



## Review Article

# Fundamentals for orientation of occlusal plane in completely edentulous patients – A review

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## ABSTRACT

In order to restore the occlusal contact to the original condition and for harmonious stomatognathic system in Conventional Prosthodontic Rehabilitation, the establishment of occlusal plane is very important. The ideal position of artificial teeth in complete denture in the same position of natural teeth will be achieved by the orientation of occlusal plane similar to the natural location of occlusal plane. This review highlights the significance of occlusal plane orientation, basic concepts, various landmarks associated with occlusal plane to achieve the functional, mechanical and esthetic rehabilitation of completely edentulous patients.

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## 1. Introduction

In orientation jaw relation for completely edentulous patients the maxillary occlusal plane should be made parallel to the base of the skull. Occlusal plane is defined as “the average plane established by the incisal and occlusal surfaces of the teeth – GPT (July 2005)”<sup>1</sup>. It is anatomically related to the cranium and theoreticall touches the incisal edges of the incisors and tips of the occluding surfaces of the posterior teeth, it can be the surface of wax occlusal rim for arrangement of denture teeth or a flat metallic plate for arranging artificial teeth. It is not a plane in the true sense of word but represents the mean curvature of the surface.<sup>2</sup> The orientation of the occlusal plane to the base of the skull is the most important step in prosthodontics for any prosthesis fabrication.

Establishing the exact parallelism to the base of the skull becomes difficult because of the presence of the muscle tissues covering the skull and mandible.<sup>3</sup> In order to make

this procedure easy there are several landmarks proposed to define the level of occlusal plane. Those defined landmarks from which measurements or reference can be made is called as Plane of reference. This review article explains in brief about various anatomical landmarks, concepts and techniques involved in the orientation of occlusal plane for prosthesis fabrication for edentulous patients.

## 2. Clinical Significance of Establishing Occlusal Plane in Completely Edentulous Patients

Rehabilitation of the completely edentulous patients can be Removable or Fixed prosthesis, tooth or implant supported overdentures involves the various anatomic, physiologic and mechanical factors have to be considered to restore the functions and health of the stomatognathic system.<sup>4</sup> The following facts describes the importance and significance of the occlusal plane.

1. Optimal functional achievement with effective biomechanics of the prosthesis.

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2. Ideal tooth arrangement for mechanically balanced articulation and improved stability of the prosthesis.
3. For achieving the effect of smile line with natural look of curvature and position of teeth in relation to the lips and avoiding artificial Denturist smile.
4. The occlusal plane in complete denture should be as harmonious providing normal function of tongue, cheek, muscles, enhancing the denture stability and masticatory efficiency.
5. Too high occlusal plane or too low occlusal plane with reference to the previous natural occlusal plane leads to tongue and cheek biting, difficulty in speech.
6. Governs the optimum esthetics, phonetics and overall comfort of the patient.

### 3. Factors Affecting the Orientation of Occlusal Plane

The factors that determines the orientation of occlusal plane are Anatomical Landmarks, Anatomic Reference Plane Related To Ridge Parallelism, Functions, and Esthetics.

#### 3.1. Anatomical landmarks for orientation of occlusal plane

In Orthodontic treatment planning there are anatomical landmarks which are useful for Cephalometric tracing. Similarly for the location of occlusal plane in Prosthodontic treatment there are specific anatomic landmarks for maxilla and mandible respectively. These proposed landmarks act as a guide for establishing the occlusal plane accurately in clinical practice of complete oral rehabilitation.

Maxillary occlusal plane was more important in facebow transfer of maxillary cast to the articulator, the occlusal plane which was determined in the patients mouth should not change while transfer to the articulator.<sup>5,6</sup> Some of the landmarks used for this maxillary occlusal plane were discussed below

#### 4. Parotid Pappila

Studies found that parotid papilla was 3.3mm above the occlusal plane. But there is a dissimilarity among the patients about the position of parotid papilla ranging from 2.56 – 6mm. Thus, considering this anatomical landmark was not an accurate guide for the occlusal plane orientation.<sup>7</sup>

#### 5. Hamular Notch – Incisive Papilla

Some authors studied hamular notch- incisive papillae as two stable anatomical landmarks for occlusal plane orientation. The hamular notch and incisive papilla were constant landmark that do not change over time but their position and parallelism was difficult to be considered as the reliable landmark.

