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Effect of cephalometric variables in paediatric snorers

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ABSTRACT

Background: There is a high prevalence of snoring in paediatric age group. There are various reasons for snoring in children, the most common being adenotonsillar hypertrophy. In our study we intended to establish a relationship between craniomorphological features and snoring.
Methods: The sudy objective was to determine the differences in craniofacial cephalometric variables between snoring and non-snoring children. 50 snoring and 50 non-snoring children between the ages of 6 and 12 years were selected. Non-snoring subjects were matched to snoring subjects by age, sex, and ethnicity. Children with adenotonsillar hypertrophy were excluded. Snoring was assessed using a sleep behavior questionnaire administered to parents or guardians. The cephalometric radiographs of the study subjects were traced by a single investigator, 9 measurements of hard and soft tissues were recorded. The paired Student’s t test was used to analyze the cephalometric data.
Results: Snoring children manifest a significantly narrower anterior-posterior dimension of the pharynx at the superior and most narrow widths. Snoring children also had a greater length from the hyoid to the mandibular plane.
Conclusions: Snoring children appear to present craniofacial factors that differ from those of non-snoring children.

Keywords: Snoring, Paediatric, Cephalometry

INTRODUCTION

Snoring is the vibration of upper respiratory structures like soft palate and pharynx, resulting in sound, due to obstructed air movement during breathing while sleeping. The sound may vary from soft and comforting to loud and unpleasant. Snoring during sleep may be a sign, or first alarm, of obstructive sleep apnea-hypopnea syndrome (OSAHS), whose medical consequences range from no physical debilitation to failure to thrive.[1] It is estimated that as many as 70% of adults with OSAHS snored during childhood.[2]

People suffering from OSAHS are at increased risk for hypertension, cardiovascular disease, cerebrovascular disease, and impaired function caused by sleepiness is a well-known fact.[3-6] Epidemiologic studies of habitual snoring in children suggest a prevalence of between 7% and 12%.[7-9] Snoring children are reportedly mouth breathers or restless sleepers, have excessive daytime sleepiness, they are hyperactive, have poorer hearing, and present with previous adenoidectomy and enlarged tonsils.[7-9] Although snoring has been reported to be a common finding in children with symptomatic OSAHS, only a subgroup of habitually snoring children have OSAHS.[10]

Snoring is a common problem. It is estimated that 30%-50% people snore.[11] One survey of Italian residents identified habitual snoring in 24% of men and 13.8% of women, rising to 60% of men and 40% of women aged 60 to 65 years; this suggests an increased susceptibility to snoring as age increases. Genetic and environmental factors influence snoring, and many studies support an anatomic origin. Palatal flutter has been reported to be the most important cause of snoring. In snoring due to airway obstruction, the blockage is often located at the level of the soft palate, but has also been identified elsewhere within the entire extent of the pharynx.

In the most severe apneics, the children presented with enlarged adenoids and narrow airways. An Italian study reported that habitually snoring children with apnea and adenotonsillar hypertrophy had increased cranio-mandibular intermaxillar, lower and upper gonial angles with a retroposition and posterior rotation of the mandible (high-angle face), and a reduction in the nasal posterior airway space because of enlarged adenoids.[12] Adeno-tonsillar hypertrophy is very common cause for snoring and adenotonsillectomy is indicated on clinical suspicion alone.[13]

Aim

The aim of the study is to prove the hypothesis that there are no differences between cephalometric variables of snoring and non-snoring children is wrong.

Objectives

a. To determine the differences in craniofacial factors between habitual snoring and non-snoring children.
b. To establish anatomic origin of snoring by analyzing these factors.

METHODS

Study sample

This study was carried at tertiary center of Armed Forces Hospital (Command Hospital Air Force, Bangalore) from July 2015 to October 2016.

Inclusion criteria

An inclusion criterion was children who snore in age group of 6–12 years.

Exclusion criteria

An exclusion criterion was children with adenotonsillar hypertrophy.

