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A COMPARATIVE STUDY OF AIRWAYS IN THE SAGITTAL PLANE WITH MCNAMARA ANALYSIS ON LATERAL CEPHALOMETRIC IMAGES

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ABSTRACT:

Aims and Objective: This present study is undertaken to compare the upper and lower pharyngeal airways width in subjects with skeletal Class I, skeletal Class II, and skeletal Class III malocclusion by McNamara analysis.

Material and Method: Pre-treatment cephalograms of 54 subjects (both males and females) were traced and divided into three groups i.e., skeletal Class I, skeletal Class II, and skeletal Class III on the basis of anterior- posterior jaw relationship using FABA, Beta and ANB angles. The data thus obtained was subjected statistical analysis to find out intergroup, intra group comparison of upper and lower pharyngeal width.

Results and Conclusion: Mean, standard deviation, t and p values were obtained .Results showed that class II group had significantly smaller upper Pharyngeal width than class I and class III .class III had bigger lower pharyngeal width than class I and class II.

Keywords: upper Pharyngeal, lower pharyngeal, airways, malocclusion.

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]

It seems to be a general belief that the oropharyngeal (OP) and nasopharyngeal structures play roles in the development of the dentofacial complex. [2] According to the functional-matrix hypothesis proposed by Moss, [3] soft-tissue units guide the hard tissues to an extent.

The studies of Linder-Aronson, [4] Woodside and Linder-Aronson, [5] and Solow and Greve. [6] Are good examples for this hypothesis, where average craniofacial morphology of the “adenoid children” approached that of the control group subjects after adenoidectomy. [7]

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.[8] 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.[9] In this situation, a number of postural changes, such as

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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 faces. [10]

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. [11]

Various methods have been used to evaluate the airway, including, cone-beam computed tomography (CT), lateralcephalogram, magnetic resonance imaging, as well as polysomnography. Cephalometric is, however, the most commonly used of the above tests. Cephalometric measurements of the posterior airway space, although a two-dimensional analysis, have proved very reliable in diagnosing pharyngeal volumes. [12]

MATERIALS AND METHODS

The present study was conducted in the department of orthodontics and Dentofacial orthopedics Tishreen dental college and Research Center Syria all 54 lateral cephalograms representing subjects in skeletal Class I, skeletal class II and skeletal class III were included in the study.

Study included subjects aged between 14-18 years, with untreated skeletal Class I ,Class II ,class III Malocclusion with mandibular deficiency.

Study excluded 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.

Grouping

On the basis of FABA, BETA, and ANB angle all the subjects were divided into skeletal Class I, II and III [figure no 1, 2, and 3]. Several researchers [13-14] have reported on validity of ANB measurement and this angle does not provide adequate assessment of jaw relationship because rotational growth of the jaws and the anteroposterior position of nasion influence the ANB angle. Beta angle: Angle formed between the Line from point A perpendicular to the C-B line and the A-B line.

BETA angle does not depend on cranial landmarks or the functional occlusal plane. It uses 3 points located on the jaws: point a, point B, and the apparent axis of the condyle (point –c) so changes in this angle reflects only changes within the jaws. In contrast to the ANB angle, the configuration of the Beta angle has the advantage to remain relatively stable even when the jaws are rotated. When B point is rotated backward and downward, then the C-B line is also rotated in the same direction, carrying the perpendicular from point A with it. Because the A-B line is also rotating in the same direction, the Beta angle remains relatively stable. Therefore, the Beta angle can assess the sagittal jaw relationship in skeletal patterns, when clockwise or counterclockwise rotation of the jaws would tend to camouflage it. Another advantage of the Beta angle is that it can be used in consecutive comparisons throughout Orthodontic treatment because it reflects true changes of the sagittal relationship of the jaws, which might be due to growth or orthodontic or orthognathic intervention [15].

