Clinical determination of the occlusal plane and its relation with orofacial measurements

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ABSTRACT

Aims: To determine the level and angulation of the occlusal plane of the artificial dental arch by measuring the level and angulation of the occlusal plane of completely dentulous subjects and to find the relation of these measurements to some of the vertical facial and intra oral dimensions. **Materials and Methods**: The sample of the study consisted from 54 completely dentulous adult subjects (24 female and 30 male) with class 1 normal occlusion aged 19–24 years. Dental casts were taken for each subject, the level and angulation of the occlusal plane, vertical facial, and intra oral dimensions were measured using digital vernier caliper and protractor. The data were analyzed with statistical package for social science program. **Results**: Sexual differences were found in the intra and extraoral measurements. Most of the measurements dealing with the occlusal plane level and angulation were correlated with each other and with facial measurements. **Conclusions**: The level and angulation of the occlusal plane of the maxillary and mandibular dental arches as measured on the dental casts are higher in maxilla than in mandible and the intra and extraoral vertical facial measurements are greater in male than female.

Key words: Occlusal plane, Facial measurements, Vestibular distance.

INTRODUCTION

Dentists particularly prosthodontist and orthodontist are responsible for restoring the natural esthetic of the patient and for developing a precise occlusion. The aspect of occlusal plane is the primary link of function and esthetic.[1] One challenging aspect of treating patients with complete dentures is establishing the occlusal plane[2], as it has variety of effects on cusp angle[3], treatment of occlusal disturbances[4], masticatory closing path and movements of the mandible[5–7], esthetic and phonetic[8], and the stability of complete denture.[9,10]

The ideal position of occlusal plane is well defined by functional and anatomical requirement.[11] In complete denture, the occlusal plane should be located in the same position in which it existed in natural dentition.[12] Many methods were advocated to determine the level and angulation of the missed occlusal plane in completely edentulous patients, some researchers advocated the use of the extraoral references that help in restoring the missed occlusal plane in completely edentulous patients while others used the intra oral soft tissues land marks for the same purposes like retromolar pad [13], parotid papilla [14–16] or lateral border of the tongue.[17,18]

In this study a new intraoral reference for determining occlusal plane was investigated, it is the maxillary and the mandibular muco buccal folds. This anatomical landmark was defined as the line of flexure of the mucous membrane as it passes to the cheek.[19] The importance of using this anatomical land marks is that, it is not affected by the loss of the teeth and the subsequ-ent residual ridge resorption, as it is related to the underlying facial and

masticatory muscle attachment. Therefore, the maxilla-ry and mandibular mucobuccal folds were depended in this study to get a new measu-ring methods of the level and angulation of the occlusal plane to be useful in complete denture construction.

MATERIALES AND METHODS

The sample of this study was a group of students of College of Dentistry in University of Mosul. This group consisted of 30 male and 24 female with age ranged between 19–24 years. The sample was chosen to fulfill the following criteria:

Normal class I occlusion, no genetic abnormality, no previous craniofacial trauma or surgery, no missing or extracted teeth, no previous or current orthodontic treatment and no restoration replacing the incisal edge of anterior teeth or buccal cusp of posterior teeth.

Each participant sat in up right position with his eyes looking forward . The following distances were measured using electronic digital vernier caliper (LEZACO, ART, 2771, China), the measurement were recorded with two decimals. The facial measurements are: [20,21]

1- Hair to nose (H–N): The perpendicular distance extends along the midline of face from anterior hairline to the inferior points of the nose.

2- Eye to lip (E–L): The perpendicular distance extends from the pupil of the eye to the angle of the mouth.

3- Lower face (LF): The perpendicular distance extends along midline of face from inferior points of nose to the most inferior point of the chin.

4- Upper lip (UL):The height of the upper lip from the inferior point of the nose to the vermilion border of the upper lip.

