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CEPHALOMETRIC STUDY OF UPPER AND LOWER PHARYNGEAL AIRWAYS IN SKELETAL CLASS-I, CLASS-II & CLASS-III MALOCCLUSIONS HAVING VERTICAL & NORMAL OR HORIZONTAL GROWTH PATTERNS

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ABSTRACT

Aims

To compare the upper and lower pharyngeal airways.

Objectives

To study the Patients with skeletal Class I, Class II and Class III malocclusions and evaluate the co-relation between different growth patterns and pharyngeal airways.

Materials and Methods

The pre-treatedlateral cephalograms that were considered in this study were obtained from those patients with skeletal Class I, Class II or Class III malocclusions, who were being treated at Sharad Pawar Dental College, Wardha, and whose existing records were available in the Department of Orthodontics. For the purpose of collection of the pre-treated cephalograms, the sample population in this study was segregated into 3 groups, with each group comprising of 30 individuals. The sample population of Group 1 comprised patients with Class I malocclusion, and on the basis of the growth pattern of the malocclusion, this group was further sectioned into Class I with vertical growth pattern and Class I with normal growth pattern. Similarly, the sample population of Group 2 comprised patients with Class II malocclusion, and the patients with Class III malocclusion, subsequent to the determination of their skeletal relation, were categorized as Group 3.The skeletal relation and the pattern of growth were ascertained in all the patients in the groups, and the upper and lower pharyngeal airways were evaluated using Mc Namara's airway analysis.

Results and Conclusion

Statistically significant outcome in the Class I, Class II and Class III malocclusions was achieved in the upper and lower pharyngeal airways between normal and vertical growth patterns. Nevertheless, on independently contrasting the Class I, Class II and Class III malocclusions and their patterns of growth, we observed no statistically significant difference. In addition, the results of these comparisons on considering the pharyngeal airway spaces generated statistically significant variations, except in the Class I versus Class II groups.

KEYWORDS: Pharyngeal Airway, Cephalogram, Growth Pattern

INTRODUCTION

Obstructive sleep apnea, excessive daytime sleepiness, cor pulmonale, chronic mouth breathing and loud snoring are triggered by nasal obstruction secondary to hypertrophied inferior turbinate's, adenoidal pad hypertrophy, including

hypertrophy of the facial tonsils. Consequently, there occur several changes in posture, including the posture of the open mandible, downward and forward positioning of the tongue and extension of the head. However, if these secondary postural changes prolong for long periods, notablyin the course of their active growth, on the basis of the level of severity, varying dentofacial disorders are reported, which are accompanied with inadequate lip structure, long face syndrome and adenoidal facies[1].

There is a significant association between the nasopharngeal airway space size and the morphology of the face, which also involves the mandible, because reduction of the nasopharyngeal airway space causes difficulties in nasal breathing, sometimes even making it impossible, and necessitates mouth breathing. Chronic mouth breathing restores the normal balance in the oral and paraoral structures; however, alteration of both structures is expected[2].

Several studies have shown statistically significant relationships at varying degrees between the pharyngeal structures and both dentofacial and craniofacial structures.

Asper Balters' philosophy, Class II malocclusions are a consequence of the backward position of the tongue, which disturbs the cervical region. As a result of this positioning, the respiratory function is impeded in the region of larynx, as well as faulty deglutition and mouth breathing. The cause of Class III malocclusions is the more forward position of the tongue, in addition to the cervical overdevelopment.

Some authors associated mouth breathing and Class II malocclusions, and others reported associations of vertical growth patterns with obstruction of the upper and lower pharyngeal airways concurrently with mouth breathing. If this relations actually exists, Class II malocclusions and vertical growth patterns must have natural anatomical predisposing factors.

Research

Functional, positional and structural assessment of the pharyngeal structures is considered important inorthodontic diagnosis and treatment planning. Thisstudy attempts to find a correlation of the pharyngeal airway sizes with different types of malocclusions and growth patterns.

MATERIALS AND METHODS

The sample size for the cephalometric study comprised 90 patients,who reported for treatment at the Department of Orthodontics, The Sharad Pawar Dental College, Wardha.

The samplepopulation wassegregated into 3 groups, with 30 patients in each group.

Group 1 patients had cephalograms with Class I malocclusion, andwerefurther sectionedasCL I with normal growthand CL I with vertical growth.

