www.djas.co.in
ISSN No-2321-1482

DJAS 1(III), 163-168, 2013

ORIGINAL ARTICLE

Dental JOURNAL
of Advance Studies

A CEPHALOMETRIC STUDY TO EVALUATE THE VARIATIONS IN PHARYNGEAL AIRWAY SPACES IN CLASS I AND CLASS II MALCOCCLUSIONS

Dr Navreet Sandhu[1] Dr Sarabjeet Singh Sandhu[2] Dr Kavita Mehta[3] Dr Rita Kashyap[4]
[1]Reader, Department of Prosthodontics, Bhojia Dental College and Hospital, Distt. Solan, Himachal Pradesh (India)
[2]Professor and Head, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Distt. Solan, Himachal Pradesh (India)
[3]PG Student, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Distt. Solan, Himachal Pradesh (India)
[4]Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Distt. Solan, Himachal Pradesh (India)
Corresponding Author:
[2]Mobile: 919876061283 Email: sarabjeet3400@yahoo.co.in

Received :
29th August, 2013

Accepted:
15th Nov, 2013

Available online:
28th Dec, 2013

ABSTRACT

Introduction: Ever since the time of **Edward H. Angle**, the effects of upper airway obstruction have been recognized in the field of craniofacial biology. Because of the close relationship between the pharynx and the dentofacial structures, a mutual interaction is expected to occur between the pharyngeal structures and the dentofacial pattern, and therefore justifies orthodontic interest. The purpose of this study was to compare the upper and lower pharyngeal widths and nasopharyngeal area in class I and class II malocclusion patients. **Methods:** The study sample consisted of 48 subjects of age group 18-26 years, divided into 2 groups : class I(n=24) and class II(n=24).Pharyngeal airways were assessed according to Mc Namara's analysis and Handelman and Osborne method of measuring pharyngeal widths and nasopharyngeal areas. **Results:** Independent t –test showed a statistically significant difference ($p<0.01$) in upper aerial width and nasopharyngeal airway area between two groups, showing that in class II cases upper aerial width is narrower and nasopharyngeal area is small when compared to class I cases. **Conclusion:** Conclusion of the study was that upper aerial width and nasopharyngeal airway area of class II cases were smaller than Class I cases. It was observed that mandibular position with respect to cranial base had an effect on pharyngeal airway.
Keywords: Malocclusion, Orthodontics, Nasopharynx

INTRODUCTION

Ever since the time of **Edward H. Angle**, the effects of upper airway obstruction have been recognized in the field of craniofacial biology.[1] Clinicians and researchers involved in the treatment of dentofacial deformities have sought to elucidate the determinants of facial morphology. The relationship between upper airways and changes in facial morphology has been extensively debated in the literature and remains controversial.[2]

The upper airway space can be described in terms of height, width and depth. It is known that the limiting factor determining respiratory capacity is a reduced cross-sectional air passage area anywhere in the pharyngeal path.[2]

The nasopharynx and the oropharynx have significant locations and functions because both of them form a part of the unit in which respiration and deglutition are carried out and they include lymphoid tissue in their structures.[3] Nasal obstruction secondary to hypertrophied inferior turbinates, adenoidal pad hypertrophy, and hypertrophy of the faucial tonsils can cause chronic mouth breathing, loud snoring, obstructive sleep apnoea, excessive daytime sleepiness, and even cor pulmonale.[4] In this situation, a number of postural changes, such as open mandible posture, downward and forward positioning of the tongue, and extension of the head, can take place. If these postural changes continue for a long period, especially during the active growth stage, dentofacial disorders at different levels of severity can be seen, together with the inadequate lip structure, long face syndrome, and adenoidal facies. [5] Because of the close relationship between the pharynx and the dentofacial structures, a mutual interaction is expected to occur between the pharyngeal structures and the dentofacial pattern, and therefore justifies orthodontic interest. Craniofacial anomalies, including Maxillary retrusion, mandibular retrognathism, short mandibular body, and backward and downward rotation of the mandible, may lead to reduction of the pharyngeal airway passage.[5] Decreased space between the mandible and the cervical column may lead to changes in posture of the tongue and soft palate posteriorly, may impair respiratory function during the day, and may cause possible nocturnal problems such as snoring, upper airway resistance syndrome, and obstructive sleep apnea.