#### 6. Interpupillary Line

Rubina Gupta in the year 2009 stated that occlusal plane was not generally parallel to interpupillary line. Anteriorly the height of the occlusal plane is determined according to the patients esthetics, phonation and speech but not with interpupillary line alone because in asymmetrical face it was not a reliable landmark for orienting occlusal plane

Mandibular occlusal plane determines the efficiency of masticatory function. The musculature of lips, tongue and cheeks should be considered for establishing the occlusal plane of mandibular arch.<sup>6</sup> Those important landmarks to be considered were described below.

#### 7. Retromolar Pad

It is the pear shaped pad that forms only after removal of most distal molar. Various authors suggested this landmark for orienting the occlusal plane by dividing it into 2 or 3 parts. It has a disadvantage that it cannot be used as a guide for tooth supported full mouth rehabilitation and has a drawback that it was a soft tissue landmark and the borders cannot be demarcated accurately. Though it was not a reliable landmark, the lower third of retromolar pad can be used commonly for posterior occlusal plane of manibular teeth setting.<sup>2</sup>

#### 8. Lateral Border of Tongue

Ala - tragus line from the inferior border of nose to inferior border of tragus corresponds to the lateral border of tongue. But in case of long span edentulism, the tongue becomes hypertrophied, results in change in anatomy of the tongue.<sup>2</sup>

#### 9. Commisure of Lips

Anatomically the commissure of lip was inferior to the occlusal plane by 1.37mm. The age changes in the older patients causes dropping of lips that becomes unreliable for the establishment of occlusal plane.

#### 10. Buccinator Groove

This is considered as the reliable landmark only when the patient have good muscle tone.

#### 11. Anatomic Reference Plane Related to Occlusal Plane

Cephalometric radiograph involves certain anatomical landmarks correlated with the guide planes that are associated with analysis of occlusal plane.<sup>8</sup> It includes

1. Skeletal landmarks.
2. Soft tissue landmarks.
3. Dentate landmarks.

Reference plane includes

1. Frankfort's horizontal plane.
2. Camper's plane.
3. Maxillary palatal plane.
4. Mandibular plane.

From the study conducted in the year 2013, about the reliability of anatomic reference planes, it was concluded that Frankfort horizontal plane, Camper's plane and Palatal plane showed definitive relation with the occlusal plane.<sup>4</sup> The occlusal plane orientation was not influenced by the type of jaw relation.

## 12. Frankfort's Horizontal Plane

It is the plane drawn from Porion to the Orbitale. Various authors suggest the angulations that relates FH plane to the occlusal plane. In 1985, Celebic suggests the angulation as  $9.43^\circ$  in dentulous and  $8.53^\circ$  in edentulous on an average value.<sup>9</sup>

## 13. Camper's Line

It was the line drawn from ala of the nose to tragus. The point tragus involves superior border, middle border and inferior border. In 1985 Niekerk found an angulation of occlusal plane to campers line as  $3.45^\circ$ .<sup>10</sup> It was the minimal value where it has been considered as the nearly parallel to the occlusal plane and so the superior border of tragus to inferior border of ala of the nose was the most reliable guide plane for establishing the occlusal plane.

## 14. Palatal Plane or Maxillary Plane

It is drawn from anterior nasal spine to posterior nasal spine. In 2017, M.A.Tantray had explained that occlusal plane is more angulated in relation to the maxillary plane in edentulous (i.e) there was increase in angulation between occlusal plane and palatal plane. Whereas there was decrease in angulation between occlusal plane and mandibular plane angle. Average occlusal plane - palatal plane angulation is  $6.00^\circ$ , wherein edentulous it is  $6.55^\circ$  and Occlusal plane mandibular plane angulation is  $16.15^\circ$  whereas in edentulous is  $11.0^\circ$ .<sup>11</sup>

## 15. Function

Relationship of occlusal plane to the lower lip and tongue.

