The Assessment Of Pharyngeal Airways In Skeletal Class I And Class Ii Malocclusion With Different Growth Patterns In Bhavnagar Population

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Abstract: Background: Aim: To evaluate the width of the pharyngeal airways and to ascertain any correlations in skeletal Class I and Class II malocclusion with different growth patterns. Materials and Methods: The sample size 90, divided into 6 groups based on class I and II skeletal relationship with Normal, Horizontal and Vertical growth patterns. Result: Tukey test revealed that the mean upper airway width of hyper divergent group was significantly different to hypo divergent and norm divergent group (P < 0.05), whereas for lower airway width of hyper divergent group was significantly lower as compared to hypo divergent group (P < 0.05). Conclusion: Upper airway is influenced by only growth pattern and not malocclusion type. Lower airway is not influenced by growth pattern or malocclusion type. [Seth P Natl J Integr Res Med, 2024; 15(1): 12-18, Published on Dated: 26/01/2024]

Key Words: Cephalograph, Upper Airway analysis, Lower Airway analysis, Class I Malocclusion, Class II Malocclusion, Growth Pattern.

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Introduction: The pharynx part of upper airway is composed of the nasopharynx, oropharynx, and hypopharynx. A normal upper airway improves nasal breathing and is considered important in the growth and development of craniofacial structures[1]. Moss's theory of functional matrix, nasal breathing allows growth and development of dentofacial complex[2].

Chronic nasal obstruction leads to mouth breathing, resulting in an anterior or lower position of the tongue, incompetent lips, lowered position of the mandible, and decreased orofacial muscle tonicity to compensate for decreased nasal airflow and facilitate respiration[3].

According to various authors, the main features of upper airway obstruction include: increased excessive anterior face height, narrowed upper dental arch, high palatal vault, steep mandibular plane angle, protruding maxillary teeth, and incompetent lip postures[4].

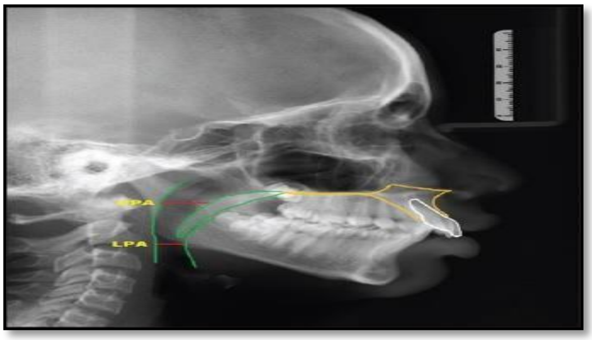
Recently, an interest has been focused on pharyngeal dimensions because of a potential relationship between size and structure of upper airway and sleep-induced breathing disturbances. Narrowing of the airway in individuals at a young age may predispose them to obstructive episodes as they mature[5].

Material & Methods: Sampling: Ninety Cephalographs were taken for tracing. They were divided into 6 groups with 15 sample size in each.

Inclusion Criteria: Skeletal class I and class II malocclusion, Normodivergent facial pattern (Frankfort mandibular plane angle [FMA] 220 – 280), Vertical growth pattern (FMA > 280), Horizontal growth pattern (FMA <220), No pharyngeal pathology, No complaints of nasal obstruction.

Exclusion Criteria: Skeletal class III malocclusion, Gross dental abnormalities, previous history of orthodontic treatment, past history of any diseases affecting the pharyngeal structures or any surgery, Suffering from craniofacial anomalies or systemic muscle or joint disorder.

Figure 1: Upper & Lower Pharyngeal Airways Width



The sample comprised lateral cephalograms of 90 untreated patients, with mean age 18-25 years, who visited the College of dental science and hospital, Amargadh, Bhavnagar, Gujarat, India.

Natural head posture (NHP) is the upright position of the head of a standing or sitting subject, while it is balanced by the post-cervical and masticatory-suprahyoid-infrahyoid muscle groups, with the eyes directed forward so that the visual axis is parallel to the floor[6].

All cephalometric roentgenograms were taken using a standardized technique with the jaw in centric relation and the teeth in occlusion, the lips relaxed and the head in the natural head position by the same operator with a cephalostat.

Standardized lateral cephalograms that fulfilled the inclusion and exclusion criteria were selected. All cephalograms were traced using a 0.003 inch matte acetate sheets. A written informed consent was obtained from each participant or his or her parents, and an ethical clearance was obtained from the Institutional Ethical Committee before inclusion in our study.

