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Evaluation of Upper and Lower Pharyngeal Airway Space in Class I and Class II Malocclusion Subjects With Different Growth Patterns in Haryana Population

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Abstract

Aim and Objective: This study aimed to comprehensively evaluate the upper and lower pharyngeal airway space in Class 1 and Class II malocclusion subjects with different growth patterns in the Haryana population.

Materials and Methods: A total of 60 lateral cephalograms were analyzed, comprising subjects with Class 1 or Class II malocclusion. Growth patterns were assessed using the Jarabak ratio, while skeletal classification relied on ANB and Witts appraisal. Subjects were further categorized into horizontal or vertical growth patterns. Pharyngeal airway space measurements were conducted using standardized methods, and statistical analyses were performed to compare dimensions between groups and subgroups.

Results: Significantly narrower upper and lower pharyngeal airway spaces were observed in subjects with vertical growth patterns compared to those with horizontal growth patterns ($p<0.05$). No significant differences were found in airway space between Class 1 and Class II subjects with similar growth patterns.

Conclusion: This study underscores the importance of considering both skeletal malocclusion classification and growth patterns when assessing pharyngeal airway dimensions in the Haryana population. Subjects with vertical growth patterns exhibited narrower airway spaces, suggesting a potential association between vertical facial growth and compromised respiratory function.

Keywords: Class I and Class II malocclusion, Witts Appraisal, Jarabak ratio, ANB angle, Horizontal and Vertical growth pattern, Pharyngeal airway, Haryana population.

Introduction

The pharyngeal airway space is a critical anatomical feature that significantly influences respiratory function, craniofacial development, and overall health [1]. Variations in the dimensions of the pharyngeal airway can lead to several clinical conditions, including obstructive sleep apnea (OSA) and various forms of malocclusion. Malocclusion, characterized by misalignment of the teeth and jaws, can be broadly categorized into Class I, Class II, and Class III, with Class I representing a normal relationship, Class II indicating a retrusive mandible, and Class III involving a protrusive mandible [2].

Previous studies have demonstrated that different craniofacial growth patterns, such as horizontal and vertical growth, significantly impact the pharyngeal airway dimensions. Vertical growth patterns are often associated with a reduced airway space, which may predispose individuals to respiratory difficulties [3]. Understanding the interplay between malocclusion types and growth patterns is essential for devising effective orthodontic treatment plans that address both functional and aesthetic concerns [4].

In orthodontics, assessing the pharyngeal airway space is crucial for identifying patients at risk of developing respiratory issues. This is particularly relevant in populations with varying craniofacial morphologies and growth patterns. The Haryana population provides a unique demographic for studying these variables due to its diverse genetic and environmental factors influencing craniofacial development [5].

This study aims to evaluate the upper and lower pharyngeal airway space in Class I and Class II malocclusion subjects with different growth patterns in the Haryana population. By analyzing 60 lateral cephalograms, this study aims to establish the relationship between skeletal malocclusion, growth patterns, and pharyngeal airway dimensions, thereby contributing to more informed orthodontic treatment strategies.

Materials and Methods

A total of 60 lateral cephalograms were obtained from patients presenting with Class I or Class II malocclusion at MMCDSR-Mullana in Haryana. The sample consisted of an equal distribution of males and females, with ages ranging from 12 to 25 years. 60 Subjects were classified into Class I or Class II malocclusion groups based on ANB and Witts appraisal measurements with 30 in each group.

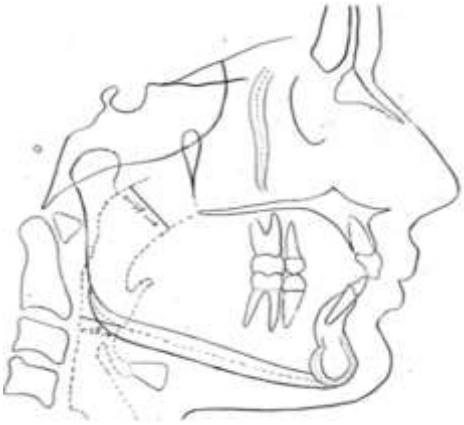


Figure 1: Upper and lower pharyngeal airway

Growth patterns were determined using the Jarabak ratio, with subjects categorized into horizontal or vertical. Fifteen subjects were further divided into each subgroup (Class I horizontal, Class I vertical, Class II horizontal, Class II vertical).