FABA angel: F—H to AB plane angle (FABA) for assessment of anteroposterior jaw relationships. FABA (Frankfort horizontal and A-B plane angle) cuts across the face and hence was considered as be a more reasonable choice for a study of relationships involving only the face, which is the focus of the orthodontist's interest, A reasonable prediction of the A-P jaw dysplasia should be possible by means of the angles (FABA, AFB) or the distance (AF-BF) between points A and B in relation to the F-H plane. An absolute measurement of the distance between points A and B projected onto the F-H plane was suggested by Chang13 and termed the AF-BF distance. This measurement, however, does not take in to account the vertical relationship between points A and B. Actually the vertical relationship of the jaws seems to affect *A·P* jaw dysplasia as well as the facial profile. The shorter the vertical distance between point A and B, the more retrusive the facial profile. Conversely, as the vertical dimension of the jaw increases. The facial profile appears more Prognathic. On the other hand, Freeman described a method to evaluate the A-P jaw relationship to eliminate point Na for more accurate evaluation. When the point A is fixed and the point B is variable, the AFB angle is correlated geometrically with FABA as evidenced by the statistical data. That is, the larger the AFB value, *the* smaller the FABA reading, and vice versa .However, when point A moves along the AF plane vertically , the angle AFB remains constant, whereas FABA show different values in response to its vertical displacement. This means that AFB does not take into consideration the vertical relationship between points A and B. FABA may provide not only a reliable Cephalometric measurement of the anteroposterior relationship of the jaws but also a clue to the facial profiles. [13]

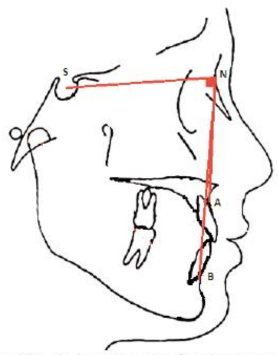


Figure No. 1 Landmarks for the measurement of ANB Angle

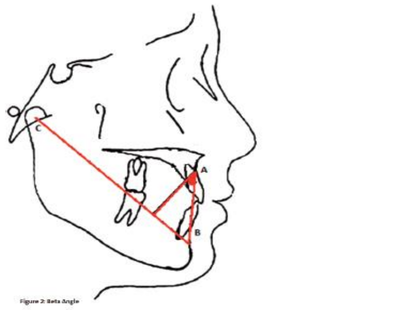


Figure No. 2 Landmarks for the measurement of Beta Angle

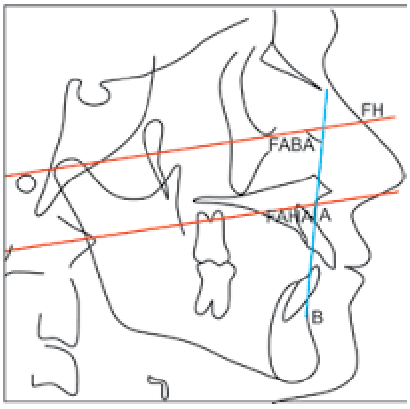


Figure No.3 landmark for the measurement of FABA angle

The following angular measurements were used to assess and classify the subjects into skeletal Class I; skeletal Class II; and skeletal Class III malocclusion (Table I). Out of above three parameters, not less than two parameter should support to classify the subjects in three groups separately

- Group A: Class I
- Group B: Class II
- Group C: Class III

Table 1: Angular measurements used to assess and classify the subjects into skeletal Class I; skeletal Class II; and skeletal Class III malocclusion [17]

Parametes	Class1	Class2	Class3
1 FABA angle	81 + 2.5	< 78.5	> 83.5
2 ANB angle	0-4	>4	<0
3 Beta angle	27°- 35°	< 27°	>35°

CEPHALOMETRIC MEASUREMENTS

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 [16]. (Figure 3)

2. McNamara’s lower pharyngeal width (mm): The minimum distance between the points where the posterior tongue contour crosses the mandible and the nearest point on posterior pharynx wall [16]. (Figure 3)

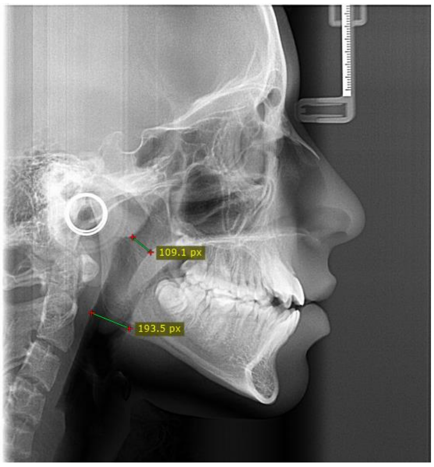


Figure 4: Upper and lower pharyngeal airways using McNamara's airway Analysis.