Maxillary and mandibular impressions were taken with irreversible hydrocolloid alginate impression material (Orthoalginate, Denturum, Germany) to get a maxillary and mandibular dental models for each individual. The distances were recorded from these dental models using non flexible dental remer which was adapted adjacent the buccal surface of the tooth and the perpendicular distance from the center of the incisal edge or cusp tip to the deepest point of the dental vestibule was measured with electronic digital vernier caliper. Recorded di-

stances include the following:

1- Central height (Ce.H): The perpendicular distance from the middle point of the incisal edge of the central incisor (determined previously by measuring the mesiodistal dimension of the tooth) to the deepest point of the labial vestibule.

2- Latral height (La.H): The perpendicular distance from the middle point of the incisal edge of lateral incisor to deepest point of labial vestibule.

3- Canine height (Ca.H): The perpendicular distance from the canine cusp tip to the deepest point of the labial vestibule.

4- 1st premolar height (1Pr.H): The perpendicular distance from the 1st premolar buccal cusp tip to the deepest point of the buccal vestibule.

5- 2nd premolar height (2Pr.H): The perpendicular distance from the 2nd premolar buccal cusp tip to the deepest point of the buccal vestibule.

6- 1st molar height (1Mo.H): The perpendicular distance from the 1st molar mesio palatal cusp tip to the deepest point of the buccal vestibule and represents the posterior level of the occlusal plane.

7- 2nd molar height (2Mo.H): The perpendicular distance from the 2nd molar mesio palatal cusp tip to the deepest point of the buccal vestibule.

8- Inter vestibular distance (IVD): The distance from the labial vestibule adjacent to the labial frenum of the maxillary dental cast to that of mandibular cast, measured when the two cast set in centric occlusion.

9- Occlusal plane angle (OPA): This angle, which represents the angulation of the occlusal plane, was calculated as following (figure):–

a- A perpendicular line (bc) was fallen from the mesio palatal cusp tip of 1st molar to the central incisor height (Ce.H).

b- The distance from the crossing point to the incisal edge of the central incisor (ac) was measured.

c- The distance from the middle point of incisal edge of the central incisor to the mesiopalatal cusp tip of the 1st molar (ab) was recorded.

d- From resulted triangle with erected angle drawn on graphic paper, the b angle (which represents OPA angle) was measured using protractor.
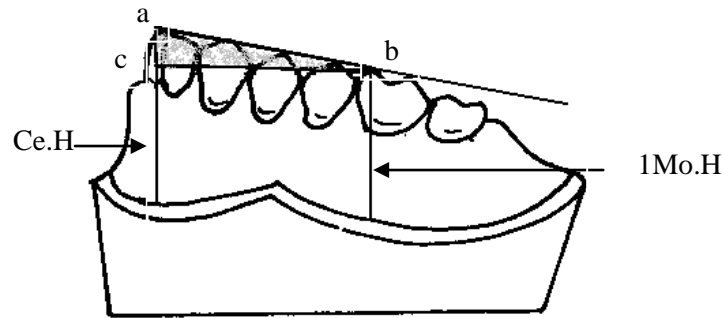
Figure : Occlusal plane angle. Ce.H: Central hight; 1Mo.H:
1st molar hight

The data were analyzed with statistical package for social science (spss) program which includes mean, standard deviation, mini-mum and maximum valu-es, Student's t–test was used to make a comparison between male and female grou-ps. The coefficient of correlation between variables and finally the perce-ntage of the occlusal plane levels and angulat-ion were obtained.

RESULTS

As the Student's t–test at p <0.05 sho-wed no significant differences between the occlusal plane levels at the right and left

teeth, therefore two segment were combin-ed for better statistical evaluation.

The level and angulation of the occlu-sal plane of the maxillary and mandibular dental arch were obtained. Table (1) illust-rated the descriptive statistics of the maxil-lary and mandibular occlusal plane level and angulation for total sample including mean, minimum and maximum values wi-th standard deviation, this table showed th-at the level of the occlusal plane at the ma-xillary and mandibular central incisor was higher than that at the maxillary and man-dibular 1st molar.