1. Phonetics
2. Chewing

## 16. Esthetics

1. The occlusal plane in the anterior and posterior regions may vary, where in anterior region the esthetics governs the vertical height of the occlusal plane.
2. Campers line posteriorly.
3. Linea alba in recently extracted patients.

## 17. Clinical Orientation of Occlusal Plane

Prosthetic reconstructive therapy for the completely edentulous patients is more challenging in all aspects. Prosthodontists are responsible for functional and morphological reconstruction that should give natural appearance which existed previously before extraction of tooth.<sup>5</sup> One of the critical but interesting part of restoring the missing teeth is orientation of occlusal plane in harmonious with the stomatognathic system.

Various landmarks and reference plane angle for pointing the occlusal plane were suggested by many authors. Prince Kumar(2013)<sup>11</sup> suggested that Frankfort horizontal plane, Camper's plane, palatal plane can be used as a reliable guide to establish occlusal plane. Among these the Ala-tragus line is clinically and extraorally used for reference in the orientation jaw relation procedure. For many years this Camper's line is considered parallel to the occlusal plane with evidence based Cephalometric radiographic analytical studies.<sup>4</sup>

This Ala–tragus line was considered as more constant reference plane because both of its end points do not change with age.<sup>5,10</sup> Petrus Camper proposed Ala tragus line or Campers plane that is elucidated as Camper's line in 1786, which was named after his name itself. As the name suggests, it extends from ala of nose to tragus of the ear but the critical factor in that is positioning the exact point on ala and the tragus.

With various study it is concluded that the ala of nose is marked on the inferior part of Ala. The tragus is divided into superior part, middle part, and inferior part, but the evidence based studies suggests that the middle and superior border is considered to be the reliable anatomical landmarks in guiding occlusal plane. Many studies of Kumar, Chathurvedi et al. stated that inferior point on tragus can also be considered as the reference point.

R. Hartono<sup>12</sup> evaluated the occlusal plane relationship to the different facial types. In his study, he determined the ala-tragus line is used for guiding the occlusal plane, so he correlated different facial types to point the reliable position in ala and tragus. He concluded that, for all the different facial types studied, the line connecting the lowest point on ala of the nose to the inferior margin of tragus is nearly parallel to the occlusal plane.

For clinical orientation of the occlusal plane, the anterior plane (i.e) anterior height of occlusal plane is evaluated by the patient esthetics and phonetics. Whereas the posterior plane is guided by the ala- tragus line. Occlusal plane in completely edentulous patients must be adjusted so that it should be 2mm below the level of upper lip during speech, whereas the lower occlusal rim must be at the level of lower lip and angle of mouth and posteriorly it must be two – third of the height of retromolar pad.

Those instruments which are used to check the parallelism of occlusal plane to ala-tragus line are Fox

plane, Digital vernier calliper, Buccinator groove relator, Level analyser and Metallic scale. Among these Fox plane and Face-bow are the main instruments used to assess the parallelism of the occlusal plane to the ala tragus line.<sup>4</sup> Fox plane is used for transferring the plane of occlusion to the non-adjustable articulator. After placing the upper bite rim in position, the correction can be done until the frontal connecting arm of fox plane should be straight when viewed from front and lateral arm of fox plane should be parallel to the ala-tragus line.

Face bow especially Stratos facebow can be also used to transfer the occlusal plane parallel to ala-tragus line from the patient to semi-adjustable articulator for achieving balanced occlusion with the prosthesis. For orienting occlusal plane with face bow the anterior and posterior reference points and third point of references were used based upon the type of articulators used.

### 18. Conclusion

The three planes- Frankfort's Horizontal plane, Camper's plane, Palatal plane and various landmarks are discussed and compared in this article to establish the occlusal plane irrespective of the facial form.<sup>12</sup> They are not influenced by the type of skeletal jaw relation in both dentulous and edentulous subjects,<sup>11</sup> because the age changes cannot alter these landmarks as like other soft tissue landmarks. For accurate and reliable location of occlusal plane in completely edentulous patients, the combination of these landmarks and reference planes will be needed. The knowledge and skill of the Operator in utilization of these landmarks and analysis of occlusal plane determines the overall esthetic and functional success in prosthodontic rehabilitation.

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### 20. Conflict of Interest

None.

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