



Occlusal Plane Orientation in Edentulous Patients: Integrating Anatomy, Function and Aesthetics

Shalabh Kumar,

Professor & Research scholar, Department of Prosthodontics, Teerthanker Mahaveer Dental College & Research Centre, Moradabad

Mukesh Kumar,

Professor, Department of Orthodontics, Teerthanker Mahaveer Dental College & Research Centre, Moradabad

Corresponding Author: Shalabh Kumar,

Professor & Research scholar, Department of Prosthodontics, Teerthanker Mahaveer Dental College & Research Centre, Moradabad. Email id: shalabk.dental@tmu.ac.in

Article Info

Volume 6, Issue 10, 2024

Received: 20 May 2024

Accepted: 15 June 2024

Doi: [10.48047/AFJBS.6.10.2024.6369-6374](https://doi.org/10.48047/AFJBS.6.10.2024.6369-6374)

Abstract: Patients who have been rendered edentulous lose the orientation of the occlusal plane, which needs to be relocated for complete dentures to be aesthetically pleasing and perform satisfactorily. This plane is crucial for the aesthetics and functionality of complete dentures. Relocating the occlusal plane accurately is essential for ensuring that dentures not only look natural but also perform effectively in terms of mastication, speech, and overall oral health. The accuracy of numerous landmarks for orienting the occlusal plane in an edentulous patient as examined by several writers is discussed in the following article.

Keywords: Edentulous, Complete denture, Occlusal plane, Ala-tragus line, Cephalogram

Introduction: When creating a full denture, the prosthodontist is entirely responsible for restoring the patient's natural appearance and function, as well as establishing an occlusion that best fits their craniofacial structure and neuromuscular system. The occlusal plane is defined in the Glossary of Prosthodontic terms as "the average plane formed by the incisal and occlusal surfaces of the teeth."¹

One of the important factors affecting occlusal balance is the inclination of the occlusal plane (IOP).² Determining the IOP is crucial since bilaterally balanced occlusion is the preferred circumstance when building equilibrated full dentures.³ Complete dentures are made to work as a vital component of the masticatory system in the mouth. Consequently, they ought to be created so that they match patient's jaw relation. One key physiologic idea between jaws & occlusion is occlusal plane.

For complete denture to work properly and have the best aesthetics, occlusal balance, and aesthetics possible, plane must be properly positioned. Occlusal plane influences how the tongue and buccinator muscle interact, causing food to gather in the sulcus and cause cheek or tongue biting in fixed or removable prosthesis. Additionally, it may cause tissue changes, premature bone resorption, and denture instability. Orientation of occlusal plane must be set

correctly to achieve optimum functional & aesthetically pleasing effects.⁴ Occlusal plane, when properly positioned, will help to a suitable sense of balance in dental composition. The operator faces a challenge in determining the proper occlusal plane; if done incorrectly, this might result in dentures that are both aesthetically and functionally undesirable.

Over the years, numerous locations and methods have been recorded for that reason. Among the present-day ideas are:

- Establishing plane posteriorly parallel to ala-tragus line and anteriorly according to aesthetic standards.
- Placing occlusal plane halfway between and parallel to remaining ridges.
- Aligning the buccinator grooves and the lip commissure with plane.
- Posterior occlusal plane terminating in middle or upper third of retromolar pad.
- Putting occlusal plane parallel to lateral edge of tongue.

Orienting Occlusal Plane: The analysis of the occlusal plane in edentulous patient is a crucial aspect of dental treatment planning and rehabilitation. This overview aims to provide a comprehensive understanding of the methods and considerations involved in assessing the occlusal plane in individuals with complete tooth loss. The overview highlights the key parameters considered during occlusal plane analysis, such as facial morphology, esthetics, phonetics, and functional occlusion. It explores the interplay between these factors and their influence on the final treatment outcome. By considering various factors, employing appropriate techniques, and promoting interdisciplinary collaboration, clinicians can optimize treatment outcomes and improve the quality of life for individuals with complete tooth loss.