The following were considered as the selection criteria for CLI malocclusion:

1. ANB of $+2^0/-2^0$and
2. WITS analysis of 2mm to -2mm.

Group 2 patients had cephalograms withClass II malocclusion, andwerefurther sectionedas CL II with normal growth and CL II with vertical growth.

The following were considered as the selection criteria for CL II malocclusion:

1. ANB >$2^0$and
2. WITS analysis > 2mm.

Group 3 patients had cephalograms withClass III malocclusion, andwerefurther sectionedasCL III with normal growth and CL III with vertical growth.

The following were considered as the selection criteria for CL III malocclusion:

1. ANB >$2^0$and
2. WITS analysis <-3mm.

GROWTH PATTERN DIAGNOSTIC CRITERIA

FMA was conducted as per the method of Mc Namara's analysis. The following observations were observed by the method:-17″-28″ normal growth pattern and>28″ vertical growth pattern.

Y-axis was determined by Rakosi Jarabak's analysis, with the following being reported:-53″-66″ normal growth pattern and >66″ vertical growth pattern.

SN-Go-Gn was ascertained by Steiner's analysis. Vertical growth pattern of 32″ was observed in the analysis.

Mc Namara's analysis method also helped to assess the upper and lower pharyngeal airways**.**

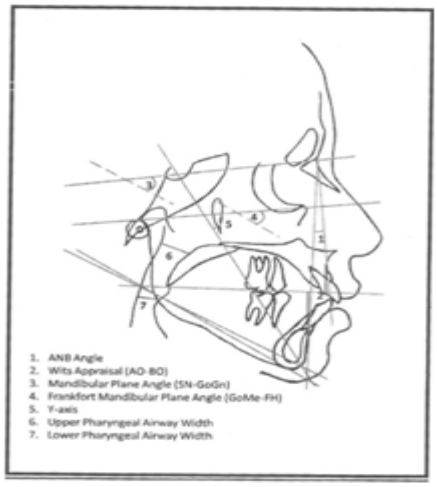
This study employed descriptive statistical analysis. Analysis of variance (ANOVA) helped to find the significance of the study parameters between three or more groups of patients.

Student t test helped to find the significance of the study parameters on a continuous scale within each group. Pairwise significance was found by post-hoc Tukey test.

RESULTS

We compared the vertical growth pattern and an average growth patternamong the Class I, II and III skeletal malocclusion groups. The comparison demonstrated the presence of a statistical difference in the upper and lower pharyngeal airways. Nevertheless, there was no statistical significance on comparing the upper and lower pharyngeal spaces within the Class I group for both the normal and vertical growth. In addition, we did not obtain significant results on comparing both patterns of growth in the Class II and Class III groups.

Significant differences were seen in pairwise comparison of the upper and lower airway spaces; this observation was reported in the vertical growth pattern as well as the normal growth pattern, and was between Class I and Class III malocclusions and a Class II and Class III malocclusions. However, there were no significant results on comparing the Class I and Class II malocclusions.



Angles and measurements used in the study

RESEARCH

Angles and Measurements Used in the Study

Table 1a: Normal Growth Pattern –Upper Pharyngeal Airway (mm) and Lower Pharyngeal Airway (mm)Comparison

Normal	Class I	Class II	Class III	P value
Upper pharyngeal airway (mm)	13.10 ± 3.00	14.13 ± 1.81	15.73 ± 2.84	F=3.895; P=0.028*
Lower pharyngeal Airway(mm)	10.20± 1.15	10.13 s 1.15	10.13± 2.07	F=6.584; P=0.003”

Normal	Class I	Class II	Class III	P value
Upper pharyngeal airway (mm)	12.70 ± 2.3	12.33± 3.4	15.57 ± 2.4	F=6. 197; P=0.004**
Lower pharyngeal airway (mm)	10.17 ± 1.9	8.93± 1.15	12.93 ± 2.2	F=12.851; P=0.001”

