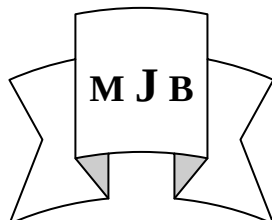


Maxillary Sinus Area in both Gender and its Relation to Skeletal Class III Malocclusion

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Abstract

The maxillary sinus is the largest of the four paranasal sinus, among the paranasal sinus. It plays an important role in the formation of facial contours. Therefore, knowledge of the development and size of the maxillary sinus may be crucial for diagnosing and treating various cases of malocclusion.

The purpose of this study is to evaluate the effect of malocclusion in skeletal class III on maxillary sinus dimensions. 80 Iraqi subjects have been chosen, lateral cephalometric radiograph had been taken for each examined subject, then samples have been divided into two groups according to SNA and ANB angle. The first group included 40 subjects who were class I skeletal malocclusion which composed of 20 males and 20 females, the second group included 40 subjects who were class III skeletal malocclusion which composed of 20 males and 20 females.

Then the radiograph were analyzed to determine the measurements of maxillary sinus area. The procedure was accomplished by mean of computer and Auto Cad program version 2008, it had been found that maxillary sinus area were Larger in male than females in both skeletal classes. There is significant difference between SNA angle and CL.III.

الخلاصة

جيب الفك العلوي هو اكبر من الجيوب الأنفية الأربعة، بين الجيوب الأنفية جيب الفك العلوي يلعب دورا مهما في تشكيل ملامح الوجه. لذلك، معرفة تطور وحجم الجيب الفكي ستكون حاسمة بالنسبة لتشخيص وعلاج حالات مختلفة من أنواع العلاقات العظمية. الغرض من هذه الدراسة هو استكشاف العلاقة بين الحالات العظمية المختلفة مع مساحة الجيب الفكي، وقد تم اختيار ٨٠ شخص عراقي، والعينات قسمت إلى قسمين وفقا لتصنيف زاوية (SNA) وشملت المجموعة الأولى ٤٠ شخص (٢٠ ذكر و ٢٠ أنثى) ولديهم إطباق هيكلي من النوع الأول، أما المجموعة الثانية شملت ٤٠ شخص (٢٠ ذكر و ٢٠ أنثى) ولديهم إطباق هيكلي من النوع الثالث. قد أخذت صورة شعاعية جانبية لكل عينة مفحوصة ثم ترسم وتقاس لتحديد مساحة الجيب الفكي ولقد تم انجاز العملية باستخدام برنامج الاوتو كاد ٢٠٠٨ ، وقد تبين ان مساحة جيب الفك العلوي عند الذكور اكبر من الإناث ، وقد تبين ان الأنماط الهيكلية المختلفة ليس لها تأثير على مساحة جيب الفك العلوي ماعدا الإناث ذوي النمط الهيكلي من النوع الثالث.

Introduction

Maxillary sinus is the largest of the four paranasal sinuses [1] it is a cavity or space filled with air in the body of maxilla [2]. Although maxillary sinus located in the body of maxilla, it is pneumatization invade the zygomatic bone during the development [3]. The development of maxillary sinus begin at ethmoidal infundibulum in the

third month of fetal life [4]. After birth maxillary sinus continues to extend both laterally and inferiorly during the rapid growth period from birth to 3 years of age and from 7 to 12 years of age [3].

The invasion of maxillary posterior teeth due to inferior growth of the maxillary sinus may influence orthodontic treatment planning for malocclusion cases [5].

The absence of the maxillary first molar over a long period of time may make the maxillary sinus invade the alveolar process of the missing site more inferiorly, thus impeding the protrusion of the maxillary second molars as a results of the contact of the cortical bone of the maxillary sinus floor with their roots.

Among the paranasal sinus, maxillary sinus play an important role in the formation of the facial contour [6, 7]

The morphological evaluation of maxillary sinus is necessary to deal with problems such as injury to the tooth root and perforation of the sinus [5,8] Therefore, knowledge of the development and size of the maxillary sinus may be crucial for diagnosing and treating various cases of malocclusion. The size of maxillary sinus depend on age [7, 9]

Panoramic radiograph, computed tomography [4] and magnetic resonance also used for diagnosing maxillary sinus. In orthodontic dentistry, cephalogram have been commonly used for diagnosis and evaluation of treatment outcome [10], Oktay in 1992 found that malocclusion and sex factor had no effect on maxillary sinus size and that sex was a significant factor only in angle class II malocclusion .