The subjects were divided into skeletal class I and class II based on FMA to NA perpendicular and Sella nasion plane to Point A. The readings were made for comparision between two different planes for accurate readings. Randomly selected cephalograms were retraced to check any possible error. All the cephalograms were then divided into six groups based on the skeletal malocclusion and growth patterns as follows:-

1. Group A: 15 samples having class I skeletal relationship with Normal growth patterns.
2. Group B: 15 samples having class I skeletal relationship with Horizontal growth patterns.
3. Group C: 15 samples having class I skeletal relationship with Vertical growth patterns.
4. Group D: 15 samples having class II skeletal relationship with Normal growth patterns.
5. Group E: 15 samples having class II skeletal relationship with Horizontal growth patterns.
6. Group F: 15 samples having class II skeletal relationship with Vertical growth patterns.

Angular and Linear measurments taken from Lateral Cephalogram listed below:-

1. Frankfort horizontal plane (orbitale to porion) to Nasion perpendicular to point A.
2. Frankfort horizontal plane to Nasion perpendicular to Pogonion.
3. Sella nasion plane to point A.
4. Sella nasion plane to Point B.
5. Y-Axis(S-Gn).
6. FMA.
7. Sella nasion - GoGn.

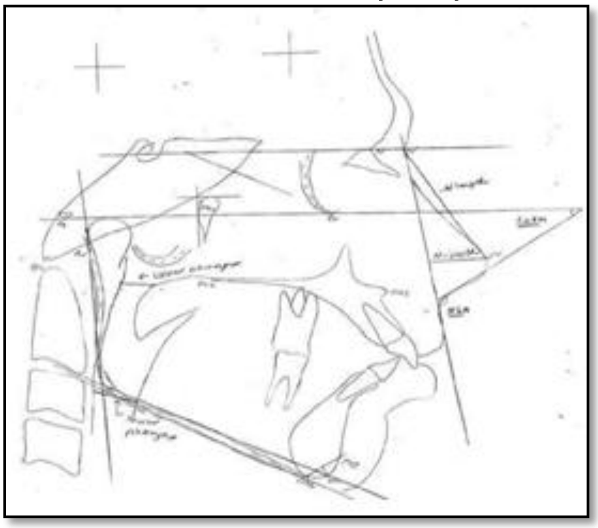
Airway space measurements will be taken: -

Upper PAS (mm): Point of intersection of line from soft palate centre perpendicular to posterior pharyngeal wall and posterior pharyngeal wall.

Lower PAS (mm): Distance of mandibular plane intersection between posterior pharyngeal wall and tongue posterior wall. Frankfort horizontal plane to Nasion perpendicular to point A and pogonion along with Sella nasion plane to point A & B is taken to estimate skeletal malocclusion.

Whereas Y-axis, FMA and SN-GoGn determines the growth pattern i.e. Average, Vertical and Horizontal, the values of Frankfort mandibular plane angle between 22 – 280, > 280and <220 respectively as proposed by Isaacson et al. The upper and lower pharyngeal airways width were measured using McNamara's airway analysis. The average nasopharynx is approximately 15-20 mm in width.

Figure 2: Diagram Of Cephalograph Tracing On Acetate Sheet For Airway Analysis.



Results: Continuous data were summarized as mean ± standard deviation while discrete (categorical) in percentage. Continuous variables were compared by one-way analysis of variance (ANOVA) and the significance of mean difference between the groups was done by Tukey'sposthoc test. All analyses were performed on statistica statistical software.

Pharyngeal Airway Measurements: Upper Airway width: The upper airway comparisons of six groups are summarized in Table 1. The mean upper airway width of hypo divergent and normo divergent group is more and less in hyper divergent group. When comparing the mean upper airway width of six groups, ANOVA [Table 1] revealed significant difference in the upper airway width among the groups (P < 0.05).

Further, Tukey test [Table 2] revealed that the mean upper airway width of hyper divergent group was significantly different to hypo divergent and normo divergent group (P < 0.05). Patients 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 malocclusionsand normal growth patterns. However, malocclusion type does not influence upper pharyngeal airway width.

Lower Airway Width: Comparing the mean lower airway width of three groups, Tukey test [Table 3] revealed that the mean lower airway width of hyper divergent group was significantly lower as compared to hypo divergent group (P < 0.05). However, no significant difference was found in the lower airway width between hypo divergent and normo divergent and hyper divergent and normo divergent (P > 0.05).

Statistical analysis

In each group, means and standard deviations for the ages, and upper and lower airways, were determined. The intergroup comparisons of the ages, and upper and lower airways, were performed by using 1-way ANOVA, with the Tukey test as a second step, at P ≥0.05.

The Class I and Class II groups with vertical growth patterns had significantly smaller upper pharyngeal airways than the Class I and Class II groups with normal growth patterns. No significant intergroup differences were found for the lower pharyngeal airway (Table 2).

