مجلة جامعة تشرين للبحوث والدراسات العلمية _ سلسلة العلوم الصحية المجلد (38) العدد (2) 2016
Tishreen University Journal for Research and Scientific Studies - Health Sciences Series Vol. (38) No. (2) 2016

A Study of maxillary and mandibular alveolar widths in skeletal class II compared with skeletal class I in adults (Cone-Beam Computed Tomography Study)

Dr. Yazan Jahjah *
Riham Abdallah **

(Received 24 / 8 / 2015. Accepted 22 / 3 / 2016)

□ ABSTRACT □

Class II malocclusion is a common clinical problem among white Caucasian population and its transverse component is a critical aspect of a functional and stable occlusion. The size and shape of the arches have considerable implications in orthodontic diagnosis and treatment planning, affecting the space available, dental esthetics, and stability of the dentition. Hence , it is important to study the alveolar arch width in this group of patients using the wide possibilities of cone beam computed tomography of evaluating real anatomy , true-to-scale images without distortions or superimpositions, and the selection of the desired sections.Objective:To evaluate the width of maxillary and mandibular alveolar arches in skelatal Class II adults compared to skeletal class I using cone beam computed tomography. Materials and methods: thirty-two subjects with skeletal Class II relationship and 10 subjects with skeletal Class I who were ordinary undergoing CBCT scan for non-orthodontics nor for otorihnolaryngology purpose were selected to measure the maxillary and mandibular alveolar width of first premolar and first molars.Independent samples' t-test was calculated. Results:No statistically significant differences were found of alveolar widths between skeletal Class II and Class I subjects in both maxillary and mandibular widths of molar and premolar regions. Gender had no statistically significant effect in the results of the study. Conclusion :There is no differences in alveolar width between adults with skeletal Class II and Class I relationships, so the transverse discrepancy in skeletal Class II when exsists , it is more probably not originated from the alveolar base.

Key words : skeletal Class II , Cone beam computed tomography , alveolar width.

***Assistant Professor , Orthodontics and Dentofacial Orthopedic Department, Dental School at Tishreen University, Lattakia, Syria.**
****Postgraduate student , Orthodontics and Dentofacial Orthopedic Department, Dental School at Tishreen University . Lattakia, Syria.**

مجلة جامعة تشرين للبحوث والدراسات العلمية _ سلسلة العلوم الصحية المجلد (38) العدد (2) 2016
Tishreen University Journal for Research and Scientific Studies - Health Sciences Series Vol. (38) No. (2) 2016

دراسة عرض القوس السنخية العلوية والسفلية في الصنف الثاني الهيكلي بالمقارنة مع الصنف الأول الهيكلي عند البالغين (دراسة باستخدام التصوير الطبقي المحوري المخروطي)

الدكتور يزن ججحاح*

رهام عبد الله **

(تاريخ الإيداع 24 / 8 / 2015. قُبِل للنشر في 22 / 3 /2016)

☐ ملخّص ☐

يعتبر سوء الإطباق من الصنف الثاني مشكلة سريرية شائعة في المجتمعات ذات العرق القوقازي الأبيض ، وتشكل مظاهره في المستوى المعترض عاملا حساسا في الوصول لإطباق وظيفي مستقر. إن دراسة عرض القوس السنخية لدى هذه المجموعة من المرضى يعد هاما نظراً للدور الكبير لشكل و قياس الأقواس في التشخيص التقويمي و وضع الخطط العلاجية من ناحية تأثيرها في المسافة المتوفرة ، العوامل الجمالية السنية و استقرار الإطباق. تمكّن الخيارات الواسعة لتقنية التصوير الطبقي المحوري المخروطي من دراسة أفضل ، بما تقدمه من تحرٍّ للبنى التشريحية الحقيقية ، بالأبعاد ذاتها دون تشوه في المقاطع أو تراكب للبنى ، مع إمكانية اختيار المقطع المراد بكل سهولة. هدف البحث: تقييم عرض الأقواس السنخية العلوية و السفلية عند أفراد بصنف ثاني هيكلي بالمقارنة مع أفراد بصنف أول هيكلي باستخدام تقنية التصوير الطبقي المحوري المخروطي. مواد وطرق البحث: بلغ عدد أفراد العينة 42 فرداً بالغا (32 بصنف ثاني هيكلي ، 10 بصنف أول هيكلي) لم يخضعوا لمعالجة تقويمية سابقة و تم انتقاؤهم من مرضى كانوا تلقائيا بصدد إجراء تصوير طبقي محوري مخروطي لأسباب غير تقويمية و لا تتعلق بأمراض الأذن و الأنف و الحنجرة ، تم قياس العرض السنخي عند الضواحك و الأرحاء الأولى العلوية و السفلية ، تم تطبيق اختبار t للعينات المستقلة . النتائج : لا يوجد فرق ذو دلالة إحصائية بين العرض السنخي العلوي و السفلي لدى أفراد الصنف الأول و الثاني الهيكلي في منطقة الضواحك و الأرحاء . لم يكن للجنس تأثير ذو دلالة إحصائية في نتائج الدراسة. الخلاصة : لا يوجد فرق في العرض السنخي بين البالغين من الصنف الثاني و الصنف الأول الهيكلي و بالتالي فإن منشأ الخلل في المستوى المعترض عند أفراد الصنف الثاني الهيكلي –عند وجوده– لا يعود غالبا للقواعد السنخية .

الكلمات المفتاحية: صنف ثاني هيكلي ، التصوير الطبقي المحوري المخروطي ، العرض السنخي .

