

Original Article

Intricate Assessments of the Consistency of Different Reference Planes in Reorienting the Occlusal Plane in Class I and Class II Jaw Relationships; A Cephalometric Based in Vivo Study

Davinderjit Kaur Shergill

Senior Lecturer, Department of Prosthodontics, Maharaja Ganga Singh Dental College, Sriganganagar (Rajasthan), India

ABSTRACT

Background and Aim: The success of complete denture depends on correct determination of occlusal plane in edentulous patients. Various landmarks maybe useful such as Frankfurt horizontal plane, campers line etc. The present study was conducted to determine the usefulness of different anatomic reference planes in determination of occlusal plane in dentulous and edentulous subjects with Angle's class I and class II maxilla- mandibular relationship. **Materials and Methods:** This study included 100 subjects divided into 4 groups. Each group had 25 subjects. Group I had young dentulous subjects with angle class I relation, group I had dentulous subjects with angle class II relation. Group III & group IV had completely edentulous in Angle's class I and class II relationship respectively. All were subjected to lateral cephalogram and tracings were performed. Results were analyzed using T- test wherein P value less than 0.05 was set as cutoff level of significant. **Results:** There was no significant difference of angle between Occlusal plane and Frankfort Horizontal plane and Camper's plane when Group I and Group III, and Group II and Group IV subjects were compared (P value >0.05). **Conclusion:** The Frankfort Horizontal plane and Camper's plane may possibly be used as a consistent tool to re-establish the lost occlusal plane in edentulous subjects in both Angle's class I and class II jaw relationships. **Clinical significance:** The correct determination of occlusal plane is a tedious task wherein clinicians frequently come across positional instability of various soft tissue landmarks in different patients. The study result indicates the intricate application and usage of lateral cephalograms in precise relocation of lost occlusal plane in two different jaw relationships.

Key Words: Ala, Frankfort Horizontal plane, Tragus, Cephalometrics

Received: 20 January 2018

Revised: 22 February 2018

Accepted: 26 February 2018

Corresponding Author: Davinderjit Kaur Shergill, Senior Lecturer, Department of Prosthodontics, Maharaja Ganga Singh Dental College, Sriganganagar (Rajasthan), India

This article may be cited as: Shergill DK. Intricate Assessments of the Consistency of Different Reference Planes in Reorienting the Occlusal Plane in Class I and Class II Jaw Relationships; A Cephalometric Based in Vivo Study. Int J Res Health Allied Sci 2018; 4(2):99-103.

INTRODUCTION

The number of complete denture patients is increasing day by day. The formation of complete denture is not a simple process. It is based on various factors. Factors such as related to operator and patients affect the most.¹ The most important are those related to operator. The role of operator is most important as the demand of patients is very difficult to fulfill to the satisfactory level.² Dentists frequently face complains regarding wrinkling near corner of mouth. Other important complain is forwardly placed chin with reference to upper jaw leading to difficulty in

mastication and speech.³ These unrealistic needs of patients are very common. Patient demands their artificial prostheses as similar as that of natural teeth.⁴ They do not accept complete denture which are not effective in providing function, speech and mastication.⁵⁻⁶ For the ideal requirement of a complete denture, effective planning is required at each step.⁷ The most important step which plays an important role in fabrication of a complete denture is occlusal plane. Its orientation determines the success and survival rate. In completely edentulous patient, the assessment of occlusal plane requires great

expertise. Exact inclination of teeth and location of plane affects the future phonetics, esthetics and function of complete denture. Thus orientation has to be in correct position for fulfilling the necessary function of a denture.⁸ Various studies have been so far conducted in locating and determining the exact and effective orientation of occlusal plane.^{9,10} The most useful in this regard is Camper's plane which is also known as a line joining the ala of the nose to the tragus of the ear. This plane was first of its kind in dentistry. A study conducted by Karkazis and Polyzois¹¹ advocated the use of radiographs in assessing occlusal plane. They took radiographs of edentulous patients and then used a radiopaque marker in locating occlusal plane. A similar study on radiographs was done by Shigali et al¹² who used different soft tissue landmarks such as lip commissure, retromolar pad area etc. A study conducted by Siefert⁷ considered frankfort horizontal plane in locating occlusal plane. He utilized anatomic landmarks in reference to occlusal plane. Similarly Karkazis and Polyzois¹¹ used Camper's plane and various authors have done much research in this subject. A very negligible data is available that compares natural teeth with artificial occlusal plane. The determination of occlusal plane in dentulous patients requires less effort as compared to edentulous patients. Similarly, the usefulness of camper's plane as reference point (for establishing occlusal plane) needs to be studied. The recording of vertical jaw relation is a clinical step which considers occlusal plane as most important landmark. The present study was attempted to assess the effectiveness and consistencies of different anatomic reference planes and their role in determining occlusal plane in both dentulous and edentulous subjects with Angle's Class I and Class II Maxillomandibular relationship using cephalometrics.

