

Pharyngeal Airway Dimension in Different Types of Malocclusion

Ashwin Kumar.V¹, Aravind Kumar², Sivaram Subbiah³, Senkutvan R.S¹

¹Madha Dental College, Kundrathur, Chennai

²Saveetha Dental College, Velapanchavadi

³Penang International Dental College, Malaysia

Abstract Objective: To assess the pharyngeal airway dimension in different types of malocclusion. **Materials and Methods:** Literature was searched through PubMed, Web of Science, Embase, and All EBM Reviews. The inclusion criteria consisted of studies written in English; published in the past three decades; concerning the pharyngeal airway dimension in different types of malocclusion. **Results:** Our search strategy identified (PUBMED -22, AND MeSH -22) titles and abstracts of studies which were independently assessed. We also ran a free text search on Google Scholar for any further potentially eligible trials which resulted in the identification of 1 published. Full text copies of these studies were obtained from the Internet, and were then subjected to further assessment. We also checked the bibliographical references of these papers for any relevant studies and found all the included articles were found through electronic search. **Conclusion:** The pharyngeal airway dimensions are subjected to change with different malocclusion and Narrow pharyngeal airway space is one of the predisposing factors for mouth breathing and obstructive sleep apnoea.

Keywords: *pharyngeal airway dimension, malocclusion and Pharynx*

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1. Introduction

The upper and lower airway has always been an area of interest because the oropharyngeal and nasopharyngeal structures play important roles in the growth and development of the craniofacial complex.

Pharyngeal space size is determined primarily by relative growth and size of the soft tissues surrounding the dentofacial skeleton.

From adulthood to older age (20–50 years of age), the nasopharyngeal skeleton may change. Many reports have demonstrated a relationship between various malocclusion patterns and variations in the size and form of the pharyngeal airway.

2. Methods

Criteria for considering studies for this review:

2.1. Types of Studies

Studies evaluated through lateral cephalogram and cone beam computed tomography was selected. The study selected were meeting the inclusion criteria.

2.2. Types of Participants

The participants in the study selected were healthy individuals. They had no history of orthodontic treatment

or any pathological disorder. Syndrome and cleft patients were not included in the study.

2.3. Search Methods for Identification of Studies

2.3.1. Electronic Searches

For the identification of studies included or considered for this review, detailed search strategies were developed for each database to be searched.

We searched the following databases in July 2011: (PUBMED Medline 1950 to July 2011), MEDLINE (1950 to July 2011); SCIENCE DIRECT (1980 to July 2011) and MeSH.

2.3.2. Hand Searches

- All the included articles were available through electronic search. Hence no hand searches were done for this review.

A search for existing meta-analyses and non-Cochrane systematic reviews was also performed.

2.4. Data Collection and Analysis

Selection of studies: The articles were assessed independently by going through the titles and the abstracts of studies which were identified in the searches. Full copies of all relevant and potentially relevant study, those appearing to meet the inclusion criteria, or for which there were insufficient data in the title and abstract to make a clear decision, were obtained. The full text papers were

assessed independently and any disagreement on the eligibility of trials was resolved through discussion and consensus.

2.5. Data extraction and Management

In the event that future studies are identified and included in updates, the following methods of data extraction and management will apply.

Study details will be collected using a pre-determined form designed for this purpose and entered into the 'Characteristics of included studies' table.

The following details will be extracted:

1. Title of the article: The title mentioned will be mentioned in the table.
2. Journal and year: The searched journal name will be mentioned.
3. Study design: Whether the study used Lateral Cephalogram, or CBCT
4. Materials and methods:
 - The no of participants.
 - Age
 - Sex
 - Sample size

Results: primary outcome of the study mentioned, Secondary outcome also mentioned if published.6 No of citations referred: The number of citations referred in the study/article will be mentioned.

3. Results

3.1. Results of the Search

Our search strategy identified (PUBMED -22, AND MeSH -22) titles and abstracts of studies which were independently assessed.

We also ran a free text search on Google Scholar for any further potentially eligible trials which resulted in the identification of 1 published-Comparison of upper and lower pharyngeal airway space in class II high and low angle cases(Pak dental journal Liffat batool).

