Assessment of Dental Implant Site Dimensions And Alveolar Bone Density in The Mandible Using Cone Beam Computed Tomography

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ABSTRACT

Background: The quantity and the quality of available bone, influence the clinical success of dental implants surgery. Cone beam Computed tomography is an established method for acquiring bone images before performing dental implant. Cone beam computed tomography is an essential tool for treatment planning and post-surgical procedure monitoring, by providing highly accurate 3-D images of the patient's anatomy from a single, low-radiation scan which yields high resolution images with favorable accuracy. The aim of study is the Measurement of alveolar bone (height and buccolingual width) and density in the mandible among Iraqi adult subject using CBCT for assessment of dental implant site dimensions.

Material and method:

The study sample include (60) Iraqi subjects (30 male and 30 females) aged between 20-65 years, sagittal view of Cone beam computed tomography was obtained to measure the height ,width and alveolar bone density of the mandibular anterior area, while coronal view was used to measure the height ,width and alveolar bone density assessment of the mandibular premolar and molar areas. Measurement of mandibular bony height and width was in(mm)and each of the three mandibular areas were represented by seven consecutive measurements for bony height and width and these seven stations were set using an average distance of 2 mm apart while the bone density in Hounsfield unit (HU) with point of measurement represent the mean of density to the area located between the height and buccolingual width.

Results:The Statistical analysis of linear measurements of mandibular bone which include the bony height , width and density showed that the mean values of all three measurements are significantly higher in males than females also there was statistically significant difference in the mean bone density of mandibular areas which was highest in anterior area and lowest in the molar area followed by premolar area among both gender, mandibular bony height showed a statistically insignificant very weak negative linear correlation with age in all the three examined mandibular areas while the effect of age on bucolingual width was significantly higher among subjects older than 50 years compared to those younger than 50 years old.

Conclusion: The mean bony height was highest in anterior area and lowest in premolar area followed by molar area, while the mean bony width was lowest in anterior area and highest in molar area followed by premolar area , finally the mean bone density was highest in anterior area and lowest in molar area followed by premolar area.

Keywords: height, width and density of mandible , cone beam computed tomography. **(J Bagh Coll Dentistry 2018; 30(2): 34-40)**

INTRODUCTION

Provision of dental implants for patients who have lost their teeth is a common practice. Anatomic structures and the surrounding bone must be assessed both clinically and radiographically before placing implants.(1) Presurgical dental implant planning requires specific and accurate data to assess the implant site so that dental implants can be placed where they have the greatest chance of success. Anatomic considerations such as determination of bone height and width, determination of bone density, identifying and localizing internal anatomy, determining jaw boundaries, and detecting pathologies are the principal determinants in selecting an optimal implant site.(2)

Bone quantity can be defined as the amount of bone height and the width of the alveolar crest at an edentulous site. Areas of lesser bone quality have higher failure rates and weaker primary stability values.(3) The introduction of CBCT, in 1998, provided a new form of 3D evaluation, and several studies have shown that CBCT provides high quality, accurate cross-sectional images with low dose exposure. (4,5) CBCT has proven to capture structures with high contrast, have excellent image acquisition of such structures as the inferior alveolar nerve canal, and has proven more reliable than medical CT(6). In the current study the dental implant site dimensions were evaluated including the height and width of the mandible with the measurement of alveolar bone density using CBCT.