In many studies carried out on this subject, it has been demonstrated that there is significant relationship between the pharyngeal space and both dentofacial and craniofacial structures at varying degrees. **Mergen and Jacobs** in a study reported that the midsagittal nasopharyngeal area was significantly greater in subjects with normal occlusion than in those with Class II malocclusion.[6] **Kirjavainen and Kirjavainen** found that children with Class II malocclusion had a narrower oropharynx and hypopharynx than did the controls.[7] However, **Freitaset *et al*** did not find a correlation between the upper pharyngeal airway and Class I and Class II malocclusion types.[8] Another subset of studies has also displayed the relationship between the age and nasopharyngeal space (**Trenouth and Timms)**. Thus, it might be considered to be useful that the assessment of the pharyngeal space should be included with the orthodontic diagnosis and treatment planning, as the functional, positional, and structural assessments of the dentofacial pattern are carried out.[9]

In view of the need to uncover new evidence to contribute to and assist in addressing this complex issue, this study was carried out by tracing certain reference points and lines combining them with surface area measurement on lateral cephalograms to evaluate the variations in pharyngeal airway spaces in class I and class II malocclusions.

MATERIALS AND METHODS

- The present study was conducted on 48 cephalograms in the Department of Orthodontics and Dentofacial Orthopaedics at Bhojia Dental College & Hospital, Baddi, Himachal Pradesh. A complete history and examination of all 48 subjects was done at the ESI hospital, Baddi, prior to their inclusion in the study
- Study included subjects aged between 18-26 years, with untreated skeletal Class I Malocclusion and untreated skeletal Class II Malocclusion with mandibular deficiency.
- Study excluded subjects with Class III malocclusion, class II malocclusion with maxillary excess, subjects who have undergone orthodontic treatment. Subjects with any pharyngeal pathology, history of adenoidectomy or any other nasopharyngeal surgeries, deglutition disorder, visual or hearing disorder leading to abnormal head posture and any history of airway allergies was also excluded from the study.

METHODOLOGY

For each enrolled subject lateral cephalograms were taken. While recording the lateral cephalograms, patients were placed in the standing position with the FH plane parallel to the floor and the teeth in centric occlusion. The head of the patient was erect. The cephalogram were exposed at the end-expiration phase of the respiration. Subjects were instructed not to move their heads and tongues and not to swallow while cephalogram exposure. All of the cephalograms were recorded with the same exposure parameters and in the same machine. All lateral cephalograms were traced manually on left side, and various landmarks were identified (Figure1). On the basis of anteroposterior parameters, the subjects were divided into two groups as follows:

Group I : Subjects with Class I malocclusion (n=24)

ANB : 1^0 to 3^0

AO-BO:Male : -1mm , Female:0

AB plane angle : 0^0 to -9^0

Group II: Subjects with Class II malocclusion (n=24)

ANB : $> 3^0$

AO-BO: Male: >-1mm, Female : >0

AB plane angle : $< -9^0$

To check for the mandibular deficiency

SNB: $< 80^0$

CEPHALOMETRIC MEASUREMENTS[13,14]

The following cephalometric measurements were recorded to assess the pharyngeal space:

1. McNamara's upper pharyngeal width (mm): The minimum distance between the upper soft palate and the nearest point on the posterior pharynx wall. (Figure 1)
2. McNamara's lower pharyngeal width (mm): The minimum distance between the point where the posterior tongue contour crosses the mandible and the nearest point on posterior pharynx wall. (Figure 1)
3. Upper aerial width (PNS-AD2) (mm): The distance between PNS and the nearest adenoid tissue measured through a perpendicular line to S-Ba from PNS (AD2). (Figure 1)
4. Lower aerial width (PNS-AD1)(mm) : The distance between PNS and the nearest adenoid tissue measured through PNS-Ba line (AD1). (Figure 1)
5. Adenoid pharyngeal wall area (Ad area) (mm^2) (Figure 2)
6. Nasopharyngeal airway area (Air area) (mm^2) (Figure 2)

The palatal line (PL), sphenoid line (SpL), anterior atlas line (AAL), and pterygomaxillary line (PML) represent the four sides of a trapezoid which defines the nasopharyngeal area (Np area). The Np area can be subdivided into Air area and Ad area. (Figure 2)