MATERIALS AND METHODS

The present study was conducted in the department of Prosthodontics in which total 100 patients of both genders were included. All were informed regarding the study and written consent was obtained. They were divided into 4 groups wherein Group I consisted of 25 completely dentulous subjects with skeletal class I jaw relation. Group II (25) completely dentulous subjects with skeletal class II jaw relation. Group III had 25 completely edentulous subjects with skeleton class I and group IV (25) with completely edentulous subjects with angles class II relation. Subjects with minimum attrition and with no gross skeletal or facial abnormality were considered in group I and II. Subjects with edentulism not more than one year and with no histories of preprosthetic surgery were included in group III & group IV. In all subjects,

right lateral cephalometric radiograph was taken and radiographic tracing was done. In group I and group II subjects, barium sulphate radio- opaque dye (Microbar Suspension™, Eskay Fine Chemicals, Mumbai, India) was applied on a line joining the ala of the nose to the tragus of the ear. Right lateral cephalograms were taken with teeth in maximum intercuspations. For taking radiographs Kodak green sensitive extraoral film was used. The cassette was held parallel to the mid sagittal plane on the left side adjacent to the shoulder and Frankfurt horizontal plane was parallel to the floor (Figure 1). The standardized parameters such as constant current of 12 mA, kVp of 90 and an exposure time of 17 seconds was used. For establishing occlusal plane on cephalometric tracing, a line joining the mesiobuccal cusp tip of mandibular first molar and tip of most lingually placed incisor tooth was marked. All cephalograms were traced on a standard acetate tracing paper of a thickness of 5 microns with the help of 0.5 mm lead pencils (Figure 2 and 3).

STATISTICAL ANALYSIS AND RESULTS

All the values and observations were tabulated and sent for statistical evaluation using statistical software SPSS software version 21 (IBM Inc., Armonk, NY, USA). Comparison of angular variables of the Group I and Group III was performed. Except the occlusal plane to frankfort horizontal plane angle and occlusal plane to camper's plane angle, there was significant difference in the means of all other angular variables ($P < 0.05$, Table I). Upon comparison of angular variables of the Group II and Group IV, significant difference ($P < 0.05$) in all variables was noticed except occlusal plane to frankfort horizontal plane angle and occlusal plane to camper's plane angle (Table II). The occlusal plane- mandibular plane angle and maxilla- mandibular plane angle showed gentle reduction with the loss of teeth. The maxilla- mandibular bisector plane was closely approximated to the occlusal plane in edentulous subjects which may be attributed to the increase in occlusal plane-palatal plane angulation and correspondence decrease in occlusal plane - mandibular plane angle. The comparison between edentulous and dentulous shows that the inclination of the occlusal plane in relation to the maxillary base was again steady with following loss of teeth and was not seems to be influenced by any (skeleton I or II) relation. Though, the maxilla-mandibular bisector plane was very much approximated to the occlusal plane in edentulous subjects which may be attributed to the increase in occlusal plane- palatal plane angulation and correspondence decrease in occlusal plane-mandibular plane angle.

Table I: Comparison of individual angular variables between two Groups I and Group III using Two sample T- Test

S.No	Variables	Group I (n=25)		Group III (n=25)		P Value
		Mean	S.D.	Mean	S.D.	
1.	Occlusal plane and Frankfort Horizontal plane	11.70	1.88	10.65	1.38	1.000
2.	Occlusal plane and Camper's plane	6.95	3.45	8.45	2.56	1.000
3.	Occlusal plane and Mandibular plane	17.35	2.96	12.40	1.46	0.000*
4.	Maxillary plane and Mandibular plane	19.35	2.97	16.95	1.51	0.000*
5.	Occlusal plane and Maxillo-mandibular plane	8.80	3.94	6.25	1.89	0.050*
6.	Frankfort Horizontal plane and Camper's plane	10.20	1.91	12.35	1.82	0.006*
7.	Occlusal plane and Palatal plane	6.70	0.81	5.68	1.83	0.050*
8.	Porion-Nasion- Anterior Nasal Spine	76.20	3.94	68.50	1.95	0.050*