Table (1): The descriptive statistics of the level and angulation of occlusal plane

Variables	Upper			Lower		
	Minimum	Maximum	Mean $\pm$ SD	Minimum	Maximum	Mean$\pm$ SD
Ce.H	17.00	26.66	22.1009$\pm$2.1800	13.13	22.38	17.8000$\pm$1.6803
La.H	17.00	25.65	21.3540$\pm$2.1933	14.70	22.38	17.7258$\pm$1.6133
Ca.H	17.38	26.66	21.2936$\pm$2.0293	15.55	22.38	18.0100$\pm$1.5285
1Pr.H	15.32	24.00	18.7791$\pm$2.1224	13.00	20.95	16.6232$\pm$1.6794
2Pr.H	12.56	22.00	17.0640$\pm$2.2506	12.75	19.66	15.7766$\pm$1.6258
1Mo.H	12.56	21.00	15.6789$\pm$1.8339	11.13	17.70	14.6725$\pm$1.6287
2Mo.H	10.17	17.00	13.7128$\pm$1.6497	8.26	17.47	12.7530$\pm$1.9585
OPA	5.00	14.00	10.2689$\pm$2.1561	2.50	10.00	5.9340$\pm$1.6757

SD: Standard deviation; Ce.H: Central height; La.H: Lateral height; Ca.H: Canine height; 1Pr.H: 1st premolar height; 2Pr.H: 2nd premolar height; 1 Mo.H: 1st molar height; 2Mo.H :2nd molar height; OPA :occlusal plane angle.

Table (2) demonstrated the comparis-on of the mean value of occlusal plane lev-el and angulation of the maxillary and ma-ndibular dental arches between male and

female groups. It was found that the male group generally exhibited larger values of occlusal plane level than female Group.

Table (2): Comparison of the level and angulation of occlusal plane between female and male group

Variables	Male Mean± SD	Female Mean± SD	t−value	Signifigancy
	Upper			
Ce.H	23.1100± 2.1252	21.1379±1.6855	4.443	Highly significant
La.H	22.2854±1.9473	20.4358±2.0209	3.870	Highly significant
Ca.H	22.0521±1.8783	20.4367±1.8125	3.379	Significant
1Pr.H	19.5454±1.9969	17.7842±1.7780	3.062	Significant
2Pr.H	17.9808±2.1878	16.1458±1.7195	3.399	Significant
1Mo.H	16.4154±1.6082	14.7867±1.4873	3.566	Significant
2Mo.H	14.4725±1.6088	12.9258±1.4073	3.499	Significant
OPA	10.5833±1.4421	10.0938±2.3158	0.875	Not significant
	Lower			
Ce.H	18.4004±1.5988	17.0313±1.6054	2.598	Significant
La.H	18.2171±1.7023	17.0508±1.4056	2.402	Significant
Ca.H	18.3750±1.7085	17.4183±1.1421	2.077	Significant
1Pr.H	16.8546±1.7160	16.1037±1.5965	1.379	Not significant
2Pr.H	16.0875±1.7096	15.2038±1.4773	1.873	Not significant
1Mo.H	15.0508±1.5606	14.0817±1.6470	2.029	Not significant
2Mo.H	13.3083±1.9568	11.8837±1.7489	2.629	Significant
OPA	5.9583±1.8292	6.0208±1.5637	−0.137	Not significant

SD: Standard deviation; Ce.H : Central height; La.H: Lateral height; Ca.H: Canine height; 1Pr.H: 1st premolar height; 2Pr.H: 2nd premolar height; 1Mo.H: 1st molar height; 2Mo.H: 2nd molar height; OPA: Occlusal plane angle.

Tables (3 and 4) contained respectively the intra and inter arch correlation of occlusal plane level and angulation of the maxillary and mandibular dental arches for total group and for female and male groups also, the intra and inter arch correlations were mainly significant. Table (5) explained the percentage of some of linear measurements to each others these included the level of occlusal plane at the maxillary and mandibular central incisor and the maxillary and mandibular 1st molars and the angulation of occlusal plane of the maxillary and mandibular dental arches.

