



ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2017; 3(11): 28-33
www.allresearchjournal.com
Received: 13-09-2017
Accepted: 14-10-2017

Mohammad Altaf Tantray
PG Scholar, Department Of
Prosthodontics, Govt Dental
College Srinagar, Shireen
Bagh, Karan Nagar, Srinagar,
Jammu and Kashmir

Sandeep Koul Bali
Professor & Head, Of
Prosthodontics Srinagar, Govt
Dental College, Srinagar,
Shireen Bagh, Karan Nagar,
Srinagar, Jammu and Kashmir

Shabir Ahmad Shah
Professor & Head, Department
Of Dental Materials, Govt.
Dental College Srinagar,
Shireen Bagh, Karan Nagar,
Srinagar, Jammu and Kashmir

Correspondence

Mohammad Altaf Tantray
PG Scholar, Department Of
Prosthodontics, Govt Dental
College Srinagar, Shireen
Bagh, Karan Nagar, Srinagar,
Jammu and Kashmir

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.

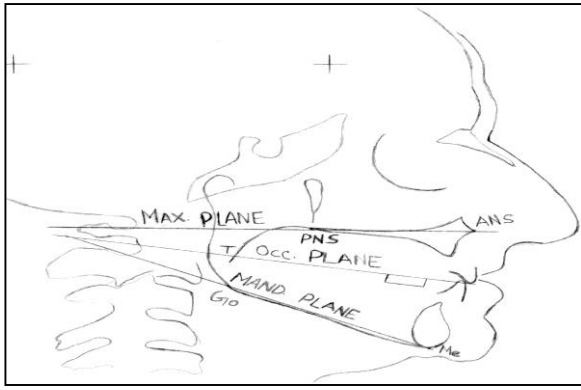


Fig 1: Points and planes: ANS (anterior nasal spine), PNS (posterior nasal spine), Go (Gonion), Me (Menton), T (Point of intersection of occlusal plane and soft pharynx), Max. Plane (Maxillary plane), Occ. Plane (Plane of occlusion), Mand. Plane (mandibular plane).

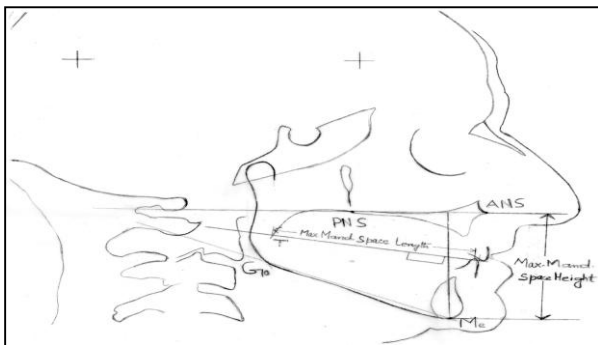


Fig 2: linear measurements maxillomandibular space length Maxillomandibular space height.

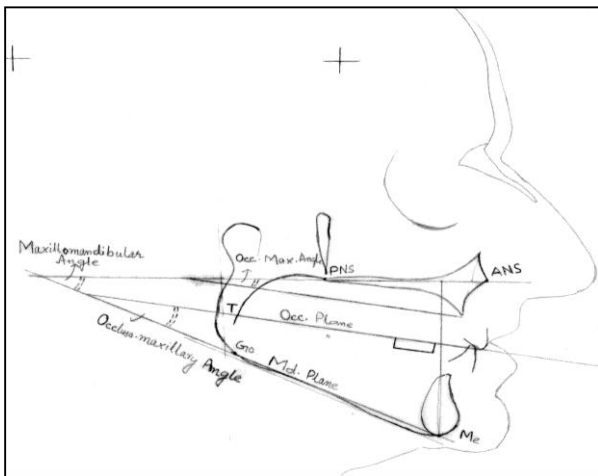


Fig 3: angular measurements: occlusomaxillary plane angle, occlusomandibular plane angle, maxillomandibular plane angle.