* مدرس – قسم تقويم الأسنان و الفكين – كلية طب الأسنان – جامعة تشرين – اللاذقية– سورية

** طالبة دراسات عليا – قسم تقويم الأسنان و الفكين – كلية طب الأسنان – جامعة تشرين – اللاذقية– سورية

Introduction

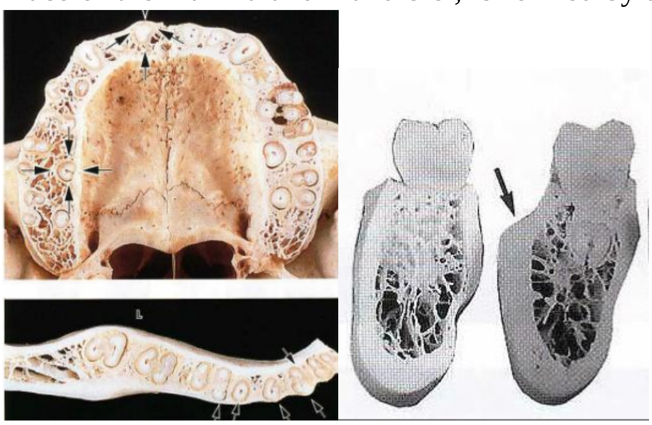
Class II malocclusion is reported as the most frequently seen skeletal disharmony in orthodontic population[1-6], and it is a common clinical problem among white Caucasian population as a point of concern [7].

The Transverse component in Class II patients is of great importance as sagittal or vertical components and it is one of the critical aspects of a functional and stable occlusion[9-13]. The size and shape of the arches have considerable implications in orthodontic diagnosis and treatment planning, affecting the space available, dental esthetics, and stability of the dentition[10] . Howes[11] stated in 1960 that in our studies of anterioposterior proportions of the face , we should not lose sight of the fact that our biggest problem is arch width , and since that a lot of studies concerning the arch width - dental or alveolar – in class II subjects had been done[12-17] . However, there is considerable controversy among the results presented in the literature. Unfortunately , Inclusion criteria of these studies did not consider the skeletal relationship . Thus, studies on the transverse discrepancy with selected samples according to skeletal relationships, are required .

Expansion is especially desirable for young Class II patients who have constricted maxillae, because the transverse deficiency does not self-correct between the deciduous, mixed, and permanent dentitions [18] . Because of the divergent shape of the dental arches anteroposteriorly, movements of a whole arch require modification to the arch width to accommodate the opposing arch . In skeletal class II Patients ,this is seen in distal movement of the upper arch and most frequently in the preamble stage anticipate mandibular functional forward movement [19]. Two basic approaches have been developed to expand the maxilla. Rapid maxillary expansion uses heavier interrupted forces to maximize orthopedic effects, and slow palatal expansion uses lighter continuous forces to move teeth at rates purported to be more physiologic[20].

So it is important to have a complete diagnosis in transverse dimension and define whether the transverse problem -if exsisted- is with dental or alveolar and basal origin in class II patients in order to come up with the best treatment plan .

Black[21] defines the alveolar process as " the projection of bone which grows up around the roots of teeth " . The outer surface of the alveolar process , which is continuous with the outer surface of the maxilla and mandible , is formed by a compact layer of bone



cortical plate – buccal and palatal/lingual (figure 1) . These plates surround the alveolar spongy bone and the lamia dura which is considered like a socket around the tooth root and unite with the cortical plate at its buccal and

Figure 1 : Anatomy of the alveolar bone[8]

palatal/lingual sides to form what is called the alveolar crest [22 – 23].

Various landmarks have been described and discussed by different investigators in previous studies to measure the alveolar width. Most of that studies had used dental casts to figure out that measurement [12-17, 24] , but the anatomy of the alveolar bone is not simple as described above , and the dental cast will not provide an accurate method to define alveolar landmarks , especially that general agreement on determining the alveolar width using dental casts has not been reached[25] Beside the measurement error[26] ; Hence , we chose to use cone beam computed tomography and its associated software wide possibilities to assess alveolar measurements .

With the introduction of cone-beam computed tomography (CBCT) into the field of orthodontics, several advantages of CBCT have been reported, including high-definition images of teeth and surrounding bone obtained at a low dose of radiation [27] and ease of quantitave and qualitative evaluation of the buccal and lingual/palatal alveolar bone [28] . Furthermore , the ability to assess an image from the three planes , the lack of distortion or overlapping structures and measurement accuracy[29-30] . Lee 2014 reported that CBCT is mandatory for the transverse analysis[31] .

Thus, studies on the transverse discrepancy of Class II skeletal relationships subjects using CBCT , are required. The aim of this research is to compare the width of maxillary and mandibular alveolar arches between Class I and Class II skeletal malocclusion using cone beam computed tomography . The null hypothesis is that there is no difference in alveolar width between skeletal Class I and Class II .

Materials And Methods:

-Subjects: Sample's subjects were selected from patients who were ordinary undergoing CBCT scan for non-orthodontic nor for otolaryngology purpose. The sample consisted of 42 CBCT scans (10 skeletal class I , 32 skeletal class II).