Full text copies of these studies were obtained from the Internet, and were then subjected to further assessment. We also checked the bibliographical references of these papers for any relevant studies and found all the included articles were found through electronic search.

3.2. Excluded Studies

After electronic search and hand search, these articles were rejected after going through the full article. Lateral cephalometric analysis of pharyngeal airway affected by head posture was rejected since it focused on only different head posture than comparing the relationship with different skeletal patterns.

Cephalometric evaluation of upper airway and its measurement article was excluded since this study reported about the important cephalometric measurement [21]. They did not compare the airway dimension with different skeletal pattern.

"Similarly" A comparative study of upper airway among different skeletal craniofacial patterns in non snoring Chinese children" [22] was excluded-where only predisposing factor for obstruction were examined.

Nasopharyngeal and facial dimension of different morphological pattern by Murilo Fernando [23]. The study did not compare the pharyngeal airway dimension of different malocclusion [21,22,23,24].

CLASS I NORMAL SUBJECTS VS CLASS I MALOCCLUSION:

Studies were done among Class I Malocclusion for assessing the pharyngeal airway dimensions.

MARTIN AND MULLES [8] did a cephalometric study to assess nasopharyngeal soft-tissue patterns in patients with ideal occlusion. A sample of 91 patients was selected with ideal occlusion. A new line of investigation were introduced for measuring the pharyngeal airway width.

YOSHIHIKO Et Al [17] did a Pharyngeal airway dimensions were evaluated within class I malocclusion by comparing among normal occlusion and prognathism patients. 25 girls with prognathism and 15 children with normal occlusion were selected for the study. They found that the Lower pharyngeal airway was wider as a result of prognathism maxilla and mandible.

Similarly FARUK [16] found out the Orofacial airway dimensions in subjects with Class I malocclusion and different growth patterns. Lateral cephalometric radiographs of 31 low angle, 40 high angle and 33 normal growth subjects with Class I malocclusion were examined. Nasopharyngeal airway space and upper airway measurements were larger and palatal tongue space was narrower in low angle than in high angle subjects.

NORMAL SUBJECTS VS CLASS II MALOCCLUSION:

Studies done among Class I and Class II subjects. In all the study Class II patients were compared with Class I patients and results were concluded. The results stated that the Class II subjects had a smaller dimensions of pharyngeal airway compared to that of Class I subjects.

MERGEN AND JACOBS [1] undertook a study to determine whether any relationship exist between normal occlusion and any dental malocclusion.20 subjects with normal occlusion and 20 subjects with class II malocclusion were considered in the study. They concluded that the nasopharyngeal dimension was larger in normal occlusion than in class II subjects and convexity of the posterior nasopharyngeal wall was more prevalent in class II cases.

F.A SOSA [2] reported that the post pharyngeal lymphoid tissue in Class I and Class II malocclusion. His study suggested that there was not any clear cut relationship between either Class I or Class II Div I Malocclusion and total pharyngeal area.

JOHN.KERR [3] Compared Class I and Class II malocclusion. He suggested that the pharyngeal airway was retruded in class II compared to class I

DE FREITAS MR, ALCAZAR NM, [7] stated that the 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. The sample comprised 80 subjects divided into 2 groups: 40 Class I and 40 Class II, subdivided according to growth pattern into normal and vertical growers.

IFFAT BATOOL Et Al 2010 [13] Compared the pharyngeal airway space in class II low angle and high angle case. They suggested that 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.

NORMAL SUBJECTS VS CLASS III MALOCCLUSION:

Studies done among Class I and Class III subjects. In all the study Class III patients were compared with Class I patients and results were concluded. The results stated that the Class III subjects had a larger dimensions of pharyngeal airway compared to that of Class I subjects.

- In 2009 TOMONORI IWASAKIHARUAKI HAYASAKI [11] used cone-beam computed tomography for evaluating the pharyngeal airway, The sample comprised 45 children (average age, 8.6 ± 1.0 years) divided into 2 groups: 25 with Class I and 20 with Class III malocclusions. They concluded that The Class III malocclusion is associated with a large and flat OA compared with the Class I malocclusion.
- MARTIN AND MUELAS [18] Did a comparative study of nasopharyngeal soft tissue characteristic in Class III malocclusion patients. A sample of 71 patients with class III malocclusion were selected. This study suggests new lines of investigation about the relationship between skeletal and dental anomalies and airway obstruction.

