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ORIGINAL RESEARCH

Comparison of cephalometric analysis of patients with obstructive sleep apnea and healthy subjects

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***ABSTRACT*:**
Background: Obstructive sleep apnea (OSA) is a condition of partial or complete upper airway obstruction leading to increased resistance to airflow and potential cessation of breathing for 10 seconds or more. The causes of OSA include factors related to the upper airway anatomy, for instance, narrow airway space, relative mandibular retrognathia, increased tongue volume, and enlargement of palatine or adenoidal tissue. **Aim of the study:** To compare cephalometric analysis of patients with obstructive sleep apnea and healthy subjects. **Materials and methods:** The study was conducted in the Department of Orthodontics and Dentofacial Orthopedics of the Dental institution. For the study, we included patients with known history of regular snoring. An informed written consent was obtained from the participating subjects. Patient with history of craniofacial injury either hard tissue or soft tissue injury, history of orthodontic treatment, or with systemic diseases were excluded from the study. A total of 80 patients with history of snoring were selected. 80 healthy subjects were selected as controls. **Results:** In the present study, 80 subjects with history of snoring and 80 controls were included. We evaluated that length of hard palate was 52.33 mm for OSA patients and 50.41 mm for controls. Distance of gonion from point B was 76.12 mm for OSA patients and 79.13 mm for controls. The findings were statistically non-significant. **Conclusion**: Within the limitations of the present study, it can be concluded that difference of pharyngeal dimensions in OSA patients and controls was non-significant.
Keywords: Cephalometric analysis, OSA, snorers, sleep apnea.

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Introduction:

Obstructive sleep apnea (OSA) is a condition of partial or complete upper airway obstruction leading to increased resistance to airflow and potential cessation of breathing for 10 seconds or more.[1] Hypopnea, in contrast, is characterized by a reduction, without complete cessation, in airflow or respiratory effort.[2] Obstructive sleep apnea/hypopnea syndrome (OSAS) is known to be a frequent clinical condition in the general population and can be diagnosed in any age group.1 Young et al reported that a prevalence of 2% existed in the adult female population and 4% existed in the adult male population.[3] The causes of OSA include factors related to the upper airway anatomy, for instance, narrow airway space, relative mandibular retrognathia, increased tongue volume, and enlargement of palatine or adenoidal tissue.[4] Severity of OSA may be assessed subjectively by the patient or his/her spouse and objectively by nocturnal polysomnography or imaging techniques.[5] However, polysomnography has the disadvantage of being time consuming and complicated.[6] Hence, the present study was conducted to

compare cephalometric analysis of patients with obstructive sleep apnea and healthy subjects.

Materials and methods:

The study was conducted in the Department of Orthodontics and Dentofacial Orthopedics of the Dental institution. The ethical clearance for study protocol was obtained from ethical committee of the institution. For the study, we included patients with known history of regular snoring. An informed written consent was obtained from the participating subjects. Patient with history of craniofacial injury either hard tissue or soft tissue injury, history of orthodontic treatment, or with systemic diseases were excluded from the study. A total of 80 patients with history of snoring were selected. 80 healthy subjects were selected as controls. For the analysis of hard tissues, lateral cephalogram was done for each patient. All images were stored digitally and the image quality was optimized separately for soft tissue and hard tissue landmarks using the inbuilt software. Hard tissue parameters evaluated on lateral cephalogram were length of hard palate, distance of gonion from Point B, distance of menton from Point B, distance of hyoid bone from mandibular plane, distance of hyoid bone from menton, height of ramus, interincisal angle and gonion angle. Width of mandible was analyzed on panoramic radiograph.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