***Control group*:** Non-snoring children.

A total of 50 snoring and 50 non-snoring children were identified. It was ensured that the child is healthy and free of serious medical problems. Subjects with craniofacial anomalies such as cleft lip and palate were excluded.

Informed consent was taken from the parents or guardians of all the subjects. The data so obtained was analyzed using a standard spreadsheet computer application.

Demographic data

The subject's age and sex was documented and the height and weight recorded for each subject in centimeters and kilograms. The body mass index (BMI) was then calculated for each subject.

Cephalometric data

The cephalometric radiographs of the subjects were then taken and measurements recorded. The landmarks for the study were as follows:

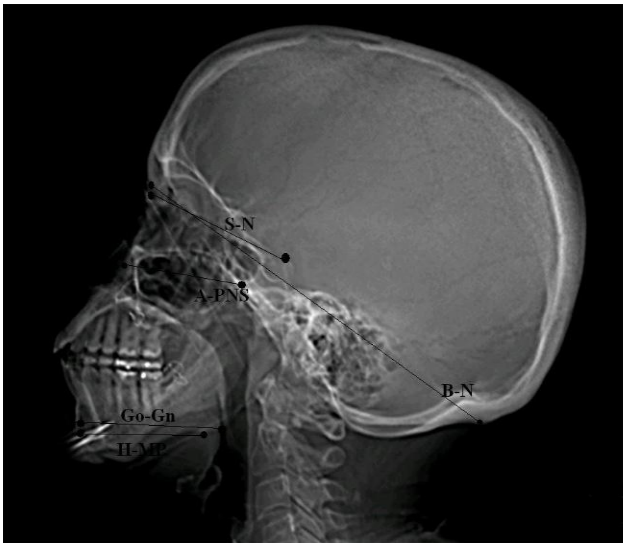

Figure 1: Conventional hard tissue linear measurements.

The following five conventional hard-tissue linear measurements were taken (Figure 1):

- The linear measurement from sella turcica to nasion (S–N)
- The linear measurement from basion to nasion (B-N)
- The anterior-posterior length of the maxilla measured from A-point to the posterior nasal spine (A–PNS)
- The effective length of the body of the mandible measured from gonion to gnathion (Go–Gn)
- H–MP (measured from the most inferior border of the mandible to menton).

The following soft-tissue linear measurements were taken:

- The length of the soft palate (LSP)
- The vertical airway length (VAL)
- Tongue length (TL) measured from the base of the epiglottis to the most anterior point of the tongue that touches the lingual surface of the mandibular incisors
- Width of the pharyngeal airway at its most narrow point inferior to the PNS and superior to gonion (N–PAS).

Figure 2: Soft-tissue linear measurements.

Statistical analysis

The independent variables measured on a continuous scale included 9 anatomic variables derived from cephalometric radiographs, age, and BMI. Sex was used as a dichotomous variable. Means and SDs were calculated for all continuous variables. Paired Student's t tests were used to test for equality of means between snoring and non-snoring children. A p>0.0055 using Bonferroni's correction (α of 0.05 divided by the total number of variables [0.05/9=0.004]) was used to determine statistical significance. All computations were performed using the statistical package for the social sciences (SPSS-PC1 for Windows; SPSS; Chicago, IL).

RESULTS

The results are illustrated in Table 1 which depicts comparison of means of cephalometric variables between snoring and non-snoring subjects.

Table 1: Results comparing means of cephalometric variables between snoring and non-snoring subjects.

Variables	Snoring subjects*	Non-snoring* subjects	P value
S-N	68±4.66	74±6.12	0.004
B-N	127±9.02	129.53±13.61	0.55
A-PNS	34.13±7.02	35.53±5.91	0.55
Go-Gn	57.26±7.85	61.93±8.49	0.13
H-MP	50.2±6.79	54.6±7.36	0.15
LSP	28.6±3.16	29.06±3.71	0.71
VAL	48.13±9.46	61±6.71	0.038
TL	51.6±11.75	42.53±8.41	0.021
N-PAS	2.26±0.7	5.4±1.55	0.014

Table 2: Distribution of children as snorers and non-snorers.