CLASS I vs, CLASS II vs CLASS III MALOCCLUSION:

A study on the pharyngeal size in different skeletal patterns were assessed. The different skeletal patterns were compared with Class I. The studies were:

- CELYEN AND OKTAY. [4] A cephalometric study of the pharyngeal size was investigated in 90 subjects, 45 males and 45 females, having different ANB angles. All of the subjects were aged 13 to 15 years. It was observed that the oropharynx area became smaller with the increase of ANB angle.
- ABU ALLHAIJA, AL-KHATEEB [6] the study was to investigate the uvulo-glosso-pharyngeal dimensions in subjects with different anteroposterior jaw relationship. Cephalometric radiograph of 90 subjects (45 females and 45 males, aged 14–17 years) were divided into three groups, Class I, class II and class III. They concluded that In conclusion, uvulo-glossopharyngeal dimensions are affected by anteroposterior skeletal pattern
- T.MUTO [10] reported that the anteroposterior bphaygeal airway space was larger in mandibular prognathism and smaller in mandibular retrognathic.
- DAN GRAUER, LUCIA S.H.CEVIDANES [12], Pharyngeal airway volume and shape was assessed using Cone beam Computed Tomography. It was found in relationship with facial morphology. They concluded that the Skeletal class II had forward inclination of airway and Class III subjects had more vertically oriented airway.
- YOON-JI KIM [14] et al compared the pharyngeal airway form in 3 dimensional in children with

different anteroposterior pattern. 60 healthy children were divided in three groups by different anteroposterior jaw relationship. He found that the Class II malocclusion has more backward orientation and smaller volume of the pharyngeal airway than do of children with class I and class III malocclusion.

- KYUNG-MIN OHA [15] 3- d Analysis of the pharyngeal airway in preadolescent children with different anteroposterior skeletal pattern was studied by 27 healthy children were considered in the study and an analysis were derived. They concluded that Retrognathic children has a smaller pharyngeal airway compared normal children.
- HASAN ET AL [19] conducted a study to evaluate the nasal passage (NP) and oropharyngeal (OP) volumes of patients with different dentofacial skeletal patterns. Methods: The study sample consisted of 140 patients (70 boys, 70 girls), divided into 3 groups as Class I, Class II, and Class III. The OP airway volumes of Class II patients were smaller when compared with Class I and Class III patients.

4. Discussion

Ever since Broadbent found out Radiograph in 1918, its being used for diagnosis in various medical field. Roentgenography and Cephalometrics has provided the orthodontist 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 the facial growth. Pharyngeal airway dimension is a area of interest for many authors. Many articles were published to explore the relationship between nasopharyngeal airway and craniofacial growth. The advancement of newer technologies lead to more precise finding of the nasopharyngeal airway and its relationship. Newer advancements like Cone Beam Computed Tomography (CBCT) explored the pharyngeal relationship in a 3-Dimensional view.

On the other hand Malocclusion is of greatest concern for an orthodontist. Malocclusion is any perversion of normal occlusion of the teeth. Many classification were put forward for describing malocclusion. The most accepted classification for malocclusion was given by EDWARD ANGLE.

Retrognathic Mandible is a common feature in class II malocclusion.

Prognathic mandible is a common feature in Class III malocclusion [14]

The relationship of the pharyngeal airway dimensions with different malocclusion was found early back 1970 by KERR 3 who compared the pharyngeal airway among class I and class II subjects (The nasopharynx, Face height and overbite). Then lot of relevant studies were published and comparison was done with different malocclusion.

Opinions differ with regard to the relationship of pharyngeal airway and type malocclusion [11,12,13,14,15].

Ceylan and Oktay [4] reported that the changes in the ANB angle affected nasopharyngeal airway size and that the oropharyngeal space.

Joseph et al reported that the nasopharyngeal airway in hyperdivergent individuals was significantly narrower than that of normodivergent individuals.

Kerr [3] reported that the class II malocclusion subjects showed narrow nasopharyngeal airway compared with class I and normal occlusion.

