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Estimation and Comparative Evaluation of Crown Mesiodistal Angulation in Angle Class I Canine Molar Relation of Iraqi Populations

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Abstract

Aims of the study: to assess the crowns' mesiodistal angulation in angle class I canines and molars relationship; provide normative data for tipping values of Iraqi populations.

Materials and Methods: 240 maxillary and mandibular dental casts of young people (18-24 years) with normal class I occlusion was used to assess mesiodistal tooth angulation. Data was examined and for each measurement, the mean and standard deviation were determined. At a significant level of ($p \leq 0.05$), the paired t-test, independent t-test and student t-test were utilized for the comparison.

Results: There were no significant differences between the right and left quadrants of the studied study sample related to the tooth mesiodistal angulation results for the adult population of Iraq. The Iraqi mesiodistal angulation data were merged because there was generally no significant variation between the male and female samples. However, there were significant differences between the combined Iraqi data and the published data when they were compared.

Conclusion: Comparing the crown mesiodistal angulations data of Iraqi population to North American, Italian, African, Japanese, Indian, and Saudi data revealed statistically significant differences. We concluded that however offering bracket recommendations, ethnic differences should be taken in consideration.

Introduction:

The achievement of a functional occlusion, stability, and beauty are the objectives of orthodontic therapy. The facial profile, buccolingual inclination, and mesiodistal angulation of the anterior teeth all affect the aesthetic function. Evaluation of tooth angulation is crucial, especially in the anterior teeth because they have the longest crowns and so have a significant impact on aesthetics. Whether or not the right and left anterior teeth are symmetrical, the mesiodistal angulation of the teeth affects how aesthetically pleasing a smile is. (1). Effective treatment methods and highly precise treatment outcomes are the product of careful treatment planning and dedicated bracket prescribing based on the demands of the patient. Furthermore, finishing the tip and torque can take less time with the right bracket prescriptions. (2). Crown angulation refers to angulation (or tip) of the long axis of the crown, not to angulation of the long axis of the entire tooth. As orthodontists, we work specifically with the crowns of teeth and, therefore, crowns represent the clinical base , the cervical portion of the long axis of each crown was distal to the incisal portion, varying with the individual tooth type. The long axis of the crown for all teeth, except molars, is judged to be the mid developmental ridge, which is the most prominent and centremost vertical portion of the labial or buccal surface of the crown. The long axis of the molar crown is identified by the dominant vertical groove on the buccal surface of the crown.(3)

Crown mesiodistal angulation is expressed in degrees, plus or minus. The degree of crown mesiodistal angulation is the angle between the long axis of the crown (as viewed from the labial or buccal surface) and a line bearing 90 degrees from the occlusal plane. A "plus reading" is established when the incisal portion of the long axis of the crown is mesial to the gingival portion. A "minus reading" is given when the incisal portion of the long axis of the crown is distal to the gingival portion.(4)

Teeth appeared to have a variation in the amount of mesiodistal angulation that is very essential for optimum spreading of occlusal stress, however; the teeth showed abnormal angulation in malocclusion cases so that examination of the mesiodistal angulation of specific dentitions is an important factor that help in the clinical diagnosis of dental abnormalities.(5)

The amount of mesiodistal angulation of anterior teeth as the treatment results of straight wire technique depends on the position of the bracket attached to the clinical crown and the use of a large rectangular arch wire in the finishing stage.(1)

In 1972, Andrews utilized a protractor to measure the mesiodistal angulation and torque angulations. The tip was the angle formed between the clinical crown’s long axis (LACC) and the line perpendicular to the occlusal plane.(6)

For North American whites, Andrews invented the estimation of mesiodistal and labiolingual values in 1972 and termed it "bracket prescriptions" and In order to achieve the best aesthetic results, he invented the straight wire and produced it in 1979.(7)

Andrews’s first key to normal occlusion indicated that the distal surface of the distobuccal cusp of the first permanent molar in the maxillary arch made contact and occluded with the mesial surface of the mesiobuccal cusp of the second molar tooth in the mandibular arch. Furthermore, the mesiobuccal cusp of the upper first molar should rest into the groove between the mesial and middle cusps of the mandibular first molar, which is consistent with Angle’s definition of a class I molar relationship, however mesial incline of the upper canine overlaps the distal slope of the lower canine (The maxillary canine occludes between the mandibular canine and first premolar) characterize Class I canine relation(8).

In the present research, the crown mesiodistal angulation readings of the adult Iraqi population with a normal class I occlusion, were measured and consistent to assess any potential racial differences, and compare the results with other outcome ethnic groups that have been circulated.

Materials and Methods

The sample selection

Retrospective study consisted of (120) adults (60 females and 60 males) aged between (18-24) years. The selected casts were chosen from clinical examination of (318) adult casts at AL- Noor specialized Dental center /Mosul, Iraq through five months. The casts found to represent different socioeconomic of the Iraqi population.