The current study was done to evaluate the effect of maxillary deficiency on the maxillary sinus area.

Materials and Method

The sample of the study was collected from the patient attending the Oral Radiology clinic in the Department of Oral Diagnosis in College of Dentistry, University of Baghdad ,within period from September 2010- April 2011. Out of 400 subjects 120 Iraqi patients are selected that fulfilled the following selection criteria:

1. The subjects were Iraqi in origin aged 18-25 years.
2. No history of abnormal habits(mouth breathing) ,no apparent facial disharmony or cleft lip and palate.
3. No history of orthodontic, orthopedic or facial surgical treatment.
4. Fully erupted permanent dentition(including upper third molar).
5. Symmetrical faces.
6. No maxillary sinus pathology.

The samples were divided into two groups according to SNA,ANB angle [11] each group consists of 40 patients and as follows:

1. SNA angle between 81 ± 2 degrees and ANB angle = 2-4mm (skeletal class I).
2. SNA angle 79 ± 2 degrees and ANB angle less than 2mm (skeletal class III).

The Equipments:

1. DIMAX3 Digital x-ray unit system machine (Finland) ,after standardization of the machine by staff responsible for the maintenance of the machine.
2. Hardware.
3. Pentium IV portable computer.
4. Soft ware: (AutoCAD program version 2008).

Method

Clinical Examination:

Each patient was seated on the dental chair ,and information about name ,age ,medical history and past orthodontic treatment was recorded, intra oral examination for each patient was done. All information were recorded in a special case sheet prepared for each patient.

Lateral Cephalometric X-Ray

The patients were prepared for the exposure by asking them to remove any spectacles, hearing aids, and personal jewellery such as ear rings, necklaces, and hairpins, these entire things may affect on the important anatomical landmarks like ear ring

may cover the Articulare point. Each patient's mandible was positioned in centric relation by mandibular manipulation before the cephalogram was obtained. The chin was guided into its most posterior position and was able to move freely vertically in this "terminal hinge position"[12] The patient was positioned within the cephalostat with the sagittal plane of the head vertical, the Frankfort plane horizontal (determined visually) and the teeth were in centric occlusion.

Every image was saved in the computer, and has been printed, the border of maxillary sinus with cephalometric landmark has been traced on printed image by 0.5 pencil. The traced image inserted again to

computer via scanner, then all angular , and area measurements were calculated by Auto Cad program version 2008 after correction of magnification, after that the measurements were saved on an Excell sheet with their records in degrees for angular measurements , in square mm for areas measurements.

The magnification was corrected by using Auto Cad program 2008, the cephalometric images have a ruler ,this ruler has been divided to mm , we measure 10 mm from the ruler of the inserted image, the number obtained treated by magnification factor by using AutoCAD ,so the 10 mm and whole image will transform to real image and real readings, as illustrated in the figure 1 below.