The selection of the subjects was based only on the skeletal relationships regardless of the dental relations , and that is because the class II malocclusion according to Angle classification might be of a pure dental origin with any of the sagittal skeletal relationships between jaws [32] , so the decision was to give the priority to skeletal relations of class II and to study the alveolar widths associated with it . The sagittal skeletal relationships was determined according to ANB angles measured on simulated lateral cephalometric images extracted from the CBCT radiographs [33, 34]. We utilized ANB angle suggested by Riedel in 1952 [39] , because it is one of accepted method of assessing the sagittal jaw base relationship [39-43]

Present study selected adult subjects aged between 19 and 26 years old (20 males , 22 females) . The samples were based on prior studies that arch width would not increase after age 13 years in girls and 16 in boys[35-38]. The inclusion criterion for Class II , Class I subjects was : 1) skeletal relationship with (ANB angle > 4) for skeletal Class II and (0° to 4) for Skeletal Class I [44,45] . 2) fully erupted first premolars and molars with no loss of their opposite teeth in the same arch, since the alveolar bone is subservient to teeth, being resorbed when they are lost . 3) No distributing big restorations or prosthetics . 4) No previous orthodontic treatment, maxillofacial or plastic surgery. 5) No cross bite, or scissor bite in the transversal plane . 6) No history of (otolaryngology, neurological disorders , neurological or dento-facial traumas). 7) Exclusion criteria also were subjects with congenital anomalies/ evident signs of neurological impairment and/or syndromes and/or dentoskeletal asymmetries and/or craniofacial malformation . All subjects had nasal breathing . That was determined by History-taking and clinical examination performed for the subjects who met the inclusion criteria [46], in addition to use the CBCT images later to ascertain the absence of anatomical variations that occur in the nasal cavity and the paranasal region and inflammatory sinonasal changes and assure the airway volume [47,48]

-Sample estimation: To determine the minimum sample size to be statistically significant, a pilot study was applied on 20 subject [who were selected according to the criteria of selecting this study`s sample]. It has been found that descriptive statistics results follow the normal distribution; therefore, determining the minimum sample size to be statistically significant was according to the following formula:

$$n = \frac{Z^2.\sigma^2}{(e)^2}$$

(N): is the sample size ;.(z): is the value corresponding to a confidence level, estimated at 99% (Z = 2.58) (i.e. significance level is 0.019), (σ): highest Standard Deviation value within all the variables (σ = 6.56) €: Margin of error (maximum acceptable error in mean estimate) (e=5) ,Thus:

$$n = \frac{(2.58)^2(6.56)^2}{5^2} \approx 11.45$$

According to this pilot study, we determined that to get an exact estimate about the mean of patients' results, and the error in his estimate does not exceed 5 of the mean, with a significance level of 99% requires a sample size (n) of 12 patients as minimum. whereas the size of the sample in this study was n= 42.

- CBCT study: CBCT scans were obtained in centric occlusion during exposure (maximum dental intercuspation); data were obtained using a 3D cone-beam volume scanner (SCANORA® 3D FOVs.). Used settings were as following: Standard scan mode with an imaging volume of 40 cmx13 cm, Scan speed of 9 s, Slice thickness 0.3 mm, 120 kV, 47mA . DICOM files obtained from the CBCT scan were reconstructed by (OnDemand3d App) and all landmark identifications and measurements were made using this software. Orientation was established as was recommended by da Silva 2013 [49] . Using the coronal view, the midsagittal plane was vertically oriented passing through nasion and through the anterior nasal spine; the right sagittal view was used as reference to determine the Frankfurt plane, horizontally oriented; the right and left sagittal visualizations were used to make the coronal plane touch the anterior walls of the right and left poria **(**Figure 2).

- CBCT Alveolar measurements : Since the alveolar bone surrounds the root of teeth [21] , the alveolar width measurement can be taken at any point of the alveolar process.

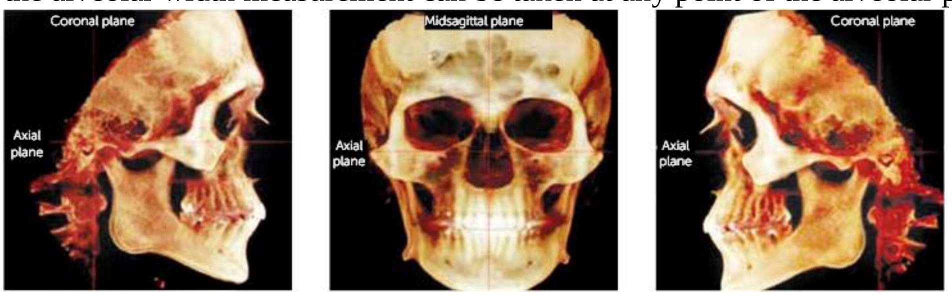


Figure 2 : The reference lines used for orientation[49]

Vertically , we chose to take the measurement at the point representing 6 mm apical to the Cemento-Enamel Junction (CEJ) using the sagittal slice showing the studied tooth (figure 3) , rather than closer points to CEJ ; to minimize the possibility of the presence of pathogenic destruction of the top of the alveolar bone especially that we are dealing with adults. However, if an alveolar bone destruction was observed in our 6 mm standard in any subject , the subject was not included in the sample .

