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Research Article

Evaluating alveolar bone thickness in upper and lower incisors from orthodontic perspective. A Cone beam computed tomography-based retrospective study

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ABSTRACT

Purpose: This study aimed to assess the thickness of alveolar bone of maxillary and mandibular incisors from orthodontics perspective.
Materials and Method: A total of 73 Cone beam computed tomography for Iraqi patients (47 females and 26 males) were included in this study. The selected images were captured and imported to AutoCAD database software to perform the measurement. To measure alveolar bone thickness, a reference line was drawn through the long axis of each incisor, from the incisal edge to the root apex. Then, labial and lingual/palatal perpendicular lines were drawn to the reference line at 3, 6, and 9mm apically from the cemento-enamel junction (CEJ).
Results: The buccal bone is generally thinner than the lingual/palatal bone. The bone gets relatively thicker closer to the apex. The buccal bone for all lower incisors was less than 1 mm at 3- and 6-mm distance. It was slightly thicker at the central incisor as compared to the lateral at 9-mm distance. Genders have a difference in the thickness of the palatal alveolar bone in their right and left lateral incisors, which are 3mm and 9mm, respectively. Alveolar bone thickness is significantly positively correlated with several teeth.
Conclusions: Males and females in this study showed comparable alveolar bone thickness. The alveolar bone thickness increased with increasing age. It is essential to assess the thickness of alveolar bone pre-orthodontic treatment (especially for patients with thin biotype, and those cases that involve labial proclamation of the lower incisors).

1. INTRODUCTION

The alveolar bone is an essential part of the tooth-supporting apparatus in the maxillofacial skeleton [1]. It is the part of maxilla and mandible that supports the teeth; therefore, a healthy dentition is related to a healthy alveolar bone, periodontal ligament (PDL), and cementum. Morphologically, it has a sandwich structure with a dense outer layer of cortical bone (both facially and lingually), a bundle bone as an inner layer (neighboring the roots of teeth), and a middle layer where the marrow spaces are filled with trabecular bone [2]. Indeed, the resilience and rigidity are furnished due to this distinctive design of alveolar bone [1] .In the maxilla, the cortical bone of the alveolar process is thinner than that in the mandible, and is also thinner anteriorly than posteriorly [2].
In the course of orthodontic tooth movement, the gingiva, [3] PDL [4], and the alveolar bone are exposed to many different changes. [5] Alveolar bone density is changed during orthodontic treatment have been observed in many studies due to the active bone remodeling. [9-6] These changes are determined by the pre-treatment anatomy of dentoalveolar bone and the adaptability of the bone during tooth movement in addition to its morphology after final teeth positioning. The planned tooth movement and the desired final spatial position and angulation of the teeth may be compromised by pre-treatment conditions as well as inadequate adaptation to tooth movement, [10] that are seen as a risk factor for dehiscence and fenestration. [11]
Until the production of three-dimensional (3D) imaging in dentistry, the assessment of labial and lingual alveolar bone was not possible by means other than direct observation by reflecting a flap in the area of interest. [12] In 1996, Fuhrman found

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that lateral cephalograms measurements are overestimated the thickness of labial and lingual bone comparing to direct measurements, expecting that all conventional radiographs like cephalograms, periapicals and panoramics have inadequate accuracy in evaluating alveolar bone tissue compared to cone beam computerized tomography (CBCT) [13]. In addition to their limitations when evaluating the alveolar bone thickness [14].

CBCT images can be used to measure the alveolar bone thickness around the roots [15] .It is generally accepted that CBCT provide sufficient details to display dehiscence and fenestration, and it can accurately detect bony defects [16], although there also other studies which reported a discrepancy in the determination of these defects on CBCT compared to direct observations[17] .

The bone can be evaluated three-dimensionally using CBCT images without the impact of head orientation, image superimpositions, or distortions, and with a relatively low radiation dose[18] That enables the accurate assessment of the labial or lingual alveolar bone thickness which is particularly important to determine the required torque of a specific tooth or teeth, as well as to evaluate any limitations in orthodontic tooth movement [19]

CBCT remains the method that is least invasive with acceptable accuracy for the orthodontists to estimate alveolar bone thickness, in order to achieve the best treatment outcome.

This study was designed to assess the labial and lingual/palatal alveolar bone thickness of lower and upper incisors for consideration of orthodontics treatment and to determine whether there is a difference in alveolar bone thickness regarding patient’s gender and age.