Sample size: Retrospective Cross sectional study of 120 patient the sample size was calculated based on single mean formula[**n = (z r/d)2]**.(9)

n = sample subjects, z= (constant) = 1.96 for 95% confidence, r= (standard deviation) = 1.1, d (precision) = 0.2 unit. The resulted number was adjusted, and the final sample size= 120

Sample choice was based on the inclusion criteria:

1. Angle's Class I molar and canine relationships.
2. 1 mm < overbite and overjet < 4 mm.
3. Slight tooth size - arch length discrepancy (< 3 mm crowding, < 1 mm spacing).
4. Flat or slight curve of Spee (< 2 mm).
5. Absence of cross bite or dental midline deviation.
6. Normal tooth size and shape of Permanent dentition.
7. No previous orthodontic treatment.

The study excluded participants with an unattractive profile, abnormal occlusion, deformed, fractured, badly broken teeth, and unbalanced occlusion.

The methodology

Blue hard stone was used to create standardized trimmed orthodontic dental casts from each of the chosen patients.

Measuring device

The torque angulation device (IN-tendo, Chaing Mai, Thailand), which comprises a flat metal base with a mirror-finished working area, a vertical shaft, a measuring compartment, and a model holder Fig.(1), was used as an manual protractor(10).

In order to retain the dental cast and modify the occlusal plane's horizontal level, the model holder features a flat metal base that slides over the flat work surface. It also has an adjustable table with three arms.

The measuring blade in the compartment has a mark in the centre of the blade's tip. Two knobs, the first for vertical motion and the second for rotation from right to left to control the movement of the measuring blade. To adjust the height, the measuring compartment can be raised and lowered on the vertical shaft, and the screw can be used to lock it in place.

Method of measurements

Three skilled orthodontists reviewed the research casts and eliminated any subjects that did not meet the requirements for inclusion. To reduce errors, the same researcher (F.B.) conducted all measurements. A pilot study of 20 randomly chosen study casts was used to determine the intra-observer reliability, and highly reliable correlation values (75-99%) were obtained.

The long axis of the clinical crown (LACC) and the midpoint of the clinical crown for each tooth were marked on the maxillary and mandibular standardized study models(L. F. S. Andrews & San, 1972). On the facial surface of the clinical crown, the LACC was defined with a hard pencil for the incisors, canine, and premolar teeth; The buccal groove was delineated for the molars. By dividing the height of the clinical crown in half, the crown mid- point was identified in the centre of the LACC of each tooth Fig.(2).

Then, Adjustable table top was used to secure the cast's base, which had been marked with a pencil. The occlusal surfaces of the dentition were facing upward, and the occlusal plane was parallel to the metal base's working surface. The cast holder was then moved in the direction of the measuring compartment.

The height adjustment was then made to the measurement compartment. The teeth's convex buccal surface was contacted by the measuring blade's tip (according to the

measurement technique demands). The midpoint of the clinical crown served as the reference point for the marking on the tip of the gauging blade Fig.(3). We made sure there was a tight fit between the tip of the measuring blade and the buccal surface of the tooth by sliding the blade to the right or left to align it with the designated LACC line. The tooth mesiodistal angulation was measured in this phase. Fig.(4)

However, Tip values that were negative denoted distal tipping of crown, whereas those that were positive denoted mesial tipping of the crown. The central incisor, then the lateral incisors, the canine, the premolars, and finally the molars, all received this procedure. Dental casts were divided into four equal quadrants, each of which was measured separately. The measurements of the maxillary right quadrant were conducted first, followed by the maxillary left quadrant, and afterwards the mandibular left quadrant. Lastly, the measurements concluded with the mandibular right quadrant.

Statistical analysis of the data

All measurements were arranged in rows using Microsoft excel software (14.0.4760.1000) all managements of the records sample were completed and classified in tables final measurement records.

For teeth angulations, The mean, standard deviation, and standard error were calculated using IBM SPSS statics (version 26).

Measurements were presented as mean ± SD and range. The 95% confidence limits were calculated for each tooth separately and are presented along with the mean and standard deviation.

The criterion of significance for this investigation was established at $P \leq 0.05$. For this investigation, a sample size of 240 participants was determined statistically. We employed the dependent paired t test and Pearson's correlation coefficient (r) to analyse the intra-examiner reliability.

About 560 variables of mesiodistal angulation values were measured during a two-week period on 20casts that were chosen at random. The same operator performed all measurements. For the 240 sets of dental casts, the mean and standard deviation were determined. The Kolmogorov-Smirnov test was used to determine whether the measurements were normal. A paired t-test assessed the variations between the two sides (right and left) at a significance threshold of $P < 0.05$, whereas an independent t-test assessed the variation between the male and female. The mesiodistal angulation values between this study's data and the formerly published data were compared using a student t-test. The mean and standard deviation are there.