Table 1: Means And Standard Deviations Of Ages, Upper And Lower Pharyngeal Airways And Results Of ANOVA Followed By Tukey Test

	Age		Upper Airway (mm)		Lower Airway (mm)	
	Mean	SD	Mean	SD	Mean	SD
Group 1 (class I, Normal growth)	15	2.86	18.6	2.86	9.4	2.36
Group 2 (class I, Horizontal growth)	18.6	3.04	20	3.04	11.4	4.82
Group 3 (class I, Vertical growth)	20	1.87	15	1.87	8.90	1
Group 4 (class II, Normal growth	14.22	2.43	14.22	2.43	8.44	1.33
Group 5 (class II, Horizontal growth)	15.22	3.15	15.22	3.15	9.33	3.35
Group 6 (class II, Vertical growth)	15.62	2.06	11.62	2.06	8.125	2.29
P Value	0.0015		0.0015		0.1652	
Statistically significant at P < 0.05.						

Table 2: Tukey Test For Upper Airway

Parameter compared using Tukey HSD (Honest significant test)	Comparision of	Comparision with	Mean difference	P Value
Upper Airway	Group 1	Group 2	- 5.6	0.0862
		Group 3	-6.2	0.0002
		Group 4	-2	0.1636
		Group 5	-1.6	0.2973
		Group 6	-2.6	0.0406
	Group 2	Group 3	-0.6	0.0086
		Group 4	3.60	0.0774
		Group 5	4	0.0656
		Group 6	3	0.0064
	Group 3	Group 4	4.2	0.0047
		Group 5	4.6	0.0046
		Group 6	3.6	0.1960
	Group 4	Group 5	0.40	0.8220
		Group 6	-0.60	0.0038
	Group 5	Group 6	-3	0.0175

Patients with vertical growth patterns in Class I and Class II malocclusions have significantly narrower upper pharyngeal airways than those with normal and horizontal growth pattern in Class I and Class II malocclusions. The upper airway intergroup comparisons in the same growth patterns (groups 1 and 4, and groups 2 and 5, group 3 and 6) showed no significant differences, with no association of upper airway space with type of malocclusion (Table 2). This study showed that the nasopharynx was found to be narrower in the vertical than in the normal and horizontal growth pattern in both Class I and Class II malocclusions. The Class I and Class II groups with vertical growth patterns had significantly smaller upper pharyngeal airways than the Class I and Class II groups with normal and horizontal growth patterns.