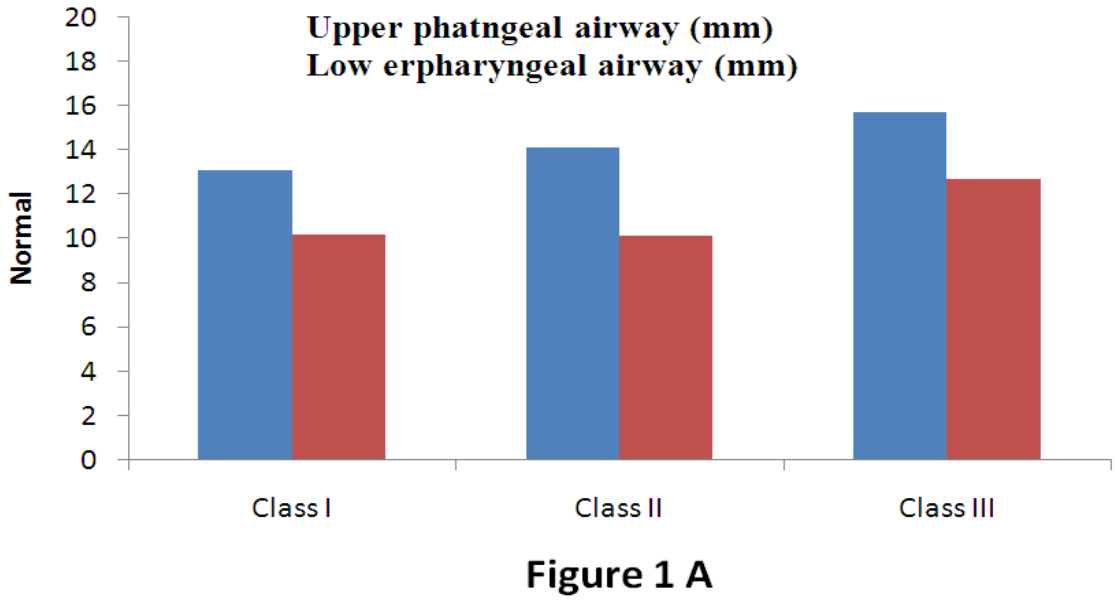


Figure 1 A

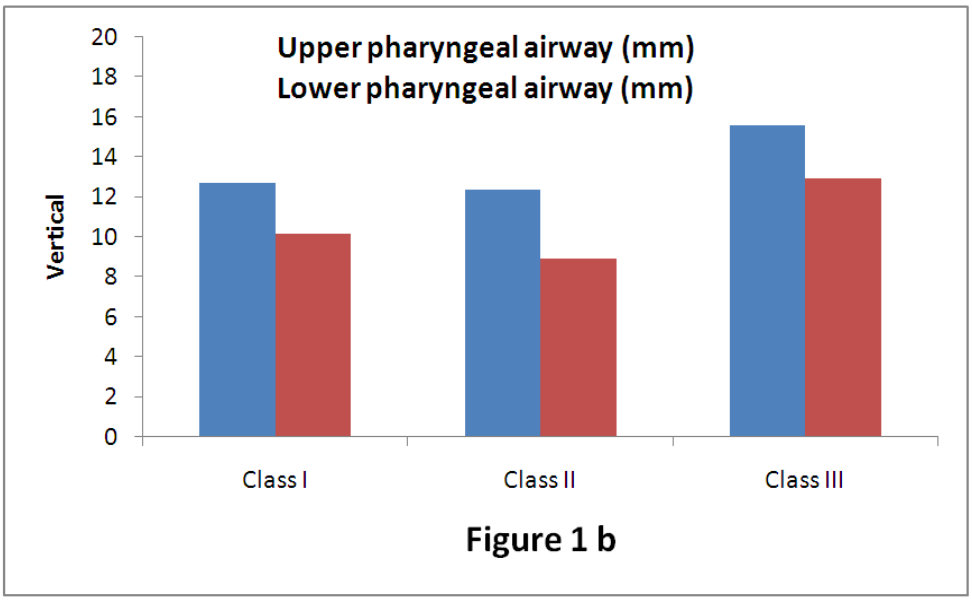


Figure 1 b

Table 2a: Vertical Growth Pattern– Pairwise Comparison of Upper Pharyngeal Airway(mm) and Lower Pharyngeal Airway(mm)

Normal	Class I vs Class II	Class I vs Class III	Class II vs Class III
Upper pharyngeal airway(mm)	0.527	0.022*	0.224
Lower pharyngeal Airway(mm)	0.996	0.009**	0.008**

Table 2b: Vertical Growth Pattern– Pair Wise Comparison of Upper Pharyngeal Airway(mm) and Lower Pharyngeal Airway(mm)