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MATERIAL AND METHOD:

A prospective study including 60 Iraqi adult subjects(30maleand 30female) were selected with age ranged from 20-65 years attended to Al-Salawy center of implant in Holey Karbala city from November 2016 to April 2017 were referred for CBCT scan for different diagnostic purposes. Patients were either with partially or fully edentulous mandible were examined. All patients were informed about the aim of the study , they fill a special consent form after their agreement to participate. All patients were included except with these exclusion criteria which include: Any pathological condition, trauma, and fracture affected the examined areas; Patient with Systemic disease that effect on bone metabolism such as diabetes millets; Long-term use of corticosteroid such as prednisone; Patient with previous dental prosthesis. CBCT images were acquired with a CBCT scanner (hyperion my rayX9 1602224)Italy. Scanning Parameter include:- (110) KVp, 24second, (1-20)mA ,Voxel size of (0.5)mm and field of view(16cm x 14cm). CBCT image and software (NNT viewer). **Methods:** Assessment of mandibular bony height and buccolingual width was in(mm) while the density in Hounsfield unit (HU). The height**,** bucolingual width and density of the mandibular bone are measured by using sagittal section of CBCT at the anterior region while coronal section for both premolar and molar regions. Each of the three mandibular areas(anterior ,premolar and molar)were represented by seven consecutive measurements for bony height and width and these seven stations were set using an average distance of 2 mm apart**.**

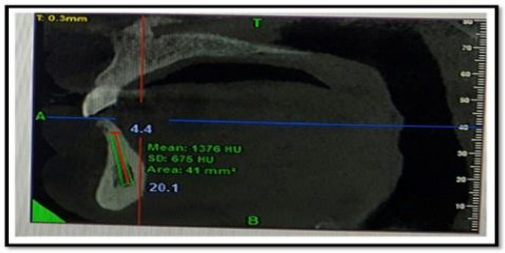

Figure (1) Sagittal view of anterior area showing the measurement of mean bone density 665 HU, the height (20.1mm) represent the vertical red line and the width (4.4mm) represent the horizontal red .

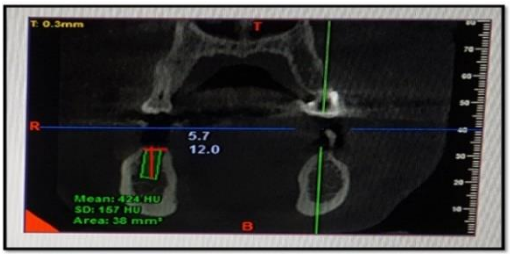

Figure (2) coronal section of mandible (premolar region) with mean bony density (671 HU) , the bony height (16.2 mm) and the width (7.8 mm).

Calibration procedure was done for randomly selected measurement for 15 CBCT images. The database was examined for errors using Statistical

1- Height of mandible measured From the crest of alveolar ridge to the internal border of the inferior cortex of mandible at the anterior area while at premolar area the height measured from the crest of the alveolar ridge to the superior border of mental foramen, while at molar area the height measured from the crest of the alveolar ridge to the superior border of the mandibular canal**. (Figure 1,2 and 3)**

2-Bucco-lingual width of mandible. It was measured from external surface of mandibular bone (buccal surface) to the inner surface (lingual surface) with sagittal view for anterior area and coronal view for premolar and molar areas .**figure(1,2 and 3)**

3- Bone density Measured the alveolar bone density among the three areas of mandible in Hounsfield unit (HU) with region of measurement represent the mean density to the area located between the height and buccolingual width. **figure(1,2 and 3)**

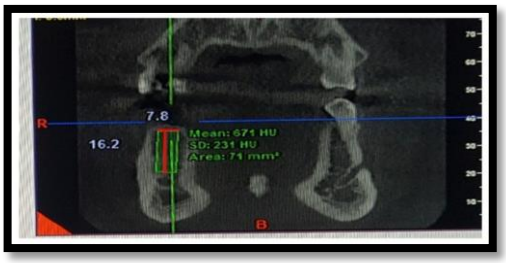

Figure (3) coronal section of mandible at (molar area) with mean density (424) HU ,the height (12.0) mm and width (5.7) mm.

Package for Social sciences **(SPSS)** version 20 computer software in association with Excel version **5**. In the present study two types of calibration were done: inter and intra examiner calibration and showed nonsignificant difference when paired t-test **(p>o.o5)**.