Ala Tragus Line: The ala-tragus line, according to the Glossary of Prosthodontics Terms, reaches a specific spot on tragus of ear from inferior border of ala of the nose, which typically is thought to be tip of tragus.¹ Additionally, it is described by Ismail and Bowman as a line that runs from middle of the external auditory meatus's tragus to the nasal ala.⁵ Latter plane was undesirable as the space it frequently provided for positioning maxillary molar teeth was insufficient. As a result, inferior margin of tragus became new posterior reference point. There are conflicting opinions in the literature about which boundary of the tragus should be used; some researchers advocate utilising the lower, others the intermediate, and yet others the higher.^{6,7,8}

Van Niekerk's study involved making 33 pairs of complete dentures to determine occlusal plane.⁷ Occlusal plane was marked with lead foil that suited right mandibular posterior teeth. Inferior boundaries of the tragus and ala were targeted with a foil strip that was attached to the face. Each patient had conventional lateral cephalometric radiographs taken. Functional occlusal plane and ala-tragus line were traced on acetate paper. The teeth were positioned in centric occlusion for all radiographs. The two planes' relationship was evaluated, and a positive value was assigned to the angle between them for posterior convergence. The relationship's mean and standard deviation were then computed. After adjusting maxillary occlusal rim to occlusal plane, ala-tragus line described in this article could be employed as a landmark because of its close connection to occlusal plane.

Additionally, there are differences in the ala tragus line that correlate with occlusion (class I, II, and III), gender, and age. According to a study by Lahori et al⁹, in class I subjects mid-tragus was discovered as posterior reference point in 75% people, 10% of people have a superior tragus border, while 15% have an inferior tragus border. In 60% of class 2 individuals, posterior reference point was discovered to be mid-tragus, inferior border in 35%, and superior border of the tragus in 5% of patients. In 75% of cases, tragus's inferior border was posterior reference point & mid-tragus in remaining of class III patients. Their research discovered that the tragus's middle & inferior border were areas of study where tragal difference was most noticeable. Tragus's superior border may no longer serve as posterior marker for plane of

occlusion. Gender had no bearing on occlusal plane. This ran parallel to line connecting ala to tragus's inferior boundary in males and females.

Kumar et al tried to precisely identify area of tragus adopted to create Ala-Tragal line in patients with orthognathic profiles. They concluded that 53.3% of patients had occlusal plane parallel to line connecting ala & tragus's bottom. There was no sex-related difference in the occlusal plane level.¹⁰ While Carole et al concluded that area that most closely resembled the natural occlusal plane was ala-tragus line, connecting inferior border of ala to tip of tragus of ear.¹¹

Bondekar et al concluded that Camper's plane may be a better tool for re-establishing the occlusal plane since it closely reflects the occlusal plane of people who are totally dentate and have a skeletal Class I maxillo-mandibular connection.¹² The artificial occlusal plane can be located with the highest degree of accuracy using tragus's middle border and ala of nose. According to Shaikh et al, there is a clear correlation between age groups and the ala-tragus line level.¹³ The inferior border of tragus is used as posterior reference point in young adults. In middle-aged & elderly, superior & intermediate borders of tragus can be employed as posterior reference points. Therefore, in fully edentulous patients, one level of Ala- Tragus line shouldn't be used. Different levels of ala tragus line should be taken into consideration depending on the case, occlusion, and age.

Hamular Notch: Pterygoid hamulus of sphenoid bone meets maxilla to form a palpable notch known as the hamular notch. In dentistry clinical applications, reference planes for skull and face include occlusal plane, Frankfort plane, Camper's plane, and hamular-incisive-papilla (HIP) plane. Bilateral hamular notches and the incisive papilla are located in a horizontal plane called the HIP occlusal plane.¹⁴

According to Thapa et al., occlusal plane and HIP are not completely parallel.¹⁵ However, within a 2 mm range, 81.25% of the instances displayed parallelism. Dentate participants were chosen for this investigation, and an alginate impression was made of them. On cast, Hamular notch's deepest point & incisive papilla's centre were marked. Each cast was installed in surveyor, and using tripodding technique, plane connecting hamular notch and incisive papilla was aligned with surface.