Normal	Class I vs Class II	Class I vs Class III	Class II vs Class III
Upper pharyngeal airway(mm)	0.929	0.018*	0.007*
Lower pharyngeal Airway(mm)	0.289	0.004*	<0.001**

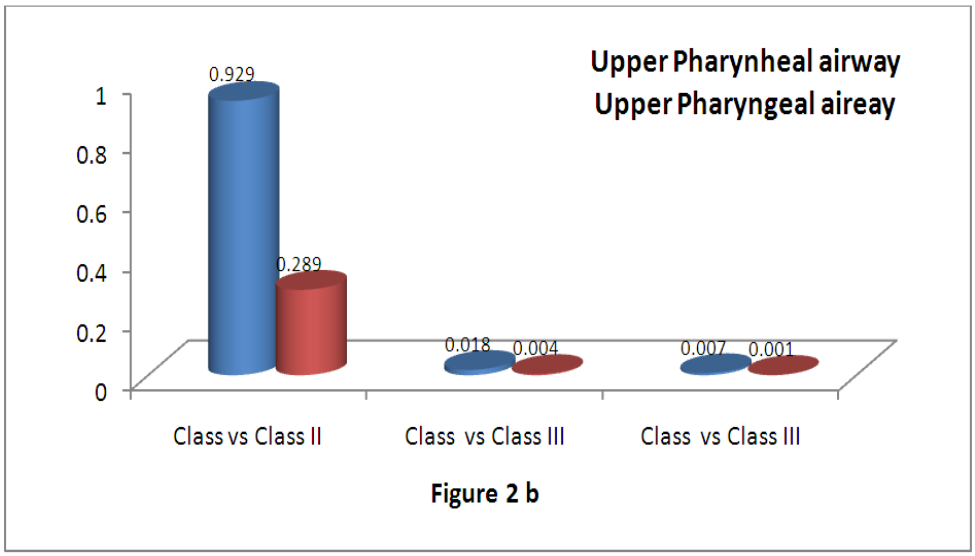


Figure 2 b

Table 3: Normal and Vertical Growth in Class I Patients– Upper Pharyngeal Airway(mm)and lower Pharyngeal Airway(mm) Comparison

CLASS l	Normal	Vertical	P value
Upper pharyngeal airway(mm)	13.10±3.00	12.70 ± 2.29	0.709
Lower pharyngeal airway(mm)	10.20±1.15	10.17±1.96	0.955