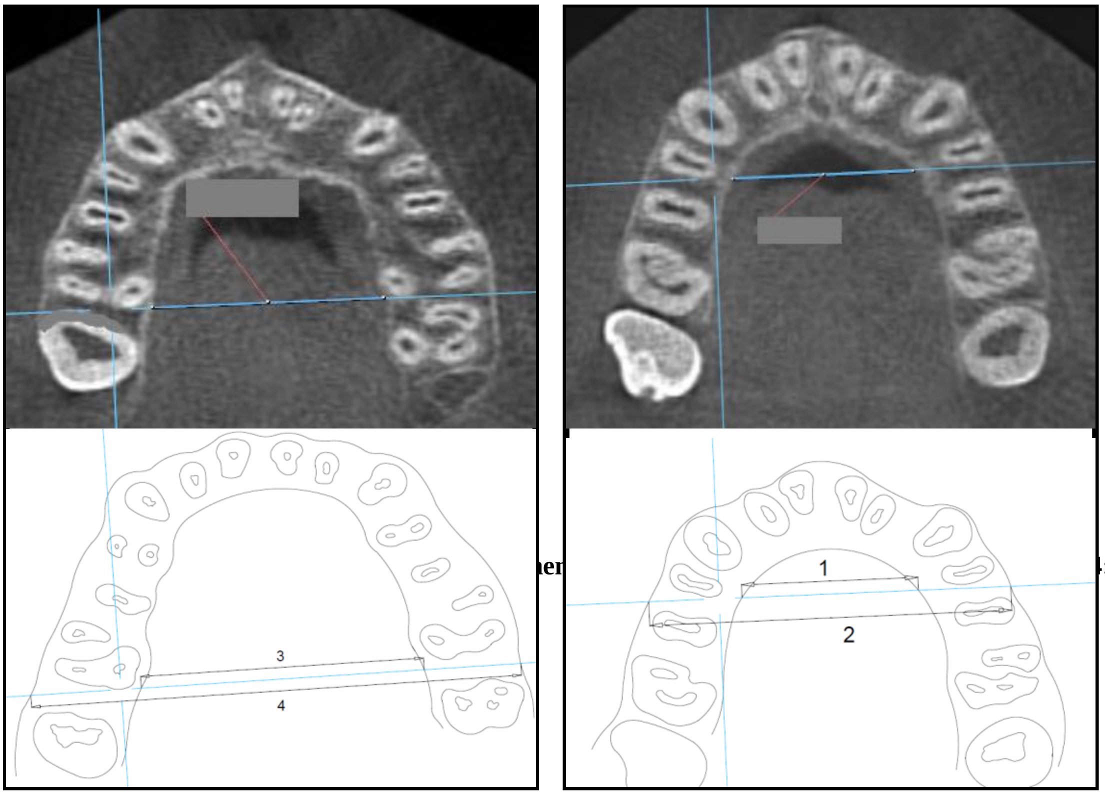
Figure 3 : shows measuring 6 mm apical to the CEJ on the sagittal view

Alveolar width measurements were obtained in the axial view as Buccal alveolar width – between buccal alveolar plates on both sides – and Palatal/Lingual alveolar width – between palatal/lingual alveolar plates on both sides- .

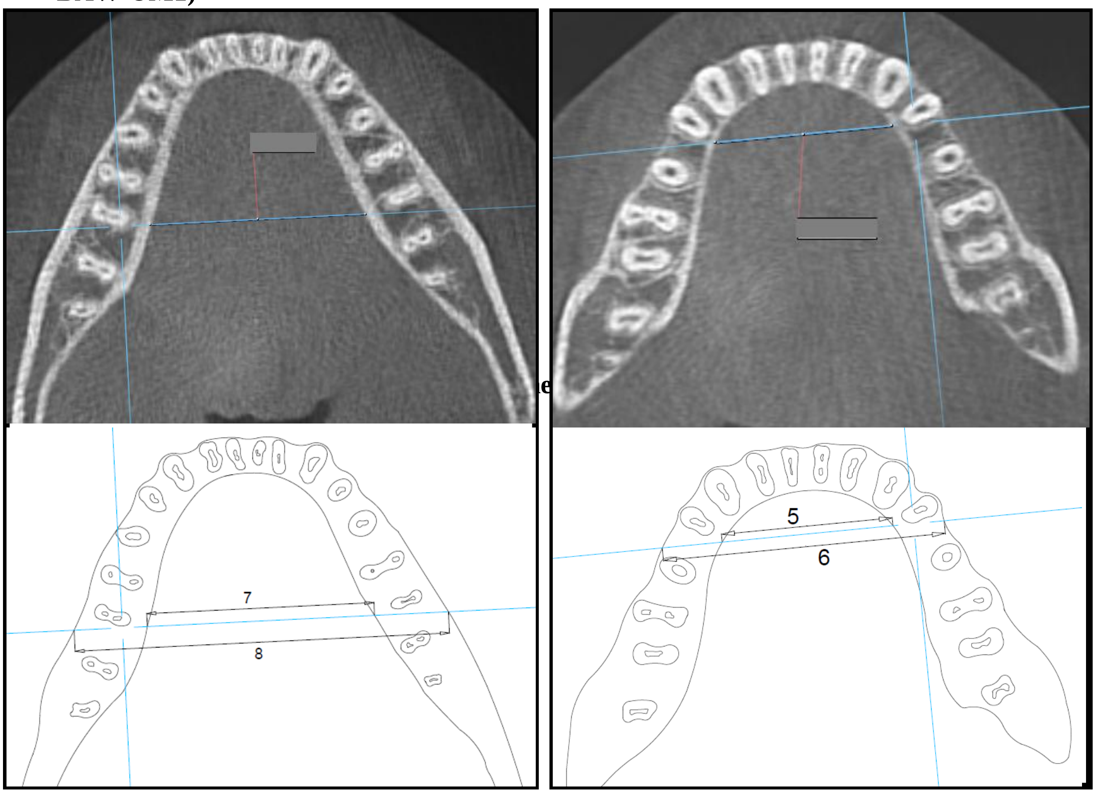
The measurement was taken at the level of the most lateral point of the most lateral first premolar and molar by geometrical projection of this point into the opposite alveolar plate in each jaw parallel to the coronal reference line . The purpose of considering the most lateral points is to standardize the measurement as the widest alveolar distance can be obtained each time .CBCT alveolar measurements are shown in (table 1) and illustrative in (figure 4,5):

Table 1 CBCT alveolar measurements :

	Measurement	Unit
PAW-UM1	Palatal Alveolar Width at the level of Upper first Molar	Mm
BAW-UM1	Buccal Alveolar Width at the level of Upper first Molar	Mm
PAW-UP1	Palatal Alveolar Width at the level of Upper first Premolar	Mm
BAW-UP1	Buccal Alveolar Width at the level of Upper first Premolar	Mm
LAW-LM1	Lingual Alveolar Width at the level of Lower first Molar	Mm
BAW-LM1	Buccal Alveolar Width at the level of Lower first Molar	Mm
LAW-LP1	Lingual Alveolar Width at the level of Lower first Premolar	Mm
BAW-LP1	Buccal Alveolar Width at the level of Lower first Premolar	Mm



BAW-UM1)



BAW-LM1)

- Error of method: All CBCT measurements were repeated twice with a month interval, by the same calibrated investigator using the same workstation, Paired t-test at α= 0.05 was applied to check the differences between the first and second measurements and determine the systematic error. The comparison showed did not show any statistical significance.