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

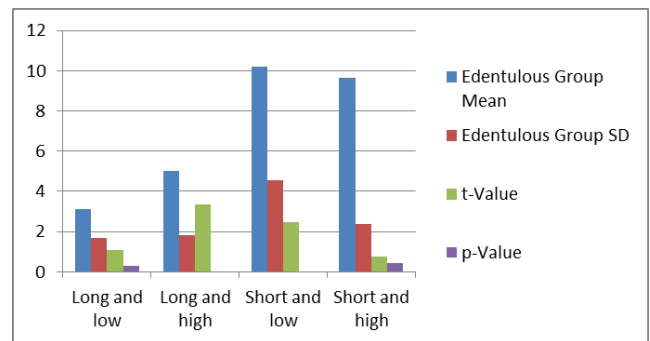
Occlusomaxillary angel: Mean of the Occlusomaxillary plane angles of the whole edentulous group is 8.1375 plus minus 4.2817. The occlusal plane tends to be more parallel to maxillary plane in long and low type of maxillomandibular space than the other subtypes of the maxillomandibular space of edentulous 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

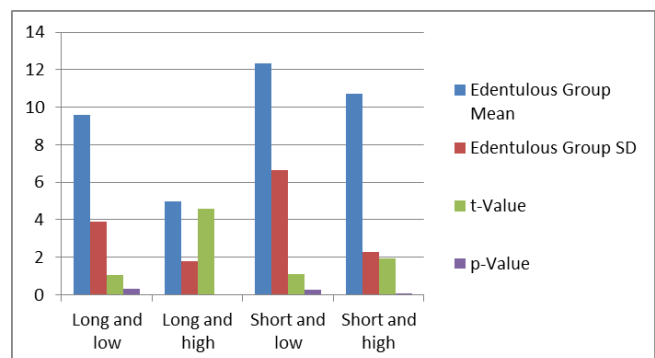


Graph 1: Comparison Based On Occlusomaxillary Plane Angles In Relation To Length and Height of Maxillomandibular Spac.

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.

References

1. Swenson MG, Complete Denture, 2nd ed. St. Louis: Mosby Company, 1990, 177-80.
2. Glossary of Prosthodontic Terms. 8th ed. St. Louis: CV Mosby, 2005.
3. Zarb GA, Bolender CL, Carlsson GE. Boucher's Prosthodontic Treatment for Edentulous Patients. 11th ed. St. Louis: Mosby Company, 2003; 3-46:183-96.
4. Annals of Medical and Health Sciences Research, 2014; 4:3.
5. Celebic A, Valentic-Peruzovic M, Kraljevic K, Brkic H. A study of the occlusal plane orientation by intra-oral method. J Oral Rehabil. 1995; 22:233-236.
6. Carey PD. Occlusal plane orientation and masticatory performance of complete dentures. J Prosthet Dent. 1978; 39:368.
7. Robert M. From prospective of facial esthetics in dental treatment planning. J Prosthet Dent. 1996; 75:169.
8. Robert Sloane B. A guide to the orientation of the plane of occlusion. Journal of prosthetic dentistry. 1953; 3(1):53-66.
9. Russell Augsburg H. occlusal plane relation to facial type. Journal of prosthetic dentistry. 1953; 3(6):755-770.
10. Howard Berkeley J. the labial and buccal accessory muscles of mastication. Journal of prosthetic dentistry. 1954; 4(3):327-34.
11. Robert Ricketts M. the role of cephalometrics in prosthetic diagnosis. Journal of prosthetic dentistry. 1956; 6(4):488-503.
12. Anders Olsson. Relationship of various skull reference lines. Journal of prosthetic dentistry. 1961; 11(6):1045-50.
13. Peter Coccaro j. cephalometric analysis of morphologic face height. Journal of prosthetic dentistry. 1965; 15(1):35-44.
14. Hartono R. The occlusal plane in relation to facial types. Journal of prosthetic dentistry. 1967; 17(6):549-59.
15. Yahia Ismail H. Position of the occlusal plane in natural and artificial teeth. Journal of prosthetic dentistry. 1968; 20(5):407-11.
16. Caleb Hull A. A cephalometric approach to establishing the facial vertical dimension. Journal of prosthetic dentistry. 1968; 20(1):37-42.
17. Anzelm Langer. Occlusal perception after placement of complete denture. Journal of prosthetic dentistry. 1968; 39(4):468-71. 19(3):246-51.
18. Yahia Ismail H. Position of the occlusal plane in natural and artificial teeth. 20(5):407-11.
19. Bernard Levin. Results of a survey of complete denture procedures taught in American and Canadian dental schools. 22(2):171-77.
20. Donald Lundquist O. Journal of prosthetic dentistry 1970; 23(5):489-98.
21. Earl Pound. An introduction to denture simplification. Journal of prosthetic dentistry. 1973; 29(6):599-607.
22. Nikzad Javid S. A technique for the determination of occlusal plane. Journal of prosthetic dentistry. 1974; 31(3):270-72.
23. Peter L'Estrange R. A comparative study of the occlusal plane in dentulous and edentulous subjects. Journal of prosthetic dentistry. 1975; 33(3):495-503.