Results

UR1 stands for the upper right central incisor, and measurements were shown in quadrants going from the central incisor to the second molar. There was no statistically significant difference between the first and second measurements ($P \leq 0.05$). The mesiodistal angulation values had a very high correlation coefficient between the two data Table(1)

Table(1) show the mean, standard deviation, p-value, and correlation coefficient (r) for mesiodistal angulation values of repeated measurements for 20 sets of dental casts determined within an interval of two weeks.

Table(2)shows the paired t tests mean, standard deviation, and P-values. These data points are utilized to compare the mesiodistal angulation values both the upper and lower teeth between the left and right side of dentition. No teeth showed statistically significant ($P \leq 0.05$) differences between the two sides.

Table(3) shows the independent t-test mean, SD, and P-values. These values were utilized to compare inter gender tip values ($P \leq 0.05$). With the exception of (U3), (U7),(L1),(L3) and (L4), no evident difference between tip values between genders were found. Fig.(5) shows the tip values for both genders.

In order to ease comparison with existing research, the data obtained from Iraqi adults was merged and given separately

for upper and lower teeth, as there were no significant variations seen in tip values between males and females. The cumulative data amounts to a sum of 240 teeth samples. Table(4)

Comparing the mesiodistal angulation values between Iraqi data and other ethnic groups showed significant differences and the upper molars in north American population have higher tipping values than Iraqi populations.

Table(5) shows the mean, standard deviation, and the p-values for the comparison between Iraqi data and North American whites, Italian, African, Japanese, Saudi and Indian published data. Significant differences were observed while comparing the values of mesiodistal angulation between the Iraqi dataset and the published dataset. When compared to the North Americans, Andrews data regarding upper posterior teeth shows a higher tip value.

For the lower molars, the greatest tip values were seen in Italians and Africans while Iraqi value of (L3) is the lowest among all the previous data . However, little variation in the mesiodistal angulation values were shown for (L2) between Iraqi and African, (L4) between Iraqi and North American and for (L5) between Iraqi and Indian and as show in table(5).

the variation between Iraqi tip value of maxillary and mandibular teeth with previous published data was shown in Fig.(6) and Fig.(7) respectively.

Discussion

The mesiodistal angulation values were measured using the torque angulation device (TAD) in this investigation, which was conducted on dental casts of adult Iraqis. For repeated measurements, TAD was accurate to within 0.1, while also being compact and easy to use (10).TAD was also utilized in a similar manner in a research of Northern Thais by Jotikasthira to determine torque and tooth tip (11). Future research utilizing the same study samples will required for a new measurement approach to obtain the prominence values necessary to finish the bracket prescription.

According to published accounts, Andrews manually measured the torque and tip values of North American whites in the late 1970s using dental casts and a protractor (12). In the same way, other investigators furthermore utilized a protractor to manually calculate these values for Indians (13,14) and Japanese (15) with an accuracy of 0.5. On the other hand, Tong utilized CBCT scans to calculate the inclination and the angulation of the dentition(16). For the Italian and African study populations, Lombardo employed computerized digital casts(17). TAD has the advantage of being used for angulation and inclination measurements directly from study casts, with additional precise readings than the protractor, because of the impaired precision of manual calculations from study casts and the radiation exposure in CBCT scan.

Houston made a distinction between systematic and random measuring errors(18). The present study utilized a sample of 20 randomly selected sets of dental casts, with repeated measurements collected at two-week intervals. The primary objective was to evaluate the consistency of the obtained data and intra-examiner reliability. Our error values matched those of earlier studies by Jotikasthira(11), Nouri(19).

Similar to the Andrews straight wire bracket (SWA)(20), Roth prescription(21), and MBT values(22), prescription of the produced brackets is frequently offered as collective values without distinctions between male and female or left and right sides. In agreement with this, the current investigation integrated measurements of mesiodistal angulation values without any apparent changes. when comparing the right and left sides of the dental arch (table 2), we found no statistically significant differences and this agree with Lombardo.(23)

When comparing male and female Iraqis, the current study found that males had greater tip values. however, the lower lateral incisor (L2) more distally angulated

in males than females while the mandibular canine (L3) more angulated misally in males than females. (table 3)

The findings of Ferrario who discovered sexual dimorphism in tooth tip and torque, supported this. Additionally, the clinical crown height of the male and female differed, with the female having a shorter clinical crown than the male(24).

It has been noted that dental angulation and inclination changes with age.(25), but the age of the study sample of the current research was not taken into account. Interpreting the results is therefore challenging. The measured data for the Iraqi adults were merged and given for both the maxillary and mandibular teeth to make it easier to compare with previously published material.

The collective data equates to a total of (240) teeth. The right and left sides, as well as the male and female data, were merged in this study, and the upper and lower quadrants were presented Table(4)

The mesiodistal angulation reading of this study will be compared to the North American whites data of Andrews (20), Italian and African data of Lombardo (23), Japanese data of Watanabe(15), Saudi data of Bukhary (26)and the Indian data of Doodamani(27).

