Nasopharyngeal Dimensions in Relation to Some Dento-Cranial Variables in Class I and II Skeletal Patterns (A Comparative Cephalometric Study)

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ABSTRACT

Background: The size of the nasopharyngeal airway was believed to have an important role in the development of the dentofacial structure. This study was carried out to test the relation between the nasopharyngeal dimensions with some dento-cranial measurements in class I and II jaw relationship.

Materials and Methods: This study was done on 60 subjects (30 males and 30 females) at age range 18-25 years. Cephalometric radiograph has been taken to each subject and the measurements were recorded. The sample was divided into two groups, class I skeletal relationship (15 males and 15 females) and class II skeletal relationship (15 males and 15 females). Comparisons between the different groups were undertaken.

Results: In class I skeletal relationship, all the nasopharyngeal liner measurements and all the dento-cranium linear measurements are significantly higher in males than females, except lower airway thickness (PNS-ad1) and upper airway thickness (PNS-ad2) showed no significant gender difference. While all the angular measurements showed no significant gender difference. In class II skeletal relationship, most of the nasopharyngeal liner measurements have no significant gender difference, while all the dento-cranium linear measurements are significantly higher in males than females.

Conclusion: In comparison for class difference between class I and class II skeletal relations in total sample, all the nasopharyngeal linear measurements have no significant class difference, except lower airway thickness showed significant difference which was higher in class II than class I and upper airway thickness showed significant difference which was higher in class I than class II. In the whole sample of the study, positive correlation was found between lower airway thickness and upper airway thickness.

Key words: Nasopharyngeal, gender, class I, class II. (J Bagh Coll Dentistry 2015; 27(4):150-154).

INTRODUCTION

The pharyngeal tonsil (Adenoid), is a group of lymphoid tissues in nasopharynx that becomes apparent clinically when they undergo hyperplasia[(1)].

Tomes (1872) presented the first article describing the adenoid face and believed that this facial type is a product of mouth breathing resulting from enlarged adenoid tissue. From that time there have been many attempts carried out in different parts of the world to establish the causal relationship between the dentofacial deformities and nasal airway inadequacy. It has been suggested that the so called "adenoid faces" is the product of mouth breathing caused by enlarged adenoids [(2)]. On the other hand, a significant number of clinicians and researchers have questioned the assumption that enlarged adenoids influence the dentofacial morphology [(3)].

The causes of mouth breathing are unquestionably multiple but restricted nasopharyngeal airway due to hypertrophy of adenoid tissue and narrow bony nasopharynx has been considered to be the most common cause[(4-7)].

Although the causes of mouth breathing has been well clarified but the effects is still a matter of controversy. Many researchers agree that mouth breathing and its associated abnormal posture and function of the oral and paraoral structures have serious effects on dentofacial development and has been regarded as an obstacle to success of orthodontic treatment. However, others disagree. This controversy is not only academically important, but it also has considerable clinical consequences because it can influence the orthodontist's decision as to whether active allergy management or a moreaggressive therapy such as adenoidectomy should be performed for solely orthodontic reasons [(8)].

MATERIALS AND METHODS

The sample consisted of patients attending the Orthodontic Department of College of Dentistry-Baghdad University either for active orthodontic treatment or consultation and undergraduate students.

Out of 97 clinically and radiographically examined subjects, only 60 subjects (30 males and 30 females) were selected according to the inclusion criteria:

(1) M.Sc. Student, Department of Orthodontics, College of Dentistry, University of Baghdad.
(2) Professor, Department of Orthodontics, College of Dentistry, University of Baghdad.

1. Class I control group (15 males & 15 females): ANB 2°- 4°, bilateral class I molar and canine relationship, normal overjet and overbite (2-4 mm), well aligned upper and lower arches with less than 3mm of spacing or crowding in either of them.
2. Class II group (15 males & 15 females): ANB > 4°, bilateral class II molar and canine relationship, overjet > 4 mm.

The sample criteria include:

1. All of the samples were Arab Iraqis with an age ranged between 18-25 years.
2. No history of previous orthodontic treatment.
3. Normal overjet and overbite and No gross facial asymmetry.
4. No oral habits according to the subject history and clinical examination.
5. No history of Nasopharyngealectomy procedure.
6. No Asthma, upper airway disease and any pathology in the pharynx according to subject's medical history.
7. The subjects possessed complete permanent dentition (except the third molar).
8. No posterior or anterior cross bite.
9. Normal medical history of the subjects.
10. Normal TMJ function.
11. No open bite posterior or anterior.