2. MATERIALS AND METHOD

2.1 Study Design

This study was a retrospective study conducted to evaluate CBCT images of adult and adolescent patients who sought dental treatment for a period from 2019 to 2021. The study had been approved by the Scientific Committee of the Department of Orthodontics and the College Council of the College of Dentistry, University of Baghdad.

CBCT images used in this study were selected from patients attending clinic for two reasons; to asses bone thickness or to localize an impacted tooth (for surgical extraction or orthodontic treatment). The same radiographic machine “MyRay Hyperion X9 pro, Made in Italy” was used to obtain CBCT images for all patients. Patients were scanned in upright position in a standard method according to the radiographic machine instructions.

2.2 Study Setting

Samples were collected from patients seeking surgical and orthodontic treatment in a private dental center.

2.3 Subjects

A total number of 120 CBCTs for Iraqi patients were scanned to be included in this study. However, after applying inclusion and exclusion criteria, only 73 CBCTs were included (47 females and 26 males).

A. Inclusion Criteria :

- 15-30 years old patients.
- Not treated orthodontically.
- No signs of alveolar bone loss.
- Adequate quality of CBCT radiographs.

B. Exclusion Criteria

- Cases with a history of endodontic treatment, extensive root resorption, and periapical lesions.
- Mandibular and maxillary anterior teeth are being treated with prosthetics
- Presence of tooth anomalies, such as supernumerary teeth.
- Cases with incomplete demographic records.

2.4 Method: Data Collection Criteria

According to the long axis of mandibular and maxillary incisor, the sagittal images were oriented in the coronal and sagittal planes by following the crown, pulp chamber, and canal. Thereafter, the selected images were captured and imported to AutoCAD (Auto Desk, 2017) database software to complete the measurement.

Magnification corrections was applied on each selected image using the real dimensions scale. To measure alveolar bone thickness, a reference line was drawn from the incisal edge to the root apex through the long axis of each incisor. Then, labial and lingual/palatal perpendicular lines were drawn to the reference line at 3, 6, and 9 mm apical from the cemento-enamel junction (CEJ). The measurements that were used in this study are presented in Table I.

TABLE I. - THE MEASUREMENTS USED IN THIS STUDY

Variables	Variables	Variables	Variables
Ll1-3	Lr2-6	Ll1-p3	Lr2-p6
Ll2-3	Ul1-6	Ll2-p3	Ul1-p6

Variables	Variables	Variables	Variables
Lr1-3	Ur1-6	Lr1-p3	Ur1-p6
Lr2-3	Ll1-9	Lr2-p3	Ll1-p9
Ul1-3	Ll2-9	Ul1-p3	Ll2-p9
Ur1-3	Lr1-9	Ur1-p3	Lr1-p9
Ll1-6	Lr2-9	Ll1-p6	Lr2-p9
Ll2-6	Ul1-9	Ll2-p6	Ul1-p9
Lr1-6	Ur1-9	Lr1-p6	Ur1-p9

Where L: Lower, U: Upper, l: Left, r: Right, Number (1,2): 1: central, 2: lateral, Number (3, 6, 9): The distance of measurement from the cementoenamel junction labially, p: The distance of measurement from the cementoenamel junction palatally.

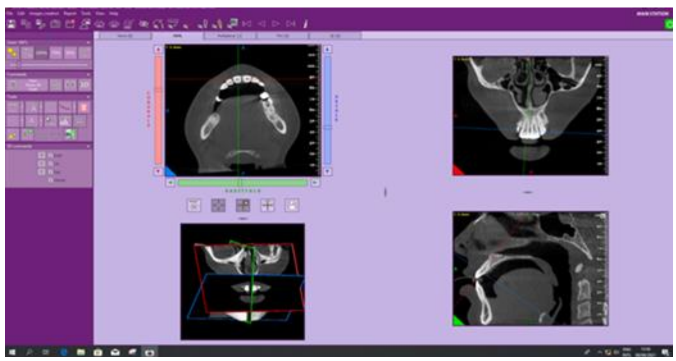

Fig. 1. - The multiplanar reconstruction (MPR) interface of the CBCT software was used to select and capture the images.

