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Evaluation of the occlusal plane in dentulous patients in relation to maxillomandibular space in Kashmiri population

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Abstract
It is an arduous task to establish the occlusal plane in its correct position in edentulous patients after loss of all teeth. Improper establishment of the occlusal plane affects not only esthetics but function as well in edentate population.
Amis and objectives of the study: So, a study was conducted to establish the occlusal plane in edentulous patients in relation to maxillomandibular space with the aid of cephalometric.
Materials and Methods: Subjects were dentulous with Angles class I occlusion
Results: Results indicated that there was a significant correlation between Occlusal maxillary plane angle and maxillomandibular space height and length
Conclusion: This study may prove helpful in restoring esthetics and function in full mouth rehabilitation cases.

Keywords: Evaluation, occlusal plane, maxillomandibular space, Kashmiri population

Introduction
The glossary of prosthodontic terms defines occlusal plane as "the average plane established by the incisal and occlusal surfaces of the teeth [2] it is not a plane but planar mean of the curvature of the surfaces".
Anatomical land marks that help in occlusal plane orientation are rima oris, retromalar pad, lateral border of tongue and Camper's plane.
This study was conducted to relate the occlusal plane inclination to relatively stable and reliable hard anatomical landmarks.

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

Methodology
Source of data
In the present study, the total of 40 dentulous subjects with age ranging from 20-35 years was randomly selected from Government Dental College and Hospital Srinagar.The edentulous group consisted of Kashmiri patients with age ranging from 35-78years who attended attended the Department of Prosthodontics and Crown & Bridge, Government Dental College And Hospital, Srinagar.

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.
6. Subjects having orthodontic, orthognathic and reconstructive surgeries done.

Armamentarium
1. Lateral cephalograms X-ray unit [80 kvp, 15 mA, and 1 sec].
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. 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.

An evaluation of the natural occlusal plane in dentulous subjects 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.

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.

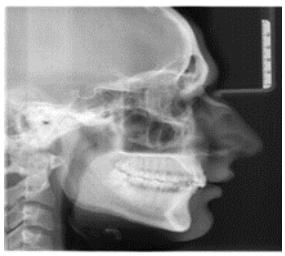
B). Planes
1. Maxillary plane (Max. P): the plane that joins the anterior nasal spine with posterior nasal spine
2. Mandibular plane (Mnd.P): that plane that joins Gonion (Go) with Menton (Me).
3. Occlusal plane (Occ.P)

(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.

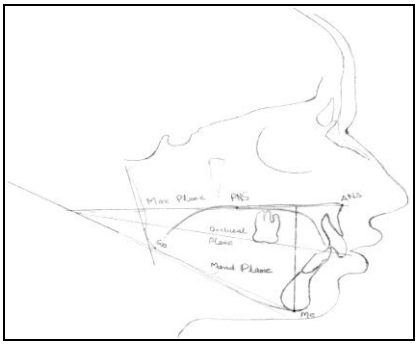
C). Linear measurement
1. **Maxillomandibular space length (L):** It was defined as the distance along the occlusal plane from the intersection of the plane with the posterior pharyngeal wall to the point where the occlusal plane meets the most lingually placed incisor tooth.
2. **Maxillomandibular space heigh t (H):** defined as the perpendicular distance from Menton to the maxillary plane.

D) Angular Measurement
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.

Patient



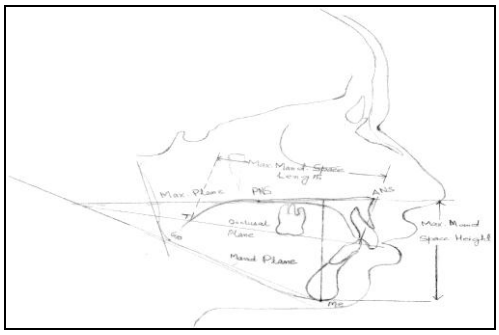
right lateral cephalogram



Tracing showing points and planes of right lateral dentulous cephalogram

Points: ANS (Anterior Nasal Spine), PNS (Posterior Nasal Spine), Go (Gonion), Me (Menton)

Planes: Maxillary Plane, Occlusal plane and Mandibular Plane



Maxillomandibular space length: extends from point of intersection of occlusal plane with posterior border of soft palate to the most lingually placed incisor.

