Assessment of mandibular third molar position by using computed tomography and reconstructed lateral radiograph

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ABSTRACT

Background: Consideration of mandibular third molar is important from orthodontic perspective due to several factors such as, lower anterior arch crowding, relapse in lower anterior region, interference with uprighting of mandibular first and second molars during anchorage preparation and molar distalization. The aims of this study were to assess of gender differences in the mandibular third molar position and compare and evaluate whether there is any differences in the results provided by CT scan and lateral reconstructed radiograph.

Materials and Methods: The sample of present study consisted of 39 patients (18 males and 21 females) with age range 11-15 years. CT images for patients who were attending at Al Suwayra General Hospital/the Computerized Tomography department. Computed tomographic images were obtained for The distance from Xi point to distal surface of permanent mandibular second molar was measured in both three dimensional volumetric images and two dimensional CT derived lateral image. The statistical analyses included: means, standard deviations. Paired t-test was used to compare between the two methods and independent t-test was used in verifying the genders difference.

Results: The results showed that there was high significant method difference between 3D CT and 2D image and gender differences was observed in values of linear measurements of present study, as males showed higher mean values than females.

Conclusion: There is high accuracy of measurement on CT images, so CT scan is advisable during the diagnosis and treatment plan of orthodontic cases.

Key words: Mandibular third molar, computed tomography, lateral radiograph. **(J Bagh Coll Dentistry 2017; 29(2):104-107)**

INTRODUCTION

The third molar is a tooth that show great difference in its formation, developmental position and size compared to the other teeth in the jaws. This variability in third molars is due to the gradual dimension in the growth of the jaw bone with a consequent reduction in the space available for the teeth (1).

Since third molars are the last tooth to form and erupt, they will become liable to be affected by abnormalities like congenital absence, ectopic eruption and impaction (2). This has led to advise removal of the third molar bud at the age of 7-10 years when unsuccessful eruption is predicted (3).

The evaluation of mandibular third molar depends on good clinical diagnosis and radiographic aid examination like periapical, panoramic and cephalometric radiograph to analyze the different factors that related to the surrounding structures such as; the amount of space available, angulation of the tooth, its height in the jaw, its relation to the mandibular second molar and to the occlusion (4).

The mandibular third molar exhibits the highest rate of impaction. The rates, as reported by Quiros and Palma (5):

- Hellman 9.5 %
- Björk 25 %
- Ricketts 50 %
- Richardson 35 %

The ability for evaluation of the third molars position is important for dentist (6). If they erupt, they have advantage for anchorage, prosthetic abutments, or transplantation (7). If they impacted, they have disadvantage because of adjacent root resorption, inflammatory process, temporomandibular joint problem and late lower anterior crowding (8); thus early removal minimize risk to a patient as extraction later in life (9). Early removal of third molar can minimize the risk of post-operative complications related to surgery on a fully developed third molar such as nerve damage with parasthesia, dry socket, inflammation, bleeding, and pain (10). Thus, assessment of third molar position and its eruption is important for the patient management.

MATERIALS AND METHODS

The sample of the present study consisted of 39 patients (18 males and 21 females with mean age of 13 years) who were attending at Al-Suwayra General Hospital/ the Computerized Tomography department, who met a special selective criteria were selected.

The following criteria were used in the selection of the total sample:

(1) orthodontist wasit ,Ministry of Health.
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1- Iraqi Arab subject their age from 11-15 years.
2- Normal general health status, by taking medical history from parents.
3- Skeletal Class I relationship assessed in three planes of space[11].
4- No history of dentofacial deformities, pathologic lesions in the jaws or facial trauma.
5- Full set of teeth with developing mandibular third molar.
6- No congenital missing or supernumerary teeth
7- Normal overbite and over jet (2-4 mm) measured by sliding caliper (Dentarum ® – Germany).
8- No shifting in dental midline.
9- Mild crowding (not more than 2 mm) measured by sliding caliper (Dentarum ® – Germany).
10- Mild spacing (not more than 2 mm) measured by sliding caliper (Dentarum ® – Germany).
11- No previous orthodontic treatment like habits breaker or chin-cap.

