Table 2. In addition, the upper arch length was significantly shorter (35.6 ± 2.5) in the snorer subjects than the nonsnorer group (36.4 ± 2.5; $P < 0.038$), and the inter-first upper premolar distance was significantly narrower (39.6 ± 2.6) in the snorer subjects than in the nonsnoring group [40.8 ± 2.9; $P < 0.013$; Table 3].

DISCUSSION

The present study was carried out to determine the prevalence of snoring among male adult at university population setting and to compare the craniofacial features of an adult with and without snoring using clinical examination. Our result indicate that the prevalence of snoring in our university population was 16.28%. In addition, the clinical examination showed that the snoring in our adult university population manifested a significantly different craniofacial feature, such as a V-shaped palate; higher NC; lower upper arch length; and a decrease in the inter-first upper premolar distance. Based on our prevalence of snoring result, it seems that the prevalence of snoring in our sample is slightly higher from the average of snoring prevalence quoted earlier[1,6,19] but lesser compared with the other studies in student population.[20-22] Table 4 summarized previous studies of snoring among the student population. Comparing our result to Malaysian medical students,[21] our result showed a higher percentage of snoring, which might be due to a mixture of students and employees in our sample; different age; and BMI and diverse definition of snoring. Hui *et al*. concluded that snoring was prevalent in student population, and male gender showed a trend as an independent predictor for snoring, which is similar to our result.[6]

Table 2: Orthodontic observation of facial profile, malocclusion class, arch morphology and palatal shape

Variables	*n*=75 (*n* (%))		*P* value[a]
	Snorer	Non-snorer	
Facial profile shape			
Straight	39 (52.0)	38 (50.7)	0.343
Convex	34 (45.3)	37 (49.3)	
Concave	02 (02.7)	0.0	
Malocclusion			
Class I	56 (74.7)	57 (76.0)	0.691
Class II	10 (13.3)	7 (9.3)	
Class III	9 (12.0)	11 (14.7)	
Arch morphology			
Constricted	15 (20.0)	12 (16.0)	0.524
Normal	60 (80.0)	63 (84.0)	
Palatal morphology			
U (shape)	63 (84.0)	71 (94.7)	0.034*
V (shape)	12 (16.0)	4 (5.3)	

[a]Pearson Chi square was used. *Significant at $P<0.05$

Table 3: Orthodontic observation of dental cast measurements (mean±SD) in snorers and non-snorers

Cast measurements	*n*=75		*P* value
	Snorers	Non-snorers	
ICDU	29.34±2.16	29.57±2.02	0.501
IP1DU	35.56±2.50	36.41±2.48	0.038*
IP2DU	40.86±2.98	41.44±2.75	0.216
IMDU	46.61±3.12	47.46±2.83	0.084
ICDL	23.82±2.06	23.62±1.74	0.542
IP1DL	30.21±2.20	29.87±2.20	0.345
IP2DL	35.11±3.52	35.11±2.26	0.999
IMDL	41.45±3.22	41.82±2.63	0.434
UAL	39.63±2.63	40.77±2.90	0.013*
LAL	34.23±2.59	35.13±3.18	0.060
PD1M	21.51±2.40	21.05±2.44	0.251
PD2P	19.84±2.30	19.48±2.64	0.381
PD1P	15.07±2.23	15.23±2.74	0.699
PDC	9.94±2.04	10.03±2.15	0.794

All measurements are in millimeters. ICDU – Inter upper canine distance; IP1DU – Inter upper first premolar distance; IP2DU – Inter upper second premolar distance; IMDU – Inter upper molar distance; ICDL – Inter lower canine distance; IP1DL – Inter lower first premolar distance; IP2DL – Inter lower second premolar distance; IMDL – Inter lower molar distance; UAL – Upper arch length; LAL – Lower arch length; PD1M – Palatal depth at first molar area; PD2P – Palatal depth at second premolar area; PD1P – Palatal depth at first premolar area; PDC – Palatal depth at canine area. *Significant at $P<0.05$

When we compared our result with the general adult population findings, our result is slightly lower than the prevalence of snoring reported by middle-Eastern studies (52.3% Saudi and 28.7% Jordanian BaHammam *et al*. and Khassawneh *et al*., respectively).[17,23] However, in Asian adults, it was found that the prevalence of snoring is higher than the western population study.[24,25] Nevertheless, it should be understood that the prevalence of snoring does not necessarily indicate the development of obstructive complications but these findings do highlight the need for awareness about possible complications.[19]