All of the teeth showed statistically significant variations between the Iraqi and Italian data reported by Lombardo (23) Generally, higher tip values were found in the Italian population upper teeth than the Iraqi population except (U7) who showed higher tip value in Iraqi population. On the other hand, the lower teeth of Iraqi population had less tip values than Italian population.(table 5)

The present investigation demonstrated statistically significant variations in all tip values when comparing it with African values. However , the tipping value of (U4) of Iraqi population are close to that of African population while the (L7) show less tipping value in Iraqi population than the African(23) Table(5).

There were statistical differences in most of the readings when comparing the Iraqi and Indian values of bracket prescription. The tipping values for the U2 and L5 teeth being close to each other. Also in the Indian population, the mesial tipping values for the U7 tooth were higher (14)

When comparing Andrews' original data, Andrews' data of 1988, F. Bukhary' data, Watanabe's data, Doodamani' data, and Lombardo' data with this maxillary angulation readings, we can conclude that our readings for the central incisor(U1) are in closest agreement with Japanese's data.(15)

The current study readings for the maxillary lateral incisor (U2) best match with Indian population ; maxillary first premolar (U4) close to the African ' data and first molar (U6) readings close to Japanese' data ..

maxillary first premolar (U4) close to the African' data but upper second premolar (U5) and first molar (U6) readings close to Japanese' data. upper second molar(U7) is best match with African data.

On comparison of Andrews' original data, Andrews' data of 1988, F. Bukhary' data, Doodamani' data, Watanabe's data, and Lombardo' data with this mandibular angulation readings we can say that our readings for the mandibular central incisor (L1) and lateral incisor (L2) are in closest agreement with African' data by Lombardo .

Our reading for mandibular canine(L3) showed less value compared to previous published data .

the first premolar tip (L4) value is near to North America and Saudi' data. Mandibular second premolar (L5) is more compatible with Indian population by Doodamani' study.

Lower first molar (L6) tip value when compared to the previous published data is very near to North America and Indian's data while the 2nd molar (L7) readings are much less comparable to all previous data.

These findings raise the potential for a clear racial and ethnic characteristic difference. Consequently, adjustments to the arch wire with additional care incorporated in might become standard practice to achieve outstanding finishing.

Although the readings of P-value had shown different significant levels for the upper (central incisor, lateral incisor, first premolar and first molar), lower lateral incisor (L2),lower first(L4) and second premolar(L5) and first molar (L6); but the variation in mean angulation values for these dentition were not more than 1° when it compared with Andrews values (1988). The remaining maxillary and mandibular teeth had angulation values that differed by 2° or more.

This would indicate that, if bracket prescriptions were to be altered, keeping in mind only the ideal values for the population in question, the bracket prescription should be changed to suit the Iraqi population.

Conclusion

Within the limitations of the current study including the sample size, Iraqi adult bracket prescriptions Tip values were determined and presented.

1. right and left sides as well as Male and female mesiodistal teeth angulation data of Iraqi population were collected together since there is no significant differences in general between them.
2. The Iraqi tip data showed statistical differences with white people in North America ,Indians, Saudis, Japanese, Africans, and Italian populations, these variances could be the result of measurement technique differences and morphological characteristics related to ethnic background. Thus, the study clarifies the significance of ethnic variations when considering bracket prescriptions.
3. Despite the fact that our study sample size was relatively small, if our findings were used as the standard, the prescription for orthodontic brackets in the Iraqi population would need to be changed, or wire bends would need to be produced to obtain a perfect result.

Ethical statement

Ethical approval of the study was endorsed by the research institutional review committee at the College of Dentistry, Mosul University (UoM.Dent/ H.DM.53/22)

