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## **A study comparing the occlusal plane in dentulous and edentulous subjects in relation to maxillomandibular space in Kashmiri population**

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### **Abstract**

**Background:** Several techniques have been documented to orient the occlusal plane properly in edentulous patients. Esthetic and phonetic considerations help orient the occlusal plane anteriorly. The intraoral landmarks that help in locating the occlusal plane posteriorly are retromolar pad, lateral border of tongue, parotid papilla and rima oris.

**Materials and Methods:** 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 4-H pencil. It consists of the patients who attended the Department of Prosthodontics and Crown & Bridge, Government Dental College and Hospital, Srinagar.

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 classic stainless steel matrix band no. 18 that was 10 mm x 4 mm wide and 0.005 inches thick was placed on the lower right occlusal plane with tape tips so that the upper border of the band was aligned with the tips of the buccal cusps of the first and second premolars and the mesio-buccal cusp of the first 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.

**Results:** The measurements for every patient were recorded and the values obtained were subjected to statistical analysis, including;

1. Mean
2. Standard deviation
3. Co-efficient of variation
4. F-test (Analysis of variance ANOVA).
5. Students t- test

**Conclusion:** A significant association exists between the inclination of the occlusal plane and maxillary plane in relation to maxillomandibular space dimensions. In the long and low subtype of maxillomandibular space of the dentulous group, the occlusal plane tends to be parallel to the maxillary plane. While as, in the short and high subtype the occlusal plane is more angulated in relation to the maxillary plane.

The occlusal plane inclination to the maxillary plane in long and low type is low while as, it is higher in short and low subtype of edentulous group.

**Keywords:** A study comparing, maxillomandibular, Kashmiri population

### **Introduction**

Several techniques have been documented to orient the occlusal plane properly in edentulous patients. Esthetic and phonetic considerations help orient the occlusal plane anteriorly. The intraoral landmarks that help in locating the occlusal plane posteriorly are retromolar pad, lateral border of tongue, parotid papilla and rima oris.

The camper's plane is defined as the line joining the inferior border of ala of nose to the superior border of tragus as per Boucher. As per Sprately, line from centre of ala to centre of tragus while Ismail and Bowman describe it as the line from al to centre of tragus of external auditory meatus.

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**Aims and objectives:** this study was conducted to compare the occlusal plane inclination in relation to maxillomandibular space in dentulous and edentulous subjects using reliable and constant bony landmarks.

**Materials and methods:**

**Source of data:**

**Method of data collection:**

### **Inclusion Criteria**

1. Subjects with class I molar relationship.
2. Subjects with second molar erupted and in occlusion.
3. Subjects with age above 19, as facial growth will be essentially complete.
4. Subjects with normal ridge relation.
5. Subjects with orthognathic profile.

### **Exclusion Criteria**

1. Subjects with apparent loss of tooth structure due to attrition or fracture
  2. Subjects with congenital or maxillofacial defects
  3. Subjects with symptoms of temporomandibular disorders, facial asymmetries, congenital facial defects.
  4. Subjects with parafunctional habits or bruxism.
  5. Subjects with occlusal discrepancies of centric occlusion.
- Subjects having orthodontic, orthognathic and reconstructive surgeries done.

### **Armamentarium**

1. New Tom Giano with cephalometric arm (Lateral High Frequency, Stationary Anode: 60-90 kV; 1-10 mA 0.5 mm focal spot dimension, IEC 60336-1993, Detector height (mm) for Ceph: 220, X-ray emission time for Lateral ceph: 3.4s)
2. Lateral cephalograms X-ray film [Green Sensitive, KODAK –TMAT].
3. Automatic X-ray film processor.
4. Tracing sheet [One side matte, 50 micrometer thick].
5. 4 H pencil.
6. X-ray viewer.
7. Cellophane tape.
8. Paper tape.
9. Compass.
10. Divider.
11. Scale.
12. Complete dentures.
13. 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 4-H pencil.

In this study, Camper's plane was used to orient the occlusal plane in edentulous subjects. A comparison of the natural occlusal plane in dentulous subjects and 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.

### **Dentulous Group**

It consists of 40 students of Government Dental College & Hospital, Srinagar. Right lateral cephalograms were taken with mandible in maximum intercuspation.