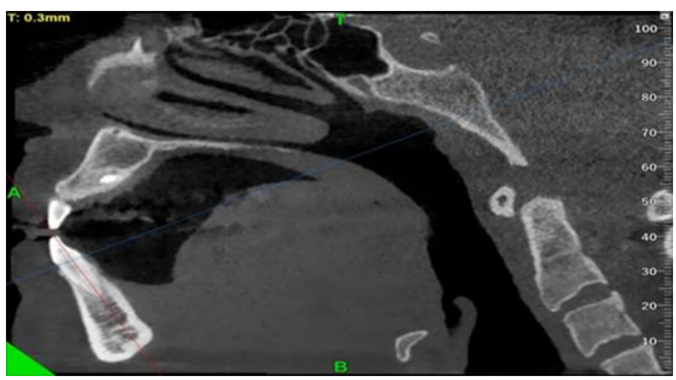

Fig. 2. – By using the CBCT program, the sagittal image was aligned using the long axis of the mandibular incisor, which divided the crown, pulp chamber, and canal in both the sagittal and coronal planes.

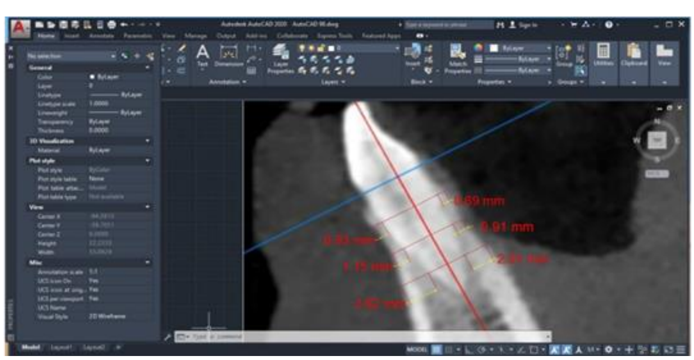

Fig. 3. – The measurement of alveolar bone thickness was made by drawing a line that traversed the long axis of each incisor from the incisal edge to the root apex. Then, labial and lingual perpendicular lines were drawn to the reference line at 3, 6, and 9 mm apical to the CEJ.

2.5 Statistical Analysis

The statistical analyses were performed using the Statistical Package for Social Sciences for Windows, version 25.0 (SPSS Inc., Chicago, Illinois, USA).

- Error Measurement:
  One examiner (LSK) performed all the measurements to minimize variation in accuracy. The calculation of intra-examiner error involved repeating the measurements on 10 subjects within a three-weeks interval. The intra-examiner reliability was assessed using the intra- class correlation coefficient test.
- Descriptive Statistics:
  Data was described using minimum, maximum, mean, and standard deviation. The normality of data distribution was inspected using the Shapiro-Wilk test.
- Inferential Statistics:
  Gender difference was assessed with the independent samples t-test, while Pearson correlation coefficient test was used to assess the correlation of bone thickness with age, and correlation of bone thickness of maxillary and mandibular incisors at each level of measurement. Mann-Whitney U test and Spearman correlation coefficient test were used for not normally distributed data. The level of significance set as $P < 0.05$.

3. RESULTS

3.1 Descriptive Statistics

Table II shows the descriptive statistics of age and the thickness of alveolar bone of maxillary and mandibular incisors labially and lingually according to the depth of measurement. The description of variables according to gender is illustrated in Table III. The buccal bone is generally thinner than the lingual/palatal bone. As we go down toward the apex, the bone gets relatively thicker (Figure 4 to Figure 7), with the most prominent increase at the palatal side of the maxillary central incisors. The buccal bone for all lower incisors was less than 1 mm at 3- and 6-mm distance. It was slightly thicker at the central incisor as compared to the lateral at 9-mm distance.