Lateral cephalometric radiographs were taken for the entire sample separately under standardized conditions. After that a software program (AutoCAD 2012) was used for analyzing them.

The following anatomical cephalometric bony landmarks were used in the present study (figure 1):

1) Point N (Nasion): The most anterior point on the fronto-nasal suture in the mid-sagittal plane.
2) Point S (Sella): The midpoint of the hypophysial fossa (sellaturcica).
3) Point Ba (Basion): The lowest point on the anterior margin of the foramen magnum in the median plane.
4) Point A (Subspinale): Is located at the most posterior part of the anterior shadow of the maxilla, usually near the apex of the central incisor root.
5) Point B (Supramentale): Is located at the most posterior point on the shadow of the anterior border of the mandible, usually near the apex of the central incisor root.
6) Point ANS (Anterior nasal spine):- The anterior tip of the bony process of the maxilla.
7) Point PNS (Posterior nasal spine):- The posterior tip of the palatine bone. It can be located at the point where the hard palate is intersected by an extension of the pterygomaxillary fissure.
8) Point Me (Menton):- The most inferior point on the symphysis of the mandible in the median plane.
9) Point Go(Gonion):- The most posterior and inferior point on the angle of the mandible located by bisecting the angle formed by the line tangent to the posterior border of the ramus and inferior border of body of mandible.

The following constructed cephalometric points were used in this study (figure 2):

1) Point ad1 (adenoid 1): The most anterior point on the adenoid tissue along the line passing from PNS-Ba.
2) Point ad2 (adenoid 2): The most anterior point on the adenoid tissue along the line passing from PNS and perpendicular to S-Ba line.
3) Point j (adenoid 3):- The most anterior point on the adenoid tissue along the line passing from DU and perpendicular to S-Ba at Z.
4) Point k (adenoid 4): The most anterior point on the adenoid tissue along the line passing from DL and perpendicular to S-Ba at Y.
5) Point DU: A constructed point at the junction of distal and occlusal surface of maxillary first permanent molar.
6) Point DL: A constructed point at the junction of distal and occlusal surface of mandibular first permanent molar.
7) Point H: A constructed point represents intersection of the two lines S-Ba and a line perpendicular to it from PNS.
8) Point Z: A constructed point represents intersection of the two lines S-Ba and a line perpendicular to it from DU.
9) Point Y: A constructed point represents intersection of the two lines S-Ba and a line perpendicular to it from DL.

The following measurements were done liner measurements (figure 1):

1) S-N: The distance measured between Sella and Nasion and represents the anterior cranial base length.
2) S-Ba: The distance measured between Sella and Basion and represents the posterior cranial base length.
3) N-Ba: The distance measured between Nasion and Basion and represents the total cranial base length.

4) Mandibular plane (MP): It is a line tangent to the lower border of the mandible, extends from Gonion to Menton.
5) ANS-PNS {palatal plane (pp)}: A line connecting the tip of the anterior nasal spine with the tip of the posterior nasal spine and represent the length of the maxilla.
6) N-ANS: A line connecting the tip of the anterior nasal spine with Nasion and represent the upper anterior facial height.
7) ANS-Me: A line connecting the tip of the anterior nasal spine with Menton and represent the lower anterior facial height.
8) N-Me: A line connecting Nasion and Menton and represent the total anterior facial height.
9) PNS-ad1 (lower airway thickness): The distance measured between PNS and ad1 and represents the sagittal depth of the nasopharyngeal airway along the line PNS-Ba.
10) PNS-ad2 (upper airway thickness): The distance measured between PNS and ad2 and represents the sagittal depth of the nasopharyngeal airway along the line PNS-Ba.
11) ad1-Ba (lower adenoid thickness): The distance measured between ad1 and Ba.
12) ad2-H (upper adenoid thickness): The distance measured between ad2-H.
13) DU-j: represent the distance from the junction of distal and occlusal surface of maxillary first permanent molar to the most anterior point on the adenoid tissue along the line passing from DU and perpendicular to S-Ba.
14) j-Z (middle adenoid thickness): The distance measured from the most anterior point on the adenoid tissue along the line passing from DU and perpendicular to S-Ba at Z.
15) DL-k: represent the distance from the junction of distal and occlusal surface of mandibular first permanent molar to the most anterior point on the adenoid tissue along the line passing from DL and perpendicular to S-Ba.
16) k-Y (middle adenoid thickness): The distance measured from the most anterior point on the adenoid tissue along the line passing from DL and perpendicular to S-Ba at Y.
17) Upper 6 ≟ pp: a line connecting the junction of distal and occlusal surface of maxillary first permanent molar and palatal plane which is perpendicular to it.
18) Lower 6 ≟ MP: a line connecting the junction of distal and occlusal surface of mandibular first permanent molar and mandibular plane which is perpendicular to it.

