Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 20s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Establishing The Occlusal Plane for Construction of Complete Dentures

Shalabh Kumar[*1], Madhurima Sharma[2], Mukesh Kumar[3]

[1]Ph.D. scholar, Department of Prosthodontics, Teerthanker Mahaveer Dental College and Research Centre, Moradabad, India.

[2]MDS, Professor, Department of Prosthodontics, Teerthanker Mahaveer Dental College and Research Centre, Moradabad, India.

[3]MDS, Professor, Department of Orthodontics, Teerthanker Mahaveer Dental College and Research Centre, Moradabad, India.

***Corresponding Author:**

Shalabh Kumar,

Department of Prosthodontics, Teerthanker Mahaveer Dental College and Research Centre, Moradabad, 244001. India.

Email ID: shalabk.dental@tmu.ac.in

Cite this paper as: Shalabh Kumar, Madhurima Sharma, Mukesh Kumar, (2025) Establishing The Occlusal Plane for Construction of Complete Dentures. *Journal of Neonatal Surgery*, 14 (20s), 324-329.

1. INTRODUCTION

While fabricating the complete denture for edentulous patients, establishing the occlusal plane is the key step for optimising the function and esthetics to the patient. This is also important in attaining the bilateral balanced occlusion for the complete denture. Occlusal plane is not a line, rather it is a 3-dimensional plane formed by the occlusal and incisal surfaced of the teeth [1]. Occlusal plane influences how the tongue and buccinator muscle interact. If occlusal plane is not position at proper orientation, it may cause accumulation of food in sulcus and cheek or tongue biting in fixed or removable prosthesis. Moreover, it may also cause tissue changes, premature bone resorption and denture instability. Over the years, numerous methods and locations have been used to orient the occlusal plane which includes the use of retromolar pad [2], hamular notch [3], buccinator groove, parotid papilla [4]. Among them, using the Ala-tragus line (ALT) is the most common method for establishing the occlusal plane for the complete denture patients [5,6].

However, there were a conflicting observation regarding which portion of the tragus should be used as posterior references point in ALT. because of the presence of multiple variables, there is lack of consensus regarding the use of this posterior reference point [7,8].

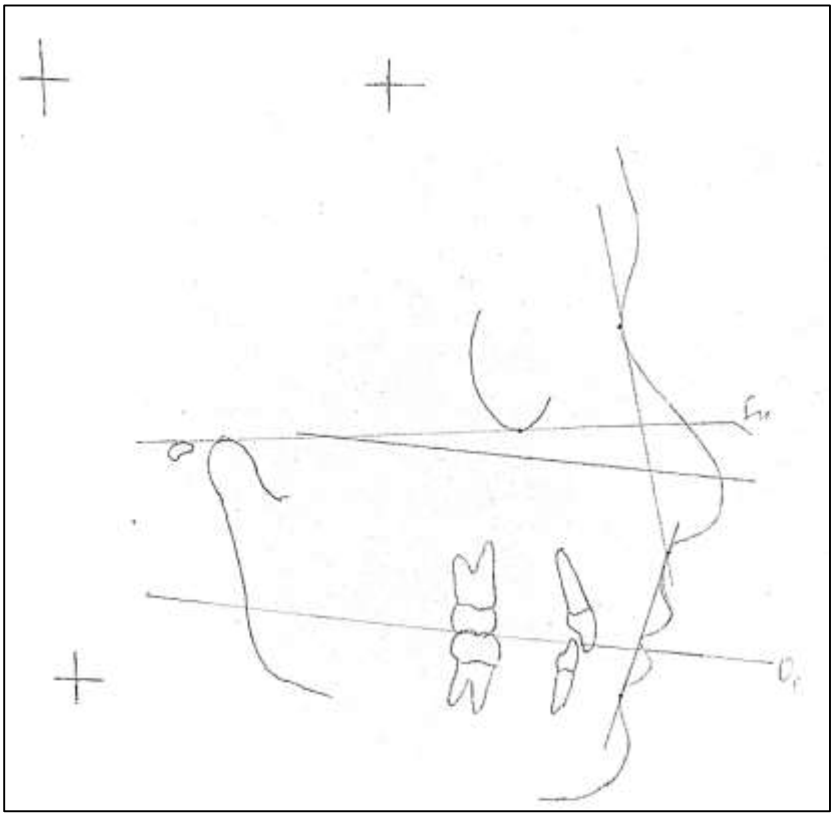
In all these concepts, soft tissue landmarks were used for positioning the occlusal plane, which may change with age and gender. Our study was aimed to establish the relationship between the occlusal plane angle with non-dental parameter like age, gender and facial profile of the dentate person so that results of this can be applied in establishing the occlusal plane in edentulous patient.