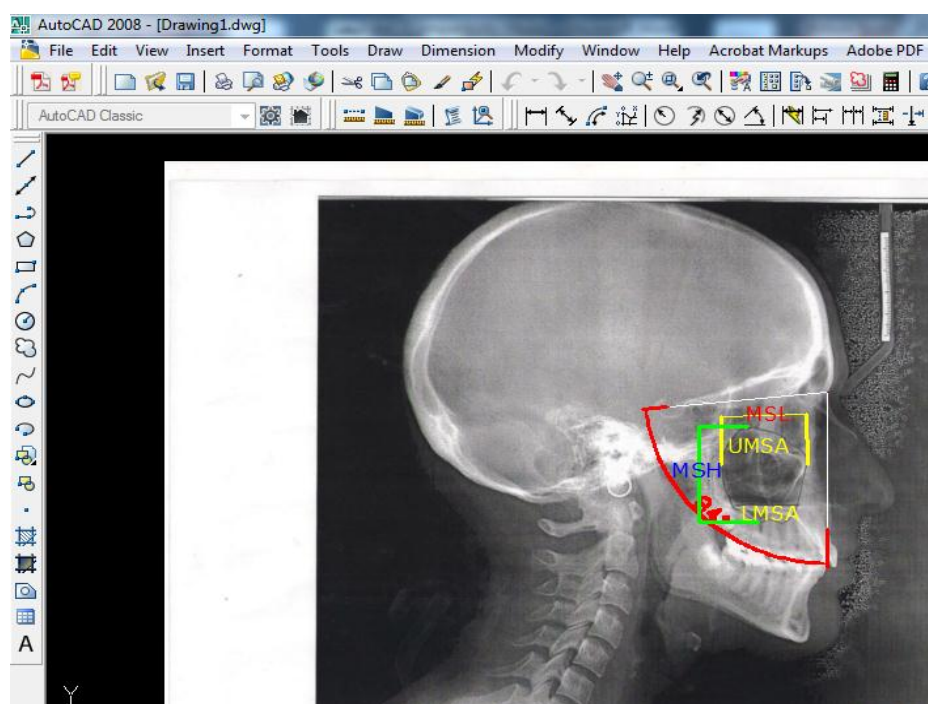


Figure 1 Detection of Maxillary Sinus Area by AutoCad 2008

Cephalometric points used in the measurement

The cephalometric bony landmarks, which were used in this study include the following: (Fig 3)

1. Point S. (Sella): The midpoint of the hypophyseal fossa[13].

2. Point N. (Nasion): The most anterior point on the naso-frontal suture in the median plane [13].

3. Point A (subspinale): The deepest midline point on the premaxilla between the Anterior Nasal Spine and Prosthion [14]

4. Point B (Supramentale): The deepest midline point on the mandible between Infradentale and Pogonion [14].

5. Point ANS (Anterior Nasal Spine): It is the tip of the bony anterior nasal spine in the median plane. [13].

6. Point PNS (Posterior Nasal Spine): This is a constructed radiological point, the intersection of a continuation of the anterior wall of the pterygo-palatine fossa and the floor of the nose. It marks the dorsal limit of maxilla. [13].

7. Point An, most anterior point of maxillary sinus. [15]

8. Point An', point projected vertically from An to the x-axis. [15]

9. Point Po, most posterior point of maxillary sinus. [15]

10. Point Po', point projected vertically from Po to the x-axis. [15]

11. Point Su, most superior point of maxillary sinus. [15]

12. Point Su', point projected vertically from Su to the y-axis. [15]

13. Point In, most inferior point of maxillary sinus. [15]

14. Point In', point projected vertically from In to the y-axis. [15]

15. Cephalometric Planes(Fig 2)

1. S-N plane (Sella-Nasion): it is the anterior posterior extent of anterior cranial base. [13]

2. Frankfort horizontal plane (FH): It is a horizontal plane running between porion and orbitale. [13]

3. Maxillary plane (Max.P.): A line joining between ANS and PNS. [13]

4. N- A line: Formed by a line joining Nasion and point A [5].

5. N- B line: Formed by a line joining Nasion and point B [5].).

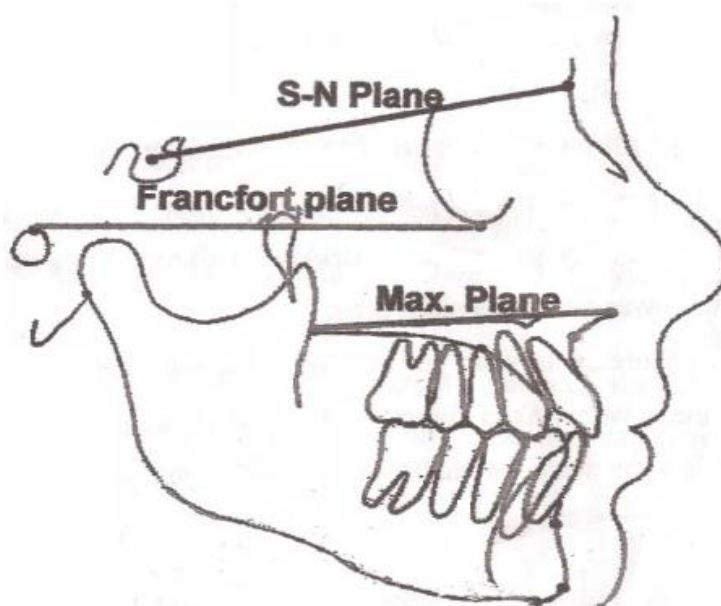


Figure 2 Cephalometric Planes

Cephalometric Angular measurement

1. SNA: It is the relative Antero-posterior position of the maxilla to anterior Cranial base. [16]

2. ANB Angle: The angle between lines N-A and N-B. It represents the difference between SNA and SNB angles or it may be measured directly as the angle ANB. It is the most commonly used measurement for

appraising Antero-posterior disharmony of the jaws [16-18]