According to H. Rich, occlusal plane can be determined using HIP.¹⁶ It might be very beneficial because they are clearly visible and seemed least influenced by resorption of residual ridge. HIP, which can be used as a clinical guideline to assess the inclination of the occlusal plane, is parallel to plane of occlusion in most cases.^{15,17} In order to examine the link between various occlusal planes and HIP plane, Fu conducted a study with 100 individuals (50 men & women each) in Taiwan.¹⁸ A 3- dimensional tool was used to measure all indicated spots on the maxillary casts. Investigated was angle between 4 distinct occlusal planes & HIP planes. Maxillary teeth's cusp tips and incisal edges' vertical lengths from the HIP plane were measured. It came to the conclusion that angle class I participants likely to have HIP occlusal planes that are more parallel to second occlusal plane (Upper right central incisor's incisal edge to mesio-buccal cusp tip of upper second molar), & can be used in clinical practise.

Retromolar Pad: It is described as a mass of tissue that is made up of loose glandular connective tissue that is covering nonkeratinized mucosa that is situated posterior to the retromolar papilla 1. It is important to distinguish between this flexible area and the pear-shaped pad. According to Duymuş et al, average vertical height of retromolar pad, which is 4 mm, has been found to be a good standard for identifying occlusal plane.¹⁹ According to Shah et al., in the majority of cases, retromolar pad's bottom third and occlusal plane were in alignment.²⁰ Discernible difference between males and females was absent in association between level of retromolar pad and occlusal plane. The retromolar pad can serve as a trustworthy intraoral reference in edentulous individuals to reestablish the orientation of the lost occlusal plane. According to another study, using retromolar pads and pterygomaxillary notches on casts is an accurate way to measure the horizontal jaw attachment.²¹ 200 patients

with complete absence of posterior occlusion were enrolled. Pterygomaxillary notch and retromolar pad were detected bilaterally on maxillary and mandibular casts after horizontal jaw relation was established. Anatomical landmarks were marked on each cast with a vertical line, and the space between the two lines was measured. A diagnostic test was carried out following outcomes of wax try-in appointment & accompanying measurements. A standard was created using largest horizontal distance between bisecting locations that still produced precise jaw connections and a receiver operating curve was produced. Evaluation of the test's precision for determining horizontal jaw relations. functional impression was made. With the aid of beading, boxing, and dental stone, master casts were made. Using techniques for swallowing, natural chewing, and gothic arch tracing, thirty dental professionals recorded the horizontal jaw relations. Individual patient facial dimensions were used to establish the vertical jaw relations, which were then confirmed using phonetics and facial expression. In order to mark the anatomical landmarks, lines were drawn into the casts. On the cast, a single line from the pterygomandibular notch's centre to the margin of the posterior lateral plane was drawn in both directions. Using the superior point of the retro-molar pad's centre, same procedure was then performed on the mandibular cast. Two vertical lines were drawn on the posterior lateral wall from the two spots on the bilateral margins of the maxillary cast to the underside of the cast. Then, starting at the intersection of the bilateral line, a second vertical line was drawn vertically. On the mandibular cast, a second vertical line was then drawn in a similar manner. The clinically acquired horizontal jaw record was used to position the maxillary and mandibular castings, which were made with wax rims and denture bases. Using a triangular ruler, line B' was then extended to the maxillary cast, and the horizontal distance (d) between lines A and B' was measured. From the original 200 patients, 30 casts and records were chosen at random. The appropriate occlusion of artificial teeth was achieved, and a wax try-in was finished. When rims were put in the mouth, intercuspation of all denture teeth served as proof of centric occlusion. These conclusions were reached by examining the reliability of the horizontal relation utilising the retromolar pad and pterygomandibular notch.