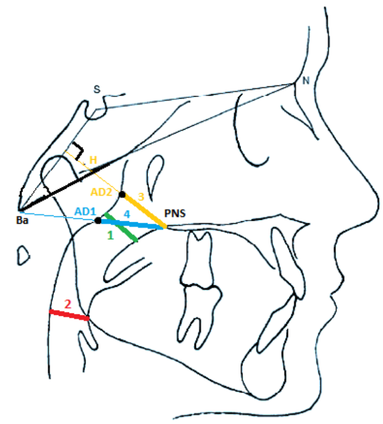


Figure 1

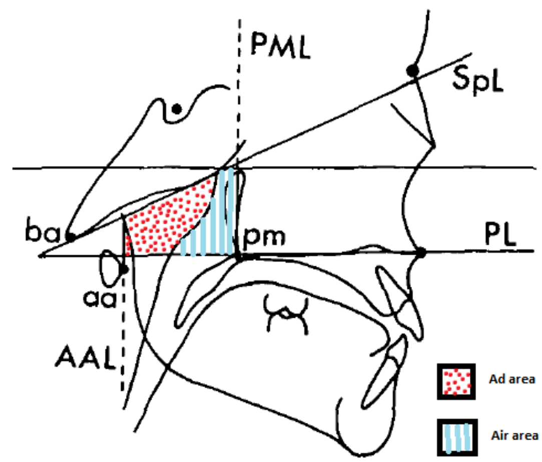


Figure 2

STATISTICAL ANALYSIS

The intergroup comparison of McNamara's upper pharyngeal width, McNamara's lower pharyngeal width, Upper aerial width, Lower aerial width, Ad area, Air area were performed using 'independent t test'.

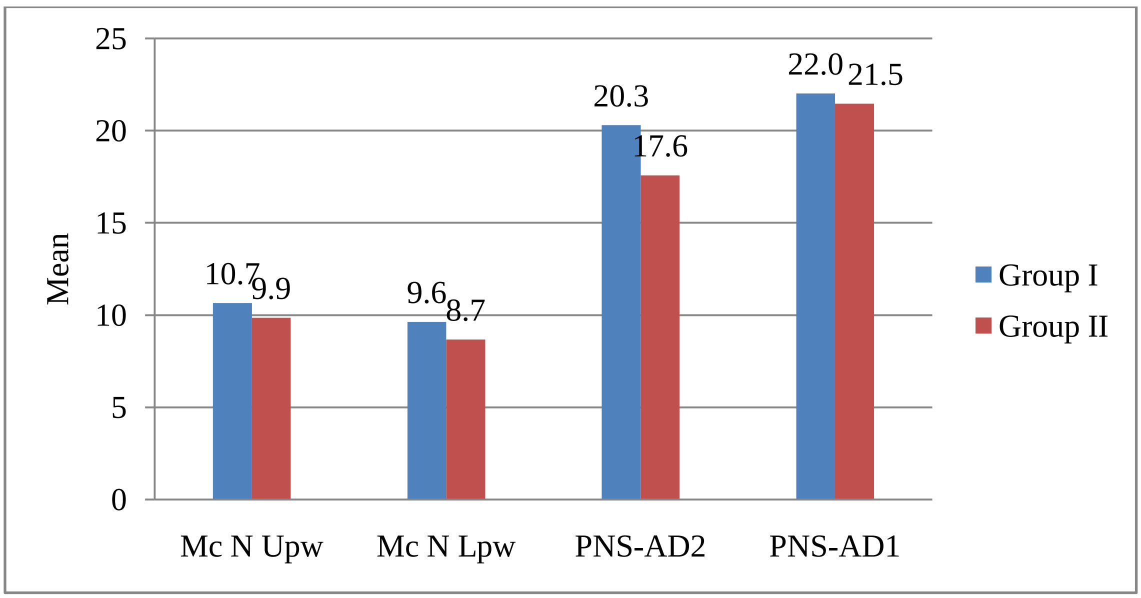
RESULTS

Mean, standard deviation, t and p values were obtained (Table 1, Graph 1, Table 2, Graph 2). Results showed that class II group had significantly smaller Upper aerial width and nasopharyngeal Air area than class I cases ($p < 0.01$). No significant intergroup difference was found for McNamara's upper pharyngeal width, McNamara's lower pharyngeal width, Lower aerial width and Ad area. Mean, standard deviation and t value of all the parameters are shown in (Table 1, Graph 1, Table 2, Graph 2).