(B). Maxillomandibular space height: the perpendicular distance of maxillary plane from menton (Me).

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

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

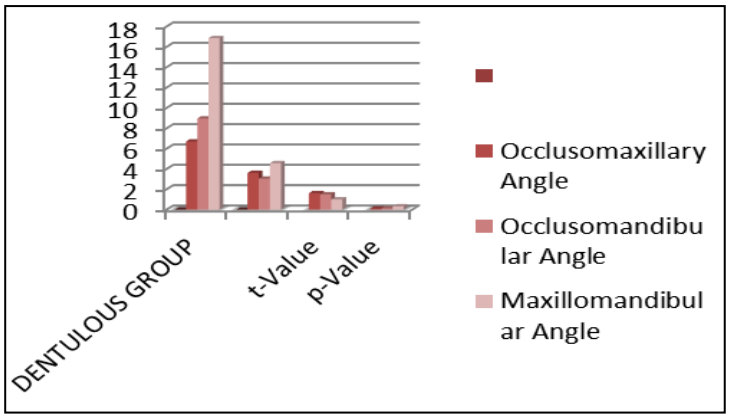
F-test (Analysis of variance ANOVA

Angulation of occlusal plane to maxillary plane

Analysis of variance within and between the four categories of maxillomandibular space showed significant differences in Occlusal maxillary plane angles associated with combined effects of length and height of maxillomandibular space. The mean value for Occlusal maxillary plane angles of the dentulous group is 6.7 plus minus 3.612. The comparison of means of the Occlusal maxillary plane angles within the subcategories of maxillomandibular space indicated that in long and low type maxillomandibular space the occlusal plane is more parallel to maxillary plane (mean of Occlusal maxillary plane angle is 4.318^0) than the high and short type maxillomandibular space (mean of Occlusal maxillary plane is 10.5^0). The other two categories of the maxillomandibular space have means of Occlusal maxillary plane angles nearer to the mean value of the occlusal maxillary plane angles of the whole group that is 6.7 plus minus 3.612

Table 1

Angular Measurements	Dentulous group		t-Value	p-Value
	Mean	SD		
Occlusal maxillary Angle	6.7	3.612	1.623	0.109
Occlusomandibular Angle	8.96	3.043	1.497	0.138
Maxillomandibular Angle	16.86	4.571	1.003	0.319

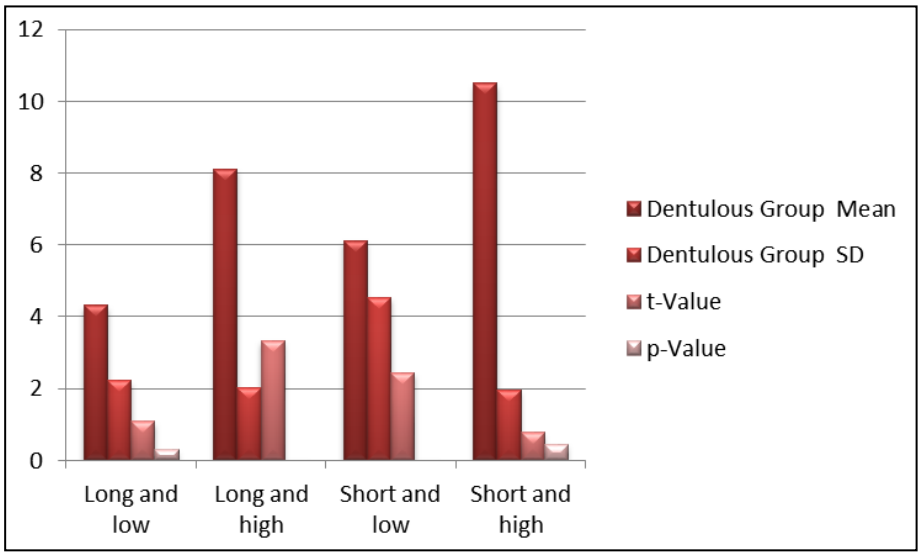


Evaluation of occlusal maxillary plane angles in various subgroups

Table 2

	Dentulous Group		t-Value	p-Value
	Mean	SD		
Long and low	4.32	2.228	1.083	0.297
Long and high	8.11	2.012	3.332	0.005*
Short and low	6.12	4.533	2.45	0.021*
Short and high	10.5	1.958	0.776	0.449