24. Girard DiPietro J. Significance of the Frankfort-mandibular plane angle to prosthodontics. *Journal of prosthetic dentistry*. 1976; 36(6):625-35.
25. Aboul-Ela M. Pre-extraction records of the occlusal plane and vertical dimension. *Journal of prosthetic dentistry*. 1977; 38(5):490-94.
26. Girard DiPietro J. A study of occlusion as related to the Frankfort-mandibular plane angle. *Journal of prosthetic dentistry*. 1977; 38(4):452-58.
27. Carey PD. occlusal plane orientation and masticatory performance of complete dentures. *Journal of prosthetic dentistry*. 1978; 39(4):468-71.
28. Jayashree Dikshit V. Muscle relaxant and rest position-A cephalometric study. *Journal of prosthetic dentistry*. 1979; 42(5):579-83.
29. Hideaki Okane. The effect of anteroposterior inclination of the occlusal plane on biting force. *Journal of prosthetic dentistry*. 1979; 39(4):468-71.
30. Brian Toolson L. Clinical measurement and evaluation of vertical dimension. *Journal of prosthetic dentistry*. 1982; 47(3):236-241.
31. Brian Monteith D. A cephalometric method to determine the angulation of the occlusal plane in edentulous patients. *Journal of prosthetic dentistry* 1985; 54(1):81-87.
32. Van Niekerk FW. The ala-tragus line in complete denture prosthodontics. *Journal of prosthetic dentistry*. 1985; 53(1):67-9.
33. Foley PF. A study of the position of the parotid papilla relative to the occlusal plane. *Journal of prosthetic dentistry*. 1978; 53(1):124-26.
34. Brian Monteith D. Cephalometrically programmed adjustable plane: A new concept in occlusal plane orientation for complete-denture patients. *Journal of prosthetic dentistry*. 1985; 54(3):388-94.
35. Brian Monteith D. Evaluation of a cephalometric method of occlusal plane orientation for complete dentures. *Journal of prosthetic dentistry*. 1986; 55(1):64-9.
36. Sam Adkisson R. Relating denture teeth to the occlusal plane. *Journal of prosthetic dentistry*. 1986; 55(2):274-77.
37. Richard KK. Ow, The relationships of upper facial proportions and the plane of occlusion to anatomic reference planes. *Journal of prosthetic dentistry*. 1989; 61(6):727-33.
38. Richard KK. Ow, Orientation of the plane of occlusion. *Journal of prosthetic dentistry*. 1990; 64(1):31-6.
39. Hercules C. Karkazis Cephalometrically predicted occlusal plane: Implications in removable prosthodontics. *Journal of prosthetic dentistry*. 1978; 65(2):258-64.
40. Altug Kazanoglu. Determining the occlusal plane with the Camper's plane indicator. *Journal of prosthetic dentistry*. 1992; 67(4):499-01.
41. Neena L, D'Souza. A cephalometric study comparing the occlusal plane in dentulous and edentulous subjects in relation to the maxillomandibular space. *Journal of prosthetic dentistry*. 1996, 75(2):177-82.
42. Urbano Santana-Penin A. The occlusal plane indicator: A new device for determining the inclination of the occlusal plane. *Journal of prosthetic dentistry*. 1998; 80(3):374-75.
