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Co-relation between airway assessment on lateral cephalogram with abnormal breathing pattern in 3–12-year-old patient.

Abstract:
Background: *The airway is assumed to play a role in dentofacial development. It was observed that there is a correlation between patients with normal nasorespiratory functions and different malocclusions and airway dimensions. Upper airway assessment is particularly important in the daily work of orthodontists, pediatric dentists, ENT specialists, speech therapists etc. A narrow upper airway is associated with obstructive sleep apnea (OSA). It can be determined by lateral cephalograms routinely.*
Objectives: *To evaluate the co-relation between airway assessment on lateral cephalogram with abnormal breathing pattern in 3–12-year-old patient.*
Methods: *A cross-sectional study included 42 children aged 3-12 year were recruited from the outpatient clinic with abnormal breathing pattern. The patients were clinically examined and parents were asked if child has habit of mouth breathing. Later patients were advised for lateral cephalogram and airway assessment was done for the same.*
Results: *The mean age of the participants was 9.93 years. There were 19 male and 23 female subjects in the study. The airway obstruction was based on the distance between the posterior wall of the nasopharynx & soft palate. Distance of 5mm between the posterior wall of the nasopharynx & soft palate was seen in 10 cases (23.8%), distance of ≤5mm was seen in 18 cases (42.9%) and a distance of >5mm was seen in 14 cases (33.3%). There was a significant difference in the prevalence of airway obstruction among male (21.10%) & female (60.90%) subjects.*
Conclusion: *It was observed that there was obstruction of the airway if a distance was lower than 5 mm (42.9%) and there was a significant difference in the prevalence of airway obstruction among male and female, with higher prevalence in females.*

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I. Introduction:

The airway is assumed to play a role in dentofacial development[1]. So, several studies tried to correlate patients with normal naso-respiratory functions with different malocclusions and airway dimensions. Lateral cephalograms was first proposed for application on patients with Obstructive Sleep Apnea Syndrome (OSAS) in 1972 by Cosman et al. Lateral cephalograms then became a popular tool for evaluating the site of obstruction and severity in patients with obstructive sleep apnea syndrome[2]. OSAS is a common form of sleep-disordered breathing which is characterized by repetitive episodes of partial or complete upper airway obstruction which induces sleep fragmentation and other symptoms[3]. It has been postulated that sleep posture influences these events because patients with the syndrome may have increased respiratory difficulty when sleeping in the supine position[3]. Upper airway size and resistance have been areas of interest in orthodontics. Since several studies have indicated that impaired nasal breathing may be associated with unfavourable dentofacial growth in children[3]. Lateral cephalometric radiograph is a conventional orthodontic method used for determining craniofacial morphology and possible airway obstruction[3].When the size of the nasopharyngeal space appears reduced-either by the presence of adenoids or due to the narrow anatomical structure of the nasopharynx-the resulting functional imbalance can impact craniofacial growth and development[4]. Several factors may be associated with mouth breathing, among which are constriction of the nasal passage, narrow or obstructed nasopharynx, hypertrophic nasal membranes, enlarged turbinate's, hypertrophic palatine or pharyngeal tonsils, nasal septal deviation, choanal atresia and tumours in the nose or nasopharynx[4]. The airway system plays an important role in craniofacial growth and the development of a respiratory function[5]. Anatomically, the respiratory tract is separated into the upper part, comprising the mouth, nose, pharynx, and larynx and the lower respiratory tract, comprising trachea, bronchi, bronchioles, alveolar duct and alveoli[5]. The growth and function of the nasal cavities, the nasopharynx, and the oropharynx are closely associated with the normal growth of the skull. In this respect, knowledge of normal cranial growth has often been gained by recognition and observation of abnormal development. Mouth breathing, which has been associated with specific facial growth patterns, may result from obstruction or restriction of any part of the upper airway. The use of lateral cephalometric radiographs to evaluate the upper airway is somewhat limited as they provide 2-dimensional images of the nasopharynx, which consists of complex 3-dimensional anatomical

structures[6]. Upper airway obstruction tends to alter breathing, which can have a significant impact on the normal development of craniofacial structures, causing deficiencies in transverse maxillary growth, as well as cause the rotational growth of the back of the mandible[7]. Lateral cephalometric radiographs (LCRs) have been widely used as a screening tool for children with suspected sleep-disordered breathing, which may be related to metabolic, cardiovascular, and neurocognitive morbidity in young people[8]. The diagnostic application of LCRs has been recognized by a meta-analysis concluding that there was reduced sagittal width of the upper airway in children with obstructive sleep apnea[8]. Hence it is essential to know airway assessment methods, which include a clinical examination and a radiographic evaluation (Lateral cephalogram). These would indicate possible functional changes that could interfere with treatment.

II. Material & Methodology:

Material: Lateral cephalograms of patients with abnormal breathing pattern.

Study design:

This cross-sectional study was carried out in the Department of Pedodontics and Preventive Dentistry after getting approval from the Institutional Ethics Committee. Total, 42 children, aged 3-12 years were recruited from the outpatient clinic with abnormal breathing pattern.