STATISTICAL ANALYSIS

Determination of Error in Measurement

To check the accuracy of the measurements, after one month 20 lateral cephalograms were randomly selected and retraced. The parameters were re-measured. Intra examiner error was examined for accuracy. The mean and the standard deviation were calculated for each group. Student t-test was applied to find out statistical difference between first and second reading to record difference in the recording measurements. In two observations to check the reliability, statistically no significant difference was found for any of the variables (p>0.05), hence the measuring reliability was found to be within confidence limits .No difference was statistically found between the first and the second readings

1. Mean used to calculate the average value:

2. Standard Deviation: Most frequently used method of dispersion, denoted by S.D.

3. Standard Error of Mean

4. Students't' test: - To test quality of two means.

5. Coupled standard deviation

6. Standard error of mean (S.E.M)

7. 't' Test

8. Level Of Significance

9. 'ANOVA (analysis of variance) analysis

RESULTS:

McNamara's upper pharyngeal: Results showed that class II group had significantly smaller Upper nasopharyngeal width than class I and class III (p <0.01). (Table **2**, Graph 1, Table **3**, Graph 2).

McNamara's lower pharyngeal width was statically bigger in class III than class I and class II. (Table **2**, Graph 1, Table **3**, Graph 2).

Table 2: Pearson correlation showed the relation between upper and lower pharyngeal with different type of malocclusion

		class I		class II		class III	
		Upper	Lower	Upper	Lower	Upper	Lower
ANB	Pearson Correlation	-.354-	.378	-.422-*	.075	.157	-.118-
	Sig. (2-tailed)	.215	.183	.040	.729	.560	.662
	N	14	14	24	24	16	16

Graph 1: the relation between upper pharyngeal and different type of malocclusion

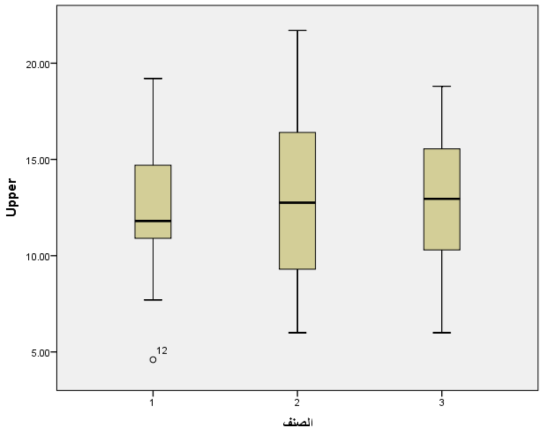
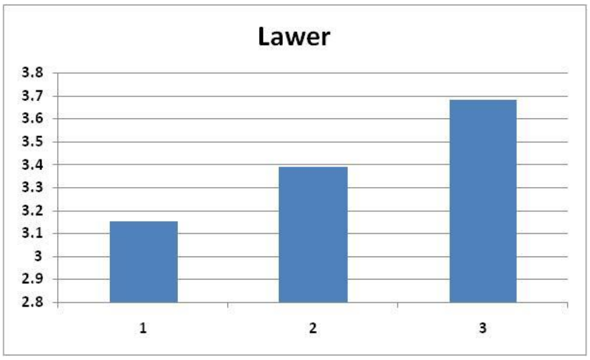


Table 3: ANOVA analysis: showed the relation between upper and lower pharyngeal with different type of malocclusion

ANOVA		III					II					I					Class
p value	F	Range	Max	Min	Std.D	Mean	Range	Max	Min	Std.D	Mean	Range	Max	Min	Std.D	Mean	
0.963	.037	3.76	12.80	18.80	6.00	3.67	12.63	15.70	21.70	6.00	4.27	12.76	14.60	19.20	4.60	3.76	**Upper**
*0.043	3.356	3.15	12.36	21.50	9.14	3.68	14.43	13.70	20.50	6.80	3.39	11.58	12.60	21.00	8.40	3.15	**Lower**



GRAPH 2 the relation between lower pharyngeal and different type of malocclusion

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. [18]

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).[19] However, in the current study it was observed that class II subjects had smaller Upper nasopharyngeal width than class I and class III 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.

Lower pharyngeal width was bigger in class III than class II and class I This was accordance with the study of Saurabh et al 2014.

In which Class III has a bigger lower pharyngeal airway width than Class I Class II subjects.

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 sagittal position of maxilla was not assessed, 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

CONCLUSIONS:

Class II group had significantly smaller nasopharyngeal width than class I, class III.

Class III group had bigger oropharyngeal width than class I, Class II

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