The results of facial and intraoral measurements were also recorded, Table (6) containeds the mean and standard deviateon of these measurements while Table (7) explained the difference between the female and male groups, it was cleared that the male group exhibits larger facial and intraoral measurements than female group.

Table (8) illustrated the significant correlation between the recorded facial measurements and intraoral measurements to each others while Table (9) showed the correlation of these measurements to the occlusal plane level at the maxillary and mandibular central incisor, the maxillary and mandibular 1st premolar, the maxillary and mandibular 1st molar and to the angulation of occlusal plane of the maxillary and mandibular dental arches, it was cleared that occlusal plane level was significantly positively correlated to the lower facial height and inter vestibular distance.

DISCUSSION

The level of occlusal plane of maxillary and mandibular dental arches were measured at different points of the dental arch, Ce.H, La.H, Ca. H, 1Pr.H, 2Pr.H, 1Mo.H, 2Mo.H, represent the level of the occlusal plane because all of them are measuring how far the occlusal plane is located from the buccal vestibule at seven points located along the occlusal plane thereofre the level of the maxillary and mandibular occlusal plane were represented by seven distances. The mean value of occlusal plane level at maxillary and mandibular central incisors were found to be higher than that of maxillary molars. This comes in consistence with the accepted view that maxillary occlusal directed posteriorly downward and backward.[22]

Table (3): Intra arch correlation of the level and angulation of occlusal plane

Variables	Sex	Ce.H	La.H	Ca.H	1Pr.H	2Pr.H	1Mo.H	2Mo.H
					Upper			
La.H	M	0.950**						
	F	0.898**						
	T	0.935**						
Ca.H	M	0.836**	0.831**					
	F	0.838**	0.867**					
	T	0.859**	0.869**					
1Pr.H	M	0.672**	0.672**	0.827**				
	F	0.584**	0.700**	0.625**				
	T	0.703**	0.552**	0.788**				
2Pr.H	M	0.735**	0.825**	0.825**	0.827**			
	F	0.517**	0.403	0.403	0.720**			
	T	0.718**	0.718**	0.718**	0.821**			
1Mo.H	M	0.727**	0.761**	0.768**	0.801**	0.858**		
	F	0.552**	0.614**	0.586**	0.421*	0.419*		
	T	0.726**	0.750**	0.747**	0.725**	0.785**		
2Mo.H	M	0.745**	0.528**	0.436*	0.436*	0.589**	0.722**	
	F	0.224	0.284	0.206	0.334	0.471*	0.654**	
	T	0.530**	0.521**	0.454**	0.510**	0.618**	0.756**	
OPA	M	0.364	0.264	0.066	−0.003	0.031	−0.216	−0.138
	F	0.467*	0.303	0.226	0.157	0.058	−0.377	−0.467*
	T	0.393**	0.288*	0.157	0.093	0.065	−0.219	−0.223
					Lower			
La.H	M	0.948**						
	F	0.911**						
	T	0.938*						
Ca.H	M	0.863**	0.836**					
	F	0.659**	0.805**					
	T	0.800	0.844*					
1Pr.H	M	0.787**	0.793**	0.852**				
	F	0.628**	0.639**	0.563**				
	T	0.739*	0.754	0.764*				
2Pr.H	M	0.737**	0.739**	0.671**	0.856**			
	F	0.558**	0.620**	0.585**	0.766**			
	T	0.698*	0.728*	0.678*	0.834*			
1Mo.H	M	0.671**	0.563**	0.631**	0.712**	0.69**		
	F	0.698**	0.725**	0.686**	0.512*	0.740**		
	T	0.725**	0.678**	0.678**	0.652*	0.743**		
2Mo.H	M	0.424*	0.412*	0.350	0.507**	0.581**	0.846**	
	F	0.359	0.402	0.230	0.374	0.569**	0.582**	
	T	0.498**	0.500**	0.405**	0.510*	0.630**	0.765*	
OPA	M	0.244	0.329	0.188	0.070	0.038	−0.432*	−0.445*
	F	0.469*	0.380	0.236	0.210	−0.224	−0.144	−0.445*
	T	0.289*	0.304*	0.173	0.109	−0.078	−0.299*	−0.434*