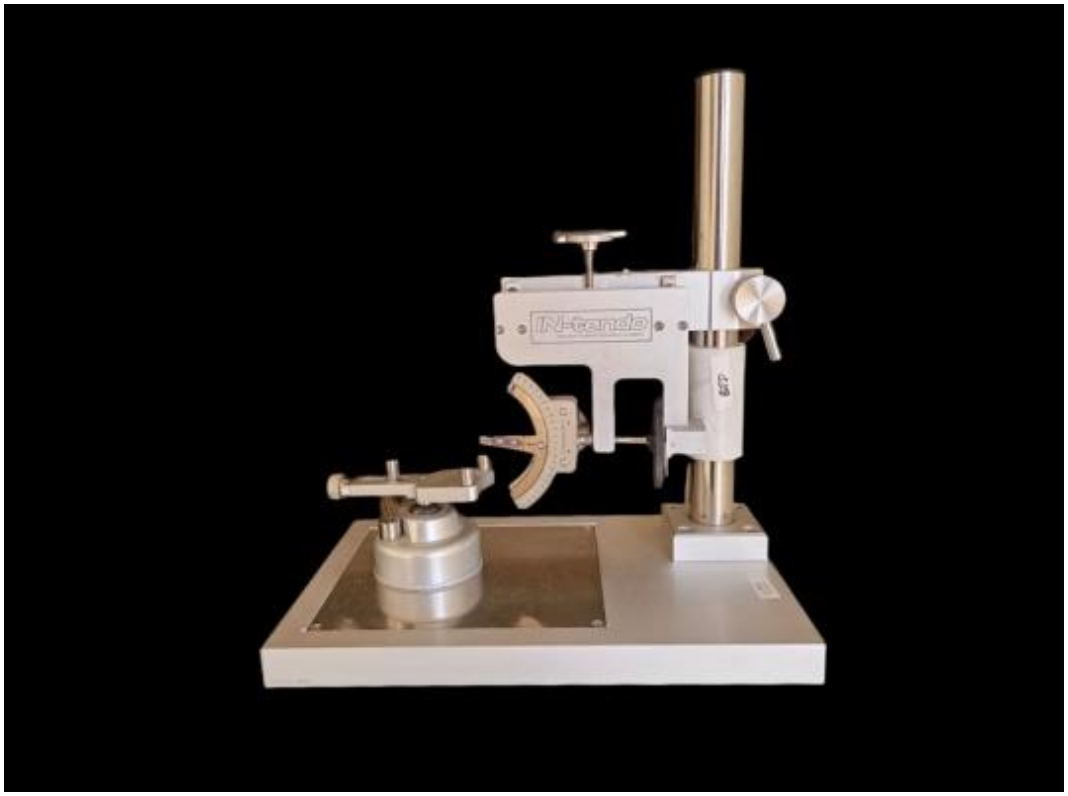

Fig.(1): The torque angulation device (IN-tendo, Chaing Mai, Thailand).

Fig.(2): Dental casts with the marked long axis and mid-point of the clinical crown.

Fig.(3): The measuring blade on the mid-point of the clinical crown.

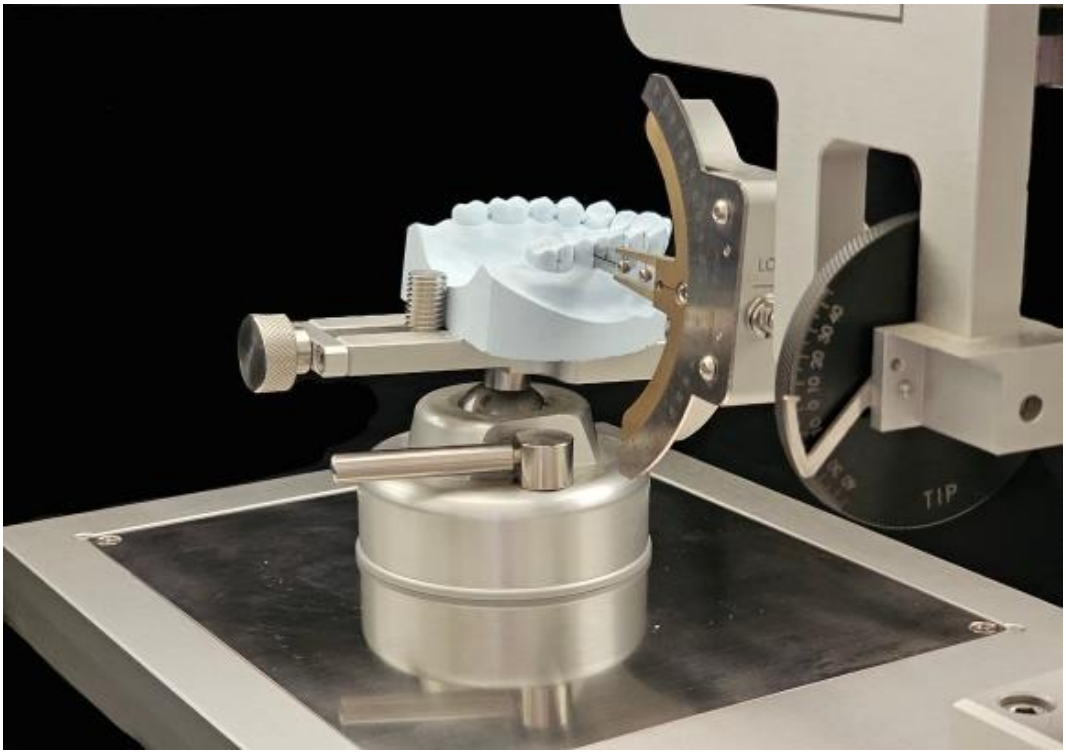

Fig.(4): Measurement of the mesiodistal angulation of the upper left first molar.