TABLE II. - DESCRIPTIVE STATISTICS OF THE STUDY VARIABLES

Variables	N	Min.	Max.	Mean	SD	Variables	N	Min.	Max.	Mean	SD
Age	71	15	30	23.85	4.04						
Ll1-3	59	0	2	0.45	0.55	Ll1-p3	59	0	1.62	0.62	0.47
Ll2-3	59	0	2.04	0.53	0.64	Ll2-p3	59	0	2.11	1.01	0.59
Lr1-3	59	0	1.82	0.43	0.51	Lr1-p3	59	0	7.87	0.77	1.07
Lr2-3	58	0	1.99	0.52	0.56	Lr2-p3	58	0	3.68	1.19	0.74
Ll1-6	59	0	2.12	0.67	0.58	Ll1-p6	59	0	2.67	1.01	0.59
Ll2-6	58	0	2.21	0.49	0.55	Ll2-p6	59	0	3.56	1.51	0.9
Lr1-6	58	0	2.57	0.65	0.55	Lr1-p6	59	0	2.3	0.92	0.67
Lr2-6	57	0	2.27	0.58	0.58	Lr2-p6	58	0	5.12	1.79	0.98
Ll1-9	59	0	5.97	1.87	1.15	Ll1-p9	58	0	4.42	1.77	0.79
Ll2-9	58	0	3.26	1.45	0.76	Ll2-p9	59	0	4.82	2.04	1.07
Lr1-9	59	0	7.77	1.84	1.4	Lr1-p9	59	0	3.97	1.68	0.92
Lr2-9	58	0	4.48	1.4	0.94	Lr2-p9	58	0	4.91	2.24	1.07
Ul1-3	62	0	5.61	1.18	0.69	Ul1-p3	62	0	6.75	1.91	0.94
Ur1-3	61	0	6.71	1.29	0.91	Ur1-p3	61	0	3.49	1.84	0.73
Ul1-6	62	0	6.45	1.11	0.78	Ul1-p6	62	1.02	6.45	3.28	1.15
Ur1-6	61	0.3	6.22	1.14	0.75	Ur1-p6	61	0.94	7.75	3.31	1.23
Ul1-9	62	0.34	2.43	1.15	0.45	Ul1-p9	62	1.57	10.19	4.99	1.74
Ur1-9	61	0.31	6.11	1.3	0.78	Ur1-p9	61	1.86	9.18	5.01	1.54

TABLE III. - DESCRIPTIVE STATISTICS OF THE STUDY VARIABLES ACCORDING TO GENDER.

Variables	Gender	N	Mean	SD	Variables	Gender	N	Mean	SD
Ll1-3	M	22	0.37	0.61	Ll1-p3	M	22	0.5	0.47
	F	37	0.5	0.52		F	37	0.69	0.46
Ll2-3	M	20	0.46	0.67	Ll2-p3	M	20	0.9	0.68
	F	39	0.56	0.63		F	39	1.07	0.55
Lr1-3	M	21	0.45	0.57	Lr1-p3	M	21	0.54	0.49
	F	38	0.42	0.48		F	38	0.9	1.27
Lr2-3	M	22	0.55	0.66	Lr2-p3	M	22	0.96	0.7
	F	36	0.51	0.5		F	36	1.34	0.74
Ll1-6	M	22	0.7	0.67	Ll1-p6	M	22	0.83	0.68
	F	37	0.65	0.53		F	37	1.12	0.51

Ll2-6	M	20	0.57	0.61	Ll2-p6	M	20	1.26	0.93
	F	38	0.44	0.52		F	39	1.63	0.87
Lr1-6	M	20	0.74	0.61	Lr1-p6	M	21	0.79	0.59
	F	38	0.61	0.52		F	38	1	0.71
Lr2-6	M	22	0.71	0.64	Lr2-p6	M	22	1.56	1.09
	F	35	0.5	0.53		F	36	1.93	0.88
Ll1-9	M	22	1.92	1.09	Ll1-p9	M	21	1.52	0.73
	F	37	1.85	1.2		F	37	1.91	0.79
Ll2-9	M	20	1.53	0.75	Ll2-p9	M	20	1.59	0.89
	F	38	1.4	0.77		F	39	2.26	1.09
Lr1-9	M	21	1.76	1.34	Lr1-p9	M	21	1.56	0.66
	F	38	1.89	1.45		F	38	1.74	1.04
Lr2-9	M	22	1.31	1	Lr2-p9	M	22	2.13	0.84
	F	36	1.46	0.92		F	36	2.3	1.2
Ul1-3	M	22	1.29	1.01	Ul1-p3	M	22	2.07	0.64
	F	40	1.12	0.43		F	40	1.83	1.07
Ur1-3	M	21	1.24	0.81	Ur1-p3	M	21	2.13	0.72
	F	40	1.32	0.97		F	40	1.69	0.7
Ul1-6	M	22	1.3	1.2	Ul1-p6	M	22	3.47	1.06
	F	40	1.01	0.39		F	40	3.17	1.19
Ur1-6	M	21	1.31	1.17	Ur1-p6	M	21	3.73	1.4
	F	40	1.06	0.38		F	40	3.09	1.08
Ul1-9	M	22	1.13	0.45	Ul1-p9	M	22	5.16	1.66
	F	40	1.16	0.46		F	40	4.9	1.79
Ur1-9	M	21	1.46	1.13	Ur1-p9	M	21	5.03	1.78
	F	40	1.22	0.5		F	40	5	1.42