43. Bassi F. Evaluation of the utility of cephalometric parameters in constructing complete denture. Part I: placement of posterior teeth. *Journal of Oral Rehabilitation*. 2001; 28:234-238.
44. Clayton Chan A. A Review of the Clinical Significance of the Occlusal Plane: Its Variation and Effect on Head Posture. *International College of Craniomandibular Orthopedics (ICCMO) Anthology*. 2007, VIII.
45. Sumit Bedia V. Determination of the occlusal plane using a custom-made occlusal plane analyzer: A clinical report. *J Prosthet Dent*. 2007; 98:348-352.
46. Akira Yosano. Influence of mandibular fixation method on stability of maxillary occlusal plane after occlusal plane alteration. *Bull Tokyo dent coll*. 2009; 50(2):71-82.
47. Shashinandan Venugopalan K. Determination of the relative parallelism of occlusal plane to three ala-tragal lines in various skeletal malocclusions: A cephalometric study. *Indian Journal of Dental Research*, 2012; 23(6).
48. Amit Hindocha D. A cephalometric study to determine the plane of occlusion in completely edentulous patients. *Indian Journal of Dental Research*. 2013; 24(6).
49. Reena Mittal, comparison of occlusal plane in dentulous and edentulous subjects. A cephalometric study. *Journal of prosthodontics society*. 2008; 8(4):195-01.
50. Riccardo Rosati. The occlusal plane in the facial context: inter-operator repeatability of a new three-dimensional method. *International Journal of Oral Science*. 2012; 4:34-37.
51. Nikola Petričević. Use of digital photography in the reconstruction of the occlusal plane orientation. *Med Glass*, 2009; 6(2):243-248.
52. Sanath Shetty. Occlusal Plane Location in Edentulous Patients: A Review. *J Indian Prosthodont Soc*. 2013; 13(3):142-148.
53. Dr. Binod Acharya. Comparison of maxillary occlusal plane with various craniofacial reference lines in Nepalese and Indian young adults. *Orthodontic Journal of Nepal*. 2011; 1(1):16-19.
54. Supriya Manvi, Occlusal Plane Determination Using Custom Made Broadrick Occlusal Plane Analyser: A Case Control Study. *International Scholarly Research Network ISRN Dentistry*, 2012.
55. Nandeeshwar DB. A cephalometric study to determine the relation of ala-tragus line with different posterior reference points from a standard occlusal plane in completely edentulous patients. *Asian J Med Cli Sci*. 2012; 1:3.
56. Koller MM. A comparative study of two methods for the orientation of the occlusal plane and the determination of the vertical dimension of occlusion in edentulous patients. *Journal of Oral Rehabilitation*. 1992; 19:413-425.
57. Sandeep Kumar. A determination of occlusal plane comparing different levels of the tragus to form ala-tragal line or Camper's line: A photographic study. *J Adv Prosthodont*. 2013; 5:9-15.
58. Sahoo S. systematic assessment of the various controversies, difficulties, and current trends in the reestablishment of lost occlusal planes in edentulous patients. *Annals of Medical and Health Sciences Research*. 2014; 4:3.