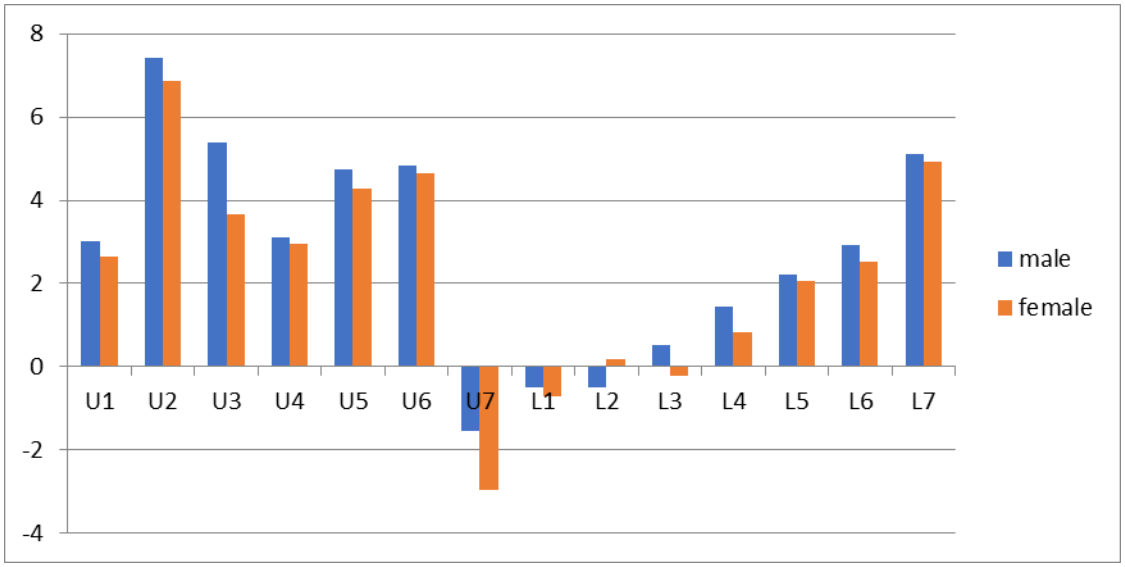

Fig.(5): Male and female comparison of the mesiodistal teeth angulations.

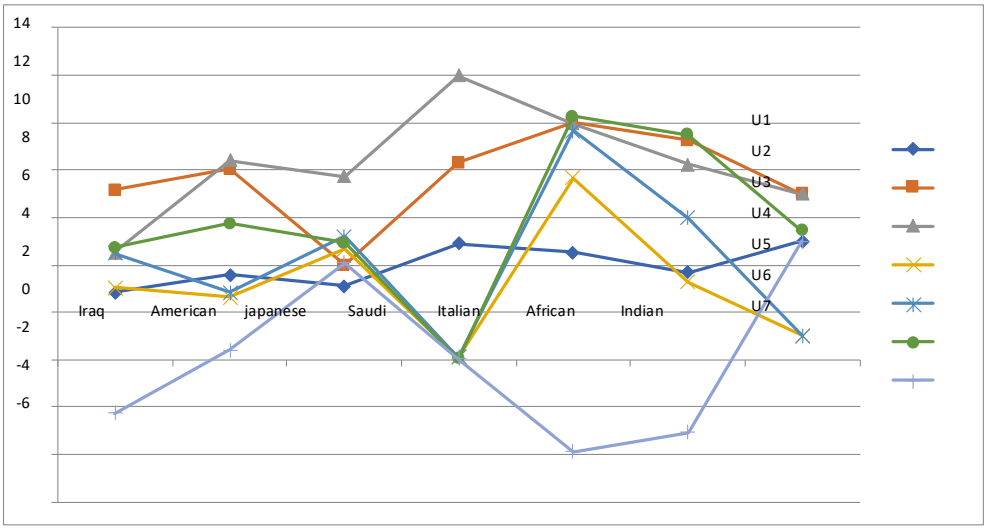

Fig.(6): Iraqi Tip data for maxillary teeth in comparison with the data published from other countries.

