COMPARISON OF UPPER AND LOWER PHARYNGEAL AIRWAY SPACE IN CLASS II HIGH AND LOW ANGLE CASES

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ABSTRACT

Normal airway is one of the important factors for the normal growth of the craniofacial structures. Skeletal features such as retrusion of the maxilla and mandible and vertical maxillary excess in hyperdivergent patients may lead to narrower anteroposterior dimensions of the airway. The purpose of this study was to compare the widths of the upper and lower pharyngeal airways in Class II malocclusion patients with low and high vertical growth patterns.

The sample comprised sixty five class II subjects divided into 2 groups: thirty three Class II high angle and thirty two Class II low angle. The upper and lower pharyngeal airways were assessed according to McNamara's airways analysis. Independent t-test was used to compare upper and lower airway space in Class II high and low growth patterns.

Independent t-test showed a statistically significant difference ($p < 0.05$) in upper and lower airway space between the two groups, showing that in class II high angle cases, both upper and lower airway space is narrow than in low angle cases.

Subjects with Class II malocclusions and vertical growth patterns have significantly narrower upper and lower pharyngeal airways than those with Class II malocclusions and horizontal growth patterns. Narrow pharyngeal airway is one of the predisposing factors for mouth breathing and Obstructive sleep apnoea (OSA).

Key words: *Pharyngeal airway spaces, vertical growth pattern, obstructive sleep apnoea.*

INTRODUCTION

Normal airway is one of the important factors for the normal growth of the craniofacial structures. Interpretation of the significance of variations in the growth and function of the nasal cavities the nasopharynx, and the oropharynx is dependent on an understanding of the normal growth of the skull. Significant relationships between the pharyngeal structures and both dentofacial and craniofacial structures have been reported.[1,3] The influence of the soft tissues in craniofacial growth has been studied for some time, and today we know that this is highly relevant to the orthodontic diagnosis and the treatment plan.[2]

Heredity plays an important role in determining the size and shape of the human face and thus of the airway; however, environment appears to play a major part in the etiology of nasal obstruction Normal upper airway space is 15-20 mm while lower airway space is 11-14 mm. Some authors associated mouth breathing and Class II malocclusions, and others reported associations of vertical growth pattern with obstruction of the upper and lower pharyngeal airways concurrently with mouth breathing.[3-7] Skeletal features such as

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retrusion of the maxilla and mandible and vertical maxillary excess in hyperdivergent patients may lead to narrower anteroposterior dimensions of the airway.[8] On the other hand, the oropharyngeal airway has been claimed to affect the growth of craniofacial structures. Hereditary, environmental, and developmental factors play a large role in dentofacial development as well as in the initiation of a malocclusion disorder. Other predisposing factors which cause obstruction of pharyngeal airways includes allergies, such as rhinitis and asthma, environmental irritants and infections are a contributing factor in malocclusion. [4,5.]

To breathe through the mouth, one must maintain an oral airway, and, to accomplish this, the mandible and the tongue are displaced downward and backward and the head is tipped back Mouth breathing has been associated with many unfavorable sequelae, the most significant of which are features such as excessively long and tapered (dolicofacial) face form, increased lower face height, and narrow maxillary arch form. Variations in pharyngeal airway have also been described with some sleep disorders such as obstructive sleep apnoea (OSA).[9] Thus evaluation of upper and lower airway space which should be an integral part of diagnosis and treatment planning to achieve functional balance and stability of the results is essential.

The purpose of this study was to compare the widths of the upper and lower pharyngeal airways in Class II malocclusion with low and high vertical growth patterns in patients reporting to Orthodontics deptt, Armed Forces Institute of Dentistry (AFID) Pakistan, a tertiary care facility.

METHODOLOGY

Pretreatment standard lateral cephalograms of 65 patients recorded on Yoshida panoura, were taken from the existing records of orthodontics department, Armed Forces Institute of Dentistry, a tertiary health care facility. Informed written consent was obtained from all the participants. Only skeletal Class II patients of either gender between the ages of 14-25 years, with no previous history of orthodontic treatment were selected for the study. Patients who had any pharyngeal pathology, allergies or undergone adenoidectomy or any other nasopharyngeal surgery were excluded from the study. Also patients with generalized growth disorders and class II with cephalometrically normal vertical angle patterns were excluded from the study.

The sample was divided into two groups; group 1 consisted of thirty three subjects with class II malocclusions, high vertical growth pattern and group II consisted of thirty two subjects with class II low vertical growth pattern. The vertical pattern was classified from the lateral cephalograms using SN-MP angle, with angle less then 28 taken as low and more than 36 taken as high vertical growth patterns.

The upper and lower pharyngeal airways were measured according to the method of *McNamara Airway Analysis*. Upper airway width was measured from point on posterior outline of soft palate to closest point on posterior pharyngeal wall, taken on anterior half of soft palate and Lower airway width was measured from intersection of posterior border of tongue and inferior border of mandible to closest point on posterior pharyngeal wall. For inter examiner reliability, measurements for 15 randomly selected patients were repeated by an equally trained examiner, 15 days after the original measurements. For intra examiner reliability, the same examiner repeated the measurements for 15 randomly selected patients almost one month after the first measurements.

The data were analyzed in SPSS v14. Means and standard deviations for the upper and lower airway space were calculated. Paired t – test was used to assess inter and intra examiner reliability. Independent t-test was used to compare upper and lower airway space in Class II high and low angle growth patterns.