The results of this current study, indicate the NC is significantly greater for the snoring group than for the nonsnorer group. This finding supports the view that NC is one of the significant risk factors for Yemeni snorer, which is in good agreement with findings obtained in the Chinese[9,26] and Japanese populations.[13] Increased NC even in the absence of obesity in our subjects, may draw our attention on the importance of the fat tissue around the neck in nonobese individuals. Furthermore, snoring and greater NC were also considered as useful clinical predictors of OSA.[27] Clinical examination findings indicate that the most frequent finding among snorer groups were straight profiles (52.0%), Class I malocclusion (74.7%), and V palatal shape (16.0%), respectively. Even though, there is no relationship between upper airway obstruction and the type of malocclusion were found but it has been reported that the upper pharyngeal width in the subjects with Class I and Class II malocclusions with the vertical growth patterns were significantly narrower than in the normal growth pattern group.[15] Therefore, this makes the orthodontist more alert to enquire about snoring even in Class I malocclusion and straight profile patients especially with vertical growth patterns. On the other hand, it has been reported that convex profiles (71.7%), Class II malocclusion (51.7%), and V palatal shape (53.3%)

Table 4: Summery of snoring among the student population (from most to least severe)

Author	Location	Year	Participant	Sex	Age	Percentage
Patel *et al.*[1]	USA	2008	University students	MF	18-25	30.0
Hui *et al.*[6]	Hong kong	1999	First year Medical students	MF	19-21	25.7
Singh *et al.*[19]	India	2012	Medical students	MF	17-25	17.7
Al-madani *et al* (current study)	Yemen	2013	University students and employee	M	18-45	16.28
Ficker *et al.*[20]	Germany	1999	Final year Medical students	MF	24-27	11.9
Tiong *et al.*[21]	Malaysia	2007	Medical students	MF	19-42	7.2
Stoohs *et al.*[22]	Germany	1998	University students	MF	19-22	3.4

MF – Male, Female

were frequent features in an Asian OSA sample.[10] This in contrast to our current study, and this could be related to the difference between the OSA as a general term while the snoring is one of the OSA symptoms and to the differences in the cranial base morphology between Asians and Caucasian.

Using dental examination, we found statistically significant difference between Yemeni snorers and nonsnorer in a V-shape palatal arch; the arch length and the inter-first premolar distance. In view of the fact that the roof of the mouth is also the floor of the nose, a narrow arch can infringe on the nasal cavity space. Therefore, maxillary constriction, in addition to his responsibility as one of the important factors for determining nasal airway properties, it can also contribute to lateral narrowing of the upper oral cavity and a low tongue posture which consequently narrow the retroglossal region.[18] This may provide a reasonable explanation for the narrowing of the posterior airway space seen in OSA patients.[10] The V palatal shape was also included as one predictive morphometric model for OSA, and the model illustrates the potential value of physical and dental examination.[27] Our cross-sectional study may have some potential limitations to consider. For instance, there is a possibility of under diagnosis of snoring when a standard full night polysomnography test is not administered. However, Berlin questionnaire can still be considered as an effective and inexpensive way for screening snoring. Another limitation of this study is the fact that females were not included. For cultural factors, females were not included in this study.

In summary, this study suggests that snoring among our university population is associated with increased NC; V-shape palatal morphology; the short upper arch length; and narrow inter-first upper premolar distance. Clinically, increased NC even in the absence of obesity may draw our attention to the importance of the fat tissue around the neck in nonobese individuals. In addition, the orthodontist and other health care should be more alert to enquire about snoring, take the complaint of snoring seriously, and perform a thorough clinical and orthodontic evaluation even in Class I malocclusion and straight profile patient especially college-aged male adult with vertical growth patterns.

Furthermore, on the basis of clinical and orthodontic observation that have been recognized in this study, we believe that those observation features could be used to improve our understanding of the influence of snoring on the surrounding dentofacial structures of the adult university population and may provide valuable screening information in the identification of patients with undiagnosed OSA. Further studies are needed to find other clinical and orthodontic features in a diverse university population with different ethnic and sex trends in regards to snoring patterns.

CONCLUSION

The null hypothesis is rejected. Snoring in our university population is associated with V-shape palatal morphology, increased NC, and decrease in the upper arch length and inter-first upper premolar distance.

Acknowledgments

The authors gratefully acknowledge the students and employees at the University of Science and Technology (UST; Yemen) for facilitating our research. We are also thankful to Professor. Ahmed BaHammam, Consultant Pulmonary and Sleep Medicine, Director, King Saud University Sleep Disorders Center, for reviewing this article.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

REFERENCES

1. Patel M, Tran D, Chakrabarti A, Vasquez A, Gilbert P, Davidson T. Prevalence of snoring in college students. J Am Coll Health 2008;57:45-52.
2. Chuang LP, Hsu SC, Lin SW, Ko WS, Chen NH, Tsai YH. Prevalence of snoring and witnessed apnea in Taiwanese adults. Chang Gung Med J 2008;31:175-81.
3. Banabilh SM, Asha'ari ZA, Hamid SS. Prevalence of snoring and craniofacial features in Malaysian children from hospital-based medical clinic population. Sleep Breath 2008;12:269-74.
4. Adewole OO, Adeyemo H, Ayeni F, Anteyi EA, Ajuwon ZO, Erhabor GE, *et al.* Prevalence and correlates of snoring among adults in Nigeria. Afr Health Sci 2008;8:108-13.
5. Marshall NS, Bartlett DJ, Matharu KS, Williams A, Grunstein RR. Prevalence of treatment choices for snoring and sleep apnea in an Australian population. J Clin Sleep Med 2007;3:695-9.
6. Hui DS, Chan JK, Ho AS, Choy DK, Lai CK, Leung RC. Prevalence of snoring and sleep-disordered breathing in a student population. Chest 1999;116:1530-6.

