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CORRELATION OF CEPHALOMETRIC MARKERS IN CHILDREN PRESENTING WITH SLEEP DISORDERED BREATHING

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ABSTRACT Children presenting with sleep disordered breathing are usually open mouth breathers and may essentially show variations in craniofacial growth overtime as compared to normal nasal breathers. These variations may include lower anterior facial height, adaptation in position of hyoid bone, increased inclination of mandibular bone, difference in tongue and soft palate in terms of size and thickness, reduced airway diameter at various levels of nasopharynx and oropharynx. The current study aims to assess and correlate the cephalometric markers in children which present with nocturnal sleep disordered breathing or obstructive sleep apnea. Fifty children, of which 28 being male and 22 being female, who presented with complaints like snoring and symptoms of obstructive sleep apnea for more than 6 months were selected. Appropriate radiographs were taken of these patients and cephalometric markings were made using these radiographs which were further used for measurements of the craniofacial anatomy. It was evident that children which showed clinical symptoms of obstructive sleep apnea also showed changes in cephalometric measurements and a significant reduction in sagittal diameter of upper airway. Thus lateral cephalograms can be used as predictors for nocturnal sleep disordered breathing.

KEYWORDS : Obstructive sleep apnea, sleep disordered breathing, cephalometric measurements, snoring

INTRODUCTION:

Children of the preschool age group frequently present with nocturnal breathing difficulties. About 10 per cent of preschool children have reported with complaints of snoring at night. [1] It is considered as a primary symptom of nocturnal sleep disordered breathing due to upper airway obstruction. Mouth breathing is also seen in habitual snorers due to nasal resistance offered. Although nasal resistance is often found in children with enlarged tonsils or adenoids, open mouth breathing can itself be responsible for increased incidence of viral infections resulting in an augmented growth of lymphatic tissue of the upper airway. Obstructive sleep disordered breathing in children refers to a spectrum of nocturnal breathing disorders characterized by prolonged increased upper airway resistance and partial or complete upper airway obstruction.[2] Such cases should be kept under close watch as it may lead to severe breathing difficulties and upper airway collapse during deep slumber state.

It has been observed that there are certain major and minor variations in the craniofacial anatomy in terms of size, shape, position, diameter of certain structures in patients with sleep disordered breathing as compared to normal individuals. It is a topic of discussion whether these variations are correlated with obstructive breathing difficulties in children. Cephalometric radiographs can be used for the purpose of assigning anatomical markers to craniofacial structures and for their significant measurements and comparisons. The use of lateral radiographs has been long established to look for certain anatomical structures such as adenotonsillar hypertrophy in children which may lead to substantial symptoms of obstructive sleep apnea or sleep disordered breathing syndromes. Even though cephalometric radiographic measurements obtained of the posterior airway space is a two-dimensional analysis, it has been proven to be a very reliable diagnostic tool for measuring pharyngeal volume. [3] Adequate observation and interpretation of the upper airway in these subjects can assist in appropriate management of sleep disordered breathing and obstructive sleep apnea syndromes and their etiologies.

MATERIALS AND METHODS:

Subjects-

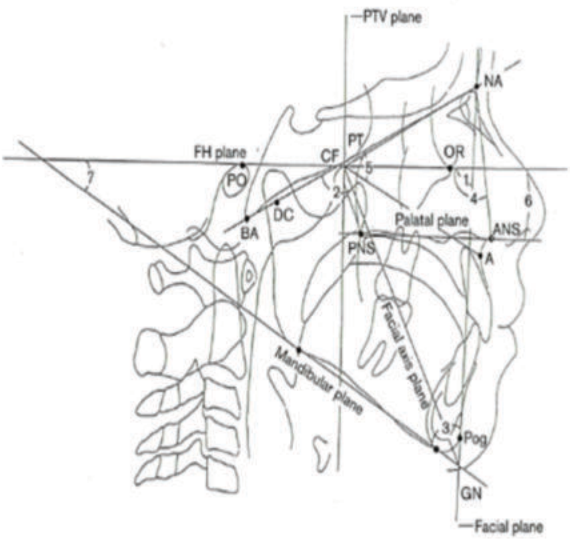
Both male and female subjects of the age group of 4-9 years who gave symptoms of sleep disordered breathing, who attended ENT OPD in Dr. Vitthalrao Vikhe Patil Pravara Rural Hospital, Loni were selected for the study. 25 children were selected out of which 14 were male and 11 were female. The parents of all these subjects were questioned and it was observed that they all had a history of disturbed sleep due to obstructive breathing disorder that was depicted by snoring, recurrent episodes of apnea, open mouth breathing. The exclusion factors for the selection of subjects were obesity, congenital craniofacial anatomical abnormalities, neurological diseases, previous corrective surgeries of the craniofacial area.