RESULTS

The mean of these seven measurements would be un-biased estimate of the bony height and width in each of the three areas. The errors in each measurement station of bony height and width ranged between a maximum decrease or increase of 0.1 mm. These errors were unbiased since their mean was zero. In addition, the average coefficient of variation for these errors reached a maximum of 0.5%, which is very small and can

be neglected.

Comparison between anterior, premolar and molar areas.

1.Bony height The mean bony height was highest in anterior area (17.2 mm) and lowest in premolar area (13.2 mm) followed by molar area (13.5 mm). The effect of changing from anterior to premolar area with average reduction of 4 mm in bony height, which is evaluated as a strong effect Similarly, the molar area was less in bony height by an average of 3.7 mm compared to anterior area, which is also a strong effect. Finally, the change observed in bony height when moving from premolar to molar area is of 0.3 mm, which was of small effect size. **Table 1**.

2.. Bony width: The mean bony width was lowest in anterior area (5.5 mm) and highest in molar area (7 mm) followed by premolar area (6.1 mm). The effect of changing from anterior to premolar area is with a mean increase of 0.6 mm in bony width, which is evaluated as a moderately strong effect. The effect of moving from anterior to molar area was a strong one and associated with a mean increase in bony width of 1.5 mm. Similarly, the molar area was associated with a higher mean bony width compared to premolar area by an average of 0.9 mm, which was also evaluated as a moderately strong effect. **Table 2.**

3. Bone density: The mean bone density was highest in anterior area (931.3 HU) and lowest in molar area (571.8 HU) followed by premolar area (730.6 HU). **Table 3.**

Effect of gender on the bony height: The mean bony height was obviously higher among males compared to females in all the 3 areas examined. The effect of gender was evaluated as a strong one (Cohen's d>0.8) in the anterior area. The gender effect in premolar and molar area was evaluated as a moderately strong effect. **Table 4.**

Effect of age on the bony height: The mean bony height showed no obvious or statistically significant difference between subjects <50 years old and those older in both premolar and molar areas. No association was examined among subjects in the anterior area, since none of them were younger than 50 years of age. **Table 5.**

Effect of gender on the mean bony width : The mean bony width was obviously higher among males (6 mm) compared to females (5.1 mm) among subjects in the anterior area group, and was evaluated as a strong effect .The gender effect on bony width in premolar and molar area was evaluated as a moderately strong effect. In these two areas males had a slightly lower mean bony width than females. **Table 6.**

Effect of age on the mean bony width: The mean bony width was higher among subjects older than 50 years compared to those younger than 50 years old in the premolar and molar areas. No association was examined among subjects in the anterior area, since none of them were younger than 50 years of age. **Table 7**.

Effect of gender on bone density: The mean bone density was significantly higher among males (1144.7 HU) compared to females (717.8 HU) in the anterior area group. The effect of gender was evaluated as a strong one in the anterior area. The effect of gender was very small in the premolar area. Finally, the gender effect in molar area was evaluated as a moderately strong effect (Cohen's d between 0.3 and 0.8). **Table 8.**

Effect of age on bone density: The mean bone density was slightly higher among older age group in the premolar a and molar area. **Table 9.**

Table (1): The mean bony height by mandibular area examined.

	Anterior	Premolar	Molar
Mean bony height (mm)			
Range	(12.3 to 23.2)	(8.1 to 20.3)	(8.8 to 19.4)
Mean	**17.2**	**13.2**	**13.5**
N	20	20	20
specific area X anterior			
Difference in mean		**-4**	**-3.7**
Cohen's d		**-1.42(Cohen's d > 0.8).**	**-1.19 (Cohen's d > 0.8).**
molar area X premolar			
Difference in mean			**0.3**
Cohen's d			**0.10 (Cohen's d <0.3).**

Table (2): The mean bony width by mandibular area examined

	Anterior	Premolar	Molar
Mean bony width (mm)			
Range	**(4 to 7.5)**	**(4.4 to 7.7)**	**(4.8 to 10.3)**
Mean	**5.5**	**6.1**	**7**
specific area X Anterior			
Difference in mean		**0.6**	**1.5**
Cohen's d		**0.6(Cohen's d between 0.3 and 0.8)**	**1.19 (Cohen's >0.8**
molar X premolar			
Difference in mean			**0.9**
Cohen's d			**0.76 (Cohen's d between 0.3 and 0.8)**

Table (3): The mean bone density by mandibular area examined.

