



ANALYZING OF OCCLUSAL PLANE IN EDENTULOUS PATIENTS – AN OVERVIEW.

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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. 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 : Occlusal plane, Landmarks, ala tragus line.

INTRODUCTION.

Occlusal plane's direction gets lost in patients with no teeth, and it must be repositioned if dentures are to be attractive and functional.¹ The occlusal plane is described as plane formed by tooth's incisive and occlusal surfaces according to the glossary of prosthodontic words.² "The plane of occlusion" is imagined surface touching incisal edges of incisors and tips of posterior teeth's occluding surfaces, according to Dr. Peter E Dawson.³

It is not a true plane, but it does reflect the average curvature of surfaces. Recent study has shed light on specific elements of oral function, revealing a link between the maxilla-mandibular space's size and the movement patterns of several oral and pharyngeal structures while speaking. Although the physician has control over the occlusal plane's orientation, esthetics, phonetics, and biomechanical aspects should be taken into account while establishing.^{4,5} When wearing dentures, the occlusal plane should be near to the plane that natural teeth once occupied.⁶ Tongue and cheek muscles can work normally in this location of occlusal plane,

which improves stability of denture.^{7,8,9}

For edentulous individuals, the exact position of occlusal plane is a point of contention. Tongue cannot rest on lower denture's lingual cusps when occlusal plane is too high. Too low an occlusal plane might result in tongue and cheek biting. It appears that there is no consensus on how it should be oriented for particular patients. Among the current concepts are:¹⁰

- Anteriorly, 1-3 mm underneath resting lip, posteriorly, parallel to ala-tragus line
- Occlusal plane should be parallel to and in middle of remaining ridges,
- The occlusal plane should be at same level as tongue's lateral border.
- Ending occlusal plane on retromolar pad in the middle or upper third, and
- Buccinator grooves and lip commissure are aligned with occlusal plane

Orienting Occlusal Plane In Mandible

Occlusal plane of mandible is functionally related to chewing.

The occlusal plane of the mandibular arch has been oriented using several landmarks. Retromolar pad, lateral border of tongue, buccinators groove, and commissure of lips are a few examples.¹¹

Retromolar Pad(RMP)

RMP has long been utilised as a benchmark for determining the appropriate occlusal level of prosthetic dentition in edentulous patients.

Syed zahid hussain shah et al¹² investigated relationship between occlusal plane and level of RMP among dentate people. Pad's vertical height was separated into three sections (bottom, middle, and upper 1/3rd). They discovered that occlusal plane corresponded in majority of patients, to the lower one third of retromolar pad.

Rubina Gupta et al¹³ studied Anatomic landmarks and occlusal plane's relationship. To determine the occlusal plane's connection and the retromolar pad, metal scale was carried from cuspid to mandibular II / III molar along the cuspid tip and extended posteriorly. There was no significant difference between males and females with occlusal planes at middle third of RMP area in 76 percent males and 78 percent females.

Lundquist and Luther¹⁴ had looked at whether intraoral markers such as the retromolar pad could accurately predict the occlusal plane's placement. In seventy-five percent of patients, the occlusal plane terminated on the bottom half of the retromolar pad, according to the findings, whereas it was on upper half for twenty-five percent.

Ruchi jain et al¹⁵ investigated the link between extraoral and intraoral landmarks and occlusal plane. The occlusal plane was discovered to correlate with middle one-third of the RMP on right side in (48%) subjects and the left side in (45%) subjects.

Lateral Border Of Tongue.

The tongue is a muscular organ placed in the mouth's floor. It's generally a factor in mandibular complete denture retention and stability. In order to ensure optimal retention and stability in complete denture, it is necessary to understand the anatomy, size, position, and categorization of the tongue and surrounding musculature while creating the complete denture.¹⁶

Occlusal plane if higher than lateral border of the tongue, may cause the denture to become unstable due to lateral tilting pressures applied against the teeth.

Barnett Kessler¹⁶ categorised functional tongue classification according to degree of activity into four kinds based on tongue functioning range.