Muto [10] reported with a smaller airway space in mandibular retrognathism than in normal individuals.

Table 1.

Authors name and year	Name of the Journal	Sample size	Methods used	Comparison between	Results outcome
C. Mergen et al 1970	Angle orthodontist	Females-40 Age – 13-14yrs	Lateral cephalogram	Class I and Class II	Class II found To have smaller dimension
Sosa, Graber 1982	Ajo-Do	2 groups- male and female 144 patients-46female and 34 males Age -7 to 12 yrs	Lateral cephalogram	Class I and Class II	Class II airway space smaller compared to normal subjects
John.C.Kerr 1985	Angle orthodontist	44 males, Age: 5,10,15yrs	Lateral cephalogram	Class I and Class II	Class II found To have smaller dimension
Ismail ceylan 1995	Ajo –Do	Total- 90 45male 45 female Age 13-15 yrs	Lateral cephalogram	Class I, Class II and Class III	Different class has different pharyngeal airway dimension.
Abu A.Joseph 1998	Oral Maxillofacial Surgery journal	Total no:50 Normodivergent:23 Hyperdivergent:27	lateral cephalogram	Class I and Class II	Hyperdivergent patients narrower than normodivergent
Elham Saleh 2005	Angle orthodontist	Total group-90 45 –Female 45-male Age – 14-17 yrs	Lateral cephalogram	Class I, ClassII and Class III	Different class had different dimensions
Marcos Roberto 2006	Ajo-Do	2 groups 40 class I 40 ClassII Age 11.6 yrs	Lateral cephalogram	Class I and Class II	Upper airway long in classII,and lower airway short compared to ClassI
Oscar Martin 2006	Ajo –Do	A sample of 91 patients. 55-men 36- female Age -26 yrs	Lateral cephalogram	Class I	No relevant identification observed.
Yu Kikuchi 2008	Bull Tokoyo	25 adult women Age -22yrs	CBCT	Different facial morphology	Airway is influence by facial morphology
T.Muto 2008	Oral and maxillofacial	Female Total -30 Age 22.7 yrs	Lateral cephalogram	Class I and ClassII	Smaller airway in retrognathic mandible
TomonoriIwasaki 2009	Ajo-Do	45 children(girls and boys) 2 groups-25 class I 20-Class III Age 11.5-13 yrs	CBCT	Class I and Class III	Class III has larger oropharyngeal dimension
Dan Grauer 2009	Ajo –Do	62 non growing patients.	CBCT	Facial morphology	Airway space is changed.
Liffat batool 2010	Pak dental journal	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	Lateral cephalogram	Class II –High angle and Class II- Low angle.	Class II pharyngeal airway is smaller in vertical growth cases.
Yoon-ji-kim 2010	Angle orthodontist	27 healthy children 12 boys 15 girls Age-11yrs	CBCT	ClassI, Class II and ClassIII	Retrognathic was significantly smaller than healthy individuals.
Kyung-Min 2011	Angle orthodontist	60 healthy children 3groups-ClassI,II,III Age-11.9-12.	CBCT	Class I,ClassII and ClassIII	Class II the oropharyngeal airway is bigger
Faruk Izzet Ucara 2011	Angle orthodontist	31 low angle 40 high angle Male and female Age 14-15yrs	Lateral cephalogram	Among Class I	Orofacial airway dimensions in subjects with Class I malocclusion and different growth patterns is identified
Yoshihiko 2011	Angle orthodontist	25 girls with prognathism 15 girls with normal occlusion Age 8.5-9.5 yrs	Lateral cephalogram	Among class I	Prognathism has larger pharyngeal space
Oscar martin 2011	AJO-DO	162 patients(boys and girls) 2 groups- Class I-91 Class III-71	Lateral cephalogram	ClassI and Class III	Class III was larger airway
Hakan El 2011	Ajo-DO	140 patients (70 boys, 70 girls), divided into 3 groups as Class I and class II and class III.	Lateral cephalogram	Class I,ClassII and ClassIII	ClassIII upper airway was smaller.

dimensions are subjected to change with retrognathic mandible and prognathic mandible comparing with normal mandible.

5. Conclusion

With the above referred study the pharyngeal airway is sensitive to different anteroposterior. The Airway

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