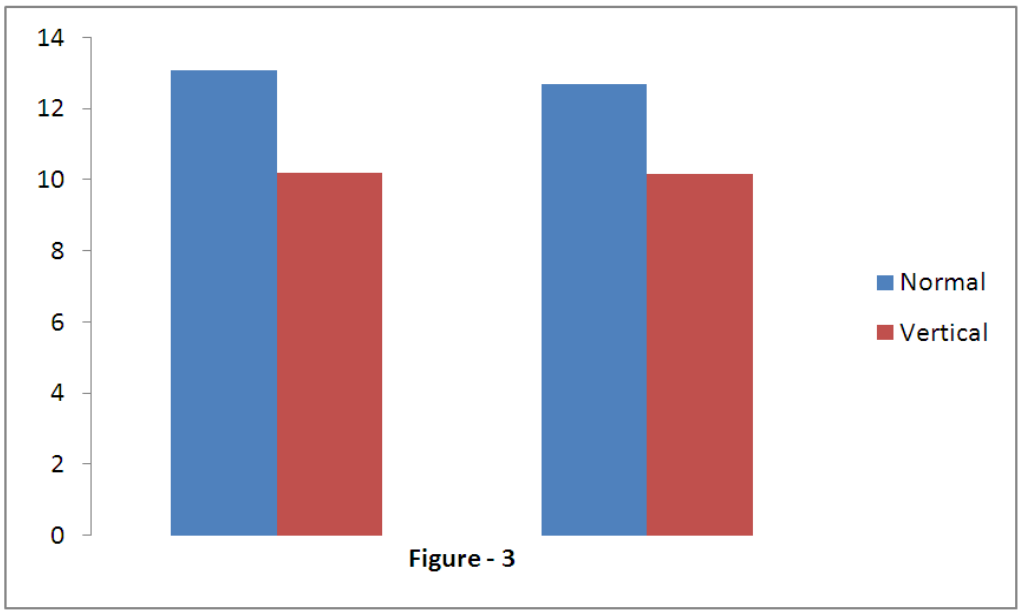
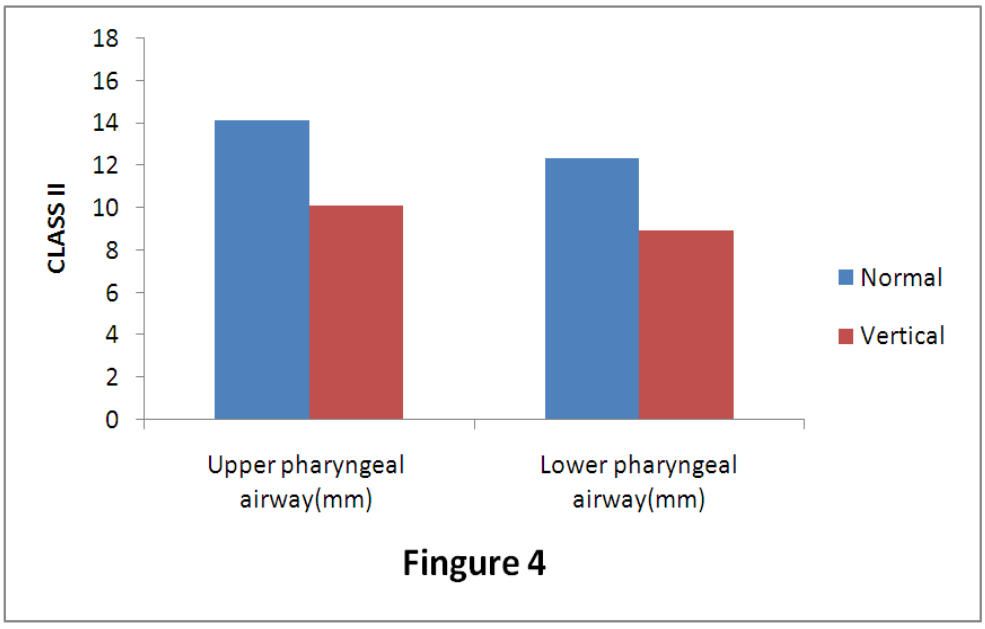


Figure - 3

Table 4: Normal and Vertical Growth in Class II Patients– Upper Pharyngeal Airway(mm)A1 and Lower Pharyngeal Airway(mm) Comparison

CLASS II	Normal	Vertical	P value
Upper pharyngeal airway(mm)	14.13±1.81	12.33±3.42	0.111
Lower pharyngeal airway(mm)	10.13±2.07	8.93±2.43	0.123



Fingure 4

Table 5: Normal and Vertical Growth in Class III Patients– Upper Pharyngeal Airway(mm)A1 and lower Pharyngeal Airway(mm) Comparison

Class II	Normal	Vertical	P value
Upper pharyngeal airway(mm)	15.73 ±2.84	15.57±2.41	0.858
Lower pharyngeal airway(mm)	12.67 ±2.94	12.93± 2.22	0.778