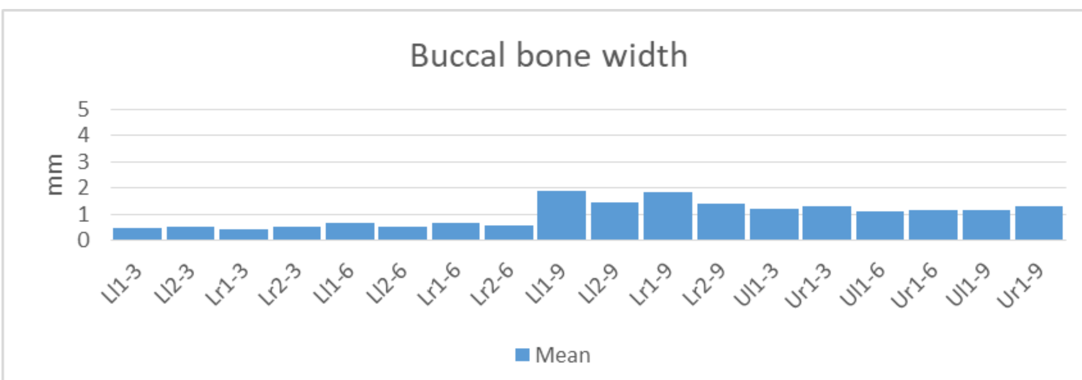

Fig. 4. – The buccal width of alveolar bone.

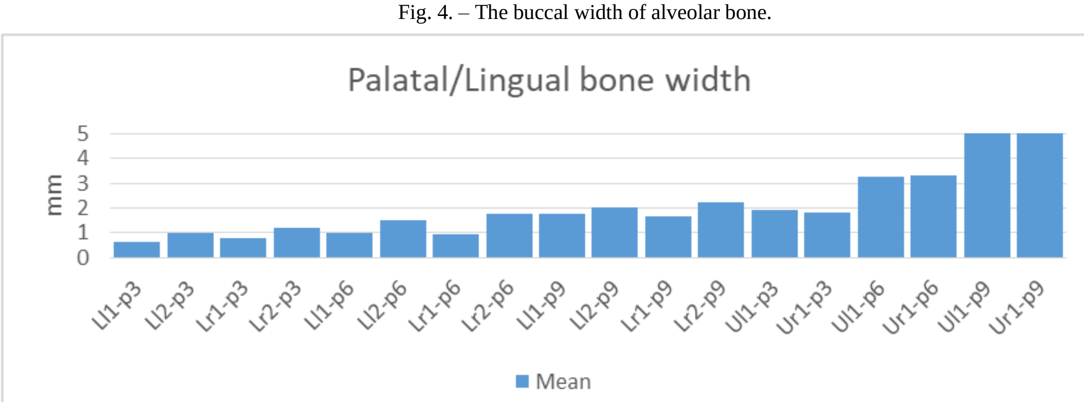

Fig. 5. – The palatal/lingual width of alveolar bone.

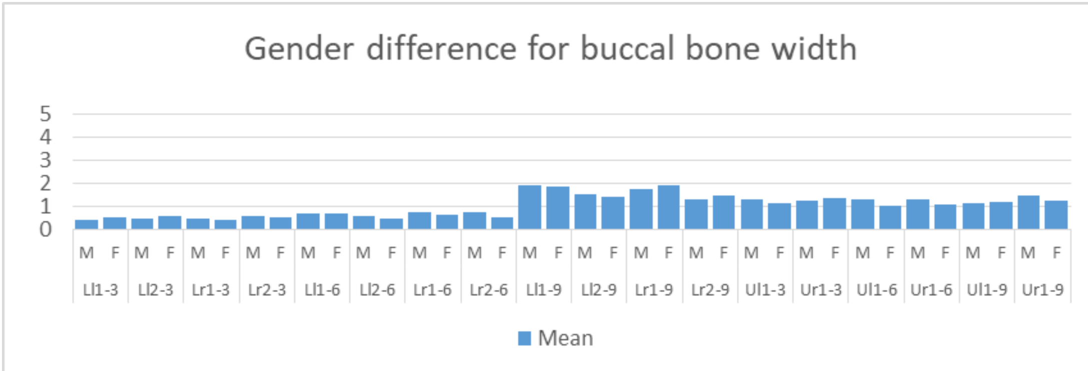

Fig. 6. – Gender difference of buccal alveolar bone width.

