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RESEARCH ARTICLE

ANTHROPOMETRIC AND CEPHALOMETRIC ANALYSIS OF OBSTRUCTIVE SLEEP APNEA (OSA) PATIENTS AND HEALTHY CONTROLS

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ABSTRACT

Objective: This study aimed to compare the cephalometric and anthropometric characteristics of obstructive sleep apnea (OSA) patients with those of healthy subjects and to determine possible relationships between cephalometric and anthropometric measurements of OSA patients and control subjects. **Methods:** Standardized lateral cephalograms of 10 OSA patients and 10 healthy controls were obtained. Airway dimensions and dentofacial parameters were measured using a cephalometric analysis program .Anthropometric assessment was done in all of them. All statistical analyses were conducted using SPSS version 17.0.0. Descriptive statistics were calculated for all measurements, and the Mann–Whitney U test was used to evaluate intergroup differences. **Results:** Midface length was shorter in the OSA group than in the controls (P<.05). SNA, SNB angles were similar in both groups. The axial inclination of the lower incisor to its respective plane was normal, and the upper incisor was not significantly protrusive in the OSA group. Distance between the hyoid and mandible was significantly greater in the OSA group than in the controls, indicating that the hyoid bone was positioned more downward in the OSA group (P<.05).soft palate length was significantly longer and posterior airway space was significantly reduced in OSA group. Anthropometric analysis revealed significantly high mallampatti score>3, high waist hip ratio, neck circumference, reduced lateral neck length and high BMI in OSA group. **Conclusions:** In this study, the patients with OSA demonstrated significant differences in several craniofacial measurements and anthropometric analysis. OSA patients showed reduced posterior airway space, increased soft palate length and inferiorly placed hyoid bone and Mallampatti score>3,increased waist hip ratio, neck circumference, neck to height ratio, reduced lateral neck length and high BMI.

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INTRODUCTION

Sleep induces an unnatural increase in upper airway resistance in 3 to 6 % of adults. It is called as Obstructive sleep apnea (OSA) (Kim *et al*., 2004; Sunitha *et al*., 2009). It is defined as a chronic sleep disorder with complete or partial upper airway obstruction during sleep that cause cessation of airflow in the presence of respiratory effort. It causes repeated arousals and fragmented sleep and therefore excessive daytime sleepiness (EDS) (Sunitha, 2012; Sunitha *et al*., 2009), affecting the activities of daily living. Symptoms of OSA are EDS, snoring, choking, GERD, sleep disruptions, morning headaches, feeling un fresh on waking up. Risk factors for OSA are male gender, BMI> 25, neck circumference >43 cm in males and 40 cm in females, smoking, hypertension, GERD, Mallampatti grade >3, large tongue and tonsils. Other anthropometric parameters which can be assessed in OSA are Neck circumference (NC), Neck circumference to Height Ratio (NHR), Lateral Neck Length (LNL) and Waist Hip Ratio (WHR).

Lateral cephalogram is a lateral facial Xray used in dental clinics. It can be used to analyse skeletal and soft tissue characteristics of OSA (Battagel, 1996; Bacon, 1990). It is available in most dental clinics, easy to perform, not cumbersome and not costly. ANB angle, midfacial height, soft palate length and thickness, inferiorly placed hyoid, posterior airway space are the common parameters altered in OSA and can be assessed using alateralcephalogram. Although several studies have analysed these skeletal differences, there is still conflicting results were obtained (Pracharktam *et al*., 1994; Svanholt *et al*., 2009). Thus suggesting a need for a controlled study on cephalometric assessment of OSA. OSA is a risk factor for stroke, CAD, myocardial infarction etc. Quality of life and ADL are severely affected in OSA patients so identifying it at the earliest is very important for the society. OSA is a very much underreported condition. Overnight Polysomnogram is the gold standard in diagnosing OSA. But it is time consuming, cumbersome and comparatively costly to

the patient. The aim of this study is to compare the radiological and anthropometric assessment in OSA and healthy controls and to analyse possible relationship between two groups.