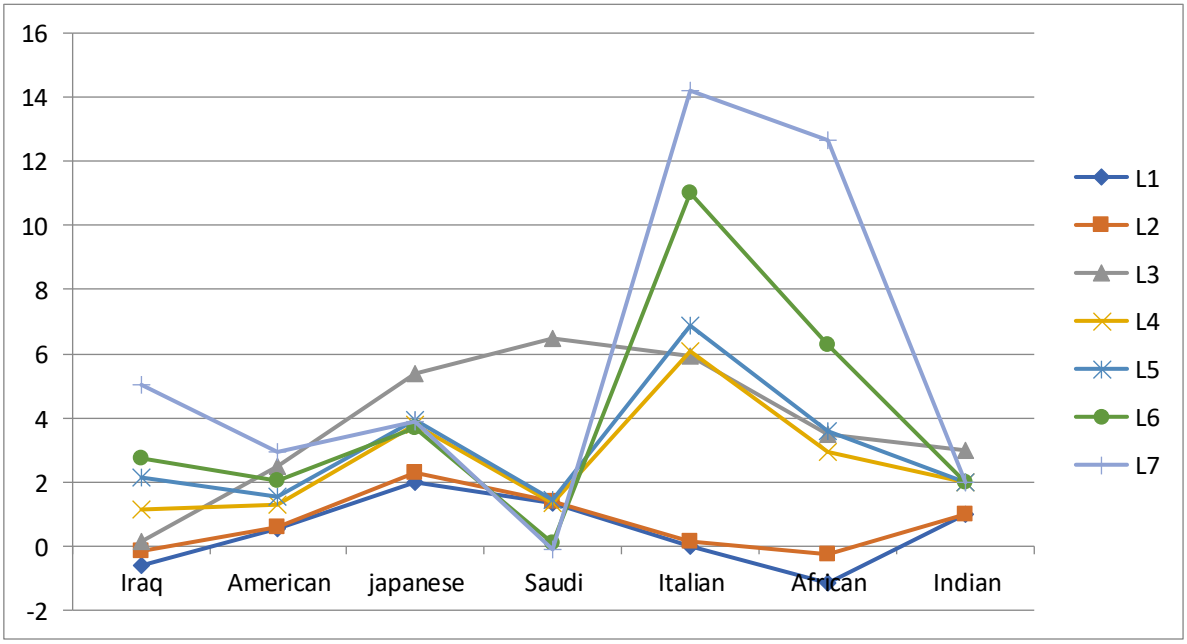

Fig.(7): Iraqi Tip data for mandibular teeth in comparison with the data published from other countries.

Table (1): Repeated measurements of tip values (on 20 dental model sets).

NO	tooth	N	First tip value		Second tip value		p-value	r
			mean	standard deviation	mean	standard deviation		
1	UR1	20	2.9920	.27264	3.0555	.25210	.426	.987
2	UR2	20	7.4520	.26096	7.4050	.26736	.570	.954
3	UR3	20	5.4195	.23451	5.3845	.27362	.650	.894
4	UR4	20	3.1155	.02064	3.1190	.01917	.594	.975
5	UR5	20	4.7225	.03177	4.7255	.02856	.770	.978
6	UR6	20	4.8320	.01196	4.8340	.01392	.674	.979
7	UR7	20	-1.5535	.01565	-1.5510	.01373	.582	.958
8	UL1	20	2.9870	.27570	2.9820	.29336	.951	.892
9	UL2	20	7.4495	.25714	7.4490	.25737	.996	.936
10	UL3	20	5.4175	.25499	5.4090	.26657	.926	.982
11	UL4	20	3.1185	.02346	3.1205	.02259	.773	.928
12	UL5	20	4.7240	.02891	4.7560	.02583	.876	.878
13	UL6	20	4.8300	.01298	4.8330	.01418	.410	.984
14	UL7	20	-1.5515	.01424	-1.5510	.01210	.888	.850
15	LR1	20	-.4885	.03937	-.4795	.03677	.534	.875
16	LR2	20	-.4985	.05234	-.4895	.07605	.697	.957
17	LR3	20	.5370	.14481	.5520	.13633	.751	.964

18	LR4	20	1.4705	.09528	1.4310	.09165	.228	.962
19	LR5	20	2.2125	.07566	2.2305	.09023	.923	.895
20	LR6	20	2.9125	.07566	2.8655	.09023	.763	.944
21	LR7	20	5.1125	.07566	5.2105	.09023	.873	.994
22	LL1	20	-.4845	.04249	-.4800	.03671	.760	.874
23	LL2	20	-.4945	.05404	-.4840	.04762	.977	.969
24	LL3	20	.5570	.18299	.5340	.14716	.695	.946
25	LL4	20	1.4310	.09165	1.4445	.09305	.639	.933
26	LL5	20	2.2105	.09223	2.2390	.07078	.879	.953
27	LL6	20	2.9105	.09265	2.8890	.06738	.769	.981
28	LL7	20	5.1105	.08543	5.0890	.08248	.969	.892

N:sample size; r: Pearson's correlation coefficient; UR1: abbreviation related to maxillary central incisor in the right side; Second: Second measurement

Table(2): Tip values comparison between right and left.

No	**Tooth**	**N**	**right tip values**		**left tip values**		**p-value**
			mean	**standard deviation**	**mean**	**standard deviation**	
1	U1	120	3.016	.2713	2.977	.2766	.510
2	U2	120	7.423	.2487	7.448	.2533	.585
3	U3	120	5.394	.2559	5.417	.2565	.615
4	U4	120	3.118	.0201	3.120	.0321	.725
5	U5	120	4.724	.0284	4.725	.0265	.892
6	U6	120	4.832	.0130	4.832	.0137	.902
7	U7	120	-1.552	.0140	-1.551	.0125	.682
8	L1	120	-.483	.0375	-.482	.0380	.471
9	L2	120	-.493	.0611	-.494	.0469	.974
10	L3	120	.522	.1409	.519	.1388	.897
11	L4	120	1.448	.0932	1.518	.9322	.764
12	L5	120	2.210	.0879	2.150	.6789	.489
13	L6	120	2.910	.0689	2.880	.7498	.568
14	L7	120	5.110	.0599	5.210	.8169	.863

N: sample size; U1: abbreviation related to maxillary central incisor.