- Statistical method: Using IBM SPSS Statistics 19 , independent samples' t-test was calculated to compare the mandibular and maxillary alveolar widths between skeletal Class I and Class II adult patients , and then to compare these widths according to gender of the subjects .

RESULTS

Descriptive statistics for alveolar measurement regardless the skeletal relationship are shown in (Table 1):

Table 1: Descriptive statistics for alveolar measurements regardless the skeletal relationship

	PAW-UM1	BAW-UM1	PAW-UP1	BAW-UP1	LAW-LM1	BAW-LM1	LAW-LP1	BAW-LP1
N Valid	42	42	42	42	42	42	42	42
Mean	32.34	60.77	26.63	48.66	36.93	67.16	22.69	43.02
Std. Error of Mean	.40	.55	.33	.43	.44	1.01	.42	.52
Std. Deviation	2.59	3.57	2.20	2.81	2.87	6.56	2.73	3.37
Variance	6.75	12.79	4.85	7.91	8.25	43.07	7.47	11.36
Range	11.08	14.42	9.12	12.49	12.98	26.78	14.32	16.57
Minimum	27.42	55.40	20.90	42.09	31.00	54.60	14.08	36.40
Maximum	38.50	69.82	30.02	54.58	43.98	81.38	28.40	52.97

Descriptive statistics for upper alveolar measurement in subjects with skeletal class I and class II relationships are shown in (Table 2):

Table 2: Descriptive statistics for upper alveolar measurements for skeletal class I and class II subjects

Descriptive study		PAW-UM1	BAW-UM1	PAW-UP1	BAW-UP1
CLASS I	N Valid	10	10	10	10
	Mean	31.96	60.17	26.73	48.37
	Std. Error of Mean	1.10	1.53	.78	.83
	Std. Deviation	3.50	4.86	2.48	2.64
	Variance	12.30	23.71	6.19	6.97
	Range	11.08	14.10	9.12	8.91
	Minimum	27.42	55.72	20.90	45.40
	Maximum	38.50	69.82	30.02	54.31
CLASS II	N Valid	32	32	32	32
	Mean	32.46	60.96	26.60	48.75
	Std. Error of Mean	.40	.55	.37	.51
	Std. Deviation	2.30	3.14	2.14	2.89
	Variance	5.29	9.89	4.61	8.40
	Range	9.41	12.36	7.97	12.49
	Minimum	27.80	55.40	21.65	42.09
	Maximum	37.21	67.76	29.62	54.58

Descriptive statistics for upper alveolar measurement in subjects with skeletal class I and class II relationships are shown in (Table 3):

Table 3: Descriptive statistics for Lower alveolar measurements for skeletal class I and class II subjects

Descriptive study			LAW-LM1	BAW-LM1	LAW-LP1	BAW-LP1
CLASS I	N	Valid	10	10	10	10
		Mean	37.01	64.75	24.13	43.10
		Std. Error of Mean	1.16	1.64	.84	1.05
		Std. Deviation	3.69	5.19	2.66	3.33
		Variance	13.63	27.0	7.10	11.13
		Range	9.90	17.31	8.10	9.92
		Minimum	33.00	57.19	20.30	36.40
		Maximum	42.90	74.50	28.40	46.32
CLASS II	N	Valid	32	32	32	32
		Mean	36.91	67.91	22.24	43.00
		Std. Error of Mean	.46	1.20	.46	.60
		Std. Deviation	2.63	6.83	2.63	3.43
		Variance	6.95	46.67	6.94	11.79
		Range	12.98	26.78	13.02	16.28
		Minimum	31.00	54.60	14.08	36.69
		Maximum	43.98	81.38	27.10	52.97

Statistical comparison of the alveolar measurements of the two groups [skeletal class I , and class II] was performed with independent samples' t-test .

Our null hypothesis was there is no difference in alveolar width between skeletal Class I and Class II. The results of t-test are shown in (Table 4) :

Table4: independent samples' t-test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. [2-tailed]	Mean Difference	Std. Error Difference	Lower	Upper
PAW-UM1	Equal variances assumed	2.53	.11	.52-	40	.603	.49-	.949	2.41-	1.42
BAW-UM1		3.45	.07	.60-	40	.552	.78-	1.30	3.42-	1.85
PAW-UP1		.10	.75	.16	40	.873	.12	.80	1.50-	1.76
BAW-UP1		.24	.62	.36-	40	.718	.37-	1.02	2.45-	1.70
LAW-LM1		4.04	.05	.08	40	.930	.093	1.05	2.03-	2.22
BAW-LM1		1.84	.18	1.34-	40	.187	3.15-	2.35	7.91-	1.60
LAW-LP1		.02	.88	1.97	40	.056	1.88	.95	.047-	3.82
BAW-LP1		.10	.74	.079	40	.937	.098	1.23	2.40-	2.59

All the alveolar width measurements for maxillary and mandibular first molar and premolar showed no significant difference between skeletal Class I and Class II subjects (α = 0.05 , P > α).

To figure out if gender affects the results , a comparison between alveolar widths in Class I and Class II was done in males and females of the sample . The males sample were 20 subjects (3 Class I , 17 Class II) , females sample were 22 subjects (7 Class I , 15 Class II) . Since n<30 , a check of the distribution of the variables was done using one-sample Kolmogorove-Smirnove test of normal distribution and the results showed that all variables have a normal distribution (α = 0.025 , P > α) , so parametric statistical tests can be applied to compare the alveolar widths between Class I and Class II within males and females samples .