	Anterior	Premolar	Molar
Bone density (HU)			
Range	**(327 to 1636)**	**(300 to 1225)**	**(238 to 1017)**
Mean	**931.3**	**730.6**	**571.8**
N	20	20	20
specific area X Anterior			
Difference in mean		**-200.7**	**-359.5**
Cohen's d		**-0.58 (Cohen's d between 0.3 and 0.8)**	**-1.13 (Cohen's d>0.8).**
molar area X premolar			
Difference in mean			**-158.8**
Cohen's d			**-0.64 (Cohen's d between 0.3 and 0.8)**

Table (4):The mean bony height (mm) by gender stratified by mandibular area examined.

	Gender		**Difference in mean (male-female)**	
	Female	**Male**		**Cohen's d**
Anterior area				
Range	(12.3 to 23.2)	(16.2 to 22.1)		
Mean	16	18.5	2.5	**0.89 (Cohen's d>0.8)**
Premolar area				
Range	(10 to 14.5)	(8.1 to 20.3)		
Mean	12.8	13.7	0.9	0.35 (Cohen's d > 0.8)
Molar area				
Range	(9 to 17.2)	(8.8 to 19.4)		
Mean	12.7	14.2	1.5	0.47 (Cohen's d > 0.8)

Table (5): The mean bony height (mm) by age group stratified by mandibular area examined.

	Age group (years)		**Difference in mean (male-female)**		
	<50	**50+**		**Cohen's d**	**P (t-test)**
Premolar area					**0.99[NS]**
Range	(8.1 to 16.7)	(10 to 20.3)			
Mean	13.3	13.2	-0.1	**-0.04 Cohen's d<0.3**	
Molar area					0.97[NS]
Range	(8.8 to 17.4)	(9 to 19.4)			
Mean	13.5	13.4	-0.1	**-0.03 Cohen's d<0.3**	

Table (6): The mean bony width (mm) by gender stratified by mandibular area examined.

	Gender		Difference in mean (male-female)	
	Female	Male		Cohen's d
Anterior area				
Range	(4 to 6.7)	(4.4 to 7.5)		
Mean	5.1	6	0.9	0.88 (Cohen's d>0.8).
Premolar area				
Range	(4.8 to 7.2)	(4.4 to 7.7)		
Mean	6.2	5.9	-0.3	-0.31(Cohen's d between 0.3 and 0.8)
Molar area				
Range	(5.5 to 10.3)	(4.8 to 8.8)		
Mean	7.2	6.7	-0.5	-0.34(Cohen's d between 0.3 and 0.8)

Table (7): The mean bony width (mm) by age group stratified by mandibular area examined

	Age group (years)		Difference in mean (male-female)		
	<50	50+		Cohen's d	P(t-test)
Premolar area					0.027
Range	(4.4 to 7.7)	(5.6 to 7.2)			
Mean	5.7	6.6	0.9	1.07 (Cohen's d>0.8)	
Molar area					0.53[NS]
Range	(4.8 to 10.3)	(6 to 9.6)			
Mean	6.8	7.2	0.4	0.28 (Cohen's d between 0.3 and 0.8)	

Table (8): The mean bone density (HU) by gender stratified by mandibular area examined.