Buccinator Groove: According to a study by Gupta et al, it is possible to connect the occlusal plane and level of groove using buccinator's groove relator.²² An investigation using this analyser of found that occlusal plane & groove are at same level in 70% males & 66% women. Hence, buccinator groove can be employed for occlusal plane alignment.

In 59 percent of individuals on right side & 62 percent on left, occlusal plane was level along buccinator groove. Interaction between occlusal plane and buccinator groove on right and left sides was not significantly different (P 0.05), according to research by Jain et al.²³ Tongue It is a muscle organ used for several things, including phonetics and mastication. When giving entire dentures, it is a crucial factor. The occlusal plane must be close to tongue's lateral border when making a denture; if it is higher, side stresses on the teeth could cause the denture to become unstable.²⁴ Completely edentulous individuals were shown to have a larger percentage of retracted tongue position than moderately edentulous patients, according to Bhushan et al.²⁵ Individuals with more tooth loss than those with partial edentulousness usually displayed the retracted tongue position. There were 100 participants in total for this study, 50 of whom were totally and 50 of whom were partially edentulous. The aberrant upper tongue position was the most prevalent with 38% in the group of people who had no teeth at all. The usual lower tongue position was 34% more frequently found in the somewhat edentulous group. In entirely edentulous and moderately edentulous people, the aberrant tongue position was seen in 68% and 40%, respectively.

Parotid Papilla: In a study by Foley et al, 407 people were evaluated to measure the distance between the tips of the matching mandibular buccal cusps and inferior borders of right & left parotid papillae.²⁶ Total number of people was 293 men and 114 women, amongst which 258 were white, 111 black, 29 Hispanic, and 9 of other ethnicities. They concluded that occlusal plane and parotid papilla have a rather stable association.

Tantray et al. discovered that left parotid papilla was 3.6 mm tall and right parotid papilla was 3.2 mm tall above plane of occlusion.²⁷ While women produced mean distances of 3.2 mm & 3.4 mm for right & left side respectively, men produced the same mean distances at both levels [not statistically significant]. This study discovered a rather constant relationship between occlusal plane and parotid papilla. In a patient who is entirely edentate, parotid papilla can be used to evaluate and validate position of occlusal plane.

Conclusion: Indicators for directing the occlusal plane in people without teeth can take many different forms. However, numerous investigations on people with no teeth reveal that no one method for figuring out the occlusal plane is completely correct. Therefore, in edentulous people, it is insufficient to determine occlusal plane using just one technique. Occlusal plane must be located in edentulous patients utilising a mix of markers and superior clinical judgement.

Funding: This research has received no external funding

Conflict of Interest: None

Acknowledgement: None

References

1. Glossary of Prosthodontic Terms. 8th ed. St. Louis: CV Mosby; 2005.
2. Hanau RL. Articulation defined, analyzed and formulated. The Journal of the American Dental Association (1922). 1926 Dec 1;13(12):1694-709.
3. Santana-Penin UA, Mora MJ. The occlusal plane indicator: A new device for determining the inclination of the occlusal plane. The Journal of prosthetic dentistry. 1998 Sep 1;80(3):374-5.
4. Kuniyal H, Katoch N, Rao PL. "Occlusal plane orientor": an innovative and efficient device for occlusal plane orientation. The Journal of Indian Prosthodontic Society. 2012 Jun;12(2):78-80.
5. Ismail YH, Bowman JF. Position of the occlusal plane in natural and artificial teeth. The Journal of prosthetic dentistry. 1968 Nov 1;20(5):407-11.
6. Van Niekerk FW, Miller VJ, Bibby RE. The ala-tragus line in complete denture prosthodontics. The Journal of prosthetic dentistry. 1985 Jan 1;53(1):67-9.
7. Zarb G, Bolender CL, Carlsson GE. Boucher's prosthodontic treatment for edentulous patients, ed 11th. St Louis, USA, CV Mosby Co. 1997.
8. Boucher CO. Complete denture prosthodontics—the state of the art. The Journal of prosthetic dentistry. 1975 Oct 1;34(4):372-83.
9. 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. The Journal of Indian Prosthodontic Society. 2013 Dec;13(4):494-8.
10. 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. The Journal of Advanced Prosthodontics. 2013 Feb 1;5(1):9-15.
11. Abi-Ghosn C, Zogheib C, Younes R, Makzoum JE. The ala-tragus line as a guide for orientation of the occlusal plane in complete dentures. The Journal of Contemporary Dental Practice. 2014 Jan 1;15(1):108.
12. Bondekar V, Wagh SB, Attal PN, Pandey VR. Evaluation of relation between occlusal plane and ala-tragus line with the help of cephalometry. Journal of Advanced Medical and Dental Sciences Research. 2015 Dec;3(6):S43.
13. Shaikh SA, Lekha K, Mathur G. Relationship between occlusal plane and three levels of ala tragus line in dentulous and partially dentulous patients in different age groups: A pilot study. Journal of clinical and diagnostic research: JCDR. 2015 Feb;9(2):ZC39.
14. Cooperman HN. HIP plane of occlusion in oral diagnosis. Dent. Survey. 1975;51:60-2.