### **Edentulous Group**

It consists of the patients who attended the Department of Prosthodontics and Crown & Bridge, Government Dental College and Hospital, Srinagar.

The occlusal plane was adjusted parallel to inerpupillary line anteriorly and Camper's Plane posteriorly during denture fabrication. During the post insertion period, a piece of classic stainless steel matrix band no. 18 that was 10 mm x 4 mm wide and 0.005 inches thick was placed on the lower right occlusal plane with tape tips so that the upper border of the band was aligned with the tips of the buccal cusps of the first and second premolars and the mesio-buccal cusp of the first 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**

1. Anterior Nasal Spine (ANS).
2. Posterior Nasal Spine (PNS).
3. Gonion (Go).
4. Menton (Me).
5. T-point: the point where occlusal plane meets the posterior border of soft palate shadow.

#### **B). Planes**

1. Maxillary plane (Max. P): the plane that joins the anterior nasal spine with posterior nasal spine
2. Mandibular plane (Mnd.P): that plane that joins Gonion (Go) with Menton(Me).
3. 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 mesiobuccal cusps of maxillary and mandibular incisors.

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

#### **C) Linear measurement:**

1. 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.

2. Maxillomandibular space height (H): defined as the perpendicular distance from Menton to the maxillary plane.

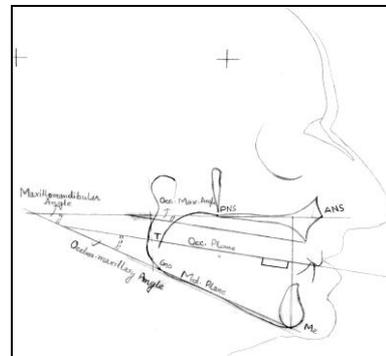
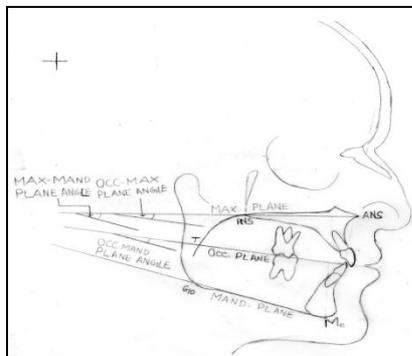
**D) Angular Measurement**



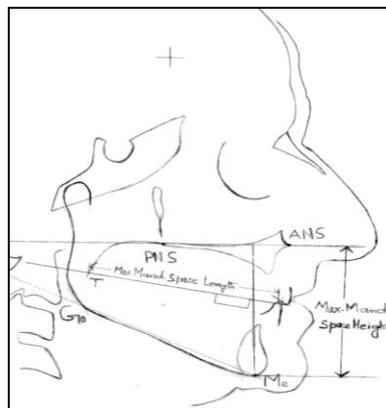
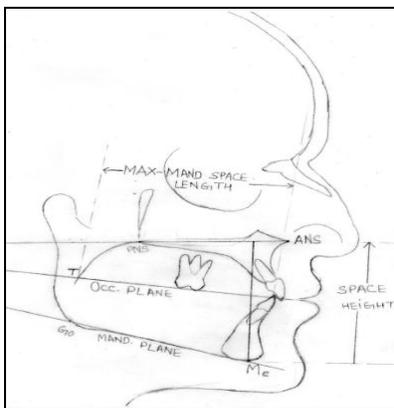
**Fig 1**



**Fig 2**



**Fig 3:** Points, planes and angular measurements in dentulous and edentulous subjects



**Fig 4:** maxillomandibular space length and height in dentulous and edentulous subjects

**Results**

The measurements for every patient were recorded and the values obtained were subjected to statistical analysis, including;

1. Mean
2. Standard deviation
3. Co-efficient of variation
4. F-test (Analysis of variance ANOVA).
5. Students t- test

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

1. Maxillary-occlusal plane angle: the angle the occlusal plane makes with maxillary plane.
2. Mandibular-occlusal plane angle: the angle the occlusal plane makes with mandibular plane.
3. Maxillomandibular plane angle: the angle the maxillary plane makes with mandibular plane.

were considered as low. Maxillomandibular space length of 80mm or more are considered as long and those under 80mm are considered as short.