	Gender		Difference in mean (male-female)	
	Female	Male		Cohen's d
Anterior area				
Range	(327 to 1040)	(455 to 1636)		
Mean	717.8	1144.7	426.9	1.24(Cohen's d>0.8)
Premolar area				
Range	(369 to 1124)	(300 to 1225)		
Mean	729	732.3	3.3	0.01(Cohen's d< 0.3
Molar area				
Range	(238 to 1017)	(356 to 922)		
Mean	508.7	634.9	126.2	0.62(Cohen's d between 0.3 and 0.8)

Table (9): The mean bone density (HU) by age group stratified by mandibular area examined

	Age group (years)		Difference in mean (male-female)		
	<50	50+		Cohen's d	P (t-test)
Premolar area					0.37[NS
Range	(300 to 1225)	(369 to 1187)			
Mean	683.1	801.9	118.8	0.42(Cohen's d between 0.3 and 0.8)	
Molar area					0.001
Range	(238 to 800)	(527 to 1017)			
Mean	449.2	721.7	272.5	1.71(Cohen's d>0.8)	

DISCUSSION

Prior to implantation, an investigation of the planned implant site is required to visualize the available bone and surrounding anatomical structures and augmented areas that could be affected. For this process, CBCT data is critically important in planning for the insertion of not only single implants, but also in the surgical treatment planning for multiple implants.**(7).**

• **comparison between (anterior, premolar and molar) area.**

1-Bone height : According to present study in **table (1)**, the mean bony height was highest in anterior area and lowest in premolar area followed by molar area. this result is similar to that reported by **Mercier et al** [8] that found the residual ridge resorption is usually more rapid in the premolar and molar region than the anterior region of the mandible because of the lower position of the reversal line in the posterior region.

2-Bone width : as shown in **table(2)** the mean bony width was lowest in anterior area and highest in molar area followed by premolar area. These results agree with many authors [9,10,11]

3-Bone density: In this study, the mean bone density was highest in anterior area and lowest in molar area followed by premolar area as demonstrated in **table (3) ,**this result agree with **Norton and Gamble**[12]recorded that the mean bone densities in the anterior mandible was (970) HU and the posterior mandible was(669)HU.[12]

The effect of gender on bony height, width and density.

In the present study as shown in **table(4)** the mean bony height was obviously higher among males compared to females in all the 3 areas examined. In the study done by **Ortman et al [13]** reported that the decrease in the height of the edentulous mandible was more pronounced in female than in male.[13],this result agree to what reveled by the present study. From the results shown in **table(6),** the mean bony width was obviously higher among males compared to females among subjects. **Sandring et al** (14) who state that there's no significant differences in bone width were determined between ethnic and age groups and, in spite of a normal anatomical trend for thicker male than female bone. the mean bone density was significantly higher among males compared to females in as shown in **table (8),** this result is similar to that found by many authors that found the bone density is more in males than females. [15,16,17]

Effect of age on the bony height ,width and density: In the present study in **table (5),** the bony height showed a statistically insignificant very weak negative linear correlation with age in all the three examined mandibular areas, such findings come in agreement with **Güler et al** [18] .

From the results shown in **table(7)** the mean bony width was significantly higher among subjects older than 50 years compared to those younger than 50 years old in the premolar area. In the molar area, the mean bony width showed no obvious difference between the two age groups. **Allen et al., 2007** [19]

In the present study as shown in **table(9)** the mean bone density was slightly higher among older age group in the examined areas . But this result disagreed with that found by **Froum et al** [20] who stated that there was a decrease in bone density of jaws which was more pronounced in the 70–74 years age. this disagreement may be due to differences in sample size.

In conclusion the mean bony height was highest in anterior area and lowest in premolar area followed by molar area, while the mean bony width was lowest in anterior area and highest in molar area followed by premolar area, and the mean bone density was highest in anterior area and lowest in molar area followed by premolar area. The effect of age on bony height showed no obvious or statistically significant difference between subjects <50 years old and those older, Male gender was associated with a statistically significant increase in bony height compared to females. The effect of age on bony width was as strong as that changing the mandibular area examined from anterior to premolar and molar .being on older age (+ 50 years old) is associated with a statistically significantly increase in bony width compared to younger age group less than 50 years old. Male gender associated with bony width higher than females. The effect of age on bone density was as strong as that changing the examined area from anterior to molar. being an older age is associated with statistically significant increase in bone density when compared to younger age ,Male gender associated with bone density higher than females.