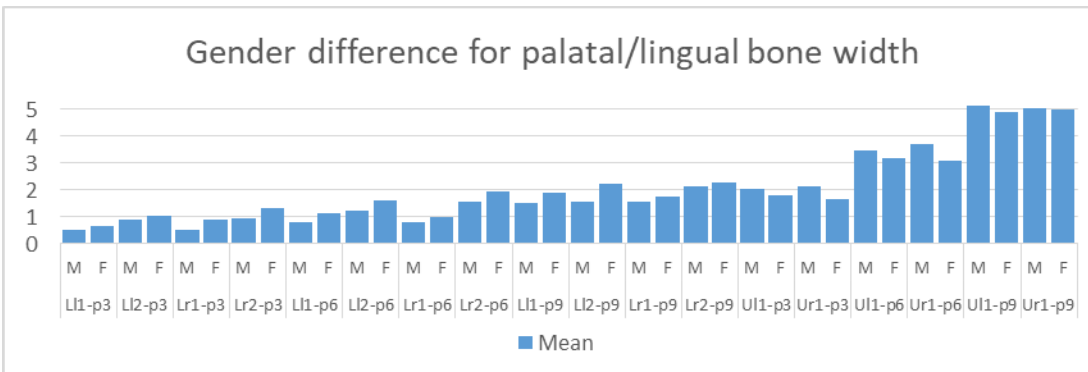

Fig. 7. – Gender difference of palatal/lingual alveolar bone width.

3.2 Reliability of Measurement

The intraclass correlation coefficient revealed excellent agreement (99.6%).

3.3 Normality of Data

The result of the Shapiro Wilk test revealed that some measurements were not normally distributed, namely: Ll1-3, Ll2-3, Lr1-3, Lr2-3, Ll1-6, Ll2-6, Lr1-3, Lr2-3, Ll1-9, Lr1-9, Ll1-p3, Ll2-p3, Lr1-p3, Ul1-p3, Lr1-p6, Ll1-p9.

3.4 Gender Difference

Comparison of alveolar bone thickness between genders is presented in (Table IV) Statistically significant differences were only observed in thickness of palatal alveolar bone of maxillary right central incisor at 3mm and mandibular left lateral incisor at 9mm. Mann-Whitney U test was used along with the independent samples t-test for the not normally distributed data and similar results were revealed.

3.5 Bone Thickness with Age

Pearson correlation coefficient test revealed that alveolar bone thickness is significantly positively correlated with Ll1-3, Ll2-3, Lr2-3, Ul1-3, Ur1-3, Ll1-p3, Lr2-p3, Ur1-p3, Ll1-p6, Lr1-p6, Lr1-p9, and Lr2-p9. While, there is a significant negative with Lr2-9 only (Table V). Spearman correlation coefficient test was used for the not normally distributed data and similar results were found except for the Lr1-p3 which showed a positive significant correlation.

TABLE IV. - INDEPENDENT-SAMPLES T-TEST OF EACH VARIABLE BETWEEN GENDERS

Variables	t-test for Equality of Means						
	t	Df	p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Ll1-3	-0.923	57	0.360	-0.14	0.15	-0.44	0.16
Ll2-3	-0.581	57	0.563	-0.10	0.18	-0.46	0.25
Lr1-3	0.226	57	0.822	0.03	0.14	-0.25	0.31
Lr2-3	0.268	56	0.790	0.04	0.15	-0.27	0.35
Ul1-3	0.931	60	0.356	0.17	0.18	-0.20	0.54
Ur1-3	-0.294	59	0.770	-0.07	0.25	-0.57	0.42