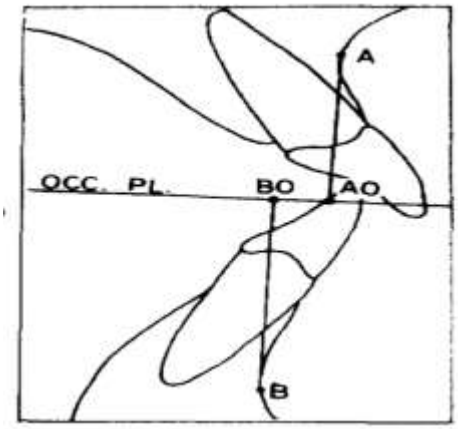


Figure 2: Witts appraisal to determine Class I and II malocclusion.

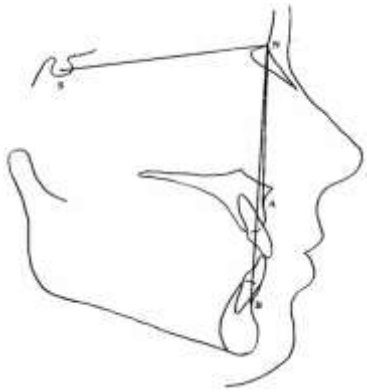


Figure 3: ANB angle to determine Class I and Class II malocclusion.

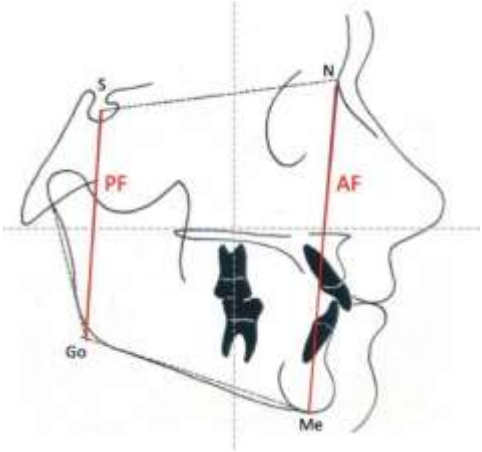


Figure 4: Jarabak ratio to determine growth pattern

Measurements of upper and lower pharyngeal airway space were conducted on lateral cephalograms. The distances between anatomical landmarks, such as the soft palate, hyoid bone, and mandible, were measured to calculate airway dimensions.

Figure 5: Study design

Statistical analysis

Was performed using SPSS software. Descriptive statistics were used to summarize the characteristics of the study population. T-test was employed to compare pharyngeal airway space between different groups and subgroups and levene's test for equality of variance.

Results

The results revealed significant differences in upper and lower pharyngeal airway space between subjects with horizontal and vertical growth patterns ($p<0.05$). Specifically, subjects with vertical growth patterns exhibited narrower airway spaces compared to those

with horizontal growth patterns, regardless of malocclusion class.

No significant differences were observed in pharyngeal airway space between Class I and Class II subjects with similar growth patterns. This suggests that growth pattern, rather than skeletal malocclusion class, may have a greater impact on pharyngeal airway dimensions in this population.

Table 1(a): comparsion between upper and lower pharyngeal airway in horizontal and vertical growth pattern patients.($p<0.05$)

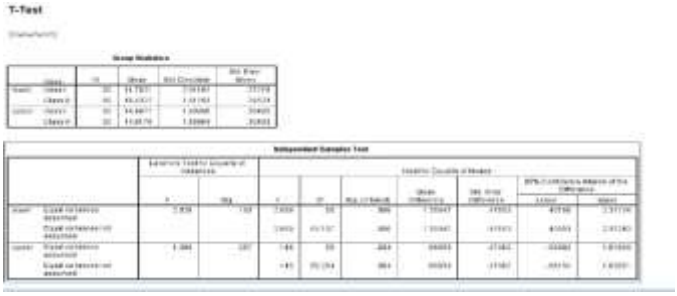
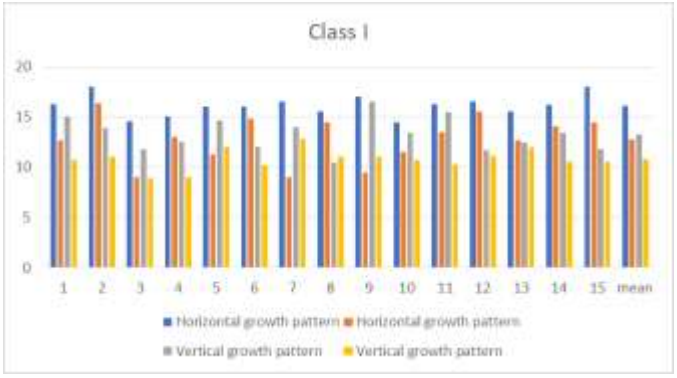
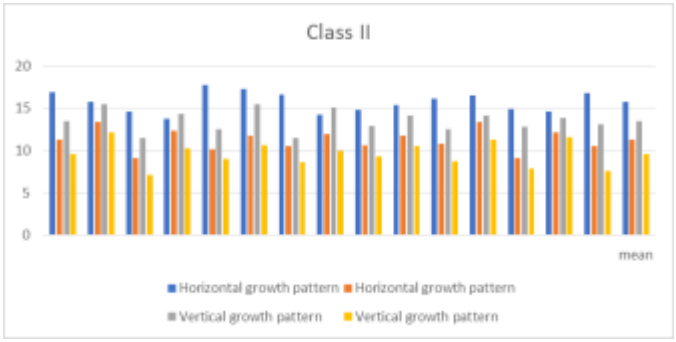