REFRENCES

1 Worthington P, Rubenstein J, Hatcher D. 2010 The role of cone-beam computed tomography in the planning and placement of implants. JADA;141(suppl 3):195-245

2 Hatcher DC, Dial C, Mayorga C. (2003). Cone beam CT for pre-surgical assessment of implant sites. J Calif Dent Assoc. 31(11):825-33.

3 Jacobs R. (2003). Preoperative radiologic planning of implant surgery in compromised patients. Periodontol . 33: 12–25.

4 Mozzo P, Procacci C, Tacconi A, Martini PT, Andreis IA.(1998). A new volumetric CT machine for dental imaging based on the conebeam technique: preliminary results. Eur Radiol. 8(9):1558-64

5 Kobayshi K, Shimoda S, Nakagawa Y, Yamamato A. (2004). Accuracy in meashrment of distance using limited one beam compnterized tomography. Int J Oral Maxillofac Implants. Mar-Apr;19(2):228-31

6 Guerrero ME, Jacobs R, Loubele M, Schutyser F, Suetens P, van Steenberghe D. (2006) .State-of-the-art on cone beam CT imaging for preoperative

planning of implant placement. Clin Oral Investig; 10(1):1-7.
7 Dreiseidler T, Midchkowaski RA, Neugebauer J, Ritter L, Zoller JE.(2009). Comparison of cone-beam imaging with orthopantomography and computerized tomography for assessment in presergical implant dentistry. Int J Oral Maxillofac Implants. Mar- Apr;24(2):216-25.
8 Mercier P. (1988). Ridge reconstruction with hydroxylapatite. Part 1. Anatomy of the residual ridge. Oral Surg Oral Med Oral Pathol. ;65:505–510.
9 Baumgaertel S, Hans MG.(2009). Buccal cortical bone thickness for mini-implant placement. Am J Orthod Dentofacial Orthop. 136:230-5
10 Park HS, Lee YJ, Jeong SH, Kwon TG. (2008). Density of the alveolar and basal bones of the maxilla and the mandible. Am J Orthod Dentofacial Orthop. ;133:30–37 .
11 Swasty D, Lee JS, Huang JC, Maki K, Gansky SA, Hatcher D, Miller AJ. (2009). Anthropometric analysis of the human mandibular cortical bone as assessed by cone-beam computed tomography. J Oral Maxillofac Surg. Mar;67(3):491-500.
12 Norton & Gamble (2001) suggested an objective scale of bone density that was besed on mean HU values taken from CT and could be used for bone tissue classification before implant treatment .
13 Ortman LF, Hausmann E, Dunford RG. (1989). Skeletal osteopenia and residual ridge resorption. J Prosthet Dent.;61: 321-5.
14 Sandring S. (2005). The anatomical basis of clinical practice. Gray's anatomy. 39th ed. Edinburgh, Toronto: Elsevier Churchill Livingstone,:489.
15 Cvijetić A, vdagić S, ColićBarić I, Keser I, Cecić I, Satalić Z Bobić J, Gomzi M.(2009). Differences in peak bone density between male and female students. Archives ofIndustrial Hygiene and Toxicology 04/60(1):79 .
16 Miyamoto MI, Ishikawa A, Morimoto Y, Takahashi T. (2013). Potential risk of asymptomatic osteomyelitis around mandibular third molar tooth for aged people: acomputed tomography and histopathologic study. PLOS ONE Journal Information. Sep 10.
17 Turkyilmaz I, Tözüm TF, Tumer C, Ozbek EN. (2006). Assessment of correlation between computerized tomography values of the bone, and maximum torque and resonance frequency values at dental implant placement. Journal of Oral Rehabilitation. 33(12):881–888.
18 Güler AU, Sumer M, Sumer P, Biçer I. (2005). The evaluation of vertical heights of maxillary and mandibular bones and the location of anatomic landmarks in panoramic radiographs of edentulous patients for implant dentistry. J Oral Rehabil. 32:741–746 .
19 Allen, M.R. (2007). Animal models of osteonecrosis of the jaw. J Musculoskelet Neuronal Interact. 7: 358–360
20 Froum SJ (2010). Dental Implant Complications. Willey-blackwell. pp. 12–3.