2. MATERIAL AND METHODS:

Our study involved the lateral cephalograms of dentate individuals which were available in the department of Oral medicine and radiology and Department of Orthodontics. Cephalograms with full component of permanent dentition (except 3rd molar) were selected. Radiographs showing any signs of pathologic involvement, trauma, habits or prosthesis were not included. Also, radiographs not mentioning the gender and age of the patient were not included. Total of 300 such radiographs were taken for this study.

Following landmarks were traced: (figure 1)

Figure 1. cephalometric tracing used in study



Soft tissue Nasion, soft tissue point A, soft tissue point B, condyle of the temporomandibular joint, outline of the maxillary and mandibular first molar and central incisor, lower most portion of the infra orbital rim (Orbitale) and Porion. For Frankfurt-Horizontal plane superior part of Porion and Orbitale were joined and occlusal plane was marked by joining the cuspal tip of molars and mid-point on anterior overjet. Angle formed between these planes was measured and mean of the samples was calculated. Facial profile was assessed by analysing the line joining the Nasion, soft tissue point A and soft tissue point B. Intergroup correlation for the angulation of the occlusal plane between gender, age and facial profile was done using Spearman test. Regression analysis was also used. Normality of the data was checked by using Shapiro-Wilk test.

3. RESULTS

The data was found to follow a normal distribution ($p > 0.05$). In the sample, 112 radiographs belonged to males, while 188 were from females. The average age of participants was 24 years, with ages ranging from 13 to 45 years. Among the profiles studied, 187 were convex, and 113 were straight; no concave profiles were observed. The mean angle between the occlusal plane and the FH plane was 10.8 degrees. Males showed a higher occlusal plane angle (mean = 11.76) compared to females (mean = 10.18). (Table 1, 2, 3, 4)

Table 1. Mean age of the study samples

	N	Minimum	Maximum	Mean	SD
Age	300	13	45	24.4	6.43

Table 2. Distribution of the study participants according to gender			
Gender	**Frequency**	**Percentage**	**Mean**
Male	112	37.3 %	11.76
Female	188	62.7 %	10.18

Table 3. Distribution of facial profile in study samples		
Profile	**Frequency**	**Percentage**
Convex	187	62.3 %
Straight	113	37.7 %

Table 4. Mean OP-FHP (degree) in study samples					
	N	**Minimum**	**Maximum**	**Mean**	**SD**
OP – FHP (Degree)	300	-15	19	10.8	5.48

There was a significant negative correlation between the OP – FHP angle (in degrees) and age (rho = -0.168, p = 0.004), indicating that as age increases, the OP – FHP angle decreases. Similarly, there was a statistically significant negative correlation between OP – FHP angle and gender (rho = -0.14, p = 0.015), suggesting that females tend to have a lower OP – FHP angle compared to males. However, the correlation between OP – FHP angle and profile type (straight vs. convex) was weak and positive (rho = 0.026) and not statistically significant (p = 0.659), implying no meaningful relationship between profile type and OP – FHP angle (Table 5).