Statistically Significant Difference (P-value<0.05)

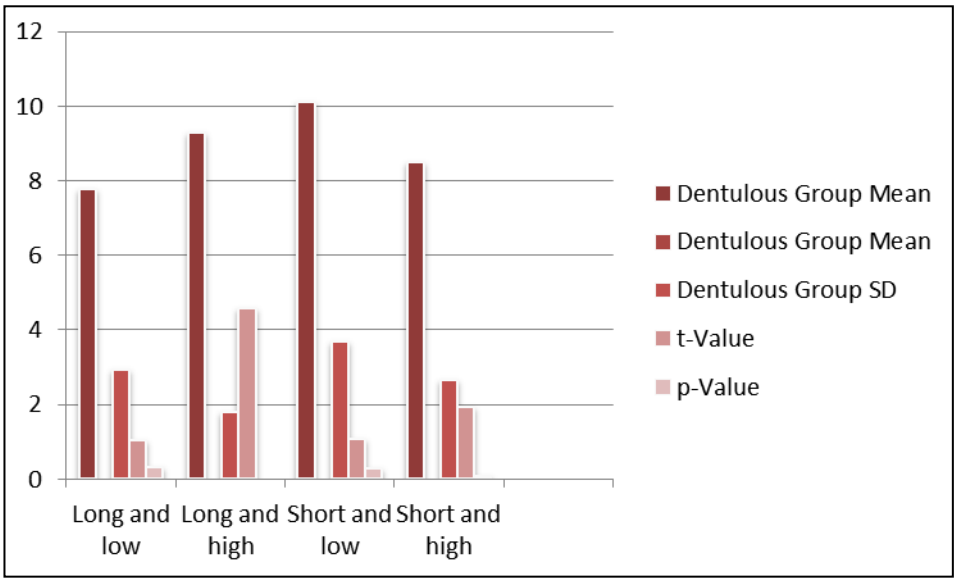


Evaluation of the Occlusomandibular Plane Angles In Relation To Length and Height of Maxillomandibular Space

Table 3

	Dentulous Group		t-Value	p-Value
	Mean	SD		
Long and low	7.77	2.927	1.046	0.313
Long and high	9.29	1.799	4.584	<0.001*
Short and low	10.12	3.686	1.09	0.285
Short and high	8.5	2.669	1.944	0.069

Statistically Significant Difference (P-value<0.05



Discussion

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].

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 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.

In Von Niekerk's [32] 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.

D. SINOBAD [67] mentioned that the angulation of the occlusal plane to the maxillary plane, what is obvious from the mean values and confidence intervals of the OccP/SpP

angle (P_1=8-62-10-70, P_2=8-03-10-52, P_3=7-32-9-64°), has higher affinity for maxillary plane than mandibular plane in various skeletal jaw-relationships.

In the present study, the inclination of the occlusal plane in subtypes of dentulous group long and low versus long and high, long and low versus short and high and short and low versus short and high showed statistically significant results with p-values of 0.01, <0.001 and 0.005 respectively.

Occlusomandibular angle of dentulous group in only subtype of long and low versus short and low showed statistically significant results with p-value of 0.045.

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

Our results showed that the mean value of occlusal maxillary plane angle 6.7^0 in the dentulous group. And the occlusal plane has higher affinity for maxillary plane than mandibular plane.

Summary and Conclusion

The present study was conducted to determine the location of the occlusal plane in relation to maxillomandibular space based on cephalometric criteria as these provide stable and reliable landmarks. Analysis of all the observations was done and following conclusion is drawn as under:

1. There exists a closer angular affinity between the occlusal and maxillary planes in both dentulous and edentulous patients
2. In the dentulous subjects, a significant association was seen between the occlusal maxillary plane angle and maxillomandibular space length and height.
    1. In the long and low subtype of maxillomandibular space, the occlusal maxillary plane angle is least. The occlusal plane tends to be parallel to maxillary plane.
    2. In the short and high subtype of maxillomandibular space, the occlusal maxillary plane angle has maximum value. The occlusal plane is more angulated to maxillary plane.
    3. In the short and low and long and high subtypes of the maxillomandibular space, mean value of occlusal maxillary approximates the mean of the entire group.

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