The Occupational tongue: Those whose jobs necessitate a lot of tongue activity should use this. E.g. jurists, teachers, lecturers, preachers, musicians.

The Still tongue: Also known as the passive tongue. Limit your tongue activity. Injury or deformity could be the cause. E.g. ankyloglossia.

The Normal tongue: It's a prosthodontist's dream come true. Tongue function and range of motion are normal.

The Habitual tongue: It refers to the annoying, strong tongue movements that have evolved as a result of habit. The tongue's base is thick and powerful, exerting displacement forces here on denture.

He believes that tooth arrangement should be done in such a

way that the tongue's function is not harmed. Lower second molars frequently catch the base of the tongue, causing lower dentures to become unstable. Lower second molars frequently grab on the tongue's base, making lower dentures insecure.

According to Wright¹⁶, tongue position is classified as;

Normal- The tongue is restricted by mandibular teeth and fills the floor of the mouth. Apex rests on incisal edges of anterior teeth, whereas posterior teeth occlusal surfaces support lateral borders. Tongue size or motion are both normal.

Class 1- Retracted. Movement of tongue is retracted. Molar area is revealed once floor of mouth is moved lower. The apex is dragged down into the mouth floor and the lateral borders are lifted over the occlusal plane. The best prognosis is found in Class 1.

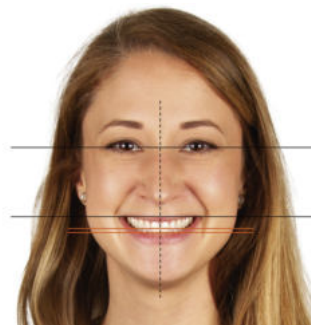
Class 2- Retracted. Tongue is stiff, being dragged backward upward. Apex of the tongue is dragged back into body and practically vanishes. Mandibular occlusal plane is above the lateral boundaries. The mouth's floor is high and tense.

Class 3- When the tongue is low in proportion to the mandibular ridge crest or is retruded in relation to the anterior ridge, mandibular denture retention is poor.

Because the floor of the tongue is at a higher height to cover the lingual flange of the denture, the Class 1 position has the best prognosis. Class II and III tongue positions are unfavourable because they lower the level of the floor of the mouth, resulting in an inadequate lingual seal and flange extension, resulting in overextension and dislodged dentures during tongue movement.¹⁶

Commissure of lip.

Compared to other immovable markers like the retromolar pad and ala-tragus line, lip commissure is a dynamic landmark.¹⁷ To maintain facial harmony, Horizontal reference lines on the face, such as the interpupillary line (IL) should be parallel to the TOP (transverse occlusal plane) and commissure line (CL) when viewed from the front.¹⁸



Different factors contribute to the absence of parallelism in TOP, IL, CL. Vertical skeletal asymmetry is commonly indicated by an increased labial commissure or alar base on a side during rest. Each patient's condition should be assessed individually; in some cases, orthognathic surgery along with orthodontic treatment is required to correct these issues.¹⁸

The mouth's commissure line can be utilised to indicate the occlusal plane's orientation. The distance between this dynamic landmark and the occlusal plane was between 0.2 and 1.3 mm. The veracity of this finding in complete denture creation has yet to be proven.¹⁷

Lundquist and Luther carried on to see if intraoral anatomic landmarks like the lip commissure could reliably determine occlusal plane's placement. They came to the conclusion that the lip commissure had a 1-3 mm association with occlusal plane position.¹⁴

Mehta P et al¹⁹ conducted a study to determine lip commissure position relating maxillary occlusal plane. Authors attempted to measure the lip commissure level in relation to maxillary occlusal plane within scope of study. Average distance between the maxillary occlusal plane and the lip commissure was 0.41 ± 0.83 mm. In 48.89 percent of instances, the lip commissure was determined to be at the occlusal plane., above the occlusal plane in 42.22 percent of the cases, and below the occlusal plane in 8.89 percent of the cases. As a result, the lip commissure is useful in physiologic and aesthetic occlusal plane positioning. Age differences were not taken into account. As a result, more research is needed to confirm the viability of this approach for complete denture construction.