Table (3): Comparison of the genders of the tip values.

No	tooth	N	Male tip values		female tip values		p-value
			mean	standard deviation	mean	standard deviation	
1	U1	120	3.016	0.671	2.645	0.734	.354
2	U2	120	7.423	0.748	6.876	0.694	.482
3	U3	120	5.394	1.655	3.662	1.730	.033*
4	U4	120	3.118	0.520	2.962	0.634	.567
5	U5	120	4.724	0.728	4.278	0.745	.288
6	U6	120	4.832	0.613	4.642	0.633	.114
7	U7	120	-1.552	1.414	-2.953	1.446	.034*
8	L1	120	-.4830	0.537	-.7190	0.543	.016*
9	L2	120	-.4937	0.461	.1717	0.520	.825
10	L3	120	.5227	1.540	-.215	1.750	.024*
11	L4	120	1.448	0.573	.835	0.623	.037*
12	L5	120	2.210	0.676	2.075	0.745	.467
13	L6	120	2.8 10	0.594	2.6 34	0.610	.543
14	L7	120	5.110	1.765	4.934	1.784	.628

N: sample size; U1: abbreviation related to maxillary central incisor; * the mean difference is significant at the 0.05 level.

Table(4): The merged male and female, right and left of Iraqi tipping statistics.

No	tooth	N	Tip				
			mean	SD	Min	Max	Range
1	U1	240	2.8306	0.629	1.23	5.48	4.25
2	U2	240	7.1500	0.756	3.62	8.99	5.37
3	U3	240	4.5283	1.566	3.00	5.72	2.72
4	U4	240	3.0407	0.546	1.94	4.16	3.22
5	U5	240	4.5013	0.697	2.26	6.77	4.51
6	U6	240	4.7377	0.646	3.62	6.86	3.24
7	U7	240	-2.253	1.428	-4.22	-1.53	2.69
8	L1	240	-.6017	0.584	-2.82	-.43	2.39
9	L2	240	-.1612	0.578	-1.61	3.23	4.84
10	L3	240	.1537	1.621	-.26	2.90	3.16
11	L4	240	1.1418	0.562	.81	3.61	2.80
12	L5	240	2.1430	0.643	0.98	6.33	5.35
13	L6	240	2.7223	0.614	1.51	5.03	3.52
14	L7	240	5.0223	1.836	3.91	8.23	4.32

N: sample size; SD: standard deviation; Min: minimum; Max: maximum; U1: tooth abbreviation related to upper central incisor.

Table(5): Iraqi Tip data in comparison with the data published from other countries**.**

No	tooth	Iraqi data		Iraqi vs. N. American		Iraqi vs. Japanese		Iraqi vs. Saudi an		Iraqi vs. Italian		Iraqi vs. African		Iraqi vs. Indian	
		mean	SD	mean	P	mean	P	mean	P	mean	P	mean	P	mean	P
1	U1	2.83	.302	3.59	S	3.11	S	4.89	S	4.53	S	3.68	S	5.00	S
2	U2	7.15	.359	8.04	S	3.99	S	8.29	S	9.99	S	9.23	S	7.00	S
3	U3	4.52	.906	8.4	S	7.73	S	11.99	S	9.96	S	8.23	S	7.00	S
4	U4	3.04	.080	2.65	S	4.67	S	0.10	S	7.67	S	3.29	S	1.00	S
5	U5	4.50	.225	2.82	S	5.20	S	0.11	S	9.64	S	5.96	S	1.00	S
6	U6	4.73	.096	5.73	S	4.94	S	0.03	S	10.2	S	9.48	S	5.44	S
7	U7	-2.25	.710	0.39	S	4.09	S	0.02	S	-3.8	S	-3.06	S	5.00	S
8	L1	-.60	.129	0.53	S	1.98	S	1.34	S	0.00	S	-1.13	S	1.00	S
9	L2	-.16	.339	0.59	S	2.28	S	1.39	S	0.14	S	-0.26	S	1.00	S
10	L3	.15	.384	2.48	S	5.40	S	6.46	S	5.91	S	3.47	S	3.00	S
11	L4	1.14	.315	1.28	S	3.80	S	1.35	S	6.06	S	2.95	S	2.00	S
12	L5	2.14	.094	1.54	S	3.91	S	1.45	S	6.90	S	3.60	S	2.00	S
13	L6	2.72	.197	2.03	S	3.70	S	0.08	S	10.9	S	6.30	S	2.00	S
14	L7	5.02	.104	2.94	S	3.88	S	-0.11	S	14.2	S	12.6	S	2.00	S

SD: standard deviation; U1: maxillary central incisor; P: t-test's p-value; S: The mean difference is significant at the 0.05 level.

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