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RESEARCH ARTICLE

EVALUATION OF UPPER AND LOWER PHARYNGEAL AIRWAY WIDTHS IN CLASS-I AND CLASS-II MALOCCLUSION WITH DIFFERENT GROWTH PATTERNS

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ABSTRACT

Many studies have suggested co-relation among facial type, malocclusion and pharyngeal airway. Any impairment in pharyngeal airway can lead to certain type of malocclusion or change in facial pattern. The aim of this study is to evaluate upper and lower pharyngeal airway widths in Angle's Class-I and Class-II malocclusions with different growth patterns. Lateral cephalograms of 40 untreated patients were categorized in four groups based on malocclusion (either Angle's Class-I or Class-II malocclusion) and type of growth pattern (vertical or horizontal) using certain cephalometric values. For each patient upper and lower pharyngeal airway width were measured according to McNamara's analysis. Statistical analysis was performed for inter and intra-group comparisons. Results showed decreased upper pharyngeal airway width in both Angle's Class-I and Class-II malocclusions with vertical growth pattern than horizontal growth pattern. Significant differences were also observed in lower pharyngeal airway in Angle's Class-I malocclusion with vertical and horizontal growth pattern. Overall comparison of upper and lower pharyngeal airway widths in both type of growth patterns showed increased pharyngeal airway width in horizontal growers. No differences were seen in upper and lower pharyngeal airways based on age and sex of an individual.

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INTRODUCTION

The upper airway has long been an area of interest in orthodontics, with topics such as the relationships between facial type and airway, airway shape and volume with growth and development, and the clinician's potential to modify the airway. Orthodontist interest in airway has been expanded into sleep breathing disorders (El and Palomo, 2010). It is believed that mouth breathing and Class II malocclusions are inter-related or there is association of vertical growth patterns with obstruction of the upper and lower pharyngeal airways concurrently with mouth breathing. According to the Balters' philosophy, Class II malocclusions are consequence of a backward position of the tongue, disturbing the cervical region and Class III malocclusions are due to a more forward position of the tongue and due to cervical overdevelopment (Ceylan, 1995). Nasal obstruction can cause chronic mouth breathing, loud snoring, obstructive sleep apnea and excessive daytime sleepiness. In this situation, a number of postural changes, such as open mandible posture, downward and forward positioning of the tongue can take place. If these postural changes continue for long period, mainly during active growth stage, dento-facial disorders at different level of severity can occur (Ceylan, 1995).

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Thus, due to close relationship between pharynx and dentofacial structures, mutual interaction occurs between pharyngeal structures and dentofacial patterns. So, it is considered to be useful to include assessment of pharyngeal structures in orthodontic diagnosis and treatment planning. Therefore, the purpose of this study is to compare upper and lower pharyngeal airway widths in class-I and class-II malocclusions and to evaluate co-relation between different growth patterns and pharyngeal airway widths.

AIM

To compare upper and lower pharyngeal airway widths in Angle's Class-I and Class-II malocclusions and to evaluate co-relation between different growth patterns and pharyngeal airway widths.

MATERIALS AND METHOD

This research involves lateral cephalograms of 40 untreated patients between age 16-30 years taken from Department of Orthodontics, Pacific dental college, Udaipur. The criteria for selection were as follows: patients with no clinical signs and symptoms or complaints of nasal obstruction, no pharyngeal pathology and no mouth breathing habits were included in this study. Subjects with birth defects like Down's or Pierre Robin syndrome which causes enlargement of structures, history of pharyngeal surgeries and endocrinal disorders were excluded. Patients with normal growth pattern and class-III malocclusion were not included in this study. The sample was divided in 2 groups based on malocclusion that is Angle's Class-I and Angle's Class-II malocclusion. Further, groups were subdivided in subgroups based on growth pattern with 10 subjects in each subgroup.

Group IA: Angle's Class-I malocclusion with horizontal growth;
Group IB: Angle's Class-I malocclusion with vertical growth;
Group IIA: Angle's Class-II malocclusion with horizontal growth pattern and
Group IIB: Angle's Class-II malocclusion with vertical growth pattern.

Angles used to determine malocclusion are ANB angle (class-I – 1-5 degrees, class-II - >5 degrees) and wits appraisal (class-I – 1mm ± 1SD, class-II - > 2mm).