Sex of the child	Non-snorer	Sometimes snorer	Often snorer
Male	29	9	19
Female	21	8	14

Table 3: BMI of children in snorers and non-snorers.

Sex of the child/BMI	Snorers	Non-snorers
Male	28	29
Female	22	21
Average BMI	19.43±1.39	16.54±1.03

A total of 100 parents and guardians completed the sleep behavior questionnaire. The parents and guardians were given the option of selecting from the following three choices when asked how often their child snored. They were given a choice of a. never, b. sometimes, c. often

Approximately 33% of the children snored often, 17% sometimes and 50% had never snored, as depicted in Table 2. The 100 subjects who constituted the study sample were 43% female, 57%male with a mean age of 9±3 years (range, 6 to 12 years). Tonsils and adenoids were present in all subjects. The BMI was significantly (p =0.000) greater in the snoring group (19.43±1.39) compared with the non-snoring group (16.54±1.03), as depicted in Table 3.

Comparison of means for the 9 cephalometric variables between the snoring and nonsnoring subjects is presented in Table 1. The variable presenting the most significant difference (p<0.0055) between the groups included S-N. The measures of VAL, TL, S–N, and N-PAS demonstrated a trend toward significance (p<0.05) between the snoring and non-snoring groups.

DISCUSSION

The commonest paediatric age group reporting in ENT OPD at our Institute was from 6-12 years. Out of these 1/3rd had frequent snoring problems when parents were interviewed. This percentage was slightly higher than the previously reported snoring prevalence of 7% to 12% in children which can be attributed to patient selection from specialised pediatric ENT clinic.[8] The parents were interviewed to differentiate between snoring and non-snoring children. Snoring children were found to exhibit higher BMI in our studies though there are other studies that have reported that snoring and apneic children may in fact be underweight or underdeveloped.[14]

We chose 9 cephalometric variables based on their importance as reported in the literature and other studies.[14-16] In comparing the means of these 9 cephalometric measurements, four variables demonstrated statistical significance. One of the two measures of pharyngeal width (N–PAS) also showed statistical significance in the present study. We ruled out adenotonsillar hypertrophy by clinical examination in the subjects as it is a very common cause for snoring.[13]

The present study found an increase in the VAL, and a shortened maxilla (A–PNS) and cranial base (S–N) in snoring subjects. The fact that snorers had a shortened maxilla (A–PNS) and cranial base (S–N) may suggest a narrowing in the sagittal dimension. Retroposition of the mandible was not essential to the development of upper-airway obstruction, but rather contributed by posterior crossbites caused by a reduced growth of the maxilla after continuous oral breathing, and anterior open-bite with lip incompetence, owing to a forward tongue position.[14-17] Studies in adults have also demonstrated a significant reduction in the sagittal dimension of the anterior cranial base in apneics, a reduction in cranial base and mandible in snorers, and a shorter maxilla in apneics.[14-17] These studies suggest that habitual snorers might have an anatomic predisposition to airway obstruction.

This study has considered snorers without excluding obstructive sleep apnoea. We aim to differentiate snorers with and without OSAHS in future studies. Although this cross-sectional study is limited in helping us understand whether anatomic variation exists from childhood, our data suggest that there are craniofacial factors that may be different between snoring and non-snoring children. Approximately 90% of the growth of the craniofacial skeleton is obtained by the age of twelve years, and 60% by the age of four years.[18]

CONCLUSION

Cephalometric variables show statistically significant difference between snorers and non-snorers. Cephalometry can be a valuable and inexpensive tool for determining the craniomorphological features differentiating between snoring and non-snoring children. A long term follow-up of children, who snore, by using cephalometry, can predict the persistence of snoring in adulthood and various craniomorhological features responsible for snoring.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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