Methods

For every patient in the sample; a clinical examination and computerized tomographic imaging had been done using **Brilliance™ 16 CT (Philips C, Netherland)**, then the CT images were collected from the workstation of the CT unit of and the imaging data were analyzed with the software provided by the manufacturer.

Firstly, the mesio-distal crown dimension of mandibular 1st molar was measured clinically using vernier. This is done to compare it with the measurements obtained from the 3D and 2D images.

On each image, the distances from "Xi" point to the distal surface of permanent mandibular second molar [12], in both 3D and 2D images was measured.

Xi point: A point located at the geometric center of the mandibular ramus. Location of Xi is keyed geometrically to Frankfort Horizantal plane (FH) and perpendicular through Pt (pterygoid vertical [PtV]; a line perpendicular to FH at the posterior margin of the pterygopalatine fossa), in the following steps as show in figure [1][13]:

1. Planes perpendicular to FH and PtV are constructed.
2. The constructed planes that tangent to points R1, R2, R3, and R4 on the borders of the ramus.

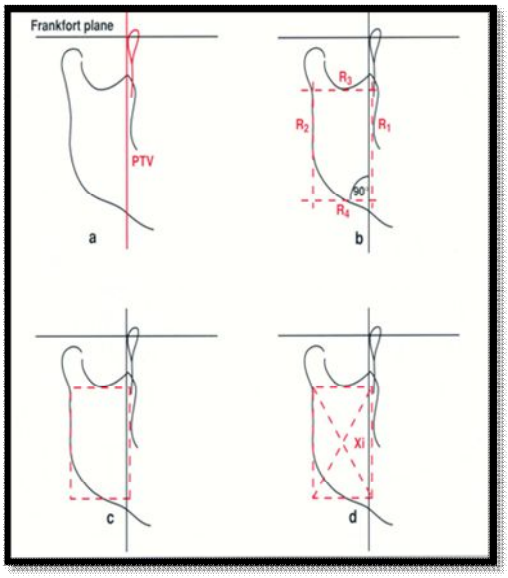
R1-mandible: The deepest point on the curve of the anterior border of the ramus, one half the distance between the inferior and superior curves.

R2-mandible: A point located on the posterior border of the ramus of the mandible.

R3-mandible: A point located at the center and most inferior aspect of the sigmoid notch of the ramus.

R4-mandible: A point on the lower border of the mandible, directly inferior to the center of the sigmoid notch of the ramus.

3. The constructed planes form a rectangle enclosing the ramus.
4. Xi is located in the center of the rectangle at the intersection of the diagonals.



(Figure1):Obtaining the location of Xi point

Statistical Analysis

All the data of the sample was subjected to computerized statistical analysis using **SPSS** for windows XP. The statistical analysis included:

A. Descriptive statistics

- Means.
- Standard deviations.
- Statistical tables.

B. Inferential statistics

Paired sample t-test: it was used to compare the measurements between the CT and the reconstructed lateral view. Independent sample t-test was used to verify the gender differences.

RESULTS

Table 1 and 2 showed the descriptive statistics and gender difference of the measured variables in 3D and 2D images. Generally, the mean values was slightly higher in males than females.

Comparing the two methods of measurements revealed highly significant difference between them in all measurement with 3D measurements slightly larger than 2D (Table 3).

Paired sample t-test was done to detect the method difference in the mean values for the permanent mandibular first molars mesio-distal width between the direct clinical measurement and the 3D CT and 2D images. A high significant difference was found between the direct clinical measurements and the 2D image and between the 3D and 2D methods with the same mean value for the clinical and 3D methods as seen in table (4).

DISCUSSION

It is important to mention that direct comparisons with results from other studies will not be always possible, since this study represents the first approach to compare the 3D CT and the 2D reconstructed lateral view in the assessment of mandibular third molar position.

The age of samples ranged between 11-15 years old because development of mandibular third molar was not completed at this age, early removal of third molar at this age is simple and atraumatic [12].

About the distance from Xi point to distal surface of permanent mandibular second molar, the result of the present study was agreed with the finding of Forsberg et al. [14] and Venta et al. [15] there was gender difference in the mean value of this measurement, since the mean value of this measurement in males higher than females.

In present study, all the measurements on 3D and on 2D images show statistically high significant difference between them. This may be explain by that the two dimensional diagnostic imaging including the reconstructed lateral view have certain analysis limitations such as geometric distortion, superimposition of structures, rotational errors and linear projective transformation.

