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Evaluation of the occlusal plane in edentulous patients in relation to maxillomandibular space in Kashmiri Population

Mohammad Altaf Tantray, Sandeep Koul Bali, and Shabir Ahmad Shah

Abstract

Background: The glossary of prosthodontic terms defines occlusal plane as “the average plane established by the incisal and occlusal surfaces of the teeth: it is not a plane but planar mean of curvature of surface.

Aims and Objectives The study was conducted: To orient the plane of occlusion precisely using hard tissues as reliable, relatively constant references. To relate inclination the plane of occlusion with the maxillary plane and to the maxillomandibular space dimensions

Results: After obtaining signed informed consent, the lateral cephalograms of selected participants were taken in the department of Oral Medicine and Diagnostic Radiology, Government Dental College and Hospital, Srinagar Jammu & Kashmir, India. Tracing of each cephalogram was made using a tracing sheet with a graphite pencil.

Conclusion: A significant association exists between the inclination of the occlusal plane and maxillary plane in relation to maxillomandibular space dimensions.

Keywords: occlusal plane, maxillomandibular space, incisal Spaces

Introduction

The glossary of prosthodontic terms defines occlusal plane as “the average plane established by the incisal and occlusal surfaces of the teeth: it is not a plane but planar mean of curvature of surface [2]”. It helps in establishing ideal occlusion.

According to Boucher, “it seems to be obvious that if the soft tissue surrounding the denture is to work around as they did around natural teeth, occlusal plane should be oriented exactly as it was when the natural teeth were present [3]”.

Craddock, 1951; Schlosser & Gehl, 1953 suggest establishing the occlusal plane according to aesthetic requirements anteriorly and parallel to the ala-tragus line posteriorly.

Nagle and Sears, 1962 recommend orienting occlusal plane on same level as the lateral border of tongue.

Ismail and Bowman, 1968 recommend terminating the occlusal plane posteriorly at the middle or upper third of the retromolar pad [15].

Lundquist and Luther, 1970 recommend orientating the occlusal plane with the buccinators grooves and the commissure of the lips [20].

It is generally agreed that in the anterior region the vertical height of the occlusal plane is governed by esthetic requirements [5, 6].

Orienting occlusal plane parallel to Camper’s plane is most acceptable method. Boucher defines Camper’s plane as an imaginary line that runs from the inferior border of the ala of the nose to the superior border of tragus of ear [37].

This study was conducted to evaluate the occlusal plane inclination in relation to relatively stable and constant anatomical landmarks.

Aims and objectives

The study was conducted

- i. To orient the plane of occlusion precisely using hard tissues as reliable, relatively constant references.

- ii. To relate inclination the plane of occlusion with the maxillary plane and to the maxillomandibular space dimensions

Materials and methods

The edentulous group consisted of Kashmiri patients with age ranging from 35-78 years who attended the Department of Prosthodontics and Crown & Bridge, Government Dental College and Hospital, Srinagar.

Method of data collection

Inclusion Criteria

- i. Subjects with normal ridge relation.
- ii. Subjects with orthognathic profile.

Exclusion Criteria

- i. Subjects with symptoms of temporomandibular disorders,
- ii. Facial asymmetries,
- iii. Congenital facial defects.

Armamentarium

- i. Lateral cephalograms X-ray unit [80 kvp, 15 mA, and 1 sec].
- ii. Lateral cephalograms X-ray film [Green Sensitive, KODAK –TMAT].
- iii. Automatic X-ray film processor.
- iv. Tracing sheet [One side matte, 50 micrometer thick].
- v. 4 H pencil.
- vi. X-ray viewer.
- vii. Cellophane tape.
- viii. Paper tape.
- ix. Compass.
- x. Divider.
- xi. Scale.
- xii. Complete dentures.
- xiii. Eraser.

Methodology

After obtaining signed informed consent, the lateral cephalograms of selected participants were taken in the department of Oral Medicine and Diagnostic Radiology, Government Dental College and Hospital, Srinagar Jammu & Kashmir, India. Tracing of each cephalogram was made using a tracing sheet with a graphite pencil.