Method of Measurement

The linear and area measurement of maxillary sinus were measured using the method of [19]

1- Maxillary sinus length(M.S.L):

this line extend from An- to the Po-

2- Maxillary sinus height(M.S.H):

this line extend from Su- to the In-

3-upper maxillary sinus area(UMSA): which defined by the area above maxillary plane that constructed from anterior nasal spin

(ANS) to posterior nasal spin (PNS)

4-Lower maxillary sinus area(LMSA): which represents lower area of Maxillary sinus from palatal plane .

5- Total maxillary sinus area(TMSA): which represents summation of upper and lower maxillary sinus area.

All measurements were put in excel sheet for whole sample; angular measurement were taken directly while linear and area measurements were divided by scale for each picture to overcome magnification factor.

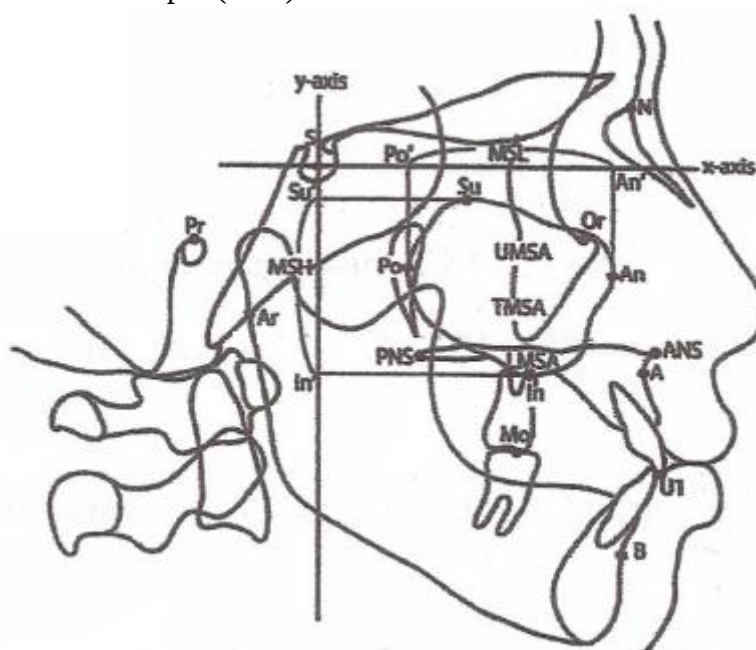


Figure 3 References points and maxillary sinus measurements [24]

Result and Discussion

Sample:

The total studies sample composed of 80 patients with aged (18-25) years, the results were based on study sample ,40 skeletal CL.I (20 male,20 female), 40 skeletal CL.III(20 male,20 female).

Variables:

1. SNA Angle.

The result shows that the mean value of SNA in CL.I > CL.III with very high significant difference between

classes and none significant difference between gender.

2. Upper Maxillary Sinus Area(UMSA).

The result indicated that the mean value of UMSA in total sample for CL.I > CL.III and mean value for male group in CL.I > CL.III. While mean value for female group in CL.I>CL.III with very high significant difference between gender, while there is none significant difference between skeletal classes, this is may be due to the role of maxillary sinus in development of

CL.III, its result agrees with Ariji et al [20], Yasir [21] and Jalal [22].

3. Lower Maxillary Sinus Area (LMSA).

The result illustrates that the mean value of LMSA in total sample for CL.I > CL.III with significant difference; this may be due to the effect of maxillary deficiency on maxillary sinus area. The mean value of male group in CL.I is larger than CL.III with no significant difference; this may be attributed to inclination of maxillary plane, while the mean value in female group in CL.I > CL.III with very high significant difference. On the other hand, there is very high significant difference between both genders in CL.III malocclusion; this may be attributed to the fact that males always exhibit larger and longer maxillary sinus area; this agrees with Ariji et al [20] and Urabi [23]. Total Maxillary Sinus Area (TMSA).