(Table 5) shows the result of independent samples' t-test for male sample to compare the alveolar measurements of the two groups (skeletal class I , and class II). Our null hypothesis was there is no difference in alveolar width between skeletal Class I and Class II in male subjects.

Table5: independent samples' t-test for male subjects

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. [2-tailed]	Mean Difference	Std. Error Difference	Lower	Upper
PAW-UM1	Equal variances assumed	.762	.394	1.447	18	.165	2.64510	1.82858	1.19660-	6.48680
BAW-UM1		3.193	.091	1.197	18	.247	2.91471	2.43430	2.19957-	8.02899
PAW-UP1		1.529	.232	1.096	18	.288	1.55451	1.41837	1.42538-	4.53440
BAW-UP1		.001	.974	1.416	18	.174	2.33941	1.65190	1.13110-	5.80992
LAW-LM1		.051	.825	.765	18	.454	1.47176	1.92294	2.56819-	5.51172
BAW-LM1		.545	.470	.992-	18	.334	4.51490-	4.54925	14.07252-	5.04271
LAW-LP1		.402	.534	1.486	18	.154	2.06667	1.39030	-.85424-	4.98757
BAW-LP1		.110	.744	.258-	18	.800	.65588-	2.54539	-6.00354-	4.69177

All the alveolar width measurements for maxillary and mandibular first molar and premolar showed no significant difference between skeletal Class I and Class II male subjects (α = 0.05 , P > α).

(Table 6) shows the result of independent samples' t-test for female sample to compare the alveolar measurements of the two groups (skeletal class I , and class II). Our null hypothesis was there is no difference in alveolar width between skeletal Class I and Class II in female subjects

Table6: independent samples' t-test for female subjects

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	T	df	Sig. [2-tailed]	Mean Difference	Std. Error Difference	Lower	Upper
PAW-UM1 Equal variances assumed	.894	.356	- 1.942-	20	.066	-1.57562-	.81119	-3.26773-	.11649
BAW-UM1 Equal variances assumed	.046	.833	- 1.497-	20	.150	-1.75857-	1.17469	-4.20893-	.69179
PAW-UP1 Equal variances assumed	.185	.672	-.163-	20	.872	-.15248-	.93459	-2.10199-	1.79704
BAW-UP1 Equal variances assumed	2.541	.127	- 1.026-	20	.317	-1.30505-	1.27184	-3.95806-	1.34797
LAW-LM1 Equal variances not assumed	5.582	.028	-.046-	8.102	.965	-.06610-	1.44377	-3.38818-	3.25599
BAW-LM1 Equal variances assumed	.777	.389	-.756-	20	.459	-2.07571-	2.74639	-7.80459-	3.65316
LAW-LP1 Equal variances assumed	.025	.877	1.820	20	.084	2.37667	1.30610	-.34782-	5.10115
BAW-LP1 Equal variances assumed	.008	.932	.900	20	.379	1.07714	1.19700	-1.41975-	3.57404

All the alveolar width measurements for maxillary and mandibular first molar and premolar showed no significant difference between skeletal Class I and Class II female subjects ($\alpha = 0.05$, $P > \alpha$).

Discussion :

This study was carried out to compare the alveolar arch width between skeletal Class II and Class I adult orthodontically untreated subjects. Previous studies had evaluated the alveolar width in dental class II malocclusion (division 1 and 2) and didn't consider the sagittal skeletal relationship of the alveolar bone which might be the cause of the transverse discrepancy and have no subdivisions. Because the dental class II of Angle (division 1 or 2) may exist with different sagittal skeletal relationships of jaws (Class I , II , or III) [50], we decided to isolate the skeletal factor alone and evaluate the alveolar width in skeletal Class II subjects regardless of the dental sagittal relations , and that is what distinguish this study from others and may lead to differences between the results. ANB angle is widely accepted diagnosis standard for sagittal jaw discrepancy and was employed in this research to divide the sample into skeletal Class I and Class II relationships [39-43]. Cephalometric measurements obtained from the CBCT radiographs is a reliable method as proved intensively in other investigations [33, 34].

Dental casts which was the method in all previous studies is a limited tool for assessment of alveolar width , because it wouldn't provide the researcher with the ability of visualizing the whole anatomy of the surrounding bone , while CBCT have the advantage of evaluating real anatomy , true-to-scale images without distortions or superimpositions [51] , and the selection of the desired sections [52] .Thus, using CBCT as the method in our alveolar arch measurements increases the power and accuracy of this study, especially considering the controversial results of earlier investigations and the presence of some contraindications within them .

The sample is of adult subjects aged between 19 and 26 years old . Therefore, we assume that the arch widths of the subjects studied were fully developed[35-38]. No statistically significant differences were found of alveolar widths between skeletal Class II and Class I subjects in both maxillary and mandibular widths of molar and premolar regions . gender had no statistically significant effect in the results of the study .

This result was in contrary to the results of Uysal,et al [12], who found that the maxillary and mandibular alveolar widths was narrower in Class II division 1 and division 2 malocclusions than in normal occlusion except for the lower molar alveolar width in Class II division 2 . Their alveolar width measurement was taken between mucogingival junction landmarks in the maxilla and their projections for the mandible and this would be the reason of the differences between our results and Uysal's along with not isolation of the sagittal skeletal relationship. Another important reason is the fact that the normal occlusion sample in Uysal,et al study included only subjects with minor or no crowding, whereas the absence of crowding was not a criterion in the Class II groups. If a Class I group with crowding would be compared with a Class I group without crowding, most probably narrower arches would be found in the Class I group with crowding. For that reason, group differences in their study may be the result of differences concerning crowding.