TABLE 1: MEANS AND STANDARD DEVIATIONS FOR UPPER AND LOWER AIRWAY SPACE

Group	N	Upper Airway		Lower Airway	
		Mean	SD	Mean	SD
Total	65	14.83	3.00	11.14	2.93
High angle	33	14.6	3.35	10.42	2.57
Low angle	32	15.62	2.38	11.88	3.13

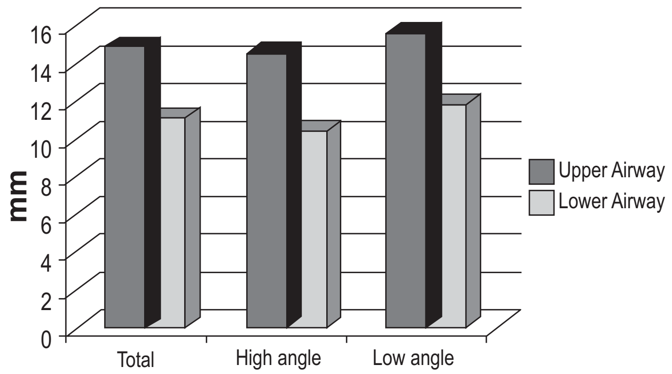

Fig 1: Means for upper and lower airway space

TABLE 2: RESULTS OF INDEPENDENT SAMPLE T-TEST

Groups	Upper Airway	Lower Airway
High angle – low angle	0.034*	0.045*

* P – value < 0.05 is considered significant

RESULTS

Mean upper airway dimension was 4.183 ± 2.99 mm and mean lower airway was 11.138 ± 2.93 mm. Paired t –test did not yield a significant result for inter examiner and intra examiner reliability. Independent t-test showed a statistically significant difference ($p < 0.05$) in upper and lower airway space between the two groups.

DISCUSSION

Roentgenography and eventually Cephalometrics has provided the orthodontists with an ability to see beneath soft tissue, which gave them greater insight into most of the hard and soft anatomical structures that contribute to facial growth and development. Ricketts[9,10] pointed out the value of an x-ray cephalometric examination in his publications dealing with nasopharyngeal anatomy and its relationship to tongue posture in children. He noted that certain children who presented for orthodontic treatment with open bites, constricted palates, and high mandibular plane angles also had medical histories that included allergies, adenoid and tonsilar enlargement, and mouth breathing patterns. In our study, we included only skeletal class II patients, with no pharyngeal pathologies, allergies or adenoids to omit the confounding effects of sagittal discrepancies and above mentioned factors on our study.

Previous Studies by Dunn,[11] Ackerman[12] and Proffitt[13] showed that Subjects with Class I and Class II malocclusions and vertical growth patterns had significantly narrower upper pharyngeal airways than Class I and Class II subjects with normal growth patterns, Analyzing these results, we can infer that upper airway width is influenced by the craniofacial growth pattern, However, some studies found weak relationships between growth pattern, facial morphology, and nasopharyngeal airway but found relationships between upper airway and type of malocclusion, showing narrower nasopharyngeal spaces in subjects with Class II malocclusion. In our study we only compared class II patients with high and low vertical angle growth patterns to exclude the confound ding effect of sagittal discrepancy.

Freitas et al[3] compared upper and lower pharyngeal widths in patients with untreated Class I and Class II malocclusions and normal and vertical growth patterns. His results showed that Subjects with Class I and Class II malocclusions and vertical growth patterns have significantly narrower upper pharyngeal airways than those with Class I and Class II malocclusions and normal growth patterns. However, malocclusion type does not influence upper pharyngeal airway width, and malocclusion type and growth pattern do not influence lower pharyngeal airway width. This statement contradicts the results of our study which showed significant changes in lower airway space in class II high and low angle cases.

Paul and Nanda[7] found greater prevalences of mouth breathing and nasopharyngeal airway obstruction in subjects with Class II malocclusions.

Sosa et al[14] to study the relationship of adenoids and type of malocclusion, took xeroradiographic lateral cephalograms of eighty Class I and sixty-four Class II, Division 1 malocclusions to obtain reliable measures of the epipharyngeal lymphoid tissue, the nasopharyngeal airway, the nasopharynx, and certain cephalometric landmarks. His results showed that Airway space did not appear to vary with the type of malocclusion. Some low-level correlations were found between the size of the nasopharyngeal area and certain skeletal characteristics. These correlations depended on both the malocclusion type and the sex of the individual. Our study excluded any pathologies and only sagital class II patients with vertically low or high angles were selected.

Moto et al [15] studied the antero-posterior diameter of the pharyngeal airway space (PAS) at the level of the soft palate and base of the tongue in lateral cephalograms of age-matched females with a normal mandible (n=31), mandibular retrognathism (n=30) or mandibular prognathism (n=38). The results showed clear-cut differences in the PAS among the three groups. Pharyngeal airway diameter was largest in the group with mandibular prognathism, followed by the normal mandible and mandibular retrognathism groups. These results indicated that the antero-posterior dimension of the PAS is affected by different skeletal patterns of the mandible. Again our study was different in that only class II patients with vertically low or high angle were included.

Although lateral cephalometric radiographs provide 2-dimensional images of the nasopharynx[17,18], which consists of complex 3-dimensional anatomical structures. Linder-Aronson[16] found a high level of correlation between the results of posterior rhinoscopy and radiographic cephalometrics in the assessment of adenoid size and nasopharyngeal airway.

The results of our study showed statistically significant differences between class II high and low angle cases, revealing that in class II high angle cases, the airway space is narrow and that vertical growth pattern, whether low or high, has an effect on pharyngeal airway space. Narrow pharyngeal airway space is one of the predisposing factor for mouth breathing and obstructive sleep apnoea.

This study was conducted with lateral cephalometric head films. Ideally studies regarding airway should be carried out with 3 dimensional evaluation such as MRI as it consists of complex three-dimensional anatomical structures. Thus the airway volume instead of the airway area should be the subject of future studies.

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