Xi POINT (MID POINT OF RAMUS)

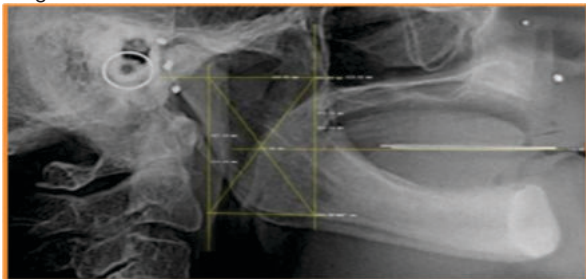
In 1955, Rickets conducted a study on mandible racial growth. During this research, he looked into the relationship between ramus and occlusal plane among natural dentition at various phases of mandible development. The findings revealed that occlusal plane when extending posteriorly to whole ramus, passes along Xi point amongst participants having stable occlusal connection. As a result, he came to the conclusion that the Xi point should be crossed by the occlusal plane in natural dentition for stable occlusion.²⁰

A Meenakshi et al²⁰ conducted a study to evaluate clinical co relation of Xi point to occlusal plane. A computerised DICOM programme was used to trace a radiographically obtained lateral cephalogram. Tracing of Xi point to occlusal plane was done digitally to determine its co-relation by following-

1. Construct four planes on the ramus's boundaries that are tangent to following points.

- R-1: at ramus's anterior edge, the deepest point,
- R-2: Opposite R-1 on the ramus's posterior edge.,
- R-3: The sigmoid notch's deepest point,
- R-4: On the inferior border of the mandible, opposite R-3.

2. Around the ramus, built planes create a rectangle.
3. In the rectangle's centre, the Xi point is at the junction of diagonals.



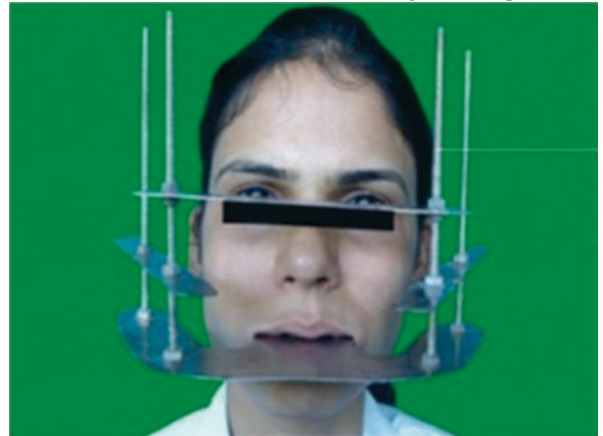
3 tragus points (superior, middle and inferior) and lower boundary of ala of nose were detected using detecting radiopaque markings after tracing the Xi point in dentate individuals. 3 alatragal lines were drawn. Then, using DICOM software, the buccal cusps of premolars and molars were used to trace OP without the 3rd molar, to examine occlusal plane's proximity to Xi point and its alignment to the ala-tragal line. They concluded that occlusal plane and superior ala-tragal line are parallel, and the OP is near to the Xi point.²⁰

Buccinator Groove

In most of the participants, regardless of sex, buccinator groove is discovered to be at occlusal plane. As a result, it is the most reliable intra-oral marker for orienting the occlusal plane.¹³

Ruchi jain et al did an in vivo study to determine the occlusal plane's connection to extraoral and intraoral anatomical landmarks. Buccinator groove relator and level analyzer were employed. They found that the buccinator groove was at the occlusal plane level on the right side in (59%) patients and on the left side in (62%) subjects.¹⁵

Rubina Gupta et al studied Anatomic landmarks and the occlusal plane's relationship. Buccinator groove relator and level analyzer were utilised. They found that 70% males and 66% females had groove at same occlusal plane, and that buccinator is a reliable reference orienting occlusal plane.¹³



Orienting Occlusal Plane in Maxilla;

Occlusal plane in the maxillary has been oriented using a variety of features. These include hamular notch- incisive papilla plane, ala-tragus line, parotid papilla.¹¹

Parotid Papilla.