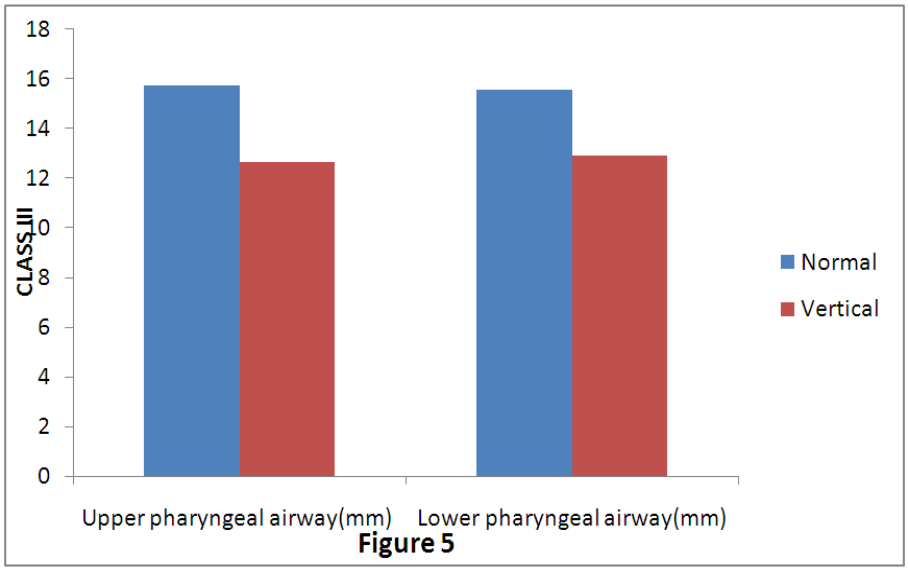


Figure 5

DISCUSSION

A normal nasal airway is reliant on two parameters, sufficient anatomical space of the airway and the size of the nasopharynx. The size of the nasopharynx also helps to ascertain the mode of breathing, whether it is nasal or oral.

Harvold and associatesperformed some experimental studies using primates. Their studies reported the presence of varyingdentofacial forms and malocclusions that resulted after mouth breathing was established.

Craniofacial relationships with mouth breathing are varied, as is seen in several clinical studies (Huber & Reynolds, 1946, Waston et al., 1968, Linder-Aronson, 1970). This observation could be associated with differing facial patterns.

Patients with Class I, Class II and Class III malocclusions had differing upper and lower pharyngeal airway widths, as is seen by the ANOVA test.

However, no significant results were obtained on comparing in dependently the upper and lower pharyngeal airway spaces, in both normal and vertical growth, in Class I, Class II and Class III skeletal patterns.

According to Mergen and Jacobs[3], midsagittal nasopharyngeal area and nasopharyngeal depth were observed to be considerably larger on comparing with Class II malocclusion in patients with normal occlusion. Changes in the ANB angle did not affect the pharyngeal structures, as is reported by Ceylan and Oktay[2]. However, this study shows contrary results, with a significant difference in the upper and lower pharyngeal airway measurements when there are changes in the ANB angle.

Ricketts, Dunn et al. and Linder Aronson[6] found a relationship between nasal obstruction that resultsin mouth breathing and the width of the nasopharynx; the narrower the nasopharynx, the lesserthe adenoidal enlargement required forobstruction ofthe airway.

Patientsin this study with a Class II malocclusion had an association with mandibular morphology, and alterations in nasopharyngeal airway size and maxillary prognathism showed a significant relationship.

Wenzel et al. reported the absence of correlations between airway size and mandibular morphology; however, they reported a significant relationship between the changes in the nasopharynxin subjects with Class II malocclusions.

Zha Zhong et al.[7]suggestedthat there was decrease in the dimension of the oropharynx; this decrease was markedly seen in the normodivergent facial pattern from Class III to Class I to Class II subgroups. This observation corresponds with those in this study.

Among Class I, Class II and Class III malocclusions, there was statistically significant difference in lower pharyngeal airways between normal and vertical growth patterns. In addition, comparisons between the groups, i.e., Class I versus Class III and Class II versus Class III, showed statistically significant results. On the other hand, significant results were absent when Class I and Class II groupswere compared.

Elham et al.[8]revealeddifferent hyoid bone positions for different skeletal patterns. Class II patients showed an upward and backward position, whereas a downward and forward position was seen in Class III patients. They concluded that the position of the hyoid bone and width of the inferior pharyngeal space had a significant but weak correlation with the changes in the pharyngeal space; when the pharyngeal space is reduced, the hyoid bone moves upwards and backwards.

However, additional studies are required to ascertain this fact, because Linder-Aronson and Leighton[9] and Linder Aronson and Backstrom have supported the aforementioned work by Elham et al. as well as suggested an alternative, that the pharyngeal space appears to be larger than normal when the nasopharyngeal airway is smaller. They however did not evaluate this correlation directly.

CONCLUSIONS

Statistically significant difference was observed in the patients with a skeletal Class I, Class II or Class III malocclusion in the upper and lower pharyngeal airway spaces. This was reported both in the vertical and normal growth patterns.

However, on comparing independently with both patterns of growth, statistically significant difference was not observed for the upper and lower pharyngeal airway spacesin Class I, II and III malocclusion types.

In both the growth patterns, there was statistically significant difference in the upper and lower pharyngeal airway space on comparing Class I and Class III groups, and Class II and Class III groups.

However, significant differences were absent when comparing Class I and Class II groups.

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