Ll1-6	0.354	57	0.725	0.06	0.16	-0.26	0.37
Ll2-6	0.870	56	0.388	0.13	0.15	-0.17	0.44
Lr1-6	0.896	56	0.374	0.14	0.15	-0.17	0.44
Lr2-6	1.377	55	0.174	0.22	0.16	-0.10	0.53
Ul1-6	1.429	60	0.158	0.29	0.21	-0.12	0.71
Ur1-6	1.281	59	0.205	0.26	0.20	-0.15	0.66
Ll1-9	0.215	57	0.830	0.07	0.31	-0.56	0.69
Ll2-9	0.634	56	0.529	0.13	0.21	-0.29	0.55
Lr1-9	-0.345	57	0.732	-0.13	0.38	-0.90	0.64
Lr2-9	-0.564	56	0.575	-0.14	0.26	-0.66	0.37
Ul1-9	-0.246	60	0.806	-0.03	0.12	-0.27	0.21
Ur1-9	1.180	59	0.243	0.25	0.21	-0.17	0.66
Ll1-p3	-1.552	57	0.126	-0.19	0.13	-0.45	0.06
Ll2-p3	-1.065	57	0.292	-0.17	0.16	-0.50	0.15
Lr1-p3	-1.261	57	0.212	-0.36	0.29	-0.94	0.21
Lr2-p3	-1.897	56	0.063	-0.37	0.20	-0.76	0.02
Ul1-p3	0.983	60	0.330	0.25	0.25	-0.25	0.75
Ur1-p3	2.286	59	**0.026***	0.44	0.19	0.05	0.82
Ll1-p6	-1.821	57	0.074	-0.28	0.16	-0.60	0.03
Ll2-p6	-1.525	57	0.133	-0.37	0.24	-0.86	0.12
Lr1-p6	-1.150	57	0.255	-0.21	0.18	-0.58	0.16
Lr2-p6	-1.420	56	0.161	-0.37	0.26	-0.90	0.15
Ul1-p6	0.986	60	0.328	0.30	0.30	-0.31	0.91
Ur1-p6	1.992	59	0.051	0.64	0.32	0.00	1.29
Ll1-p9	-1.862	56	0.068	-0.39	0.21	-0.81	0.03
Ll2-p9	-2.374	57	**0.021***	-0.67	0.28	-1.23	-0.10
Lr1-p9	-0.723	57	0.473	-0.18	0.25	-0.68	0.32
Lr2-p9	-0.583	56	0.562	-0.17	0.29	-0.75	0.41
Ul1-p9	0.561	60	0.577	0.26	0.46	-0.67	1.19
Ur1-p9	0.061	59	0.951	0.03	0.42	-0.81	0.86

TABLE V. - PEARSON CORRELATION COEFFICIENT OF EACH VARIABLE WITH AGE

Ll1-3	R	0.303	Ll1-9	r	-0.218	Ll1-p6	r	0.308
	p	**0.020***		p	0.098		p	**0.017***
	N	59		N	59		N	59
Ll2-3	R	0.414	Ll2-9	r	-0.020	Ll2-p6	r	0.202
	p	**0.001****		p	0.884		p	0.124
	N	59		N	58		N	59
Lr1-3	R	0.154	Lr1-9	r	-0.135	Lr1-p6	r	0.316
	p	0.245		p	0.307		p	**0.015***
	N	59		N	59		N	59
Lr2-3	R	0.338	Lr2-9	r	-0.274	Lr2-p6	r	0.234
	p	**0.009****		p	**0.037***		p	0.077
	N	58		N	58		N	58
Ul1-3	R	0.348	Ul1-9	r	-0.099	Ul1-p6	r	0.100
	p	**0.005****		p	0.442		p	0.441
	N	63		N	62		N	62
Ur1-3	r	0.319	Ur1-9	r	-0.109	Ur1-p6	r	0.103
	p	**0.012***		p	0.403		p	0.430
	N	61		N	61		N	61
Ll1-6	r	-0.048	Ll1-p3	r	0.267	Ll1-p9	r	0.201
	p	0.719		p	**0.041***		p	0.130
	N	59		N	59		N	58
Ll2-6	r	0.107	Ll2-p3	r	0.204	Ll2-p9	r	0.206
	p	0.425		p	0.121		p	0.117
	N	58		N	59		N	59
Lr1-6	r	-0.196	Lr1-p3	r	0.123	Lr1-p9	r	0.368
	p	0.140		p	0.353		p	**0.004****