Inclusion criteria:

• Patient aged 3–12-year-old

• Patient with abnormal breathing pattern.

Exclusion criteria:

• Patient with age above 12-year-old.

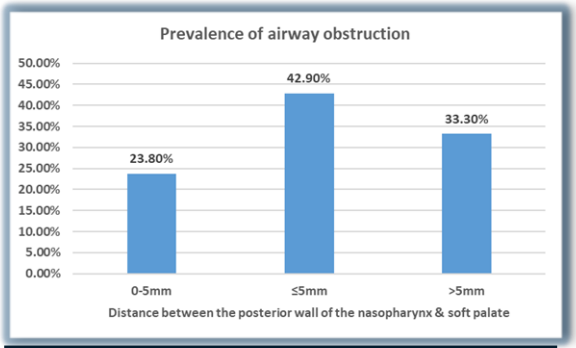
• patient with normal breathing pattern.

• patient not willing for treatment.

The patients were clinically examined and parents were asked if child has habit of mouth breathing. Then patients were advised for lateral cephalogram and airway assessment was done for the same. Lateral cephalogram was taken for mouth breathing patients and airway assessment was done for the same. On lateral cephalogram, distance between nearest point of posterior wall of the nasopharynx & soft palate was examined. Distance was measured with the help of measuring scale. If there was a distance lower than 5mm, considered that there was obstruction of airway. The results thus obtained were tabulated and sent for statistical analysis. Statistical analysis was be done using **Chi Square test with SPSS PROGRAM version 23.0.**

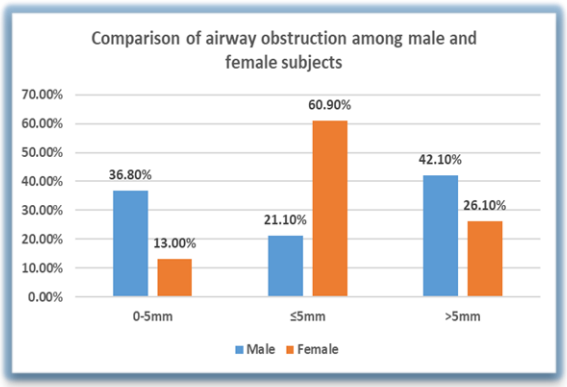
III. Results:

The demographic details of the study participants were calculated. The mean age of the participants was 9.93 years. There were 19 male and 23 female subjects in the study.



Graph 1: Graph showing prevalence of airway obstruction

Graph 1 showed that the distance of 5mm between the posterior wall of the nasopharynx & soft palate was observed in 23.80%. A distance of ≤5mm between the posterior wall of the nasopharynx & soft palate was seen in 42.90%. While a distance of >5mm between the posterior wall of the nasopharynx & soft palate was found in 33.30% cases.



Graph 2: Comparison of male female subjects

Graph 2 compared the airway obstruction among male and female subjects. It was observed that there was a significant difference in the prevalence of airway obstruction among male and female subjects.

IV. Discussion:

The airway is assumed to play a role in dentofacial development. So, several studies tried to correlate patients with normal naso-respiratory functions with different malocclusions and airway dimensions. A normal nasal airway is dependent on sufficient anatomical dimensions of the airway.

In 1984, McNamara stated that there is obstruction of the airway if there is a distance lower than 5 mm from posterior wall of nasopharynx and soft palate. This study was in accordance with this study.

Owing to this factor and concern regarding obstruction, this study was conducted[9]. In our study demographic details showed that mean age of the participants was 9.93 years. There were 19 males and 23 females subjects in the study.

Distance of 5 mm between the posterior wall of the nasopharynx & soft palate was seen in 10 cases (23.8%). Distance ≤5mm was seen in 18 cases (42.9%). Distance of >5mm was seen in 14 cases (33.3%). There was a significant difference in the prevalence of airway obstruction among male (21.10%) & female (60.90%) subjects.

According to Solow B et al 1996, the largest difference was observed at the level behind the soft palate where the diameter was 50% narrower in the obstructive sleep apnea[11]. While, in this study distance of ≤5mm between the posterior wall of the nasopharynx & soft palate was seen in 42.90%.

According to Katyal V et al 2013, An increased ANB angle of less than 2 in children with obstructive sleep apnea and primary snoring, compared with the controls, showed marginal clinical significance. There was strong support for reduced upper airway width in children with obstructive sleep apnea[12].

However, Rojas E et al 2017, in the cephalometric study assessed and determined factor for development of paediatric sleep disorders. The assessment of adenoid tissue with lateral cephalogram was a reproducible and easy-access exam in their daily work[7]. Which was in accordance with our study.

Limitations:

The limitation of this study was that did not mention any behaviour management of abnormal breathing pattern children. Another limitation of the study was that did not show age wise comparison of abnormal breathing pattern children.

V. Conclusion:

Therefore, within the limitations of the current study, the following conclusions can be made:

1. There was obstruction of the airway if a distance between nasopharynx and soft palate was lower than 5 mm 42.9%.
2. There was a significant difference in the prevalence of airway obstruction among male and female, with higher prevalence in females.

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