In this study, Camper's plane was used to orient the occlusal plane in edentulous subjects. An evaluation of the established occlusal plane in edentulous patients was then made cephalometrically based on the dimensions of the maxillomandibular space, namely, height, length, and maxillomandibular angle. Maxillomandibular space length was measured at the level of the occlusal plane. It was defined as the distance along the occlusal plane from the intersection of the plane with the posterior pharyngeal wall to the point where the occlusal plane meets the most lingually placed incisor tooth. Maxillomandibular space height was defined as the perpendicular distance from Menton to the maxillary plane. Maxillomandibular angle was defined as the angle between the maxillary plane and the mandibular plane, which was extended beyond the

posterior pharyngeal wall for the convenience of measurement.

The occlusal plane was adjusted parallel to interpupillary line anteriorly and Camper's Plane posteriorly during denture fabrication. During the post insertion period a piece of orthodontic band material that was 10 mm x 4 mm wide and 0.005 inches thick was placed along the buccal cusps of the first and second mandibular premolars and the mesio-buccal cusp of the first mandibular molar. A strip of anterior band material 0.003 inches thick was placed longitudinally on the maxillary right central incisor and mandibular right central incisor, from the gingival margin on the labial aspect, over the incisal edge, and to the gingival margin on the lingual/ palatal aspects. Right lateral cephalograms were obtained while the dentures were placed in the mouth and the jaws were approximated in centric relation.

Cephalometric Analysis

All lateral cephalograms were traced with 4-H pencil. The cephalometric points, planes and angles traced are as under:

A). Points

- i. Anterior Nasal Spine (ANS).
- ii. Posterior Nasal Spine (PNS).
- iii. Gonion (Go).
- iv. Menton (Me).
- v. T-point: the point where occlusal plane meets the posterior border of soft palate shadow.

B). Planes:

- i. Maxillary plane (Max. P): the plane that joins the anterior nasal spine with posterior nasal spine
- ii. Mandibular plane (Mnd.P): that plane that joins Gonion (Go) with Menton (Me).
- iii. Occlusal plane (Occ.P)
 - (a). Dentulous occlusal plane: A plane that extends from the point midway between the incisal tips of maxillary and mandibular incisors to the point midway between mesio-buccal cusps of maxillary and mandibular incisors.

(b). Edentulous occlusal plane: A plane that extends from the incisal tip of maxillary central incisor to the mesio-buccal cusp tip of lower right molar.

C). Linear measurement:

- i. Maxillomandibular space length (L): It was defined as the distance along the occlusal plane from the intersection of the plane with the posterior pharyngeal wall to the point where the occlusal plane meets the most lingually placed incisor tooth.
- ii. Maxillomandibular space height (H): defined as the perpendicular distance from Menton to the maxillary plane.

D) Angular Measurement:

- i. Maxillary-occlusal plane angle: the angle the occlusal plane makes with maxillary plane.
- ii. Mandibular-occlusal plane angle: the angle the occlusal plane makes with mandibular plane
- iii. Maxillomandibular plane angle: the angle the maxillary plane makes with mandibular plane.

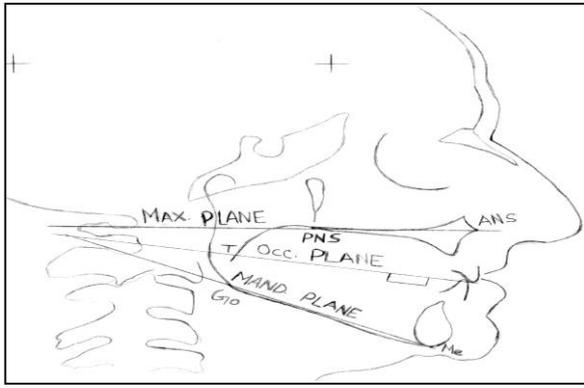


Fig 1: Points and planes: ANS (anterior nasal spine), PNS (posterior nasal spine), Go (Gonion), Me (Menton), T (Point of intersection of occlusal plane and soft pharynx), Max. Plane (Maxillary plane), Occ. Plane (Plane of occlusion), Mand. Plane (mandibular plane).