MATERIALS AND METHODS

This study included 10 OSA patients(7 males and 3 females, mean age 48.5+/_4.5)and 10 controls(7males and 3 females mean age 47.5+/_5.5).subjects diagnosed with OSA by polysomnography done at Institute of Neurology, Madras Medical College was referred to Tamilnadu dental college for cephalogram.OSA group was classified into mild, moderate and severe on the ba sis of AHI(Apnea Hypoapnea Index).control group had AHI < 5 and no snoring or EDS. 3,4 and 3 patients of OSA group had mild, moderate and severe OSA respectively.(mild :AHI 5 to 15,moderate 15 to 30,severe >30). Informed consent was obtained from all participants. cephalogram was done in all participants. This study was approved by Institutional ethics committee.

Inclusion criteria: those who had snoring, excessive daytime sleepiness and Epworth sleepiness score > 10 underwent polysomnography and those with AHI > 5 were included.

Exclusion criteria: those with claustrophobia, CAD, COPD, severeperiodontitis, temporomandibular disorders were excluded. Cephalometric parameters were measured using acephalometric analysis program. features assessed were ANB angle, hyoid mandible distance, posterior airway space, soft palate length and thickness and midfacial length. All participants underwent anthropometric assessment. Neck circumference (NC), Neck circumference to Height Ratio (NHR),Waist Hip Ratio(WHR), BMI, and Lateral neck length (LNL)were measured with help of an inchtape and standardised weighing machine. Mallampatti score was assessed in all of the participants.

Statistical method: All analysis were conducted using SPSS version 17.0.0.significance for all statistical tests was predetermined at P<0.05.Descriptive statistics were calculated for all measurements. Mann Whitney U test was used to evaluate intergroup differences.

RESULTS

In the OSA group age varied from 15 to 65 with mean age of 48.5+/_3.5 years. control group age varied from 18 to 69 mean age 47.5+/_4.5 Mallampatti score was more than 3 in 9 patients in OSA group, whereas it was < 2 in all controls.BMI was >30 in 8 patients in OSA group and 2 in the controls. mean BMI was 33.3 it varied from 24 to 36 in OSA group. mean BMI in control group was 25.9. NC was > 43 cm in 6 male patients and > 40 cm in all female patients with OSA (p<.05).it varied from 40 to 45.9cms.in the control group, only 2 had NC >40 cms. NHR was >0.25 and WHR was >0.9 in 9 patients with OSA.(p<.05)NHR varied from 0.20 to 0.27 and WHR varied from 0.8 to 0.99 in OSA group. in the control group, only 3 had NHR and WHR in the abnormal range. LNL was <12 cm in 9 patients in OSA group(p<.05).it varied from 11.5 cms to 12.9 cm.LNL was <12 cm in 2 people in control group. In cephalogramanalysis, soft palate length (SPL), posterior airway space (PAS) inferiorly placed hyoid was seen in 9 patients and none in the controls(p <.05)mid facial length was shorter in 8 patients in OSA group. SNA, SNB angles were similar in both groups. Dental examination revealed there was no differences in the position of teeth in two groups. The upper incisor was protrusive in 5 patients but not significant. Soft palate thickness and tongue thickness was seen in 7 patients in OSA group and 3 patients in controls. Posterior Airway Space (PAS) was significantly smaller in 9 patients in OSA group(p<.05)

Comparison of anthropometric variables: (Mann Whitney U test:p<.05*)

Parameters	OSA group		controls		P
	Mean	SD	Mean	SD	
NC	43.9	3.5	38.2	3.5	*
NHR	0.29	0.05	0.22	0.02	*
WHR	0.95	0.05	0.8	0.02	*
BMI	33.3	0.5	25.9	0.6	
LNL	11.5	0.2	12.7	0.2	*

Comparison of cephalometric variables: (Mann Whitney U test :p<.05*)