Ce.H: Central height; La.H: Lateral height; Ca.H: Canine height; 1Pr.H: 1st premolar height; 2Pr.H: 2nd premolar height; 1Mo.H: 1st molar height; 2Mo.H: 2nd molar height; OPA: Occlusal plane angle; F: Female; M: Male; T: Total sample
* Significant at 0.05 level ; ** highly significant at 0.01 level

Table (4): Inter arch correlation of level and angulation of occlusal plane

Lower	Sex	Variables							
		Upper							
		Ce.H	La.H	Ca.H	1Pr.H	2Pr.H	1Mo.H	2Mo.H	OPA
Ce.H	M	0.272	0.254	0.309	0.241	0.302	0.359	0.212	−0.144
	F	0.722**	0.728**	0.595**	0.510*	0.523**	0.469*	0.237	0.284
	T	0.540	0.559**	0.529**	0.472**	0.478**	0.515**	0.365**	0.095
La.H	M	0.243	0.258	0.283	0.223	0.248	0.344	0.162	−0.116
	F	0.689**	0.711**	0.614**	0.475*	0.526**	0.439*	0.356	0.227
	T	0.493**	0.528**	0.504**	0.433*	0.437*	0.486*	0.367**	0.064
Ca.H	M	0.138	0.144	0.227	0.217	0.281	0.287	0.037	−0.157
	F	0.696**	0.687**	0.715**	0.360	0.531*	0.537**	0.534**	0.103
	T	0.405**	0.424**	0.475**	0.375**	0.435**	0.465**	0.327*	−0.024
1Pr.H	M	0.066	0.077	0.188	0.202	0.274	0.274	0.043	−0.146
	F	0.438*	0.374	0.385	0.311	0.354	0.385	0.286	−0.031
	T	0.294*	0.292*	0.350*	0.335*	0.374**	0.399**	0.248	−0.066
2Pr.H	M	0.013	0.038	0.092	0.134	0.206	0.225	0.010	−0.164
	F	0.519**	0.493*	0.450*	0.300	0.319	0.543**	0.283	−0.058
	T	0.300*	0.326*	0.334*	0.310*	0.335*	0.439**	0.244	−0.084
1Mo.H	M	0.019	0.003	0.178	0.172	0.279	0.200	0.037	−0.270
	F	0.729**	0.707**	0.660**	0.549**	0.588**	0.630**	0.382	−0.173
	T	0.419**	0.421**	0.476*	0.430*	0.469*	0.472**	0.309*	−0.016
2Mo.H	M	0.056	0.063	0.208	0.271	0.354	0.242	0.108	−0.161
	F	0.297	0.401	0.198	0.159	0.215	0.304	0.228	−0.010
	T	0.285*	0.333*	0.329*	0.362**	0.408**	0.399**	0.308*	−0.051
OPA	M	0.394*	0.366	0.236	0.149	0.2127	0.229	0.214	0.339
	F	0.203	0.177	0.187	0.216	0.113	−0.165	−0.105	0.447*
	T	0.278*	0.247	0.180	0.137	0.095	0.051	0.059	0.379*

Ce.H: Central height; La.H: lateral height; Ca.H: Canine height; 1Pr.H: 1st premolar height; 2nd premolar height; 1Mo.H: 1st molar height; 2Mo.H: 2nd molar height; OPA: Occlusal plane angle; F: Female; M: Male; T: Total sample.
* Significant at 0.05 level; ** Highly significant at 0.01 level.

Table (5): Percentage of some values of occlusal plane level to each other

Variables	Male	Female
Upper 1Mo.H /Upper Ce.H	71.03%	69.95 %
Lower 1Mo.H/Lower Ce.H	81.79 %	82.68 %
Lower Ce.H /Upper Ce.H	79.62 %	80.56 %
Lower 1Mo.H/Upper 1Mo.H	91.68 %	95.23 %
Lower OPA/Upper OPA	56.29%	59.64 %

Ce.H: Mean of central height; 1Mo.H: Mean of 1st molar height; OPA: Mean of occlusaL plane angle .