*p<0.05 significant

Table II: Comparison of individual angular variables between two Groups II and Group IV using Two sample T- Test

S.No.	Variables	Group II (n=25)		Group IV (n=25)		p Value
		Mean	S.D.	Mean	S.D.	
1.	Occlusal plane and Frankfort Horizontal plane	11.95	2.49	12.40	1.28	.712
2.	Occlusal plane and Camper's plane	6.85	3.10	7.20	1.38	.892
3.	Occlusal plane and Mandibular plane	22.35	2.70	19.25	1.79	.000*
4.	Maxillary plane and Mandibular plane	23.65	2.32	23.00	2.67	.000*
5.	Occlusal plane and Maxillo-mandibular plane	11.15	1.89	2.75	1.08	.000*
6.	Frankfort Horizontal plane and Camper's plane	10.10	2.58	11.35	2.20	.000*
7.	Occlusal plane and Palatal plane	6.75	1.31	7.25	1.79	.940
8.	Porion-Nasion- Anterior Nasal Spine	79.10	7.58	82.55	3.30	.050*

*p<0.05 significant



Fig. 1: Group I subject positioned on Cephalostat for recording Ala-Tragus points

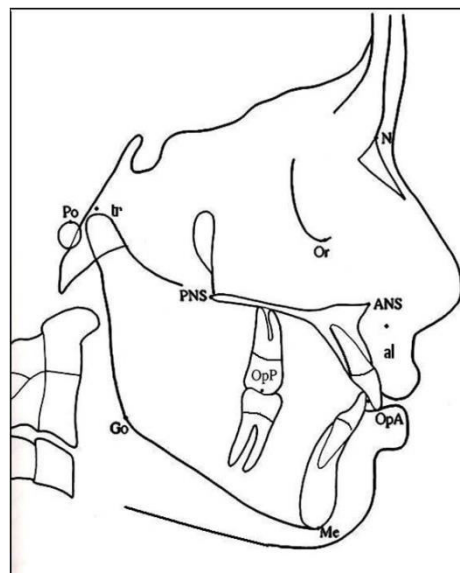


Fig. 2: Various Reference points marked on the tracing of a lateral cephalogram

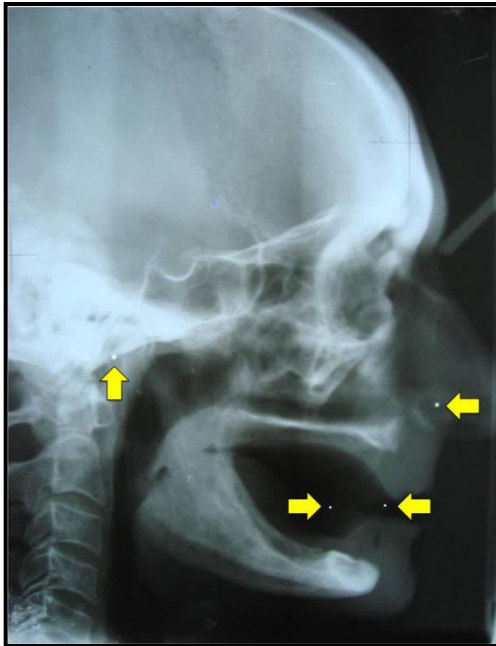


Fig. 3: Lateral cephalogram of Group III with marked radio-opaque landmarks (Yellow arrows)

DISCUSSION

The role of dentist in correcting the phonetics, mastication and esthetics in edentulous patient is very important. Any error while recording occlusal plane may alter the success of complete denture. During recording relation, the form of the denture must restore neuromuscular function. The exact localizing the orientation of occlusal plane determines the future outcome of denture and hence to be correctly located. It is one of the fundamental step in fabrication of denture. It is recorded by certain reference points on the patient's jaw which shows variation and it is technique sensitive.¹³ A study by Zarb and Bolender¹⁴ utilized upper lip in finalizing the occlusal plane. Similarly, Yasaki¹⁵ used lateral margins of tongue as reference point. Van Niekerk¹⁶ conducted a study in recording occlusal plane with the help of soft tissue landmarks such as two-third of the height of the retromolar pad, parallel to the Camper's plane and interpupillary lines. Cephalometric analysis is one of the beneficial tools in research and diagnosis. Although it's clinical application has been directed largely toward orthodontics, cephalometrics is of special value to prosthodontics in that it can be used to reestablish the spatial position of lost structures such as the teeth. This purpose is solved by establishing relation between the teeth and specific reference points used for evaluation of facial growth and development.¹⁷ Few authors have conducted study using cephalograms in recording occlusal plane in both dentulous and edentulous patients.^{11,17} The present study was conducted to determine the efficacy of different anatomic reference planes and their role in determining occlusal plane in both dentulous and edentulous subjects with Angle's Class I and Class II maxilla- mandibular