Growth pattern were determined by FMA angle (horizontal growth: < 24 degrees, vertical growth: > 26 degrees), Sn(GoGn) (horizontal growth: <31 degrees, vertical growth: >33 degrees) and Y axis (horizontal growth: < 65 degrees, vertical growth: >67 degrees). Upper and lower pharyngeal widths were measured based on McNamara's analysis for each subject.[3] (Figure.1) Differences in upper and lower pharyngeal airway width was evaluated based on type of malocclusion, growth pattern, age and sex of subjects. Arithmetic mean and standard deviation values were calculated for each measurement (Tables: 1, 2, 3 & 4). Group differences were analysed with one way analysis of variance (ANOVA). For multiple comparisons, Tukey-Kramer multiple comparison test was performed. "P value" less than .05, regarded as significant and less than .001 regarded as very significant.

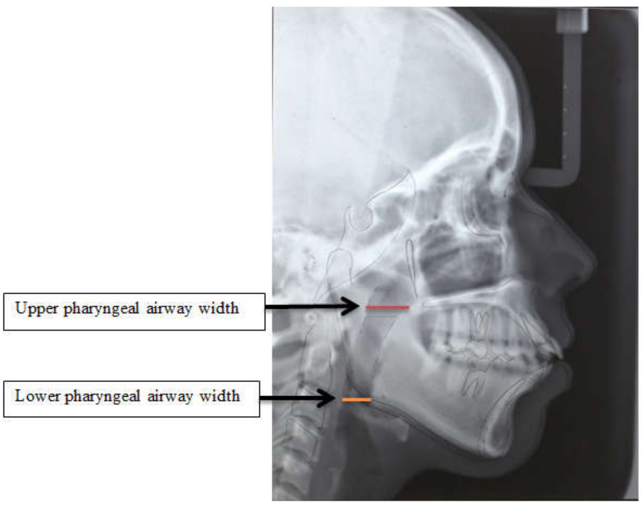


Figure 1.

RESULTS

Significant differences were seen in upper pharyngeal airway width in class-I horizontal and vertical growth pattern (P<.05). Horizontal growth pattern showed more of upper pharyngeal space than vertical growers.(Graph.I) Upper pharyngeal airway width was less in class-II vertical growers than horizontal growers. (P<.001)(Graph.II). Lower pharyngeal airway showed differences only in class-I malocclusion with horizontal and vertical growth patterns in which horizontal growers had more width (P<.01) (Graph.III), while class-II malocclusion showed no significant differences in lower pharyngeal width.

Table 1.

	Class-I Vert		Class-I Hori	
	Mean	SD	Mean	SD
Age	21.60	4.17	22.40	3.63
Upper	12.10	2.46	14.95	2.51
Lower	6.55	0.96	9.05	1.88

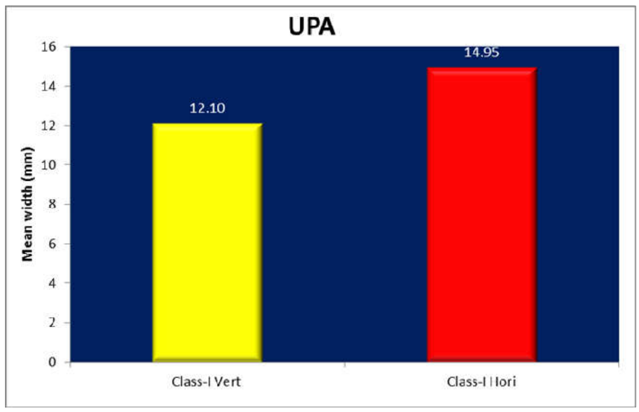
Table 2.

	Class-II Vert		Class-II Hori	
	Mean	SD	Mean	SD
Age	20.90	3.21	19.60	3.86
Upper	11.30	1.90	15.60	1.05
Lower	6.90	1.58	7.65	1.90

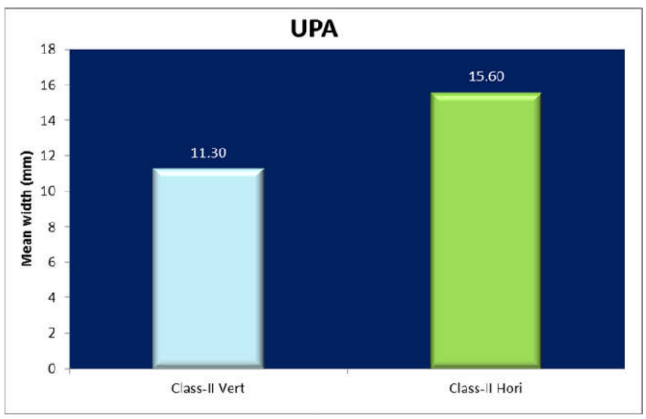
Table 3. Table 4.