Staley, et al [14] compared untreated normal-occlusion subjects with Class II, Division 1 subjects , using mucogingival junction landmarks to measure the alveolar width , and they found that maxillary alveolar widths was narrower in subjects with malocclusion; and only male subjects had a narrower mandibular alveolar widths than the normal occlusion subjects . These results did not coincide with ours, again probably because of sample selection and method of measuring along with the fact that Staley, et al had not mentioned about posterior crossbite in the Class II group. In selecting the subjects, we took into consideration that no posterior crossbites were present. This may be an important factor that can affect the results if Class I patients had no crossbites and some of the Class II patients had crossbites . Class I patients who have well-aligned arches may have posterior crossbites too. If posterior crossbites would not have been taken into consideration in both Class I and Class II subjects, then the results may be affected by other factors and need further investigations.

Sayin and Turkkahraman [13] excluded crossbite subjects from their sample , and they found in their study of alveolar widths of Class I and Class II division 1 malocclusion that no significant differences were found for the alveolar widths between these two groups which coincide with our results .

Another study which came up with a similar results to ours is the study of Shu [24], et al who compared alveolar widths between Class II division 1 malocclusion and Class I occlusion subjects . Their Class II division 1 malocclusion were of skeletal Class II as well , and the normal occlusion sample was also of a skeletal and dental Class I , but as all other studies they used dental casts to measure the alveolar width.

CONCLUSION:

1- CBCT measurements of alveolar width showed No statistically significant differences between skeletal Class II and Class I subjects in both maxillary and mandibular widths of molar and premolar regions .

2- Gender had no statistically significant effect in the results of the study .

3- Our results suggests that the transverse discrepancy in skeletal Class II when exists, it's probably not originated from the alveolar bases .

References:

1. AST, D; CARLOS, J; CONS, D. *Prevalence and characteristics of malocclusion among senior high school students in up-state New York*. Am J Orthod, 1965, 51:437–445.

2. BURGERSDIJK, R; TRUIN, G; FRANKENMOLEN, F; KALSBEEK, H; MULDER, J. *Malocclusion and orthodontic treatment need of 15-74-year-old Dutch adults.* Community Dent Oral Epidemiol, 1991, 19:64–67.

3. TANG, E. *The prevalence of malocclusion amongst Hong Kong male dental students.* Br J Orthod, 1994, 21:57–63.

4. WILLEMS, G; DE BRUYNE, I; VERDONCK, A; FIEUWS, S; CARELS, C. *Prevalence of dentofacial characteristics in a Belgian orthodontic population.* Clin Oral Investig, 2001, 5:220–226.

5. SILVA, R; KANG, D. *Prevalence of malocclusion among Latino adolescents.* Am J Orthod Dentofacial Orthop, 2001, 119:313–315.

6. LAUC, T. *Orofacial analysis on the Adriatic islands: an epidemiological study of malocclusions on Hvar Island.* Eur J Orthod, 2003, 25:273–278.

7. MOYERS, R. *Handbook of Orthodontics.* Chicago, Ill: Year Book Med Publishers, 1988, 191.

8.LINDHE, J. *Clinical periodontology and implant dentistry*: 4th edition.

9.VANARSDALL, R; WHITE, J. *Three-dimensional analysis for skeletal problems.* Int J Adult Orthodon Orthognath Surg, 1994, 9:159.

10. VANARSDALL, R. *Transverse dimension and long-term stability.* Semin Orthod, 1999, 5:171–180.

11.HOWES, A. E. *Expansion as a treatment procedure – Where does it stand today ?* Am. J. Orth., 1960, 46 : 515-534.

12. UYSAL, T. *Dental and Alveolar Arch Widths in Normal Occlusion, Class II division 1 and Class II division 2.* Angle Orthod, 2005, 75:941–947.

13. SAYIN, M. *Comparison of Dental Arch and Alveolar Widths of Patients with Class II, Division 1 Malocclusion and Subjects with Class I Ideal Occlusion.* Angle Orthodontist, Vol 74, No 3, 2004.

14. STALEY, R; STUNTZ, W; PETERSON, L. *A comparison of arch widths in adults with normal occlusion and adults with Class II, division 1 malocclusion.* Am J Orthod, 1985, 88:163–169.

15. TOLLARO, I; BACCETTI, T; FRANCHI, L; TANASESCU, C. *Role of posterior transverse interarch discrepancy in Class II, division 1 malocclusion during the mixed dentition phase.* Am J Orthod Dentofacial Orthop, 1996, 110:417–422.

16. BALL, R; MINER, R; WILL, L; ARAI, K. *Comparison of dental and apical base arch forms in Class II division 1 and Class I malocclusions.* Am J Orthod Dentofacial Orthop, 2010, 138: 41–50.

17.GUPTA, D; MINER, R; ARAI, K; WILL, L. *Comparison of the mandibular dental and basal arch forms in adults and children with Class I and Class II malocclusions.* Am J Orthod Dentofacial Orthop, 2010, 138:10 e11–e18, discussion 10–11.

18. BISHARA, S; BAYATI, P; JAKOBSEN, J. *Longitudinal comparisons of dental arch changes in normal and untreated Class II, Division 1 subjects and their clinical implications.* Am J Orthod Dentofacial Orthop, 1996, 110:483-9.

19. ROBERT, T. *Arch width and form: A review* . Am J Orthod Dentofacial Orthop, 1999, 115:305-13.

20. HAAS, A. *Palatal expansion: just the beginning of dentofacial orthopedics.* Am J Orthod, 1970, 57:219-55.

21.BLACK, G.V. *Descriptive Anatomy Of Human Teeth*. 4th Edition, 1902.

22.THOMPSON, W. M. *A discussion of the distribution of the bone of the alveolar process*. Angle Orthodont, 1933.