Angular Measurements (Figure 3):

1) SNA: Represents the antero-posterior position of the maxilla in relation to the anterior cranial base.
2) SNB: Represents the antero-posterior position of the mandible in relation to the anterior cranial base.
3) ANB: Difference between SNA and SNB and represents the antero-posterior relation of the maxilla and mandible to each other.
4) N-S-Ba: The angle between the anterior and the posterior cranial base (anterior rim of foramen magnum).
5) SN/MP: The angle between the SN plane and the mandibular plane.
6) SN/PP: The angle between the SN plane and the palatal plane.

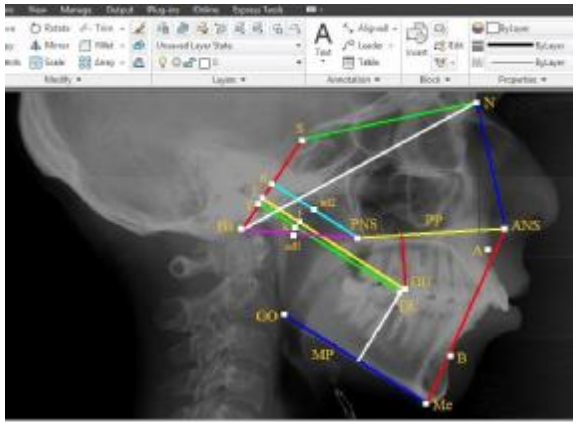

Figure (1): Cephalometric Landmarks and Liner Measurements.

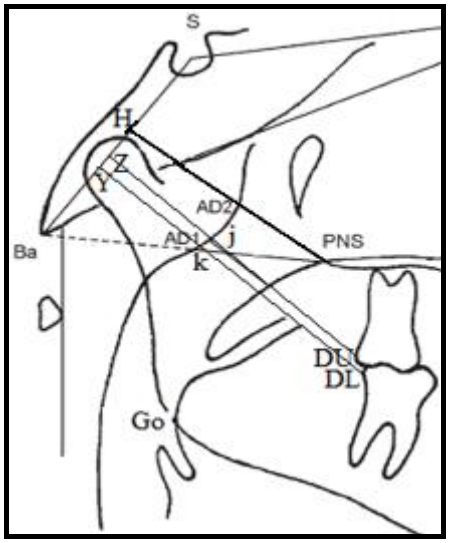

Figure 2: Constructed Points

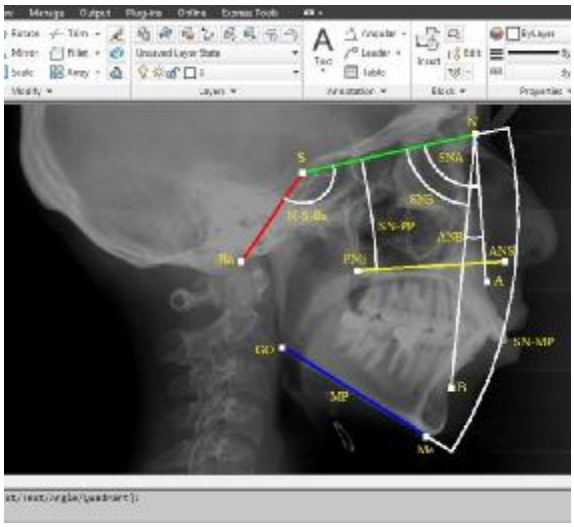

Figure (3): Angular Measurements

Statistical Analysis

All the data were subjected to computerized statistical analysis by using descriptive statistics including mean, standard deviation, minimum and maximum and by using inferential statistics including Independent sample t-test and Pearson correlation test.