Table 5. Correlation of OP – FHP and age, gender and profile					
		OP – FHP (Degree)	**Age**	**Gender**	**Profile**
OP – FHP (Degree)	Spearman's rho	—	-0.168	-0.14	0.026
	df	—	298	298	298
	p-value	—	0.004	0.015	0.659
Note. * p < .05, ** p < .01, *** p < .001					

The overall model test revealed a statistically significant relationship between the predictors and OP – FHP angle, with an F-statistic of 4.14 and a p-value of 0.007. The model explains 4.02% of the variance in OP – FHP ($R^2 = 0.0402$), with an adjusted R^2 of 0.0305. The Akaike Information Criterion (AIC) is 1868, used for model comparison, and the Root Mean Square Error (RMSE) is 5.36, indicating the model's prediction error. The intercept, representing the baseline level, is 14.647 with a standard error of 1.3916 and is highly significant. The coefficient for age is -0.118 (SE = 0.0491), which is significant (p = 0.017), indicating that as age increases, the OP – FHP angle decreases. The coefficient for gender (Female vs. Male) is -1.772 (SE = 0.6488), also significant (p = 0.007), suggesting that females have a lower OP – FHP angle compared to males, controlling for other variables. The estimate for profile type (Straight vs. Convex) is 0.328 with a standard error of 0.6457 and is not statistically significant (p = 0.612), indicating no significant difference in OP – FHP angle between individuals with straight and convex profiles (Table 6, 7).

Table 6. Model Fit Measures									
						Overall Model Test			
Model	R	R^2	Adjusted R^2	AIC	RMSE	F	df1	df2	p
1	0.201	0.0402	0.0305	1868	5.36	4.14	3	296	0.007

Table 7. Model Coefficients - OP – FHP (Degree)				
Predictor	Estimate	SE	t	p
Intercept [a]	14.647	1.3916	10.525	< .001
Age	-0.118	0.0491	-2.41	0.017
Gender:				
Female – Male	-1.772	0.6488	-2.731	0.007
Profile:				
Straight – Convex	0.328	0.6457	0.508	0.612
[a] Represents reference level				

4. DISCUSSION

The accurate alignment of the occlusal plane is essential for aesthetics, phonetics, and restoring lost vertical dimension. This alignment is often indicated by the incisal edges of teeth and occlusal surfaces [9,10,11,12]. For edentulous individuals, appropriately positioning denture teeth ensures that the surrounding muscles and structures function naturally [13,14]. This study employed radiographic and 3D methods, differing in invasiveness, to establish a reliable and precise approach for reconstructing the occlusal plane [15,16]. Achieving a correct occlusal plane orientation is critical for several reasons [17]:

1. Optimal prosthesis function through effective biomechanics.
2. Proper alignment of teeth for balanced articulation and improved prosthesis stability.
3. Achieving a natural smile with appropriate tooth curvature and lip positioning, avoiding an artificial look.
4. Harmonious alignment in complete dentures facilitates natural tongue and cheek muscle function, enhancing stability and chewing efficiency.
5. Inappropriately high or low occlusal planes can cause tongue and cheek biting and speech difficulties.
6. Optimal aesthetics, phonetics, and overall comfort for the patient.

A well-oriented occlusal plane improves denture stability, reduces stress on residual ridges, and enhances aesthetics, supporting natural functions like speech, smiling, and mastication.

This study explored the relationship between the occlusal plane, age, gender, and facial profile. We used the Frankfort Horizontal (FH) plane as a horizontal reference to measure occlusal plane angulation, avoiding other planes like the Sella-Nasion (SN) plane and maxillary plane. Although the SN plane remains stable over time, the position of the Nasion point (N) varies vertically and horizontally. Due to the palatal plane's clockwise rotation over a person's life, the maxillary plane was also excluded.