Amongst edentate, parotid papilla is useful for reorienting the occlusal plane that has been lost.

Parotid papilla, according to Winkler, is 1/4 inch (6 mm) above maxillary first molars occlusal surface.²¹

Mehta P et al¹⁹ conducted a study to determine Position of parotid papilla in relation to maxillary occlusal plane. They found that distance on average, the parotid papilla is 3.69 ± 1.19 mm away from the maxillary OP.

Dr. Mohammad Altaf Tantray et al²² conducted study to observe the occlusal plane's position in relation to the parotid papilla. They discovered that The plane of occlusion was 3.7 mm away from all parotid papillae, with right papilla measuring 3.2 mm while left papilla measuring 3.6 mm.

P. F. Foley et al²³ conducted study to determine the location of the occlusal plane in relation to the parotid papilla. They found that the occlusion plane was 3.3 mm distant from all parotid papillae, with 3 mm for right papilla and 3.5 mm for left papilla.

Hamular Notch-Incislve Papilla.

In dentulous subjects, the incisive papilla is a prominent marker. Its posterior border remains generally consistent even after losing anterior teeth. The hamular notch remains unaffected following surgical or any degenerative procedures.

Deepti Tambake et al²⁴ analysed in Edentulous Subjects, Hamular-Incislve Papilla Plane (HIP) and Campers Plane Parallelism. They used three occlusal planes to assess HIP parallelism: a line connecting superior, middle, and inferior points on tragus and ala of nose. They came to conclusion that inferior border of the ala of nose formed a Campers plane with tragus's inferior point is parallel to the HIP

Dipak Thapa²⁵ evaluated Hamular Notch-Incislve Papilla Plane (HIP Reliability) in Establishing Occlusal Plane. For each patient, alginate imprints were taken, and castings were created with Type III dental stone. Colour pencil was used to mark the incisive papilla centre and deepest point of hamular notch. Cast was placed on marathion surveyor, and plane of HIP was brought parallel to floor. Tripoding method was used,

which involved bringing all 3 indicated points to the similar level and in touch with fixed vertical arm. They discovered that 81.25 percent of the cases had parallelism within 2 mm, and occlusal plane tends to be parallel to the HIP plane, which can be used in assessing occlusal plane inclination.

Sangamma K. Tippashetty et al²⁶ determined occlusal plane employing HIP plane evaluator. They looked at four occlusal planes and compared them to the HIP;

Plane I- Mesiobuccal cuspal tip (maxillary 1st molar) to Mesiolabial incisal edge of upper right central incisor

Plane II- Mesiopalatal cuspal tip (maxillary 1st molar) to Mesiolabial incisal edge of upper right central incisor

Plane III- Mesiobuccal cuspal ends of upper 2nd molars to Mesiolabial incisal edge of upper right central incisor

Plane IV- Mesiopalatal cuspal ends (maxillary 2nd molar) to Mesiolabial incisal edge of upper right central incisor.

To H.I.P plane, occlusal plane (incisal edge of upper central incisor to the mesio-buccal cusp of upper 2nd molar), had least angle of $1.316^{\circ} \pm 1.158^{\circ}$, signifying HIP plane being parallel to plane III.

Ala Tragus Line (ATL).

Because of absence of consensus on exact points of reference for ATL, its use in occlusal plane (OP) orientation is problematic. According to GPT- 9 ATL is "a line running from the inferior border of the ala of the nose to the superior border on the tragus of the ear; It is usually used to construct the ala-tragus plane, along with a third point on the opposing tragus; the ala-tragus plane should ideally be parallel to the occlusal plane."

Shrestha L et al²⁷ checked reliability of ATL for Orientation of the OP. Following cephalometric points were employed in this investigation:

Ala (A): lower ala of nose.