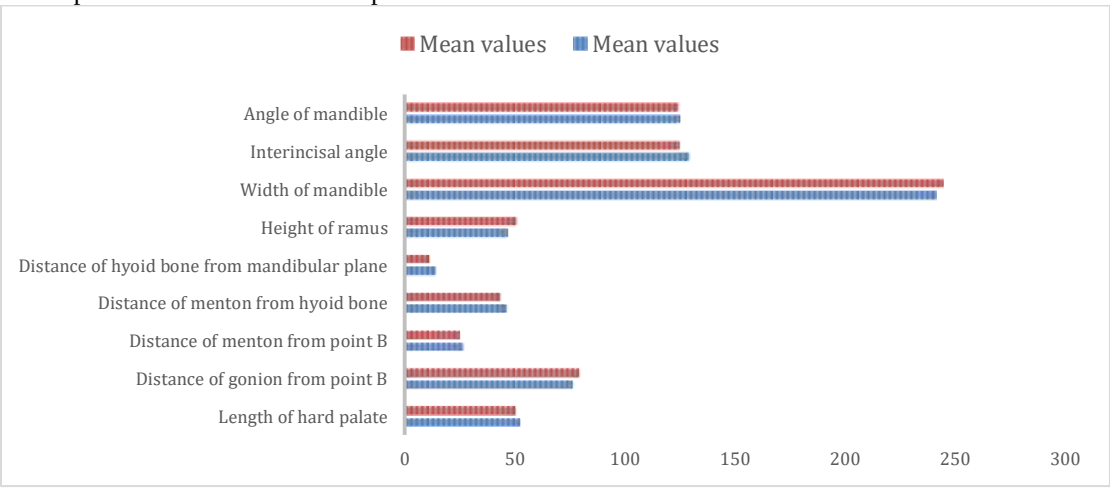
Results:

In the present study, 80 subjects with history of snoring and 80 controls were included. Standard lateral cephalogram was done for each patient. We evaluated that length of hard palate was 52.33 mm for OSA patients and 50.41 mm for controls. Distance of gonion from point B was 76.12 mm for OSA patients and 79.13 mm for controls. Distance of menton from point B was 26.52 mm for snorers and 26.33 mm for controls. Distance of menton from hyoid bone was 46.35 mm for OSA patients and 43.29 mm for controls Distance of hyoid bone from mandibular plane was 14.02 mm for OSA patients and 11.02 mm for controls. Height of ramus was 46.77 mm for OSA patients and 50.52 mm for controls. Width of mandible was 241.23 mm for OSA patients and 244.49 mm for controls. Interincisal angle was 129.09 mm for OSA patients and 124.77 mm for controls. The findings were statistically non-significant. [Table 1, Fig 1]

Table 1: Comparison of cephalometric landmarks in patients with sleep apnea and healthy subjects

Parameters	Mean values		p-value
	OSA patients	Healthy subjects	
Length of hard palate	52.33	50.41	0.21
Distance of gonion from point B	76.12	79.13	0.71
Distance of menton from point B	26.52	25.02	0.62
Distance of menton from hyoid bone	46.35	43.29	0.21
Distance of hyoid bone from mandibular plane	14.02	11.02	0.12
Height of ramus	46.77	50.52	0.33
Width of mandible	241.23	244.49	0.11
Interincisal angle	129.09	124.77	0.46
Angle of mandible	125.11	124.22	0.31

Graph 1: Cephalometric landmarks comparison



Discussion:

In the present study, we compared OSA patients from healthy patients using cephalometric analysis of hard tissues. We observed that there was difference in pharyngeal dimensions between OA patients and healthy subjects, however, non-significant difference was observed between the measurement of various pharyngeal dimensions. The results were compared to previous studies and were found to be consistent. Tangugsorn V et al performed a study with one hundred male obstructive sleep apnea (OSA) patients classified into 2 groups, on the basis of Apnea-Hypopnea Index (AHI), as severe (AHI > or = 50) and non-severe (AHI < 50). A comprehensive cephalometric analysis of cervicocraniofacial skeletal morphology and upper airway soft tissue morphology was performed in 51 non-severe OSA patients, 49 severe OSA patients, and 36 controls with the purpose of examining the different features among these 3 groups. Sixty-eight cephalometric variables were compared among these 3 groups by 1-way analysis of variance with post hoc Bonferroni test. The results showed that both OSA groups had aberrations of cervicocraniofacial skeletal morphology and upper airway soft tissue morphology versus the controls. Severe OSA patients demonstrated increased maxillo-mandibular retrognathism, with a high mandibular plane angle resulting from increased anterior lower facial height and decreased posterior lower facial height, versus the non-severe OSA group. The craniocervical extension, forward head posture, inferiorly positioned hyoid bone, and the enlarged and elongated soft palate and upright tongue posture were more exaggerated as well. These findings imply that there should be different treatment regimens for the 2 subgroups of OSA patients to achieve treatment success. Cephalometric analysis is therefore highly recommended to verify the aberrant cervicocraniofacial morphology in severe and non-severe OSA patients. Battagel JM et al analysed the upright lateral cephalometric radiographs of 115 dentate, Caucasian males. Forty-five subjects exhibited proven obstructive sleep apnoea (OSA), 46 were simple snorers, and the remaining 24 subjects, who had no history of respiratory disease and did not snore, acted as controls. Radiographs were traced and digitized, and comparisons were made of the dento-skeletal, soft tissue, and oropharyngeal features of the three groups. Differences were also sought between the snoring and OSA subjects. Of the hard tissue measurements, only the cranial base angle and mandibular body length showed significant inter-group differences. When the airway and associated structures were examined, both snorers and OSA subjects exhibited narrower airways, reduced oropharyngeal areas, shorter and thicker soft palates, and larger tongues than their control counterparts. Comparison of the two sleep disordered breathing groups showed no differences in any of the skeletal or dental variables examined. However, in OSA subjects, the soft palate was larger and thicker, both lingual and oropharyngeal areas were increased and the hyoid was further from the mandibular plane. Thus, whilst the dento-skeletal patterns of snorers resembled those of subjects with OSA, some differences in soft tissue and hyoid orientation were apparent. There was not, however, a recognizable gradation in size of the airway and its associated structures from control through snoring to OSA subjects. This suggests that there may be a cephalometrically recognizable predisposition towards the development of sleep disordered breathing, but that this is only one facet of the condition. [7, 8]

Borges Pde T et al correlated cephalometric and anthropometric measures with OSAHS severity by using the apnea-hypopnea index (AHI). A retrospective cephalometry study of 93 patients with OSAHS was conducted from July 2010 to July 2012. The following measurements were evaluated: body mass index (BMI), neck circumference (NC), waist circumference (WC), hip circumference (HC), the angles formed by the cranial base and the maxilla (SNA) and the mandible (SNB), the difference between SNA and SNB (ANB), the distance from the mandibular plane to the hyoid bone (MP-H), the space between the base of the tongue and the posterior pharyngeal wall (PAS), and the distance between the posterior nasal spine and the tip of the uvula (PNS-P). Means, standard deviations, and Pearson's correlation coefficients were calculated and analyzed. AHI correlated significantly with BMI, NC, WC, PNS-P, and MP-H. They concluded that anthropometric measurements and cephalometric measurements can be used as predictors of OSAHS severity. Shastri D et al obtained normative data for cephalometric measurements of the upper airway in the North Indian population. A total of 180 healthy patients were included out of which 90 were males (age range, 8-16 years), and 90 were females (age range, 8-16 years), with normal skeletal facial profile, no history of snoring, sleep apnea, upper airway disease, tonsillectomy or adenoidectomy, obesity, or pathology in the pharynx. Twenty cephalometric airway measurements, including size of the tongue, soft palate, nasopharynx, oropharynx, hypopharynx, and relative position of the hyoid bone and valleculae were obtained. Landmarks on cephalometric radiographs were digitized and measurements were made using a specially designed computer program. Error analysis of measurements was performed and comparison of measurements according to sex was made. Significant sex dimorphism was seen for the majority of measurements, with the exception of minimal depth of

the airway, oropharyngeal depth of the airway, and the soft palate angle with the hard palate. They concluded that a minimum sagittal dimension of the upper airway was evident despite differences in measurements between sexes. [9,10]

Conclusion:

Within the limitations of the present study, it can be concluded that difference of pharyngeal dimensions in OSA patients and controls was non-significant.

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