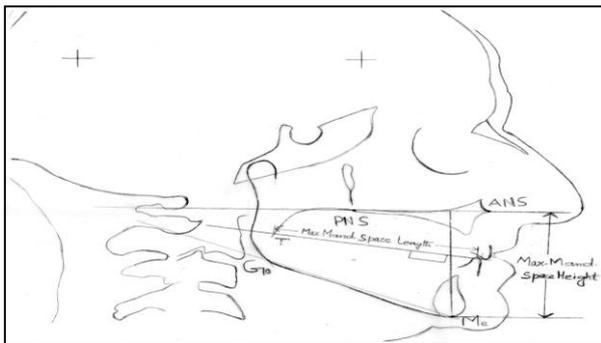


Fig 2: linear measurements maxillomandibular space length Maxillomandibular space height.

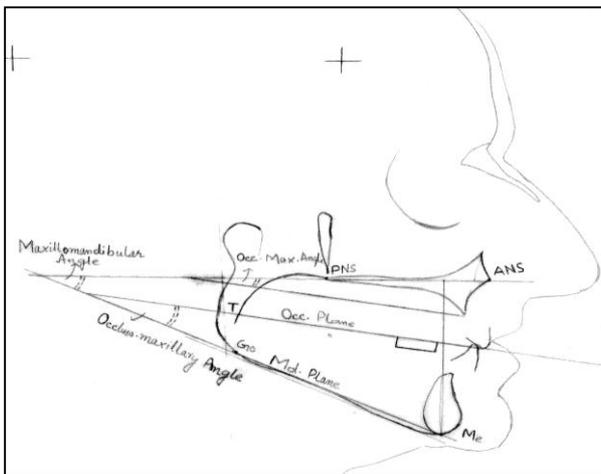


Fig 3: angular measurements: occlusomaxillary plane angle, occlusomandibular plane angle, maxillomandibular plane angle.

Results

Arbitrary mean values were taken for maxillomandibular space height and length. Maxillomandibular space heights of 70mm or more are taken as high while those under 70mm are were considered as low. Maxillomandibular space length of 80mm or more are considered as long and those under 80mm are considered as short.

On the basis of maxillomandibular space dimensions, edentulous subjects are divided into four subtypes mentioned as under

1. Long and low
2. Long and high
3. Short and low

4. Short and high

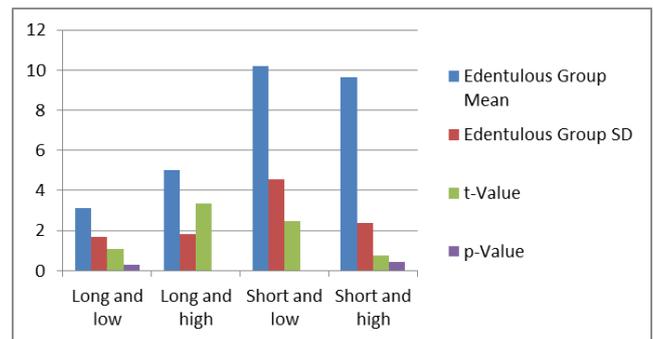
Occlusomaxillary angel: Mean of the Occlusomaxillary plane angles of the whole edentulous group is 8.1375 plus minus 4.2817. The occlusal plane tends to be more parallel to maxillary plane in long and low type of maxillomandibular space than the other subtypes of the maxillomandibular space of edentulous group. The mean of Occlusomaxillary plane angle for the long and low type of max-mand space is 3.1 plus minus 1.67 and for short and low type is 10.20588 +_ 4.53. In short and low and short and high types of maxillomandibular space the occlusal plane is more angulated with mean values of 10.2⁰ and 9.65⁰.

Occlusomandibular angle: The mean of Occlusomandibular plane angle for edentulous group is 10.375+ - 5.1027.

ANOVA was applied to the study.

Table 1: Comparison Based On Occlusomaxillary Plane Angles In Relation To Length and Height Of Maxillomandibular Space.