	N	58		N	59		N	59
Lr2-6	r	0.015	Lr2-p3	r	0.335	Lr2-p9	r	0.276
	p	0.909		p	**0.010***		p	**0.036***
	N	57		N	58		N	58
Ul1-6	r	0.241	Ul1-p3	r	-0.140	Ul1-p9	r	0.156
	p	0.057		p	0.279		p	0.227
	N	63		N	62		N	62
Ur1-6	r	0.228	Ur1-p3	r	0.281	Ur1-p9	r	0.194
	p	0.077		p	0.028*		p	0.133
	N	61		N	62		N	61

4. DISCUSSION

The anterior bone plays an essential role in the decision of movement of the incisors in the anteroposterior and vertical dimensions. This study investigated the average horizontal width of labial and lingual/palatal alveolar bone in male and female in the second and third decades of life (average age 23.85 years; range 15-30 years), who had no signs of alveolar bone loss and no previous orthodontic treatment. For simplification purposes, measurements were made relative to the CEJ, not to the alveolar bone crest; bearing in mind that normally the distance between CEJ and the alveolar bone crest is within 2-mm[20] Therefore, the absence of bone thickness at levels more than 3-mm highlights the possibility of dehiscence and fenestration. According to this study, the thickness of the buccal bone of the anterior teeth is thinner than the palatal wall this agrees with Januario et al. (2011) [21] and Fuentes et al (2015)[22]. Twenty percent of the sample have bone thickness less than 0.5-mm at 3-mm depth from the CEJ, and around 8% have bone thickness less than 0.5-mm at 6-mm depth.

4.1 Gender Difference

Non-significant difference was found between all measurements except for the maxillary right central incisor at 3-mm (palatally) and mandibular left lateral incisor at 9-mm (palatally), which is of little clinical significance. This agrees with the results of other studies [20,23]. Differences in the variability of the sample and population of interest caused a conflict result.

4.2 Bone Thickness with Age

Alveolar bone thickness for many sites had significant positive correlation with age. It is worth noting that all measurements at 9-mm depth had negative correlation, but only the Lr2-9 had a significant negative correlation. This may be explained by that the sample of our study included teenagers and young adults, while other studies included elderly subjects (over 65). The negative correlation could reflect the change in the inclination of the incisors that occurs as a result of facial growth and maturation after 18 years of age.

Studies by Januario et al. (2011) [21] and Nowzari et al. (2012) [23] found no correlation between age and facial plate thickness; which may be attributed to different sample as pointed out.

Evidence suggests that orthodontic treatment can cause the loss of periodontal support when plaque and inflammation are present [24]. Periodontal complications, dehiscence, and fenestration can be attributed to the the alveolar bone thickness reduction around the roots of mandibular incisors caused by orthodontic treatments that result in pronounced labial inclinations of mandibular incisors. [27-25][11] Thus, orthodontic patients with thin soft-tissue margins must be treated with caution before treatment, since buccal tooth movement may decrease the gingival tissue resistance to brushing trauma and plaque.

4.3 Study implications for clinical practice

To ensure functional and aesthetic purposes, it is crucial to analyze the alveolar bone initial morphology and the position of mandibular incisor as they are critical for lips fullness, overbite stability, and face attractiveness. The decision on the extent of mandibular incisors movment or the impact of tooth movement on the bone is a significant factor in treatment planning.

The findings of the current study showed that there is a high prevalence of thin buccal alveolar bone among our potential patients. This highlights the importance of proper examination of the patients prior to the initiation of treatment as well as throughout treatment, with special concern for those cases with thin biotype, cases that are to be treated by non-extraction approach and any other case involving anteroposterior movement.

4.4 Limitation of the study

The study was performed retrospectively, using present patient pretreatment radiographs to perform measurements and analysis, therefore some records were not available.

5. CONCLUSIONS

- Males and females in the current study showed comparable thickness of alveolar bone.
- The alveolar bone thickness increased with increasing age in young adults below 30 years of age.
- It is necessary to evaluate the alveolar bone thickness pre orthodontic treatment, with special regards for patients with thin biotype, and those cases that involve labial proclination of the lower incisors to avoid iatrogenic effects and to ensure treatment success.

6. SUGGESTIONS

A prospective study that uses strict criteria and high-quality patient records. with increased sample size to explore the effect of confounding variables on alveolar bone thickness

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Conflicts of Interest:

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