Table (6): Descriptive statistics of facial and intra oral measurements

Variables	Minimum	Maximum	Mean± SD
H–N	98.29	127.35	111.8296±7.2283
E–L	55.00	87.83	68.6526±5.9489
LF	48.00	80.04	67.9230±6.2754
UL	17.18	26.81	21.1802±2.4163
IVD	25.52	40.79	34.4523±3.1864

SD: Standard deviation, H–N: Hair to nose; E–L: Eye to lip; LF: Lower face; UL: Upper lip; IVD: Intervestibular distance

Table (7): Comparison of facial and intra oral measurements between female and male groups

Variables	Male Mean± SD	Female Mean± SD	t–value	Significancy
H–N	113.9158±7.8185	109.1096±6.8996	2.379	Significant
E–L	70.9667±6.4388	65.8683±4.7074	3.455	Significant
LF	70.7537±5.4925	63.9450±5.3132	4.766	Highly significant
UL	22.5212±2.1578	20.0711±2.4986	3.266	Significant
IVD	35.9354±2.6847	327572±3.1040	4.321	Highly significant

SD: Standard deviation; H–N: Hair to nose; E–L: Eye to lip; LF: Lower face; UL: Upper lip; IVD: Inter vestibular distance.

Table (8): Correlation of facial and intra oral measurements to each others

Variables	Sex	H–N	E–L	LF	UL
E–L	M	0.630**			
	F	0.186			
	T	0.530*			
LF	M	0.213	0.425*		
	F	−0.003	0.605**		
	T	0.259	0.609*		
UL	M	−0.083	0.188	0.474*	
	F	−0.059	0.560**	0.439*	
	T	0.212	0.394*	0.477*	
IVD	M	0.306	0.098	−0.096	0.279
	F	−0.258	0.316	0.252	0.383
	T	0.141	0.341*	0.299*	0.341*

H–N: Hair to nose; E–L: Eye to lip; LF: Lower face; UL: upper lip; IVD: Inter vestibular distance; F: Female; M: Male; T: Total sample.
* Significant at 0.05 level ; ** Highly significant at 0.01 level .

Table (9): Correlation of facial and intra oral measurements to some values of occlusal plane level and angulation

Variables	Sex	Ce.H	1Pr.H	1Mo.H	OPA
		Upper			
H–N	M	0.028	–0.149	0.077	–0.060
	F	–0.257	–0.310	–0.082	–0.123
	T	0.047	–0.069	0.133	–0.060
E–L	M	–0.159	–0.139	–0.118	–0.024
	F	–0.301	0.329	0.058	0.286
	T	0.158	0.234	0.170	0.108
LF	M	–0.108	0.033	0.022	–0.148
	F	0.214	0.314	0.428**	0.089
	T	0.268	0.427**	0.376**	–0.042
UL	M	–0.112	0.022	–0.013	–0.005
	F	0.678**	0.664**	0.378	0.229
	T	0.166	0.119	0.216	0.119
IVD	M	0.508**	0.342	0.569**	0.092
	F	0.680**	0.548**	0.204	0.586**
	T	0.649**	0.536**	0.516**	0.267
		Lower			
H–N	M	0.304	0.353*	0.187	0.034
	F	0.004	0.142	–0.130	0.223
	T	0.322*	0.328*	0.086	0.225
E–L	M	0.304	0.353*	0.187	0.034
	F	0.245	0.050	0.374*	0.000
	T	0.389*	0.319*	0.295	0.074
LF	M	0.072	0.089	–0.209	0.065
	F	0.321*	0.167	0.284	0.105
	T	0.365*	0.204	0.174	0.128
UL	M	–0.065	0.005	0.023	–0.066
	F	0.543**	0.220	0.725**	0.157
	T	0.197	0.161	0.147	–0.021
IVD	M	0.514**	0.332	0.160	0.400*
	F	0.499*	0.261	0.493*	0.398*
	T	0.597**	0.368**	0.416**	0.305

Ce.H : central height, 1Mo.H:1st molar height, OPA:occlusal plane angle, H–N :hair to nose , E–L :eye to lip; LF: Lower face; UL: Upper lip; IVD: Inter vestibular distance; F: Female; M: Male; T: Total sampl;
* Significant at 0.05 level ; ** Highly significant at 0.01 level .