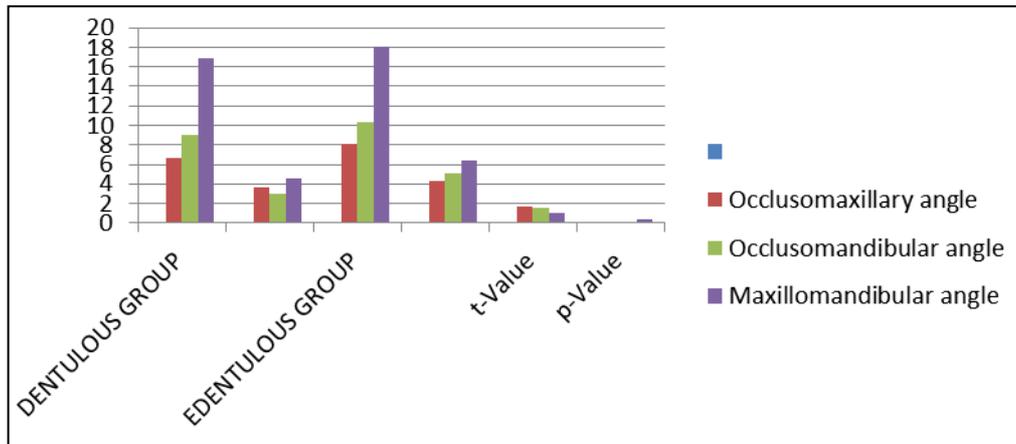
On the basis of maxillomandibular space dimensions, each group of dentulous and edentulous is divided into four subtypes mentioned as under

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

Parametric measurements for both the dentulous and edentulous groups are shown in tables

**Table 1:** Comparison Based On Angular Measurements In Two Groups

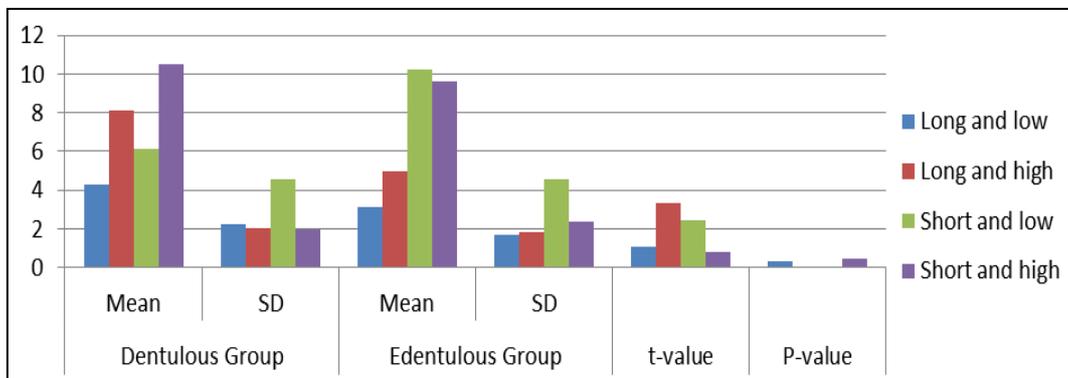
Angular Measurements	Dentulous group		Edentulous group		t-Value	p-Value
	Mean	SD	Mean	SD		
Occlusomaxillary angle	6.7	3.612	8.14	4.282	1.623	0.109
Occlusomandibular angle	8.96	3.043	10.38	5.136	1.497	0.138
Maxillomandibular angle	16.86	4.571	18.11	6.426	1.003	0.319



**Table 2:** Comparison Based On Occlusomaxillary Plane Angles In Relation To Length and Height Of Maxillomandibular Space Between Two Groups

	Dentulous Group		Edentulous Group		t-Value	p-Value
	Mean	SD	Mean	SD		
Long and low	4.32	2.228	3.10	1.673	1.083	0.297
Long and high	8.11	2.012	5.00	1.813	3.332	0.005*
Short and low	6.12	4.533	10.21	4.531	2.45	0.021*
Short and high	10.5	1.958	9.65	2.381	0.776	0.449

\*Statistically Significant Difference (P-value<0.05)