Table 1.Mean, SD and t value

	Group I		Group II		t value	df	pvalue
	Mean	SD	Mean	SD			
Mc N Upw	10.65	3.28	9.85	2.66	0.92	46	0.36
Mc N Lpw	9.63	2.98	8.67	2.11	1.28	46	0.21
PNS-AD2	20.29	3.62	17.58	3.56	2.61	46	0.01**
PNS-AD1	22.02	3.57	21.46	3.50	0.55	46	0.58

**p<0.01

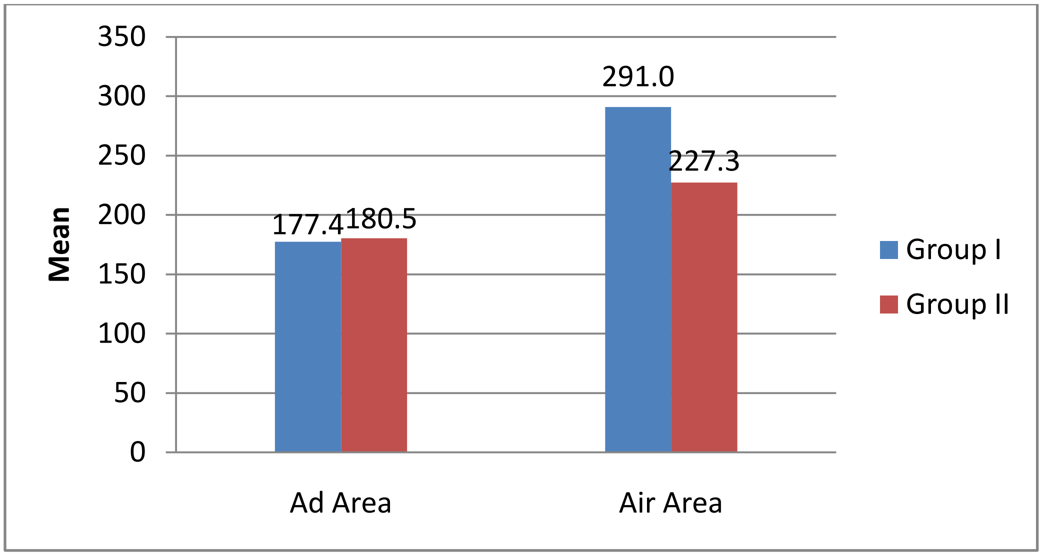


Graph 1

Table 2.Mean, SD and t value

	Group I		Group II		t value	df	pvalue
	Mean	SD	Mean	SD			
Ad Area	177.38	73.02	180.50	81.77	-0.140	46	0.89
Air Area	291.04	68.59	227.25	74.18	3.09	46	0.00**

**p<0.01



Graph 2

DISCUSSION

A normal nasal airway is dependent on sufficient anatomical dimensions of the airway. In addition, the size of the nasopharynx is of particular importance in determining whether the mode of breathing is nasal or oral. Experimental studies using primates carried out by Harvold and associates also showed varied dentofacial forms and malocclusions resulting after the establishment of mouth breathing.[15]

It has been mentioned in the literature that malocclusion type does not influence pharyngeal width (Watson et al., 1968; de Freitas et al., 2006; Alves et al., 2008).[8] However, in the current study it was observed that class II subjects had smaller Upper aerial width and nasopharyngeal Air area than class I cases which was statistically significant. This was accordance with the study of Kim et al. (2010) ,in which the mean total airway volume of retrognathic patients was significantly smaller than patients with normal antero-posterior relationship. Grauer *et al.* (2009) also confirmed that airway volume and shape differed among patients with different antero-posterior jaw relationships. However no statistically significant differences in McNamara's upper pharyngeal width, McNamara's lower pharyngeal width, Lower aerial width and Ad area were found which corroborates previous studies. Additional studies are required to clarify this issue because Linder –Aronson and Leighton and Linder-Aronson and Backson suggested that oropharyngeal space appears to be larger than normal when the nasopharyngeal airway is smaller, although they did not evaluate this correlation directly. However in a study by Freitas et al it was concluded that malocclusion type and growth pattern do not influence lower pharyngeal width.