	Edentulous Group		t-Value	p-Value
	Mean	SD		
Long and low	3.10	1.673	1.083	0.297
Long and high	5.00	1.813	3.332	0.005*
Short and low	10.21	4.531	2.45	0.021*
Short and high	9.65	2.381	0.776	0.449

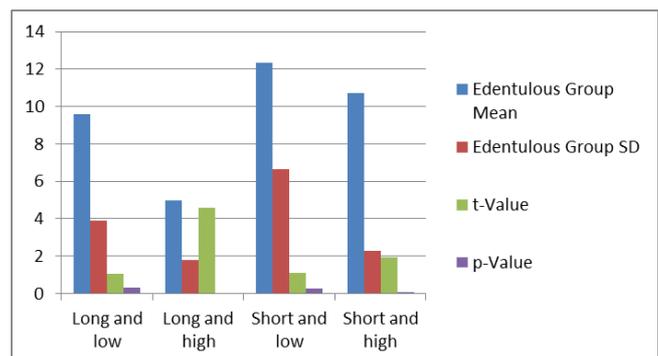


Graph 1: Comparison Based On Occlusomaxillary Plane Angles In Relation To Length and Height of Maxillomandibular Spac.

Table 2: Comparison Based On Occlusomandibular Plane Angles In Relation To Length and Height of Maxillomandibular Space between Two Groups.

	Edentulous Group		t-Value	p-Value
	Mean	SD		
Long and low	9.6	3.91	1.046	0.313
Long and high	5.0	1.81	4.584	<0.001*
Short and low	12.35	6.64	1.09	0.285
Short and high	10.7	2.26	1.944	0.069

*Statistically Significant Difference (P-value<0.05)



Graph II

Discussion

The ideal position of the teeth in complete dentures is the same as that of the natural teeth. Facial harmony is achieved when teeth are set in their proper relation^[14].

The position of the occlusal plane of orientation forms the basis for ideal tooth arrangement, and should fulfill the necessary mechanical, esthetic, and phonetic requirements, and aid respiration and deglutition^[80].

Ausburger's^[9] study indicated a strong correlation between the occlusal plane and the lateral aspects of facial type.

L'Estrange and Vig^[23] compared the occlusal plane in dentulous and edentulous in relation to maxillomandibular space. The authors concluded that angulations of occlusal plane and maxillary planes were relatively consistent in both dentulous and edentulous group and may be used as a reliable guide to establish the lost occlusal plane in edentulous patients. The study indicated (I) a significant difference at the 5% level within and between four groups, (II) a significant difference at the 5% level between high and low groups and (III) a significant difference at the 5% level between long and short groups.

According to our results, the sub-types long and low versus short and low, long and low versus short and high, long and high versus short and low, long and high versus short and high showed statistically significant difference with p-value of <0.001.

In 1953, Sloane and Cook^[8] conducted a study of 26 dry skulls and found that the plane of occlusion is strongly related to the length of the line connecting the ANS and the hamular notch, which also represents the skeletal base of the maxillae. The longer the Cook's plane length the less inclined the occlusal plane.

However, in my study, the angulation of the occlusal plane with the maxillary plane varies inversely with the dimensions of maxillomandibular space.

A cephalometric study done by Van Niekerk *et al.*^[32] on 33 edentulous patients, found the angulation of occlusal plane to Camper's plane as 3.45 whereas Koller *et al.*^[56] and Karkazis^[85] and Polyzois^[85] reported it as 7.00 and 10.00 respectively.

Conclusion

A roentgenographic comparative study was conducted in the edentulous subjects to determine the proper location of the occlusal plane in relation to the maxillomandibular space. The results from edentulous subjects indicate that a close angular affinity exists between the occlusal plane and the maxillary plane.

A significant association exists between the inclination of the occlusal plane and maxillary plane in relation to maxillomandibular space dimensions.

In the edentulous subjects, a significant association is seen between the occlusomaxillary plane angle and the length of maxillomandibular space.

- i. In the long and low subtypes of maxillomandibular space, the value of occlusomaxillary plane angle is minimum. The occlusal plane tends to be parallel to maxillary plane.
- ii. In the short and low, the occlusal plane inclination to maxillary plane is maximum. The occlusal plane is more angulated.
- iii. In the short and high subtype the mean of occlusomaxillary plane angle is closer to the mean of the entire group.

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