7. Zhang G, Spickett J, Rumchev K, Lee AH, Stick S. Snoring in primary school children and domestic environment: A Perth school based study. Respir Res 2004;5:19.
8. Franklin KA, Janson C, Gíslason T, Gulsvik A, Gunnbjörnsdottir M, Laerum BN, *et al.* Early life environment and snoring in adulthood. Respir Res 2008;9:63.
9. Kohler M, Bloch KE, Stradling JR. The role of the nose in the pathogenesis of obstructive sleep apnoea and snoring. Eur Respir J 2007;30:1208-15.
10. Banabilh SM, Samsudin AR, Suzina AH, Dinsuhaimi S. Facial profile shape, malocclusion and palatal morphology in Malay obstructive sleep apnea patients. Angle Orthod 2010;80:37-42.
11. Banabilh SM, Suzina AH, Dinsuhaimi S, Singh GD. Cranial base and airway morphology in adult malays with obstructive sleep apnoea. Aust Orthod J 2007;23:89-95.
12. Löfstrand-Tideström B, Thilander B, Ahlqvist-Rastad J, Jakobsson O, Hultcrantz E. Breathing obstruction in relation to craniofacial and dental arch morphology in 4-year-old children. Eur J Orthod 1999;21:323-32.
13. Pirilä-Parkkinen K, Pirttiniemi P, Nieminen P, Tolonen U, Pelttari U, Löppönen H. Dental arch morphology in children with sleep-disordered breathing. Eur J Orthod 2009;31:160-7.
14. Stellzig-Eisenhauer A, Meyer-Marcotty P. [Interaction between otorhinolaryngology and orthodontics: Correlation between the nasopharyngeal airway and the craniofacial complex]. Laryngorhinootologie 2010;89 Suppl 1:S72-78.
15. de Freitas MR, Alcazar NM, Janson G, de Freitas KM, Henriques JF. Upper and lower pharyngeal airways in subjects with Class I and Class II malocclusions and different growth patterns. Am J Orthod Dentofacial Orthop 2006;130:742-5.
16. Netzer NC, Stoohs RA, Netzer CM, Clark K, Strohl KP. Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. Ann Intern Med 1999;131:485-91.
17. BaHammam AS, Alrajeh MS, Al-Jahdali HH, BinSaeed AA. Prevalence of symptoms and risk of sleep apnea in middle-aged Saudi males in primary care. Saudi Med J 2008;29:423-6.
18. Seto BH, Gotsopoulos H, Sims MR, Cistulli PA. Maxillary morphology in obstructive sleep apnoea syndrome. Eur J Orthod 2001;23:703-14.
19. Singh V, Pandey S, Singh A, Gupta R, Prasad R, Singh Negi MP. Study pattern of snoring and associated risk factors among medical students. Biosci Trends 2012;6:57-62.
20. Ficker JH, Wiest GH, Lehnert G, Meyer M, Hahn EG. Are snoring medical students at risk of failing their exams? Sleep 1999;22:205-9.
21. Tiong TS, Hassan SA. Prevalence and correlates of snoring in medical and nursing students in University Malaysia Sarawak. Neurol Asia 2007;12:115-9.
22. Stoohs RA, Blum HC, Haselhorst M, Duchna HW, Guilleminault C, Dement WC. Normative data on snoring: A comparison between younger and older adults. Eur Respir J 1998;11:451-7.
23. Khassawneh B, Ghazzawi M, Khader Y, Alomari M, Amarin Z, Shahrour B, *et al.* Symptoms and risk of obstructive sleep apnea in primary care patients in Jordan. Sleep Breath 2009;13:227-32.
24. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med 1993;328:1230-5.
25. Ong KC, Clerk AA. Comparison of the severity of sleep-disordered breathing in Asian and Caucasian patients seen at a sleep disorders center. Respir Med 1998;92:843-8.
26. Ng TP, Seow A, Tan WC. Prevalence of snoring and sleep breathing-related disorders in Chinese, Malay and Indian adults in Singapore. Eur Respir J 1998;12:198-203.
27. Chang ET, Yang MC, Wang HM, Lai HL. Snoring in a sitting position and neck circumference are predictors of sleep apnea in Chinese patients. Sleep Breath 2014;18:133-6.