In the current study skeletal discrepancy taking into account the saggital position of maxilla was not acessessed, which might have an effect on nasopharyngeal airway dimensions.

Growth pattern is also assumed to influence the nasopharyngeal and oropharyngeal volumes. The anteroposterior dimension of the airway in hyperdivergent patients is narrower than in normodivergent patients (Joseph et al.,1998; Grauer et al.,2009; Batool et al.,2010) . Therefore further grouping in accordance to growth pattern is required for more relevant results.[11]

CONCLUSION

Class II group had significantly smaller Upper aerial width and nasopharyngeal Air area than class I cases. No significant intergroup differences were found for McNamara's upper pharyngeal width, McNamara's lower pharyngeal width, Lower aerial width and Ad area.

REFERENCES

1. Grewal N, Godhane A. Lateral cephalometry: A simple and economical clinical guide for assessment of nasopharyngeal airway space in mouth breathers. ContempClin Dent 2010; 1(2): 66–69.

2. Zinsly S, Moraes L, MouraP,Ursi W.Assessment of pharyngeal airway spaceusing Cone-Beam Computed Tomography. Dental Press J Orthod.2010;15(5):150
3. Agarwal V, Reddy G , Jain S, Goyal V , Chugh T. Relation of pharynx with orofacial structures in Jaipur (India) population exhibiting normal occlusion with respect to sex : a cross sectional study. J IndOrthodSoc 2011;45(4):207-211.
4. Chan J, Edman J, Koltai P.Obstructive Sleep Apnea in Children.Am Fam Physician 2004;69:1147-54.
5. Raffat A, Hamid W.Cephalometric assessment of patients with Adenoidal faces.J Pak Med Assoc2009;59:747-52.
6. Mergen D, Jacobs R. The size of nasopharynx associated with normal occlusion and class II malocclusion. Angle orthod, 1970; 40(4):342-346.
7. Kirjavainen M, Kirjavainen T.Upper Airway Dimensions in Class II Malocclusion Effects of Headgear Treatment. Angle Orthod 2007;77(6):1046-1053.
8. Freitas M, Lima D, Freitas K, JansonG,Henriques J, Cephalometric evaluation of Class II malocclusion treatment with cervical headgear and mandibular fixed appliances. Eur J orthod 2008;30:477-482.
9. Trenouth M,TimmsD. Relationship of the functional oropharynx to craniofacial morphology. Angle Orthod 1999;69(5):419-423.
10. Joseph A, Elbaum J, Cisneros G.A Cephalometric Comparative Study of the Soft Tissue Airway Dimensions in Persons with Hyperdivergentand Normodivergent Facial Patterns. J Oral MaxillofacSurg1998;56:135-139.
11. Allhaija E, Al- Khateeb S.Uvulo-Glosso-Pharyngeal Dimensions in Different Anteroposterior Skeletal Patterns. Angle Orthodontist 2005;75(6):1012-1018.
12. Martin O, Muelas L, Vinas M.Nasopharyngeal cephalometric study of ideal occlusions. Am J Orthod Dentofacial Orthop 2006;130:436e1-436.e9.
13. Zhong Z, Tang Z, Gao X, Zeng X.A Comparison Study of Upper Airway amongDifferent Skeletal Craniofacial Patterns in Nonsnoring Chinese Children.Angle Orthod. 2010;80:267–274.
14. Ucar FI, Uysal T.Orofacial airway dimensions in subjects with Class I malocclusion and different growth patterns.Angle Orthod. 2011 May; 81(3):460-8.
15. Reddy R, Chundri R, Thomas M, Ganapathy K, Shrikant S, Chandrashekar M.Upper And Lower Pharyngeal Airways In Subjects with skeletal class –I, class- II, class-III malocclusions and growth patterns- A Cephalometric Study. Int Journal of Contemporary Dentistry 2011;2(5):12-18.

Source of Support: Nil, Confilict of Interst: None Declared