	Class-I n II upper vertical	Class-I n II upper horizontal
Mean	11.70	15.28
SD	2.18	1.90

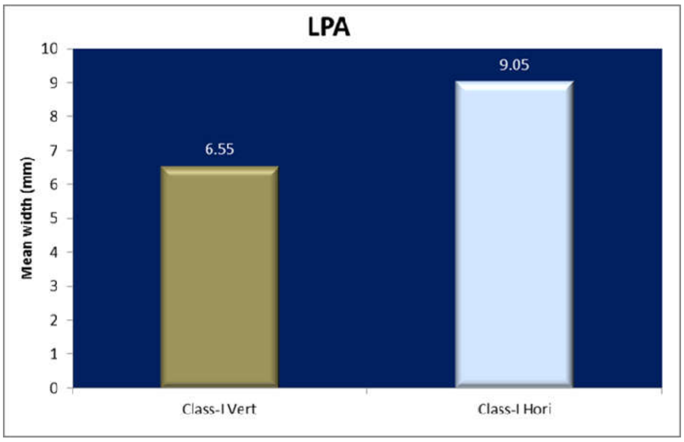
	Class-I n II lower vertical	Class-I n II lower horizontal
Mean	6.73	8.35
SD	1.28	1.97



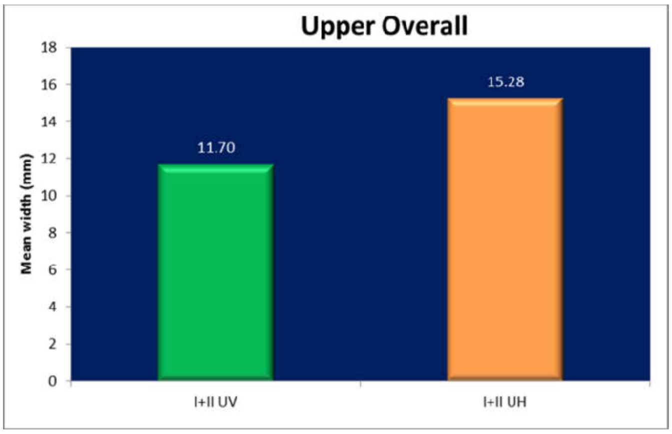
Graph 1. Comparison of upper pharyngeal airway in class-I vertical and horizontal growth pattern



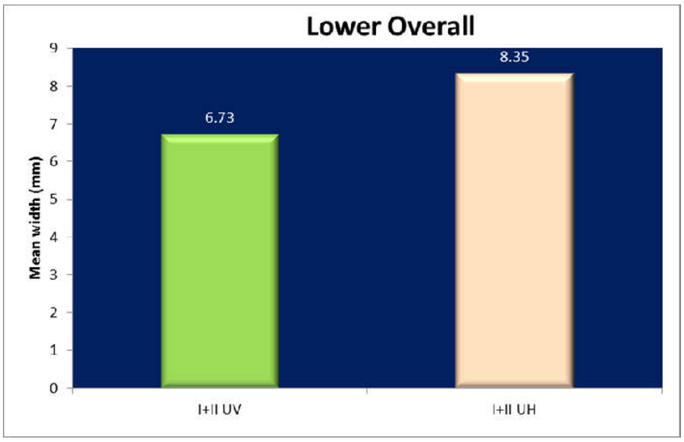
Graph 2. Comparison of upper pharyngeal airway in class-II vertical and horizontal growth pattern



Graph 3. Comparison of lower pharyngeal airway in class-I malocclusion with vertical and horizontal growth pattern



Graph 4. Overall comparison of upper pharyngeal airway in class-I and class-II malocclusion with vertical and horizontal growth pattern



Graph 5. Overall comparison of lower pharyngeal airway in class-I and class-II malocclusion with vertical and horizontal growth pattern

The overall comparison of upper pharyngeal airway in both the malocclusions class-I and class-II with horizontal and vertical growth pattern showed statistically very significant difference.($P<.001$)(Graph.IV) Similarly, overall comparison of lower pharyngeal airway showed significant differences too ($P<.05$)(Graph.V). In both of above conditions, horizontal growth pattern had more width then vertical. No differences were seen in upper and lower pharyngeal airways based on age and sex of an individual. So, this part of the null hypothesis was rejected.