15. Thapa D. Evaluation of the reliability of hamular notch-incisive papilla plane (hip) in establishing occlusal plane. *Orthodontic Journal of Nepal*. 2014 Oct 24;4(1):45-7.
16. Rich H. Evaluation and registration of the HIP plane of occlusion. *Australian Dental Journal*. 1982 Jun;27(3):162-8.
17. Jayachandran S, Ramachandran CR, Varghese R. Occlusal plane orientation: a statistical and clinical analysis in different clinical situations. *Journal of Prosthodontics: Implant, Esthetic and Reconstructive Dentistry*. 2008 Oct;17(7):572-5.
18. Fu PS, Hung CC, Hong JM, Wang JC. Three-dimensional analysis of the occlusal plane related to the hamular–incisive–papilla occlusal plane in young adults. *Journal of Oral Rehabilitation*. 2007 Feb;34(2):136-40.
19. Duymus ZY, Yanikoğlu ND. The Relation of The Occlusal Plane And Retromolar Pad. *Atatürk Üniversitesi Diş Hekimliği Fakültesi Dergisi*. 2004(3).
20. Hussain Shah SZ, Azad AA, Hassan SH, Aslam A. Association of occlusal plane with the level of retromolar pad. *Pakistan Oral & Dental Journal*. 2016 Sep 30;36(3).
21. Zhang XX, Liu JZ, Zou W, Wang M. Diagnostic Testing Using Pterygomaxillary Notches and Retromolar Pads on Casts to Check Horizontal Jaw Relation. *Chin J Dent Res*. 2021 Apr 1;24(1):61.
22. Gupta R, Aeran H, Singh SP. Relationship of anatomic landmarks with occlusal plane. *The Journal of Indian Prosthodontic Society*. 2009 Jul 1;9(3):142-7.
23. Jain R, Shigli K. An in vivo study to correlate the relationship of the extraoral and intraoral anatomical landmarks with the occlusal plane in dentulous subjects. *Indian Journal of Dental Research*. 2015 Mar 1;26(2):136.
24. Puri D, Dhawan P, Tandan P. Tongue and its prosthodontic implications. *International Journal of Applied Dental Sciences* 2020; 6(2): 362-366
25. Bhusal DS, Shrestha B. Evaluation of Resting Tongue Position in Partially Edentulous and Completely Edentulous Patients. *Journal of BP Koirala Institute of Health Sciences*. 2020 Jul 26;3(1):73-8.
26. Foley PF, Latta Jr GH. A study of the position of the parotid papilla relative to the occlusal plane. *The Journal of Prosthetic Dentistry*. 1985 Jan 1;53(1):124-6.
27. Tantray MA, Bali SK, Shah SA. A study comparing the occlusal plane in dentulous and edentulous subjects in relation to maxillomandibular space in Kashmiri population. *Int J Applied Dent Sci*. 2017;3(4):96-102.