Subgrouping Persons with Snoring and/or Apnea by Using Anthropometric and Cephalometric Measures


ABSTRACT

Craniofacial and anthropometric characteristics are identified risk factors for obstructive sleep apnea syndrome (OSAS). Phase 1 of this study used cephalometric radiographs to record craniofacial measurements from 60 OSAS subjects with a respiratory disturbances index (RDI) of 20 or greater (group A) and 60 subjects with a history of loud snoring and an RDI less than 20 (group B). From this data set, a craniofacial risk index (CRI) was constructed using age, body mass index (BMI), and 14 cephalometric measures previously reported to be associated with OSAS. A separating boundary (CRIS) was established by using discriminant analysis to differentiate between the two groups. All measurements were determined by an investigator who was blinded to the subjects’ RDI score. Phase 2 used a second sample of 19 group A and 47 group B subjects to test the ability of the CRI derived from the first sample to classify subjects in this second sample into the correct age group. The CRI was able to classify correctly 72.3% (34 of 47) of the group A subjects when all variables were used in the discriminant model. Using only four variables (age, BMI, hyoid mandibular plane distance, and tongue length) selected by the stepwise method, 72.3% (34 of 47) of the group B subjects and 78.7% of group A subjects were classified correctly. These results suggest that a stepwise CRI could be used to classify heterogeneous groups of individuals with increased RDI into subgroups with varying degrees of anatomic risk for disease. Such subgrouping by anatomic risk could be important in determining the pathophysiology of OSAS because it is likely that differences
Obstructive sleep apnea syndrome (OSAS) is a serious medical condition. It is characterized by decreased arterial oxygen saturation and sleep fragmentation caused by pharyngeal obstruction during sleep. A recent epidemiologic survey suggested that the prevalence of this disease may be as high as 4% of the adult male population between 30 and 60 years of age. Although OSAS is usually thought of as a disease of obese, middle-aged men, women with upper-body obesity and a thick neck and children with tonsillar and adenoid hypertrophy are also at risk. Clinically, the designation of OSAS should be applied to persons who experience frequent apnea and hypopnea during sleep, with pathophysiologic consequences. Both cardiovascular and pulmonary complications have been reported. In addition, patients may experience adverse behavioral changes such as snoring and excessive daytime hypersomnia, leading to occupational disability.

The etiology of OSAS appears to relate to related to neuromuscular and anatomic factors that compromise the patency of the pharyngeal airway during sleep. Certain craniofacial anatomic factors may operate specifically to reduce airway patency. In addition, obesity, alcohol use, and abnormalities in ventilatory control are risk factors of the disorder. Because all these factors are subject to both genetic and environmental influences, it may be that there is a significant familial basis for OSAS.

Obstructive sleep apnea syndrome can be considered a continuum that begins with snoring (mild to severe) and extends through the more significant disturbances of multiple apneas, hypopneas, and the frequent nocturnal arousals. Snoring (sounds produced by turbulent flow in a narrow or obstructed at the level of the nasopharynx or oropharynx) is the hallmark of the syndrome and is the most common reason for patients to contact an otolaryngologist. Obstruction can occur at the oropharynx or nasopharynx.

Williams and co-workers studied 25 adult men diagnosed with this syndrome. They found airway anomalies at the oropharynx level in 76%, at the hypopharynx level in 44%, and at the larynx level in 8% of cases. Some research studies attempted to distinguish features in nonapneic snorers from those in apneic snorers and to provide a likely explanation as to why some snorers develop airway occlusion during sleep. Stauffer and colleagues conducted a well-controlled study that demonstrated that increased inspiratory resistance to airflow in the nasooropharynx was present during wakefulness in overweight men with obstructive sleep apnea. Differences in craniofacial anatomic structures of apneic and nonapneic snorers in the upright and supine position were reported by Pracharktam et al. They concluded that whereas the magnitude of some variables increases in the supine position, these increases produced no additional posture-related differences between the two groups. Thus, anatomic assessment of subjects at risk for sleep apnea can be made in the upright and awake state.

Several studies have been done that used cephalometric analysis to evaluate upper airway anatomy and craniofacial morphology of OSAS patients. Many investigators have concluded that the craniofacial profile has important diagnostic value in both pretreatment and posttreatment evaluation. The most consistent findings related to OSAS are a lower position of the hyoid bone, increased length of the soft palate, and decreased size

**KEYWORDS:** Cephalometrics, subgrouping, anatomy, apnea