RESULTS

The results show that in class I skeletal relationship, all the nasopharyngeal liner measurements and all the dento-cranium linear measurements are significantly higher in males than females, except (PNS-ad1 and PNS-ad2) showed no significant gender difference and all the angular measurements showed no significant gender difference. While In class II skeletal relationship, all the dento-cranium linear measurements are significantly higher in males than females, and all the nasopharyngeal liner measurements have no significant gender difference except k-Y.In comparison for class differences between class I and class II skeletal relations for males group, all the nasopharyngeal liner measurements are significantly higher in class I than class II, except PNS-ad1which were higher in class II than class I and (ad2-H and DU-j) have no significant class difference.

In comparison for class differences between class I and class II skeletal relations for females group, all the angular measurements showed no significant class difference, except SNB^{o} showed significant class difference which was higher in class I than class II and ANB^{o} which were higher in class II than class I.

In comparison for class differences between class I and class II skeletal relations for total sample, all the nasopharyngeal liner measurements and all the dento-cranium linear measurements showed no significant class difference, except (PNS-ad1, ANS-Me and DU I PP) showed significant class difference which were higher in class II than class I and (PNS-ad2 and N-ANS) showed significant class difference which were higher in class I than class II. Additionally, positive correlation found between PNS-ad1 and PNS-ad2 and between DU-j and DL-k in total sample.

DISCUSSION

Nasal breathing is a physiological function responsible for the process of air conditioning, warming, humidification and filtering, it also serves as protection for respiratory tract. Moreover it has effects on development and determination of dentofacial morphology.

Adenotonsiller hypertrophy causes upper airway obstruction and may lead to pulmonary alveolar hypoventilation, pulmonary hypertension, symptoms like chronic mouth breathing, loud snoring, obstructive sleep apneas, excessive daytime sleepiness. 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.

Oral respiration alters the muscle forces exerted by the tongue, cheeks, and lips upon the maxillary arch. Intraorally, it might be expected to find a narrow maxillary arch with a high palatal vault, a posterior crossbite, a Class II or III dental malocclusion, and an anterior open bite. That is why this study targeted two types of skeletal jaw relationships (class I and class II skeletal patterns) and it's aimed to investigate the difference in their nasopharyngeal dimensions and gender difference.

The sample selected in this study was composed of cephalometric radiographs of young adults 18-25 years of age because most of the growth of the dento-cranium bones could be considered as complete after the age 18 years [9] and the members of this age group are often under orthodontic treatment. The identification of cephalometric points, angular and liner measurements where done directly on a digital radiograph by using a computer with modern analyzing software in an effort to enhance the reliability of the measurements and to reduce tracing and measuring errors.

In class I skeletal relationship, all the nasopharyngeal liner measurements are significantly higher in males than females, except (PNS-ad1 and PNS-ad2) showed no significant gender difference and this was in agreement with previous studies [10,11] regarding the PNS-ad1 and

PNS-ad2.While In class II skeletal relationship, all the nasopharyngeal liner measurements have no significant gender difference except k-Yand this was in agreement with previous studies [12,13] regarding ad1-Ba, PNS-ad1 and PNS-ad2 although their method were different {they use Ptm (Pterygomaxillary fissure) instead of PNS to measure ad1 and ad2}.

In general, the linear measurements were found larger in males than females and this indicated that the males have larger head than females and can be attributed to the fact that the maximum growth rate of females is reached two years earlier than males [14] and this was also in agreement with previous studies [15-20].

The reason why the angular measurements were not significantly different between genders in contrast to the linear measurements was because the angular measurements usually refer to the direction of growth rather than to increase or decrease in the size. Additionally, the angular measurements were influenced by the geometrical factors.

In the present study, we can conclude that all the nasopharyngeal linear measurements have no significant class difference, except (PNS-ad1) showed significant difference which was higher in class II than class I and (PNS-ad2) showed significant difference which was higher in class I than class II. Moreover; positive correlation was found between PNS-ad1 and PNS-ad2 and between DU-j and DL-k.

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