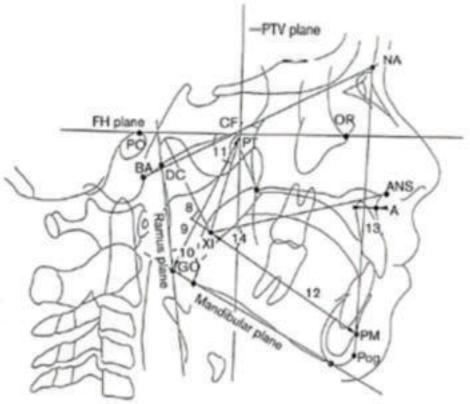
Cephalometric Analysis-

Lateral cephalometric radiographs were taken of all the selected patients using a standardised technique. The lateral cephalometric radiographs were taken in a natural head position. All cephalometric markers were located and identified. Identified landmarks, planes, and measurements proposed by Ricketts were used.[4]

Major Landmarks-

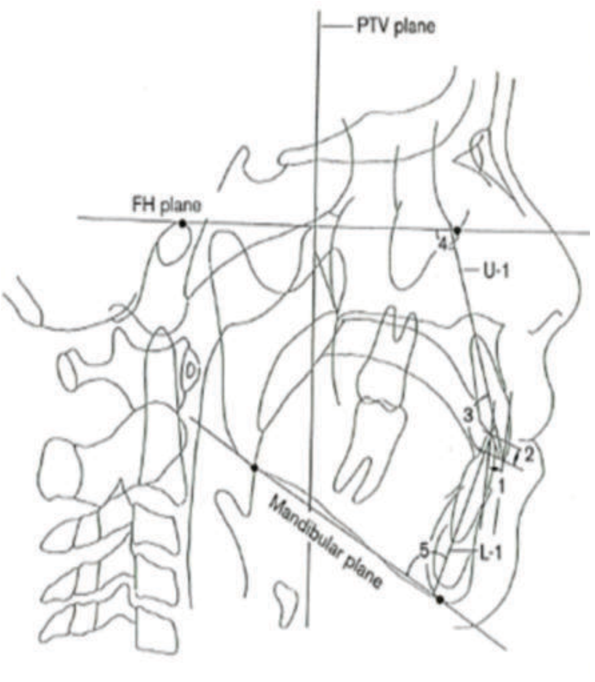
A- Deepest point on the concave outline of the upper labial alveolar process, extending from the anterior nasal spine to the prosthion
ANS- Anteriormost point at the sagittal plane on hard palate
BA- Inferiormost point of occipital bone at anterior margin of occipital foramen
NA- Anteriormost point of frontonasal suture
OR- Inferiormost point on the lower border of the orbit
PM- point where curvature of anterior border of the symphysis changes from concave to convex
PNS- Posteriormost point at the sagittal plane on hard palate
PO-Superiormost point on radiolucency of external and internal auditory meati
Pog- Most prominent point of chin
S- center of pituitary fossa of sphenoid bone





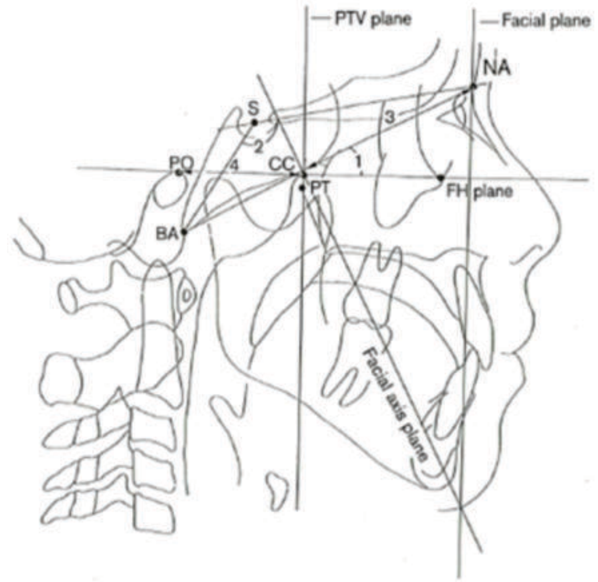
1 Facial depth: The angle between the facial plane and the FH plane.
2 Facial axis: The angle between the facial axis plane and BA-NA plane.
3 Facial taper: The angle between the mandibular plane and the facial plane.
4 Maxillary depth: The angle between the FH plane and the NA-A plane.
5 Maxillary height: The angle between the NA-CF plane and the CF-A plane.
6 Palatal plane angle: The angle between the FH plane and the palatal plane (ANS-PNS).
7 Mandibular plane angle: The angle between the FH plane and the mandibular plane.
8 Mandibular arc: The angle between the PM-XI plane and the XI-DC plane.
9 Posterior facial height: The distance between the GO point and the CF point.
10 Gonial angle: The angle between the mandibular plane and ramus plane.
11 Ramus position: The angle between the FH plane and the CF-XI plane.
12 Corpus length: The distance between the XI point and the PM point.
13 Convexity: The distance between the A point and the facial plane.
14 Lower facial height: The angle between the ANS-XI plane and the XI-PM plane.