Table 1 shows the mean value of TMSA for total sample CL.I > CL.III with significant difference; this is the most important goal of this research to clarify the effect of maxillary sinus size on malocclusion and clearly the results show this role because the

criteria of CL.III based on skeletal deficiency and the result illustrates the maxillary sinus area is the most important one in development of this type of malocclusion. This comes in agreement with Reem et al [24]. The mean value of male group is CL.I > CL.III, this may be due to the inclination of maxillary plane, while the mean value of female group is CL.I > CL.III with very high significant difference; additionally, there is very high significant difference between both genders; this result totally agrees with Emirzeoglu et al. [25], and Urabi [23] generally due to the fact that males exhibit higher and wider maxillary sinus than females.

Table 2 illustrates that there is no significant difference between SNA and UMSA, LMSA and TMSA in CL.I malocclusion; this agrees with Urabi [23].

Table 3 demonstrates that there is significant difference between SNA and LMSA in female group only in CL.III malocclusion; this may be due to the fact that females have small maxillary sinus dimensions; this comes in accordance with Urabi [23] and disagrees with Toshiya et al [26].

Table 1 Descriptive statistics of total data

Variables	Genders	Descriptive statistics						Class Difference	
		Class I			Class III				
		Mean	S.D.	S.E.	Mean	S.D.	S.E.	t-test	P-value
SNA	Total	80.65	0.86	0.14	76.83	0.90	0.14	19.36	0.000 ***
	Males	80.90	0.72	0.16	76.70	0.73	0.16	18.31	0.000 ***
	Females	80.40	0.94	0.21	76.95	1.05	0.23	10.95	0.000 ***
	t-test	1.89			-0.87				
	d.f.	38			38				
	P-value	0.066 (NS)			0.388 (NS)				
UMSA	Total	1074.33	109.33	17.29	1026.83	152.98	24.19	1.60	0.114 (NS)
	Males	1151.40	74.42	16.64	1113.10	149.60	33.45	1.03	0.312 (NS)
	Females	997.25	80.56	18.01	940.55	99.94	22.35	1.98	0.056 (NS)
	t-test	6.29			4.29				
	d.f.	38			38				
	P-value	0.000 ***			0.000 ***				
LMSA	Total	194.10	58.28	9.21	164.08	56.42	8.92	2.34	0.022 *
	Males	201.90	50.53	11.30	202.65	54.10	12.10	-0.05	0.964 (NS)
	Females	186.30	65.49	14.64	125.50	21.81	4.88	3.94	0.000 ***
	t-test	0.84			5.92				
	d.f.	38			38				
	P-value	0.404 (NS)			0.000 ***				
TMSA	Total	1268.43	103.95	16.44	1190.90	174.80	27.64	2.41	0.018 *
	Males	1353.30	41.26	9.23	1315.75	132.04	29.53	1.21	0.232 (NS)
	Females	1183.55	72.87	16.29	1066.05	111.64	24.96	3.94	0.000 ***
	t-test	9.07			6.46				
	d.f.	38			38				
	P-value	0.000 ***			0.000 ***				

Table 2 Relationship between SNA and All Variables in Cl.I

Variables	Genders		UMSA	LMSA	TMSA
SNA	Total	r	0.120	0.252	0.268
		p	0.459 (NS)	0.117 (NS)	0.095 (NS)
	Males	r	0.143	-0.137	0.090
		p	0.549 (NS)	0.566 (NS)	0.706 (NS)
	Females	r	-0.328	0.436	0.030
		p	0.158 (NS)	0.054 (NS)	0.901 (NS)

Table 3 Relationship between SNA and All Variables in Cl.III

Variables	Genders		UMSA	LMSA	TMSA
SNA	Total	r	0.021	0.161	0.070
		p	0.899 (NS)	0.320 (NS)	0.667 (NS)
	Males	r	0.022	0.423	0.199
		p	0.925 (NS)	0.063 (NS)	0.401 (NS)
	Females	r	0.249	0.447	0.310
		p	0.290 (NS)	0.048 *	0.183 (NS)

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