Parameters	OSA group		controls		
	Mean	SD	mean	SD	P
SNA(^{0})	80.1	3.8	80.3	3.9	
SNB(^{0})	79.5	4.5	78	4	
Maxillary length	53.2	4.7	55.1	4.9	
Midface length	88.5	5.3	93.1	5.9	
Upper incisor to nasion(^{0})	23.1	6.1	21.1	5.8	
Hyoid to mandible	25.5	7.1	19.5	6.5	*
Posterior airway space	10.1	2.5	13.5	3.4	*
Soft palate length	43.1	6.1	37.9	6.2	*

DISCUSSION

Skeletal differences between OSA and control groups have been reported in a few studies (Pracharktam *et al*., 1994; Svanholt *et al*., 2009; Seto, 2001; Sonnesen *et al*., 2008). Battagel *et al* stated that these differences make facial complex and spine closer, thus reducing the airway space causing sleep disordered breathing (Battagel, 2000). This study didnotdemonstrate any positional differences of maxilla and mandible in both groups.mandibularretrognathia has been reported by few authors (Hochban, 1994; Jamieson *et al*., 1986; Series *et al*., 1992; Andersson *et al*., 1991). OSA patients had reduced midfacial length and this finding supported that of Tangugsorn *et al*. (1995). It is a cause of reduced airway space. This study didnot reveal any significant association between protrusive upper incisors but protrusive upper incisors may be a cause of oral breathing. In OSA group hyoid was inferiorly placed and it was consistent with those of previous studies (Pracharktam *et al*., 1994; Battagel, 2000; Andersson *et al*., 1991). Lower position of hyoid causes more of the tongue to be accommodated in hypopharyngeal region and so it is a prognostic indicator in successful use of mandibular advancement splints (Battagel *et al*., 2000; Lyberg *et al*., 1989; Mayer *et al*., 1995). A lower hyoid increases the mandibular load for extra energy to lift the tongue.this in turn may aggravate OSA by resulting in open mouth posture during sleep (Arya *et al*., 2010; Caballero *et al*., 1998). In this study PAS is significantly shorter in OSA group.but there was no significant difference in anterior and middle airway spaces. Airway collapse often occurs in supine position and base of tongue abuts the posterior pharyngeal wall and soft palate. Elongated or thickened soft palate is one of the commonest causes of snoring and OSA (Ephros, 2010). This study revealed significant differences in soft palate length between two groups. This finding was consistent with those of other studies. But thickness was not significant. With regards to anthropometric analysis, this study revealed significant

differences between two groups in LNL,NHR,WHR, BMI,NC and mallampattiscore.LNL was measured from mid clavicle to angle of mandible. The reference value was 12 cms. Previous studies also showed reduced LNL is associated with OSA and this study also proved it. Increased BMI is a risk factor for OSA. but it is common in people having a normal BMIalso. This study revealed a significant difference between two groups in BMI. NHR >.25 was taken as cutoffvalue.OSA patients had a highly significant NHR. So was WHR whose reference values were 0.9 and 0.85 in males and females respectively. Mallampatti score on the higher range infers a reduced airway space due to big tongue, soft palate and pillars of the palate. This study revealed significant difference between two groups in mallampatti score. On the basis of these results null hypothesis was rejected. significant differences existed in craniofacial morphology and anthropometric assessment of OSA and control group.

Conclusion

Polysomnography is the gold standard for diagnosis of OSA .but it is time consuming and cumbersome. whereas these anthropometric analysis and lateral cephalogram are easy, less time consuming and less costly. they can be used for screening OSA. Significant differences existed in the craniofacial morphology and anthropometric assessment of OSA patients and control group. Mallampatti score >3,high WHR,NHR,NC and reduced LNL in the anthropometric analysis and reduced PAS, inferiorly placed hyoid and increased soft palate length in lateral cephalogram was significantly associated with OSA.

Sponsorship: Nil

Conflict of Interest: nil

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