Table 1(b): comparison between upper and lower pharyngeal airway space between Class I and Class II subjects.($p<0.05$)



Graph 1: shows the variation between the mean values of Class I horizontal and vertical growth patterns in Haryana population.



Graph 2: shows the variation between the mean values of Class II horizontal and vertical growth patterns in Haryana population.

Discussion

Adequate anatomical space of airway is required for normal respiration. Several authors in their studies have found that growth pattern influences the pharyngeal airway space. The findings of this study align with previous research suggesting an association between vertical facial growth and compromised pharyngeal airway space [6]. Vertical growth patterns may lead to anatomical restrictions within the upper and lower airway, potentially contributing to respiratory issues such as obstructive sleep apnea [7].

The absence of significant differences in airway space between Class I and Class II subjects with similar growth patterns is consistent with some previous studies [8]. This suggests that other factors, such as soft tissue morphology or cranial base configuration, may also influence pharyngeal airway dimensions independently of skeletal malocclusion class.

The relationship between craniofacial morphology and pharyngeal airway space has been extensively studied. Profitt et al[9] and Dunn et al[10] in their studies found out that people with Class I and Class II malocclusion having vertical growth had significantly reduced upper pharyngeal airway as compared to people with average growth pattern. Several studies have reported associations between smaller mandibular angles and

narrower pharyngeal airway dimensions, indicating the influence of mandibular morphology on airway patency [11]. Additionally, changes in hyoid bone position following orthodontic and orthognathic interventions can affect pharyngeal airway space, highlighting the dynamic nature of airway morphology [12].

In this study, cephalometric head film which gives a two dimensional view is used to evaluate only the pharyngeal airway space and not the amount of airflow. Advanced imaging techniques, such as cone-beam computed tomography (CBCT), have provided valuable insights into the three-dimensional anatomy of the pharyngeal airway. CBCT allows for more accurate assessment of airway volume and morphology compared to conventional lateral cephalograms [13]. This improved understanding of airway anatomy can aid in the diagnosis and management of sleep-disordered breathing disorders, particularly in pediatric populations [14]. Malkoc et al. in their study found out that the cephalometric head film were reliable in reproducing pharyngeal airway dimensions.[15]

The implications of compromised pharyngeal airway space extend beyond respiratory function to impact overall health and quality of life. Children with untreated obstructive sleep apnea may experience cognitive and behavioral problems, as well as impaired growth and development [16]. Early detection and intervention are therefore crucial in mitigating the long-term consequences of airway obstruction [17].

Orthodontic treatment modalities, such as rapid maxillary expansion, have been shown to increase pharyngeal airway volume and improve respiratory function in patients with constricted airways [18]. However, the effects of orthodontic treatment on pharyngeal airway dimensions are complex and multifactorial, requiring careful consideration of individual patient characteristics and treatment goals [19].

This study highlights the intricate relationship between craniofacial morphology, growth patterns, and pharyngeal airway dimensions in the Haryana population. The significant differences observed in upper and lower pharyngeal airway space between subjects with horizontal and vertical growth patterns underscore the importance of considering facial morphology when assessing airway dimensions. Vertical growth patterns have been associated with reduced pharyngeal airway space in previous research, suggesting a potential predisposition to respiratory issues such as obstructive sleep apnea [20].

Further research is warranted to explore the underlying mechanisms driving these observed associations. Longitudinal studies and the use of advanced imaging modalities can provide more comprehensive insights into the development of pharyngeal airway dimensions over time. Additionally, investigating the impact of various orthodontic interventions on airway space can inform evidence-based treatment strategies aimed at improving both dental and respiratory health outcomes.

Conclusion

In conclusion, this study underscores the importance of considering both skeletal malocclusion classification and growth patterns when assessing pharyngeal airway dimensions in the Haryana population. Subjects with vertical growth patterns exhibited narrower upper and lower pharyngeal airway spaces, suggesting a potential association between vertical facial growth and compromised respiratory function. The findings highlight the need for comprehensive orthodontic evaluation and treatment planning that addresses potential respiratory issues associated with specific facial characteristics. Future research should focus on

elucidating the underlying mechanisms driving these associations and evaluating the long-term effects of orthodontic interventions on pharyngeal airway dimensions and respiratory health.

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