Tragus superior (Ts): Ear tragus' superior border

Tragus middle (Tm): The tragus's middle point

Tragus inferior (Ti): Ear's tragus's inferior boundary

I: The incisal border of upper central incisor at its lowest point.

MP: lowest point of the radiopaque shadow cast by a lead foil across the maxillary right 1st molar's Mesio-palatal cusp.

The following cephalometric planes and lines were employed:

Superior ATL (ATs): A line connecting points A and Ts.

Middle ATL (ATm): A line connecting points A and Tm.

Inferior ATL (ATi): A line connecting points A and Ti.

Occlusal plane (OP): Line connecting incisal edge of upper central incisor (I) with Mesio-palatal cusp of right upper 1st molar.

The angle formed between occlusal plane and all ATL were evaluated.

They came to the conclusion that alatrags line, from the tragus's middle point to ala's inferior border, in edentulous patients, is most precise line in orienting occlusal plane.

Prashanthi N et al²⁸ evaluated in younger people, occlusal plane-ala tragal line parallelism. The individuals were requested to hold a fox plane covered in dental wax placed between natural teeth, touching the upper incisal edges and cusps of the left and right upper first molars. Subjects were photographed with heads in natural position. with their backs straight for left lateral profile pictures. Angles between fox plane and superior, middle, and inferior borders of alatrags line were measured. In younger age individuals, the inferior boundary of the alatrags line serves as posterior reference point, according to this study.

Saquib Ahmed Shaikh et al²⁹ did a pilot study to see correlation between OP and 3 ATL levels amongst Dentulous and Partially Dentulous Patients of Various Ages. Fox plane was placed

intraorally. Photograph were taken. On pictures, the inferior, middle or superior border of the tragus, and inferior border of the ala of the nose were all marked as reference points. Three different tiers of Ala-Tragus line were created by joining them. When The tragus's inferior border was used, they discovered that ATL was more parallel to OP in young adult. When the middle of tragus was used, the occlusal plane was found to be more parallel to the Ala-tragus line in older age groups.

Carole Abi-Ghosn et al³⁰ studied relationship between occlusal plane and ala tragus line. Each subject had lateral cephalometric radiographs recorded using a normal procedure. On acetate paper, tracings of OP and 3 ala-tragal lines were constructed. Following landmarks were used in this study:

ATL1: A line that goes from the ala of nose's inferior margin to tragus of ear's superior border.

ATL2: A line that runs from the ala's inferior margin to the tragus's tip.

ATL3: Line stretching from the ala's inferior margin to the tragus's inferior border.

Natural OP: mesio-incisal angle of upper central incisor to mesio-palatal cusp of 1st molar.

Ala-tragal line, (nose's inferior border to tragus's tip) was shown to have closest similarity to natural occlusal plane.

Sanath Shetty et al³¹, determined with relation to ATL, the position of OP in dentate patients. There were 3 parts to tragus: superior, middle, and inferior. Participant's lips were inserted in the equipment, and the posterior spots on the tragus were measured. They came to the conclusion that the inferior region of the tragus was the most usual position for the posterior point on tragus (50.8%). Middle section of tragus was the 2nd most common site (24.7 percent), followed by superior location (12.1 percent).

Shashinandan K Venugopalan³² et al determined parallelism of OP to 3 ATL in different occlusions. They concluded that in Class I and Class III malocclusion, line from tragus's inferior border to nose's lower border was roughly parallel to OP. Lines drawn from tragus's middle border to ala of nose's lower border in class II malocclusion were parallel to occlusal plane.

CONCLUSION

In edentulous patients, various markers are accessible for occlusal plane orienting. However, no single method for locating the occlusal plane appears to be completely accurate, according to several research on dentulous patients. As a result, determining the occlusal plane in edentulous individuals using just single method will not suffice. Location of the occlusal plane in edentulous patients must be determined using a mix of landmarks as well as sound clinical judgement.

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