23.ORBAN, B. *Oral Histology and Embryology*. St. Louis, mo, Mosby Company , 1953, 176-192 pp.

24. SHU, R. *Comparison of arch width, alveolar width and buccolingual inclination of teeth between Class II division 1 malocclusion and Class I occlusion*. Angle Orthodontist, Vol 83, No 2, 2013.

25.LING, J. *Dental Arch Widths of Southern Chinese*. Angle Orthodontist, 2009.

26. GARINO, F. *Comparison of Dental Arch Measurements Between Stone and Digital Casts.* WORLD JOURNAL OF ORTHODONTICS, VOLUME 3, NUMBER 3, 2002.

27. HUANG, J; BUMANN, A; MAH, J. *Three-dimensional radiographic analysis in orthodontics.* J Clin Orthod, 2005, 39:421-8.

28. FUHRMANN, R; WEHRBEIN, H; LANGEN, H; DIEDRICH, P. *Assessment of the dentate alveolar process with high resolution computed tomography.* Dentomaxillofac Radiol, 1995, 24:50-4.

29. LUDLOW, J; GUBLER, M; CEVIDANES, L; MOL, A. *Precision of cephalometric landmark identification: cone-beam computed tomography vs conventional cephalometric views.* Am J Orthod Dentofacial Orthop, 2009, 136:312.e1-10.

30. MOREIRA, C; SALES, M; LOPES, P; CAVALCANTI, M. *Assessment of linear and angular measurements on threedimensional cone-beam computed tomographic images.* Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 2009.

31. LEEA, K; HYEON-SHIK, H; JIN-HYOUNG, C. *Comparison of transverse analysis between posteroanterior cephalogram and cone-beam computed tomography.* Angle Orthodontist, Vol 84, No 4, 2014.

32. Graber, TM; *Orthodontics current principles and techniques*. 2nd. ed., Mosby Inc., 1994, 528.

33.KUMAR, V; LUDLOW, J; SOARES, L; MOL, A. *In vivo comparison of conventional and cone beam CT synthesized cephalograms.* Angle Orthod, 2008 Sep, 78[5]:873-9.

34.MATTHEW, M; BRENT, L; PHILLIPPE, R; ANDREW, W. *Asymmetry assessment using cone beam CT ,A Class I and Class II patient comparison.* Angle Orthod, 2012, 82:410–417.

35. KNOTT, V. *Size and form of the dental arches in children with good occlusion studied longitudinally from age 9 years to late adolescence.* Am J Phys Anthropol, 1961, 19:263–284.

36. KNOTT, V. *Longitudinal study of dental arch widths at four stages of dentition.* Angle Orthod, 1972, 42:387–394.

37. DEKOCK, W. *Dental arch depth and width studied longitudinally from 12 years of age to adulthood.* Am J Orthod,1972, 62:56–66.

38. SILMAN, J. *Dimensional changes of the dental arches:longitudinal study from birth to 25 years.* Am J Orthod Dentofacial Orthop, 1964, 50:824–842.

39. RIEDEL, R. *The relation of maxillary structures to cranium in malocclusion and in normal occlusion* . Angle Orthodontist, 1952, 22[3]:142-145.

40. STEINER, C.C. *Cephalometrics for you and me.* Am. j. Orthod, 1953, 39: 729.

41. OKTAY, H. *A Comparison of ANB, Wits, AF-BF, and APDI measurements* . Am J Orthod Dentofacial Orthop 1991, 99:122-8.

42. KIRCHNER, J; WILLIAMS, S. *A comparison of five different methods for describing sagittal jaw relationship.* Br J Orthod, 1993, 20:13-7.

43. BOSKOVIC-BRKANOVIC, T; NIKOLIC, Z. *Correlation between five parameters for the assessment of sagittal skeletal Intermaxillary relationship.* Serbian Dental J, 2007, 54:231-9.

44. BONG, K. C; CHUN, H. K; SEUNG, H. B. *Skeletal Sagittal and Vertical Facial Types and Electromyographic Activity of the Masticatory Muscle* . Angle Orthodontist, Vol 77, No 3, 2007.

45. ALKOFIDE, E. *The shape and size of the sella turcica in skeletal Class I, Class II, and Class III Saudi subjects.* European Journal of Orthodontics, 29, 2007, 457–463.

46. Farid, M; Metwalli, N. *Computed tomographic evaluation of mouth breathers among paediatric patients.* Dentomaxillofacial Radiology, 2010, 1–10.

47.Kim, Y; Hong, J; Hwang, Y; Park, Y. *Three-dimensional analysis of pharyngeal airway in preadolescent children with different anteroposterior skeletal patterns.* Am J Orthod Dentofacial Orthop, 2010, 306.e1–306.e11.

48. Ghonaima, A; Kula, K. *Accuracy and reliability of cone-beam computed tomography for airway volume analysis*. European Journal of Orthodontics, 2011, 502-512

49.DA SILVA, M; Gois, B; SANT'ANNA, E. *Evaluation of the reliability of measurements in cephalograms generated from cone beam computed tomography.* Dental Press J. Orthod, vol.18 no.4 Maringá, July/Aug 2013.

50. Mitchell, L. *An Introduction to orthodontics*. 2^{nd} .ed., Oxford University Press, Hong Kong, 2004, 106.

51. FUHRMANN, R; WEHRBEIN, H; LANGEN, H; DIEDRICH, P. *Assessment of the dentate alveolar process with high resolution computed tomography.* Dentomaxillofac Radiol, 1995, 24:50-4.

52. NAUERT, K; BERG, R. *Evaluation of labio-lingual bony support of lower incisors in orthodontically untreated adults with the help of computed tomography.* J Orofac Orthop, 1999, 60:321-34.