relationship using cephalometrics. We found that there was non- significant comparison of occlusal plane with camper's plane angulation. This shows that there was constant relationship between these in dentulous and edentulous subjects with Angle's class I jaw relationship. Karkazis and Polyzois¹¹ reported the inclination of artificial Occlusal plane–Camper's plane almost the same as the inclination of natural Occlusal plane–Camper's plane in their study. In our study, a mean angulation of Occlusal plane–Camper's plane was 6.95° in group I and 6.75° in group II. This is in agreement with the result of study conducted by Koller et al¹⁸ who recorded it as 6.80°. This is in contrast to study by Van Niekerk¹⁶ who reported it as 3.45°. Petricevic et al¹⁹ proposed it as 9.43° and 8.53° in dentulous and edentulous subjects. The difference in values in group I and group II subjects may be due to resorption of bone and decrease in bone height. Similar findings were seen in Angle's class II dentulous and edentulous subjects who indicate that it is independent of skeleton jaw relations. We found 11.70° in group I and 10.65° in group II angulation of occlusal plane relationship with Frankfort Horizontal plane. However, the difference was non-significant ($P>0.05$). We found that among Angle's class I dentulous and edentulous subjects, the inclination of the Occlusal plane was steady with the subsequent loss of teeth. A study conducted by Seifert et al¹³ recorded a higher angulation (11.42°). The difference in value may be attributed to the visual error as up to 8° of difference in angular perception does usually arise in binocular vision.²⁰ There is relative consistency in the angle between Occlusal plane–Frankfort Horizontal plane in dentulous and edentulous subjects with Angle's class I jaw relationship. Our results are in agreement with the Seifert et al.¹³ These findings suggest relatively stable relation of the Frankfort horizontal plane and Camper's plane with Occlusal plane. The perpendicular distance between Menton (Me) to ANS indicated the height & length is measured as a distance from lingual surface of Mandibular left incisor to the point where it bisect the posterior pharyngeal wall. Atwood et al²¹ & Bassi et al²² in their study also studied this dynamic nature of vertical dimensions in edentulous subjects. They confirmed that there is relative resorption of lower ridge in edentulous patients and there is variation in vertical dimension. Patient prefers to stabilize the mandibular denture in the lower arch that results into relative settling of lower denture. This brings the mandible into more forward and upward position which thereby results into decreased occlusal vertical dimension.²³⁻²⁸ Our results also confirms that the height of the Maxillomandibular space relative to Angle's class I and class II relationship were similar, though there is marked reduction in height of the Maxillomandibular space in the edentulous subjects as compared to dentulous subjects.

CONCLUSION

Authors concluded that cephalometrics can be successfully used to define reference planes with different angular relationships and their clinical applicability. The frankfort horizontal plane and Camper's plane illustrated a definitive relation with occlusal plane in both dentulous and edentulous subjects with Angle's class I and II maxillomandibular relationship. Hence, clinicians can logically utilize these two planes as and when reestablishing the lost occlusal plane in completely edentulous scenarios.