The angle between the facial profile and occlusal plane influences facial aesthetics, but our study found no significant association. Among our 300 samples, 113 had straight profiles, and none had concave profiles. Given the low incidence of Class III relationships in the Indian population (3.4%) [18], future research with larger and more varied sample sizes may help clarify these associations.

Our study found that occlusal plane inclination decreases with age, revealing a negative correlation. Previous research did not establish this link, likely due to individual differences in dental development, tooth wear, and skeletal morphology. Variations in attrition, tooth drift, and changing occlusal relationships may influence these findings, with biological diversity potentially obscuring any significant connection between age and occlusal plane angle.

Gender differences emerged in our study, with males showing greater steepness in the occlusal plane than females. Functional adaptations, chewing forces, and hormonal changes (e.g., puberty) likely contribute to these differences, as well as distinct patterns of dental compensation and socio-cultural factors like dietary habits and cultural norms related to oral health. Genetic factors affecting craniofacial development may also play a role.

However, previous research by Tuncay [19] found no gender-related differences in occlusal plane steepness, likely due to a small sample size of 37. Other studies report a steepness angle of 11.42° in dentate individuals and 9.43° in edentulous subjects [20], with another study noting an angle of 8.53° [21]. These variations may stem from demographic differences.

Within this study's limitations, the following conclusions were drawn:

- A significant correlation exists between occlusal plane angulation and gender, with males showing greater steepness than females.
- Age correlates with occlusal plane angulation, as steepness decreases with age.
- No significant correlation was found between occlusal plane angulation and facial profile.

Clinical Implication: There is inconsistency in the literature regarding the optimal steepness for the occlusal plane. Studies recommend different tragus reference points (lower [5], centre [22], or upper [23]) as posterior markers for setting the occlusal plane, without considering age or gender. Our findings suggest using the lower or middle part of the tragus in females and the upper or middle part in males.

Further studies with larger and more diverse samples, including varied maxillomandibular relationships and older age groups, are recommended to support these findings.

REFERENCES

[1] Glossary of Prosthodontics terms. J Prosthet Dent May 2017; 115 (5s): e63. DOI: https://doi.org/10.1016/j.prosdent.2016.12.001.

[2] Shah SZH, Azad AA, Hassan SH, Aslam A. Association of Occlusal Plane with The Level Of Retromolar Pad. Pakistan Oral & Dental Journal 2016; 36(3): 484-86.

[3] Thapa D. Evaluation of the Reliability of Hamular Notch-Incisive Papilla Plane (HIP) in Establishing Occlusal Plane. Orthodontic journal of Nepal 2014; 4(1): 45-47. DOI: 10.3126/ojn.v4i1.11311.

[4] Foley PF, Latta GH Jr. A Study of the Position of the Parotid Papilla Relative to the Occlusal Plane. J Prosthet Dent 1985 Jan; 53 (1): 124-6. DOI: 10.1016/0022-3913(85)90080-0

[5] Van Niekerk FW, Miller VJ, Bibby RE. The Ala-Tragus Line in Complete denture Prosthodontics. J Prosthet Dent Jan 1985:53; 1: 67-69. DOI: 10.1016/0022-3913(85)90068-x

[6] Bondekar V, Wagh SB, Attal PN, Pandey VR. Evaluation of relation between occlusal plane and ala-tragus line with the help of cephalometry. J Adv Med Dent Scie Res 2015; 3(6): S43-48.

[7] Lahori M, Nagrath R, Malik N. A Cephalometric Study on the Relationship Between the Occlusal Plane, Ala-Tragus and Camper's Lines in Subjects with Angle's Class I, Class II and Class III Occlusion. J Indian Prosthodont Soc 2012 Nov; supplementary. DOI: 10.1007/s13191-012-0215-9

[8] Kumar S, Garg S, Gupta S. A determination of occlusal plane comparing different levels of the tragus to form ala-tragal line or Camper's line: A photographic study. J Adv Prosthodont 2013; 5: 9-15. DOI: http://dx.doi.org/10.4047/jap.2013.5.1.9