DISCUSSION

Significant relationships between the pharyngeal structures and both dentofacial and craniofacial structures have been reported. Skeletal features such as retrusion of the maxilla and mandible and vertical maxillary excess in hyperdivergent patients may lead to narrower antero-posterior dimensions of the airway. On the other hand, the oropharyngeal airway has been claimed to affect the growth of craniofacial structures (Abu Allhaija et al., 2005). McNamara (1981) did a study to know the influence of respiratory pattern on craniofacial growth in which he presented 4 clinical case reports. In his study he found out that even with normal antero-posterior relationship between maxilla and mandible, the slight increase in anterior facial height and relative posterior displacement of maxillary complex caused face to become more retrognathic and thus upper pharyngeal space got reduced.In our study we have found decreased upper pharyngeal airway space in Angle's Class-I and Angle's Class-II malocclusion with vertical growth pattern than the horizontal growth pattern. This may be due to the reason that patient with vertical growth pattern shows more of anterior facial height and posterior displacement of jaws which leads to reduced upper pharyngeal airway space.

While, Sosa et al. (1982) did a study on post pharyngeal lymphoid tissue in Angle's Class-I and Angle's Class-II division 1 malocclusion. He measured epi-pharyngeal lymphoid tissue and nasopharyngeal airway space and investigated their relationships with type of malocclusion. He concluded from his study that type of malocclusion was not associated with nasopharyngeal airway space. Ceylan and Oktay (1995)[6] did a study on lateral cephalograms of 90 subjects with different skeletal patterns and investigated the pharyngeal size. They claimed that pharyngeal structures were not affected by the changes of ANB angle except for oropharyngeal airway. They observed that as ANB angle is increased, oro-pharyngeal airway gets reduced while naso-pharyngeal airway remains unaffected. The fact that larger the ANB angle, less the oropharyngeal area may be attributable to a more posterior location of tongue and mandible in Angle's Class-II malocclusion than in other skeletal configurations. However in our present study we have found decreased width of lower pharyngeal airway in Angle's Class-I malocclsuion with vertical growth pattern than the horizontal growth pattern which contradict above author findings and reveals that growth pattern also has some role in affecting pharyngeal airway width. No changes were observed in lower pharyngeal airway in Angle's Class-II malocclusion with vertical and horizontal growth pattern.

Ucar and Uysal (2011) did a study to test the null hypothesis that there are no significant differences in craniofacial structures and orofacial dimensions in subjects with Angle's Class-I malocclusion and different growth patterns. They examined lateral cephalograms of 31 low angle cases, 40 high angle cases and 33 normal growth individuals. They observed that decreased naso-pharyngeal and oro-pharyngeal airway widths were obtained for high angle cases than low angle and normal growers. They concluded that smaller naso-pharyngeal obtained may be due to the relative bi-maxillary retrusion exhibited by hyper divergent group and decreased oro-pharyngeal airway width may occur as mandible gets both retruded and rotated in downward and backward directions, the tongue base might get positioned more posteriorly and inferiorly, thus oro-pharyngeal space may get decreased. In our present study, similar results were obtained for upper and lower pharyngeal airway widths, where both the widths got reduced in hyper divergent growth pattern than the hypo divergent growth pattern. In our present study no significant differences were found between upper and lower pharyngeal airway width of any malocclusion with age and sex of an individual. This means that sex and age of an individual do not affect the airway patency. Similar results were also obtained by Ceylan and Oktay (1995) did a study on pharyngeal airway size in different skeletal patterns and found out no relation between sex of an individual and pharyngeal size in the age group 13-15 years except for oro-pharyngeal airway. While no such correlation between sex and pharyngeal airway size was noted in age group of 16-30years in our study which may be due to the fact that age group taken in our study were all post pubertal so no age related changes in pharyngeal airway dimensions were expected. In this study evaluation of upper and lower pharyngeal airway was done for different malocclusion (class-I and class-II) based on different growth patterns (horizontal and vertical). All measurements were done on lateral cephalograms. Although, lateral cephalograms provides 2-dimensional image of 3-dimensional anatomic structures. Many studies, however, have stressed the value of cephalometric radiographs in assesment of airways.[8,9,10] But still more complex 3-dimensional and dynamic evaluation is required for measuring airflow capacities.

CONCLUSION

- Patients with class-I and class-II malocclusions with vertical growth patterns have significantly narrower upper pharyngeal airways than those with class-I and class-II malocclusions with horizontal growth patterns.
- Lower pharyngeal airway show more width in horizontal growers than vertical.
- However, upper and lower pharyngeal airway widths are not influenced by age and sex of an individual.

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