59. Hasan Suat Gokce. Effects of complete denture wearing on the head posture and posterior airway space: A cephalometric study. *Journal of Dental Sciences*. 2011; 6:6-13.
60. Hans Wellens, Improving the concordance between various anteroposterior cephalometric measurements using Procrustes analysis. *European Journal of Orthodontics*. 2009; 31:503-515.
61. CELEBIC. Occlusal plane orientation in Klinefelter syndrome (47, XXY males). *Journal of Oral Rehabilitation*. 1997; 24:942-946.
62. Nissan J. Relationship between occlusal plane determinants and craniofacial structures. *Journal of Oral Rehabilitation*. 2003; 30:587-591.
63. Sivakumar Jayachandran. Occlusal Plane Orientation: A Statistical and Clinical Analysis in Different Clinical Situations. *Journal of Prosthodontics*. 2008; 17:572-575.
64. Prince Kumar. Reference guide for prosthetic occlusal plane orientation: An obscured dilemma. *European Journal of General Dentistry*. 2012, 2.
65. Carole Abi Ghosen. Relationship between the occlusal plane corresponding to the lateral border of the tongue and ala-tragus line in edentulous patients. *J Contemp. Dent Pract*. 2012; 13(5):590-94.
66. Prince Kumar, Reliability of Anatomic Reference Planes in Establishing the Occlusal Plane in Different Jaw Relationships: A Cephalometric Study. *J Indian Prosthodont Soc*. 2012.
67. Sinobad D. The position of the occlusal plane in dentulous subjects with various skeletal jaw-relationships. *Journal of Oral Rehabilitation*. 1988; 15:489-498.
68. Al Quran FA. The position of the occlusal plane in natural and artificial dentitions as related to other craniofacial planes. *J Prosthodont*. 2010; 19(8):601-5.
69. Lestrel PE, Kapur KK, Chauncey HH. A cephalometric study of mandibular cortical bone thickness in dentulous persons and denture wearers. *J. Prosthetic Dent*. 1980; 43:89-94.
70. Seifert D, Jerolimov V, Carek V, Ibrahimagic L. Relation of the reference planes for orientation of the prosthetic plane. *Acta Stomatol Croat*, 2000; 34:413-6.
71. Vukusić N, Lapter M, Muretić Z. Change in the inclination of the occlusal plane during crani/ofacial growth and development. *Coll Antropol* 2000; 24:145-50.
72. Jayachandran S, Jayachandran CR, Varghese R. Occlusal plane orientation: A statistical and clinical analysis in different clinical situations. *J Prosthodont*. 2008; 17:572-5.
73. Shigli K, Chetal BR, Jabade J. Validity of soft tissue landmarks in determining the occlusal Plane. *J Indian Prosthodont Soc*. 2005; 5:139-45.
74. Mittal R. Comparison of the occlusal plane in dentulous and edentulous patients: A cephalometric study. *J Indian Prosthodont Soc*. 2008; 8:195-200.
75. Sadr K, Sadr M. A study of parallelism of the occlusal plane and Ala-Tragus line. *J Dent Res Dent Clin Dent Prospects*. 2009; 3:107-9.
76. Lahori M, Nagrath R, Malik N. A cephalometric study on the relationship between the occlusal plane, Ala-Tragus and camper's lines in subjects with angle's Class I, Class II and Class III occlusion. *J Indian Prosthodont Soc*. 2012; 13:494-8.
77. Hall-Scott J. The maxillary-mandibular planes angle (MM degrees) bisector: A new reference plane for anteroposterior measurement of the dental bases. *Am J Orthod Dentofacial Orthop* 1994;105:583-91.
78. Williams DR. Occlusal plane orientation in complete denture construction. *J Dent*. 1982; 10:311-6.
79. Singh G. Ala tragus line- A cephalometric evaluation. *Int J Prosthodont*. 2010; 1:1-5.
80. Silverman SI. Denture Prosthesis and Functional Anatomy of the Maxillofacial Structure, *J, Pros. Dent*. 1956; 6:305-331.
81. Chow TW, Clark RKF, Darvell BW. Letter to the editor. *J Prosthetic Dent*. 1986; 55:662-3.
82. Rich H. Evaluation and registration of the HIP plane of occlusion. *Aust Dent J*. 1982; 27:162-8.
83. Brian D. Monteith Cephalometrically programmed adjustable plane: A new concept in occlusal plane orientation for complete-denture patients. *J Prosthetic Dentistry*. 1985; 54(3):387-94.
84. Polyzois GL, Zissis AJ, Karkazis HC, Demetriou PP. Changes of vertical occlusal relationships in fast-boiled denture base resins: a comparative study. *Quintessence Dent Technol*. 1986; 10:441-5.
85. Karkazis HC, Polyzois GC. A study of the occlusal plane orientation in complete denture construction. *J Oral Rehab*. 1987; 14:399-404.
86. Yasaki M. The height of the occlusal rim and the interocclusal distance. *J Prosthet Dent*. 1961; 11:26-31.
87. Boucher CO. Current clinical dental terminology. 3rd ed. St. Louis: CV Mosby, 1982, 175.