To compare between the clinical and image method of measurement, the mean value of the width of mandibular 1st molar measured clinically and by 3D image is coincide, while it is about 0.8 mm smaller than 2D image. This result gives an impression about the accuracy of 3D image in measurement and diagnosis of orthodontic problems. Although the method difference is statistically significant but clinically is of no value (0.3).

Table 1: Descriptive statistics and gender difference for the variables measured in 3D image

Measurements	Descriptive Statistics						Gender Difference (d.f.=37)		
	Total sample (N=39)		Males (N=18)		Females (N=21)				
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean Difference	t-test	p-value
Xi to 7(mm)	19.98	0.77	20.02	0.83	19.96	0.72	0.06	0.24	0.812(NS)

Table 2: Descriptive statistics and gender difference for the variables measured in 2D image

Measurements	Descriptive Statistics						Gender Difference (d.f.=37)		
	Total sample (N=39)		Males (N=18)		Females (N=21)				
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean Difference	t-test	p-value
Xi to 7(mm)	18.74	0.81	18.77	0.80	18.71	0.83	0.06	0.20	0.843(NS)

Table 3: Descriptive statistics and image difference for the variables measured

Measurements	Descriptive Statistics				Image comparison (d.f.=38)		
	3D image		2D image				
	Mean	S.D.	Mean	S.D.	Mean Difference	t-test	p-value
Xi to 7	19.98	0.77	18.74	0.81	1.25	34.47	0.000 (HS)

Table 4: Descriptive statistics and measurements difference for the MD width of permanent mandibular first molars

MD of 6 measurement	Descriptive Statistics		Measurements difference (d.f.=38)		
	Mean	S.D.	Mean difference	t-test	p-value
3D image	10.28	0.31	0.80	125.73	0.000 (HS)
2D image	9.48	0.30			
Clinical	10.28	0.32	-0.001	-0.007	0.994 (NS)
3D image	10.28	0.31			
Clinical	10.28	0.32	0.799	11.531	0.000 (HS)
2D	9.48	0.30			

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المستخلص

من الضروري الاخذ بنظر الاعتبار موقع سن العقل الاسفل من الناحيه التقويميه وذلك لعدة عوامل منها ازدحام الاسنان الاماميه السفلى,رجوع الحاله في المنطقه الاماميه السفلى بعد العلاج وتداخل مع علاج الاضراس السفلى.

هذا البحث يهدف الى تحري ومقارنه موقع سن العقل الأسفل وملاحظه الفرق بالنتائج بين الجنسين بواسطه الاشعة ثلاثيه الابعاد والاشعة الجانبيه ثنائيه الابعاد المصنعه بواسطه جهاز المفراس الحلزوني.

لقد تم فحص وتشخيص تسعه وثلاثين مريضا (ثمانيه عشر من الذكور واحدى وعشرين من الاناث) وباعمار تراوحت ما بين (11-15)سنة وقد تم تقيمهم بطريقتين:الطريقه الاولى (تم تقيمها باستخدام الاشعه المقطعيه ثلاثيه الابعاد) والطريقه الثانيه (تم تقيمها باستخدام الاشعه الجانبيه المصنعه ثنائيه الابعاد) وقد تم اخذ التقيم الاتي لكل طريقه: المسافه من المركز الهندسي لعظم الفك الاسفل الى اقصى الضرس الثاني الاسفل.

لقد ظهر وجود فرق بالمعدل الحسابي بالنسبه للجنس,حيث تبين ان المعدلات الحسابيه للقياسات الماخوذه للذكور اعلى من الاناث.

كذلك لوحظ وجود اختلافات ذوات اهميه احصائيه ما بين الاشعه الثلاثيه الابعاد والثنائيه الابعاد فيما يتعلق بالقياسات المتعلقه بهذه الدراسة.

تبين وفقا لنتائج هذه الدراسه ان الاشعه الحلزونيه ثلاثيه الابعاد توفر معلومات دقيقه وقيمه, لهذا ننصح باستخدام المفراس المقطعي الحلزوني الثلاثي الابعاد خلال التشخيص والتقيم العلاجي لحالات التقويم.