[9] Venugopalan SK, Babu S, Rani MS Determination of the relative parallelism of occlusal plane to three ala-tragal lines in various skeletal malocclusions: A cephalometric study. Indian Journal of Dental Research, 2012; 23(6): 719-25. DOI: 10.4103/0970-9290.111246

[10] Sahoo S, Singh D, Raghav D, Singh G Sarin A, Kumar P. Systematic assessment of the various controversies, difficulties, and current trends in the reestablishment of lost occlusal planes in edentulous patients. Ann. Med. Health Sci. Res. 2014, 4, 313–319. d DOI:10.4103/2141-9248.133450

[11] Shetty S, Zargar NM, Shenoy K, D’Souza N. Position of Occlusal Plane in Dentate Patients with Reference to the Ala-Tragal Line Using a Custom-Made Occlusal Plane Analyzer. J Prosthodont. 2015, 24, 469–474. DOI:10.1111/jopr.12250.

[12] Seifert, D.; Jerolimov, V.; Carek, V.; Ibrahimagic, L. Relation of the reference planes for orientation of the prosthetic plane. Acta Stomatol. Croat 2000, 34, 413–416.

[13] Landa, J.C. A scientific approach to the study of the temporomandibular joint and its relation to occlusal disharmonies. J. Prosthet Dent. 1957, 7, 170–174.

[14] Lang, B.; Swartz, W. Clinical Dentistry, 5th ed.; Harper and Row: Hagerstown, MD, USA, 1979; p. 9.

[15] Rosati, R.; Rossetti, A.; De Menezes, M.; Ferrario, V.F.; Sforza, C. The occlusal plane in the facial context: Inter-operator repeatability of a new three-dimensional method. Int. J. Oral Sci. 2012, 4, 34–37. DOI:10.1038/ijos.2012.2

[16] Bassi, F.; Deregibus, A.; Previgliano, V.; Bracco, P.; Preti, G. Evaluation of the utility of cephalometric parameters in constructing complete denture. Part I: Placement of posterior teeth. J. Oral Rehabil. 2001, 28, 234–238.

[17] Hussels W, Nanda RS. Analysis of factors affecting angle ANB. Am J Orthod 1984; 85:411-23. DOI:10.1016/0002-9416(84)90162-3

[18] Agarwal SS, Jayan B, Chopra SS (2015) An Overview of Malocclusion in India. J Dent Health Oral Disord Ther 3(3): 00092. DOI: 10.15406/ jdhodt.2015.03.0009

[19] Tuncay OC, Thomson S, Abadi B, Ellinger C. Cephalometric Evaluation of the Changes in Patients Wearing Complete Dentures. A ten-year longitudinal study. J Prosthet Dent. Feb1984:51; 2; 169-180. DOI: 10.1016/0022-3913(84)90254-3

[20] Sharab L, Jensen D, Hawk G, Kutkut A. A Cephalometric Analysis Assessing the Validity of Camper’s Plane to Establishing the Occlusal Plane in Edentulous Patients. Dent. J. 2023, 11, 81. DOI: https://doi.org/10.3390/dj11030081.

[21] Petriˇcevi´c, N, Guberina M, Celi´c R, Mehuli´c K, Krajnovi´c M, Antoni´c R, Borˇci´c J, ´ Celebi´c A. Use of digital photography in ˇ the reconstruction of the occlusal plane orientation. Med. Glas. 2009, 6, 243–244.

[22] Okane H, Yamashina T, Nagasawa T, Tsuru H. The Effect of Anteroposterior Inclination of the Occlusal Plane on Biting Force. J Prosthet Dent.Nov1979: 42(5):497-501. DOI: 10.1016/0022-3913(79)90241-5.

[23] Winkler S. Essentials of Complete Denture Prosthodontics. 2nd Edi. Ishiyaku Euro America Inc. USA. 1996.

..