REFERENCES

1. Rathod N, Sood P, Pasam N. Analysis and Comparison of Correlation between Camper's Plane and Natural Occlusal Plane in Normal Dentulous Subjects. *Int J Prosthodont Restor Dent* 2017;7(3):81-85.
2. Tantray MA, Bali SK, Shah SA. A study comparing the occlusal plane in dentulous and edentulous subjects in relation to maxillomandibular space in Kashmiri population. *Int J Applied Dent Sci* 2017;3(4):96-102.
3. Sherry SA, Jain AR. Reliability of various craniofacial reference planes with occlusal plane in Dravidian population. *J Pharmacy Res* 2017;11:1503-5.
4. Kaur K, Nelogi SY, Patil R. Comparative evaluation of the most reliable posterior reference point of Camper's plane in relation with hamular notch-incisive papilla plane with change in gender of edentulous subjects: A cephalometric study. *Indian j health sci* 2016;9:165-9
5. Gandhi N, Daniel S, Kurian N. Cephalometric study of the position of ala-tragus line in relation to Frankfort horizontal plane and Occlusal plane among Ludhiana population. *Indian J Dent Sci* 2017;9:165-9.
6. Saha MK, Dhariwal P, Vinod V, Jindal A, Dave M, Agrawal P. A comparative evaluation of the parallelism of the occlusal plane with different levels of the tragus forming the ala-tragal line in Indore-Malwa dentate population – A Photographic study. *J Applied Dent Med Sci* 2017;3:1-7.
7. Mittal R. Comparison of the Occlusal Plane in dentulous and edentulous patients: A Cephalometric study. *J Ind Prosthodont Soc* 2008;8:195-200.
8. Swenson MG Complete denture 2nd ed St Louis. Mosby Company p 177-80.
9. Singh G. Ala Tragus line - A cephalometric evaluation. *Int J Prosthodont* 2010;1:1-5.
10. Abrahams R, Carey PD. The use of ala tragus line for Occlusal Plane determination in complete dentures. *J Prosthet Dent* 1979;7:339-41.
11. Karkhazis HC, Polyzois GC. A study of the Occlusal plane orientation in complete denture construction. *J Oral Rehab* 1987;14:399-404.
12. Shigli K, Chetal BR, Jabade J. Validity of soft tissue landmarks in determining the Occlusal Plane. *J Ind Prosthodont Soc* 2005;5:139-45.
13. 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.
14. Zarb GA, Bolender CL, Carlsson GE. Boucher's Prosthodontic treatment for edentulous Patients. 11th ed St Louis. Mosby Company p 3-46, 183-196.
15. Yasaki M. The height of the Occlusal rim and the interocclusal distance. *J Prosthet Dent* 1961;11:26-31.
16. Niekerk FWV, Miller VJ, Bibby RE. The Ala-Tragus line in Complete Denture Prosthodontics. *J Prosthet Dent* 1985;53:67-9.
17. Ismail YH, Bowman JF. Position of Occlusal Plane in natural and artificial teeth. *J Prosthet Dent* 1968;20:407-11.
18. Koller MM, Merlini L, Spandre G, Palla S. 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. *J Oral Rehab* 1992;19:413-25.
19. Petricevic N, Guberina M, Celic R, Mehulic K, Krajnovic M, Antonic R, Borcic J, Celebic A. Use of digital photography in the reconstruction of the Occlusal Plane orientation. *Medicinski Glasnik* 2009;6:243-4.
20. Schillingburg HT, Hobo S, Whitsett LD, Jacobi R, Brackett SE. Fundamentals of Fixed Prosthodontics. 3rd ed Chicago. Quintessence Publishing Company p 124.
21. Atwood DA, Willard AC. Clinical, cephalometric, and densitometric study of reduction of residual ridges. *J Prosthet Dent* 1971;53:280-95.
22. Bassi F, Deregibus A, Previgliano V, Bracco P, Preti G. Evaluation of the utility of cephalometric parameters in constructing complete denture. Part I: placement of posterior teeth. *J Oral Rehab* 2001;28:234-8.
23. D'Souza N, Bhargava K. A cephalometric study comparing the Occlusal plane in dentulous and edentulous subjects in relation to the Maxillomandibular space. *J Prosthet Dent* 1996;75:177-82.
24. Kumar P. Reference guide for prosthetic occlusal plane orientation: An obscured dilemma. *European J General Dent.* 2012;1:1-2.
25. Kumar P, Kumar A, Goel R, Khattar A. Anterior point of reference: Current knowledge and perspectives in prosthodontics. *J Orofac Sci* 2012;4:96-9.
26. Jayachandran S, Ramachandran CR, Varghese R. Occlusal plane orientation: a statistical and clinical analysis in different clinical situations. *J Prosthodont* 2008 Oct;17(7):572-575.
27. Hickey, JC.; Zarb, GA.; Bolender, CL. Boucher's prosthodontic treatment for edentulous patients. 9th ed. St Louis (MO): Mosby; 1985. p. 299-300.
28. Fu PS, Hung CC, Hong JM, Wang JC. Three-dimensional analysis of the occlusal plane related to the hamular-incisive papilla occlusal plane in young adults. *J Oral Rehabil* 2007 Feb;34(2):136-140.

Source of support: Nil

Conflict of interest: None declared

This work is licensed under CC BY: **Creative Commons Attribution 3.0 License.**