الخلاصة:
كمية ونوعية العظام تؤثرعلى نجاح زراعة الأسنان السريرية ، وكل هذه العوامل تلعب دورًا حيويا في نجاح زرع الأسنان. التصوير المقطعي بالاشعه المخروطيه هو طريقه لاقتناء الصور للعظام قبل تنفيذ عملية زرع الأسنان كذالك هو أداة أساسية لتخطيط العلاج ورصد ما بعد العملية الجراحية، بتوفير صور ثلاثية الأبعاد عالية الدقة للمريض من مسح واحد، وأشعاع منخفض الذي يعطي صور عالية الدقة ؛ ولذلك يزداد استخدامه لتقييم مجالات ومساحات واسعه للفك .

الهدف من الدراسة:تقييم أبعاد الموقع والمساحه لزراعه الأسنان ويتضمن ذلك الارتفاع والعرض وكثافة العظام السنخية لمناطق مختلفة من الفك السفلي باستخدام نظام التصوير المقطعي بالاشعه المخروطيه لمجموعه من المرضى العراقيين.

المواد والطريقةهذه الدراسة المؤلفة من (60) شخص عراقي (30 ذكور و 30 إناث) الذين تتراوح أعمارهم بين 20-65 سنة. العينة التي تم جمعها من المرضى الذين يزورون مركزالسيلاوي لزراعه الاسنان في مدينة "كربلاء المقدسة باستخدام التصوير المقطعي بالاشعه المخروطيه لأغراض تشخيصية مختلفة من عام 2016 في تشرين الثاني/نوفمبر إلى نيسان/أبريل عام 2017.

النتيجة:التحليل الإحصائي للقياسات الخطية لعظم الفك السفلي التي تشمل االارتفاع والعرض والكثافة والتي أظهرت أن متوسط قيم كافة القياسات الثلاثة أعلى بكثير في الذكور من الإناث أيضا كانت هنالك زيادة في كثافة عظم الفك السفلي حيث كانت الكثافه العظميه لمنطقه القواطع اعلى من منطقه الطواحن تليها منطقه الضواحك لكلا الجنسين كذلك وجد أن ارتفاع الفك السفلي له علاقه ضعيفة جدًا وسلبية مع التقدم في السن في جميع مناطق الفك السفلي الثلاث بينما كان أعلى بكثير بين أشخاص تزيد أعمارهم عن 50 عاما مقارنة بأولئك الذين تقل أعمارهم عن 50 عامًا بينما تأثير العمر على عرض الفك السفلي وكثافة العظام كان اعلا قليلا لاصحاب الاعمار الكبيره.

الاستنتاج: متوسط ارتفاع العظم آعلى في منطقه القواطع من منطقه الضواحك تليها منطقه الطواحن، بينما متوسط عرض العظم اقل في منطقه القواطع واعلى في منطقه الطواحن تليها منطقه الضواحك. اخيرا متوسط كثافه العظم اعلى في منطقه القواطع واقل في منطقه الطواحن تليها منطقه الضواحك.

كلمات البحث :ارتفاع، عرض وكثافه عظم الفك السفلي، جهاز التصوير الشعاعي المخروطي المقطعي.