The distance from incisal edge of maxillary central incisor to the labial vestibule adjacent to the labial frenum was (22 mm). The corresponding distance for mandibular was (17 mm). These results approximated the result obtained by Fayz *et al*.,[23] who found that these distance were equal to (21.28 mm) for maxillary central incisors and (16.78 mm) for mandibular central incisor.

The result listed in Table (2), which included the difference in the occlusal plane level and angulation between male and female, indicated that the occlusal plane level of the male group was significantly higher than that of female group. The difference in this parameter between the two sexes are mostly due to the fact that the male have longer growth period than female. [24,25]

The data of occlusal plane level and angulation were to subject to correlation analysis. Tables (3 and 4) indicated that the inter and intra arch correlation of occlusal plane level and angulation was mainly significant which indicate the harmonious alignment of occlusal surface of the teeth in the dental arches, this matter is very important to produce a harmonious occlusal function. Furthermore, the occlusal angle was significantly positively correlated to the occlusal plane level at the maxillary and mandibular central incisors while this correlation was negative at the maxillary and mandibular first molar, this simply because the occlusal plane angle increased as the occlusal plane level posteriorly decreased.

The calculations of the percentage of the occlusal plane level of the maxillary and mandibular dental arches at the maxillary and mandibular central incisor (which represent the anterior level of the occlusal plane) and at the maxillary and mandibular 1st molars (which represent the posterior level of the occlusal plane) these percentages will be as guide to the prosthodontists for the purpose of the ideal arrangement of the teeth of the artificial dental prosthesis in relation to each other which result in harmonious occlusal surface of the dental arch (Table 5).

The results of the facial and intra oral measurements are listed in Tables (6 and 7). It was obvious that the mean values of these measurements for the male group was significantly larger than the corresponding measurements in female this was in agreement with other previous studies.[26–28] Furthermore it was found that the mean of the lip to eye distance is equal to (70 mm) in male and (65mm) in female and the mean of the lower facial high is equal to (69 mm) in male and (63 mm) in female. Rauf [21] found that the mean of the lip to eye distance is equal to (70 mm) in male and 64 mm in female while the mean of the lower facial height is equal to (68 mm) in male and (60 mm) in female. The mean value of the inter vestibular distance is (34 mm). This results was similar to the corresponding results obtained by Fayz *et al.* [23]

The result listed in Table (8) indicated that the facial measurements were significantly correlated to each other a result

that confirms the result of previous study.[20] It was also found that the lower facial height and inter vestibular distance were significantly positively correlated to the occlusal plane level at the anterior (Ce.H), middle (1Pr.H) and the posterior (1Mo.H) parts of the dental arch (Table 9). This may simulate the result obtained by Ingervall and Helkimo[10] who found that the reduction in the anterior face height results in parallelism of the occlusal plane and mandibular angle i.e. flattening of the occlusal plane.

CONCLUSIONS

The anterior level of the occlusal plane is higher than the posterior level in the maxillary and mandibular dental arches. In general, the occlusal plane level of the maxillary arch is higher than that of mandibular dental arch. The occlusal plane level of the maxillary and mandibular dental arches of male is higher than that of female. The angulation of the occlusal plane of the maxillary arch is higher than that of mandibular dental arch. The vertical facial and intra oral measurements of male are greater than that of female and these measurements are significantly correlated to each other. Generally, the lower facial height and the inter vestibular distance are associated with the occlusal plane level.

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