Graph 1: Comparison Of Mean Values Of Upper And Lower Airways All Six Groups

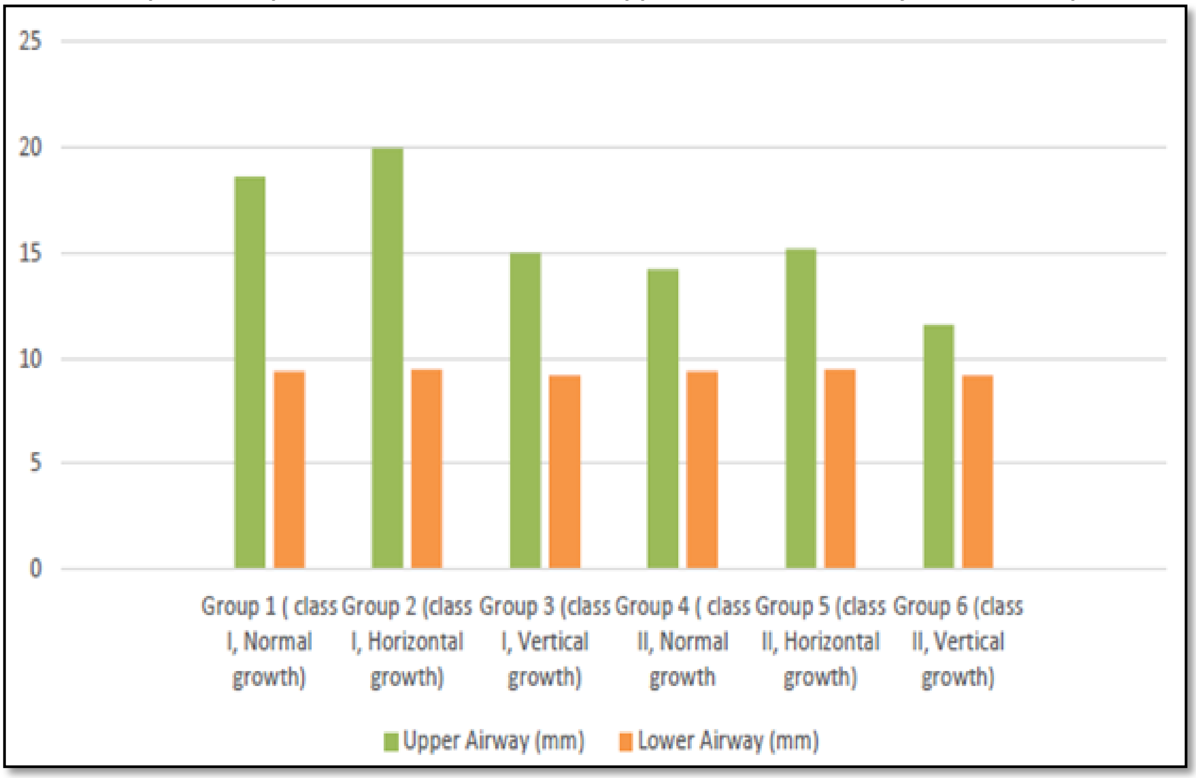


Table 3: Tukey Test For Lower Airway

Parameter compared using tukey HSD	Comparision of	Comparision with	Mean difference	P Value
Lower Airway	Group 1	Group 2	-2	0.4386
		Group 3	2.4	0.0909
		Group 4	1.8	0.1950
		Group 5	0.20	0.9264
		Group 6	2.6	0.0592
	Group 2	Group 3	4.4	0.0810
		Group 4	3.8	0.1250
		Group 5	2.2	0.4507
		Group 6	4.6	0.0666
	Group 3	Group 4	-0.40	0.4021
		Group 5	-2.2	0.2564
		Group 6	0.20	0.6938
	Group 4	Group 5	0.40	0.7524
		Group 6	0.80	0.1823
	Group 5	Group 6	0.40	0.7328

No statistically significant difference in lower pharyngeal airways between groups was found, showing no association of lower pharyngeal airway space with craniofacial growth pattern and malocclusion type. Thus upper airway varies in various growth patterns and skeletal malocclusions as well apart from being affected by the orthodontic treatments.

Discussion: Ucar et al studied Class I subjects with different vertical growth patterns (low, normal, and high angle). They reported larger upper pharyngeal airway space in low angle subjects than in high angle subjects[7].

Akcam et al. reported a decrease in the upper airway dimensions of subjects who had posterior mandibular rotation[8].

Joseph et al. compared the pharyngeal dimensions of hyper divergent and normo divergent facial types and found that hyper divergent group had a narrower anteroposterior pharyngeal dimension (nasopharyngeal airway) than the normo divergent control group[9].

Similar findings were reported by de Freitas et al., the upper pharyngeal width was affected by vertical growth pattern but not lower pharyngeal airway width[10].

Because only relatively healthy pharyngeal patients with malocclusions were selected, we expected that the pharyngeal widths would reflect only their natural anatomical conditions with no pharyngeal pathology. 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 (Table 1), confirming previous results in the literature[7,11].

Analyzing these results, we can infer that upper airway width is influenced by the craniofacial growth pattern, as previously suggested.

However, some studies found weak relationships between growth pattern, facial morphology, and nasopharyngeal airway. Probably, this is because those studies evaluated the influence of the nasopharyngeal airway on facial form and occlusion, this was the opposite of our study.

Nevertheless, the prevalence of mouth breathing in subjects with vertical growth pattern can be explained by the findings of Ricketts[12] and Linder-Aronson[13] found that nasal obstruction leading to mouth breathing was related to the width of the nasopharynx; the narrower the nasopharynx, the less adenoidal enlargement was needed to obstruct the nasopharyngeal airway. This helps to explain the prevalence of mouth breathing in subjects with vertical growth patterns[14].

The upper airway intergroup comparisons in the same growth patterns (groups 1 and 4, and groups 2 and 5) showed no significant differences, with no association of upper airway space with type of malocclusion; this corroborated previous findings[13,15] (Table II).

Kerr[15] reported that Class II malocclusion subjects showed narrow nasopharyngeal airway space compared with Class I and normal occlusion subjects.

The upper pharyngeal width in the subjects with Class I and Class II malocclusions and vertical growth patterns was statistically significantly narrower than in the normal and horizontal growth pattern groups.

Also the upper pharyngeal airway was wider in subjects with same growth pattern but having class II malocclusion than in those having class I malocclusion.

The lower pharyngeal airway was not found to correlate with any change in growth patterns or with different malocclusion types.

Thus upper airway varies in various growth patterns and skeletal malocclusions as well apart from being affected by the orthodontic treatments[11,15].

Conclusion: No statistically significant difference was found in the upper airway width between normo divergent and hypo divergent growth pattern.

The mean lower airway width did not differ significantly between hypo divergent, normo divergent, and hyper divergent group.

Patients 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.

Analyzing these results, we can infer that the upper airway width is influenced by the craniofacial growth pattern.

Malocclusion type does not influence upper pharyngeal airway width, and malocclusion type and growth pattern do not influence lower pharyngeal airway width.

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