Figure: 1 Measurements of the skeleton



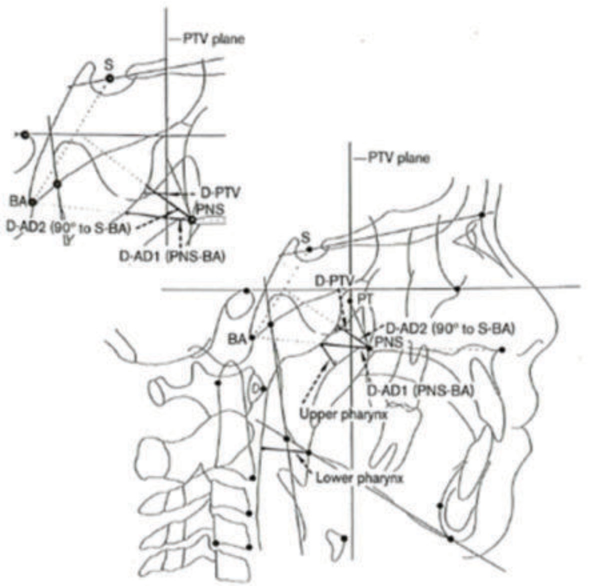
1 Incisor overjet: The horizontal distance between the upper incisor edge and the lower incisor edge.
2 Incisor overbite: The vertical distance between the upper incisor edge and the lower incisor edge.
3 Interincisal angle: The angle between the U-1 plane and the L-1 plane.
4 U-1 to FH plane: The angle between the U-1 plane and the FH plane.
5 L-1 to mandibular plane: The angle between the L-1 plane and the mandibular plane.

Figure: 2 Measurements of the dentition



1 Cranial deflection: The angle between the FH plane and the BA-NA plane.
2 NA-S-BA: The angle between the NA-S plane and the S-BA plane.
3 Cranial length anterior: The distance between the NA point and the CC point.
4 Porion location: The distance between the PO point and the PTV plane.

Figure: 3 Measurements of the cranial base



D-AD1
The distance between the PNS point and the nearest adenoid tissue, measured along the PNS-BA plane.

D-AD2
The distance between the PNS point and the nearest adenoid tissue, measured along a line from the PNS point perpendicular to the S-BA plane.

D-PTV
The distance between the nearest adenoid tissue and a point on the PTV plane 5 mm above the PNS point.

Upper pharynx
The shortest distance from the upper surface of the palatine velum to the adenoid tissue.

Lower pharynx
The distance between the intersection point where the tongue base meets the lower contour of the mandible and the posterior pharyngeal wall.

Figure: 4 Measurements of the pharyngeal airway

RESULTS:

Cephalometric analysis of all 25 children, 14 male and 11 female was done. On cephalometric analysis, it was seen that there were significant findings in the facial taper ($p<0.05$), the mandibular plane angle (p<0.01),the gonial angle (p<0.001), and the lower facial height (p<0.001). Significant findings were also seen in values of the interincisal angle e (p<0.001) and the L- I to mandibular angle (p<0.001). The nasopharyngeal AP airway was seen to be significantly smaller (p <0.05). The oropharyngeal AP airway was also significantly smaller (p< 0.01), soft palate being significantly thicker smaller (p< 0.01).

DISCUSSION:

The above results of the study imply that there are significant variations in the craniofacial and pharyngeal anatomy of children having symptoms of sleep disordered breathing. The most important being the pharyngeal airway measurements. Although it is not possible to identify a direct relationship between the cause of respiratory obstruction and its effect on craniofacial growth, it may be seen that mouth breathing may be related to an alteration of the position of the orofacial muscles and of the mandible influencing mastication, deglutition and phonation, leading to occlusal and skeletal alterations.[5]

CONCLUSION:

It can be concluded that from this study it can be established that there are significant variations in the craniofacial anatomy of patients with OSA or sleep disordered breathing. Although it is not possible to find the cause of such variations by just looking at the cephalometric markers, it is still of value to understand the correlation between these modalities.

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