**Table 3:** Intragroup comparison of occlusomaxillary plane angles in edentulous group

	Mean	SD	Min	Max	Group Compared	P-value\$
Long and low (1)	3.10	1.673	1	5	1 vs 2	0.332
Long and high (2)	5.00	1.813	2	7	1 vs 3	<0.001*
Short and low (3)	10.21	4.531	0	19	1 vs 4	0.001*
Short and high (4)	9.65	2.381	7	14	2 vs 3	0.001*
*Statistically Significant Difference (P-value<0.05), \$P-value by ANOVA					2 vs 4	0.006*
					3 vs 4	0.683

**Table 4:** Intragroup Comparison of Occlusomaxillary Plane Angles in Dentulous Group

	Mean	SD	Min	Max	Group Compared	P-value\$
Long and low (1)	4.32	2.228	0.0	7.5	1 vs 2	0.010*
Long and high (2)	8.11	2.012	5.0	10.0	1 vs 3	0.169
Short and low (3)	6.12	4.533	-3.0	14.0	1 vs 4	<0.001*
Short and high (4)	10.5	1.958	7.5	13.0	2 vs 3	0.150
* Statistically Significant Difference (P-value<0.05), \$P-value by ANOVA					2 vs 4	0.138
					3 vs 4	0.005*

## 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<sup>[14]</sup>.

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<sup>[80]</sup>.

Ausburger's<sup>[9]</sup> study indicated a strong correlation between the occlusal plane and the lateral aspects of facial types.

According to the results of my study, the occlusal plane inclination is related to the growth pattern of the face. The occlusal plane inclination is less inclined in the hypodivergent patients than the hyperdivergent patients.

In Von Niekerk's<sup>[32]</sup> study, the angle formed by the functional occlusal plane and the ala-tragus line had a mean of +2.45 degrees, a standard deviation of 3.24 degrees, and a range of +8-to -7.5 degrees. The mean difference between the planes was 2.45 degrees with a standard deviation of 3.24 degrees. Such relatively narrow limits showed a close relationship between the two planes.

Our results showed that the occlusal plane is almost parallel to maxillary plane in long and low subtype with mean of 3.10 and more angulated in short and low type maxillomandibular space of the edentulous patients with mean of occlusomaxillary angle of 10.21<sup>0</sup> when the occlusal plane is oriented parallel to Camper's plane.

Hercules C. Karkazi<sup>[39]</sup> mentioned in his study that no strong linear correlation ( $p > 0.05$ ) between the following variables: (a) the length of Cook's plane to Cook's occlusal plane angle, (b) the length of the maxillary plane to the maxillary occlusal plane angle, and (c) the PO Na AN6 angle to the occlusal Frankfort plane angle; (2) no parallelism between the occlusal and HIP plane with a mean angle of 4.57 degrees, SD 2.57 degrees, and range of 0 to 9.5 degrees; and (3) no correlation between the predicted and clinically determined occlusal planes ( $r = 0.267$ ,  $t = 1.797$ ,  $p = 70.05$ ).

In the present study, it was seen that the occlusal plane is closely related to the maxillary plane.

Seifert *et al*<sup>[70]</sup>, have concluded Occlusal plane-Frankfort Horizontal plane angulation as 11.42 in dentulous subjects whereas Celebic *et al*<sup>[61]</sup>, proposed it as 9.43 and 8.53 in dentulous and edentulous subjects.

Karkazis and Polyzois<sup>[85]</sup> correlated Occlusal plane with Camper's planes in dentulous and edentulous subjects and reported the inclination of artificial Occlusal plane-Camper's plane (10.00 ± 3.25) almost the same as the inclination of natural Occlusal plane-Camper's plane (7.00 ± 2.88).

Our study confirmed that long and low subtype has the occlusal plane parallel to maxillary plane with mean of 4.32<sup>0</sup> plus minus 2.228<sup>0</sup> in dentulous group and the occlusal plane is almost parallel to maxillary plane in long and low subtype with mean of 3.1 degrees in edentulous group

## Conclusion

A roentgenographic comparative study was conducted in the dentulous and edentulous subjects to determine the proper location of the occlusal plane in relation to the maxillomandibular space. The results from both the dentulous and 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 long and low

subtype of maxillomandibular space of the dentulous group, the occlusal plane tends to be parallel to the maxillary plane. While as, in the short and high subtype the occlusal plane is more angulated in relation to the maxillary plane.

The occlusal plane inclination to the maxillary plane in long and low type is low while as, it is higher in short and low subtype of edentulous group.

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