The usefulness of cephalometric measurement as a diagnostic tool for obstructive sleep apnea syndrome: a retrospective study

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Objective. Obstructive sleep apnea syndrome (OSAS) is a disorder characterized by apnea and hypopnea maintained for over 10 seconds and occurring at least 5 times per hour, with at least 30 episodes during 7 hours of nocturnal sleep. The most important pathophysiology in OSAS is the obstruction of the upper airway during sleep. The aim of this study was to identify the correlations between lateral cephalometric parameters, which seemed to be related to OSAS severities, and polysomnography (PSG) indices and to thus determine the cephalometric parameters reflecting OSAS severity.

Patients and Methods. A total of 140 participants (122 males, 18 females) were evaluated by lateral cephalography and PSG. A total of 29 measurements (24 distances and 5 angles) were made on lateral cephalography. Cephalometric and PSG parameters were evaluated statistically to select and validate the cephalometric parameters reflecting OSAS severity.

Result. OSAS has a significant relationship with the anatomic deformities of craniofacial and soft tissues. Lateral cephalometry revealed that patients with OSAS have a significant vertical airway length, a regrognathic mandible, a thick uvula, a large tongue, and a long mid-face length. The position of the hyoid bone had a tendency to displace inferiorly and/or posteriorly. Using the discriminant variable combination, including tongue base-posterior nasal spine (T1-PNS), sella−nasion−B point angle (SNB), maximum uvula thickness (Max U), tongue base-tongue tip (T1-TT), and nasion-anterior nasal spine (N-ANS), 102 of 140 (72.9%) patients were correctly assigned to the normal-to-mild and moderate-to-severe apnea−hypopnea index (AHI) groups.

Conclusions. Lateral cephalometric radiography may be an accessible and suitable tool for evaluation of craniofacial and soft tissue deformities in their correlations with OSAS severity. Further research on the cephalometric parameters reflecting OSAS severity is needed. (Oral Surg Oral Med Oral Pathol Oral Radiol 2015;119:20-31)

Obstructive sleep apnea syndrome (OSAS) is a disorder characterized by apnea and hypopnea maintained for over 10 seconds and occurring at least 5 times per hour, or with at least 30 episodes during 7 hours of nocturnal sleep.[1,2] Various symptoms are associated with OSAS, including excessive daytime sleepiness, diminished executive function, oxygen desaturation, cardiovascular disorder, depression, and personality change.[3] The estimated prevalence in Western countries is 4% among men and 2% among women.[4,5]

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The most important pathophysiology in OSAS is the obstruction of the upper airway during sleep. The upper airway is a pliant tube and, as such, is subject to collapse.[6] Airflow velocity increases at the site of the obstruction in the respiratory tract, in accordance with the Bernoulli effect.[7] Since the tendency for upper airway obstruction in OSAS patients is greatly influenced by the anatomic state of the respiratory tract,[8,9] evaluating the structure of the upper airway is essential to make the correct diagnosis of, and provide effective treatment for, OSAS.[2]

A variety of tools for the identification of the obstruction site, anatomic structure, and pattern have been introduced, all of which have advantages and disadvantages (Table I).[10] Although polysomnography (PSG) is

Statement of Clinical Relevance

Our aim was to find out whether the use of lateral cephalometric radiography is an accessible and suitable methodology for the evaluation of craniofacial and soft tissue deformities related to obstructive sleep apnea syndrome (OSAS) severity. As lateral cephalometric radiography is an easily used clinical tool in dentistry, early diagnosis of potentially severe OSAS was possible.

Table I. Advantages and disadvantages of available methods for evaluation of obstruction site in patients with OSAS

Method	Non-invasive	No radiation	Dynamic	Allow sedation	In-expensive	Widely available	Supine exam possible	Allow PSG	Technical ease	Evaluate surrounding tissue	Cross-section
Visual inspection	+	+	−	−	+	+	+	−	+	−	−
Fiberoptic endoscopy	−	+	+	+	+	+	+	−	−	−	+
Cephalometry	+	−	−	−	+	+	−	−	+	+	−
Fluoroscopy	+	−	+	+	+	−	+	−	+	+	−
CT	+	−	+	+	−	−	+	−	+	+	+
MRI	+	+	+	+	−	−	+	−	+	+	+
Acoustic reflections	+	+	+	−	+	−	+	+	−	−	+
Manometry	−	+	+	+	+	−	+	+	+	−	−

PSG, polysomnography; *CT*, computed tomography; *MRI*, magnetic resonance imaging.

the "gold standard" for the identification of individuals with OSAS, quantification of its severity, medical management guidance, and determination of the success of treatment modalities, it does not identify the site of obstruction or predict surgical results. Development of diagnostic tools for correct detection of the pattern of upper airway obstruction is, however, important because during sleeping periods, this pattern is dynamic, and its direction is variable and three-dimensional.[11]

Dynamic means of obstruction site evaluation are sleep videofluoroscopy (SVFS) and drug-induced sleep endoscopy (DICE). The advantages of SVFS include direct observation of the dynamic anatomy and the obstructive site during drug-induced sleep and its easy availability; the disadvantages are exposure to high doses of radiation and superimposition of normal anatomic structures. DICE is an inexpensive, accessible technique for dynamic evaluation of the airway in multiple positions in drug-induced sleep. However, both SVFS and DICE require sedation to attain sleep during the procedure, and the differences in reproducibility between natural sleep and drug-induced sleep remain controversial.

Lateral cephalometric radiography also is widely used for evaluation of upper airway obstruction in patients with OSAS. Although there are some disadvantages, such as studying a three-dimensional object with a two-dimensional picture, superimposing structures, and having the patient awake and in the upright position, lateral cephalometric radiography is a noninvasive, inexpensive, widely available, and technically easy method for evaluation of skeletal and soft tissue abnormalities contributing to obstruction and, indeed, has been widely used in the examination of patients with OSAS. Also, this tool can be used to evaluate the obvious abnormalities of the maxillary and mandibular position for sagittal airway computed tomography (CT). The correlations between lateral cephalometric parameters and OSAS-related indices (e.g., AHI, RDI, etc.) have been analyzed in numerous studies.[12-17] Unfortunately, the widely known parameters associated with OSAS are numerous, taking all of them into consideration is time consuming, and in any case, not all of them correctly coincide with PSG results. Also, there are no finely designed methods for the identification of potential patients with OSAS on the basis of routine lateral cephalometric radiography. Development of such methods would provide a very valuable diagnostic tool for distinguishing between those with OSAS and those without OSAS.

The aims of this study were to identify the correlation between lateral cephalometric parameters seeming correlated with OSAS severities and PSG indices and, further, to determine the cephalometric parameters reflecting OSAS severity.