DOI: 10.7860/JCDR/2015/11820.5575

Original Article

Dentistry Section

# Relationship Between Occlusal Plane and Three Levels of Ala Tragus line in Dentulous and Partially Dentulous Patients in Different Age Groups: A Pilot Study

SAQUIB AHMED SHAIKH[1], LEKHA K.[2], GAURAV MATHUR[3]


## ABSTRACT

**Statement of problem:** Correct orientation of the occlusal plane plays a vital role in achieving optimal aesthetics, occlusal balance and function of complete dentures. The use of ala tragus line for determination of occlusal plane has been a topic of debate over past many years. Also, the effect of age on level of ala tragal line has not been investigated in the past.

**Purpose:** To determine the effect of age on location of Ala-Tragus line.

**Materials and Methods:** A total of 180 patients (90 males and 90 females) were selected with complete dentition and were grouped according to their age in three age groups with 60 subjects in each age group (Group A: 20-35 y, Group B: 36-50 y, Group C: 51-65 y). Right lateral profile photographs were taken with subjects having fox plane placed intraorally parallel to occlusal plane. Reference points corresponding to inferior border, middle or superior border of tragus and inferior border of ala of nose were marked on photographs. These were joined to get three different levels of Ala-Tragus line. Images were analysed photometrically and most parallel relationship was determined in between arms of fox plane (that represented the occlusal plane) and three different levels of ala tragus line. Data obtained was subjected to statistical analysis using Pearson chi-square and Likelihood-ratio chi-square test.

**Results:** Significant correlation was found between age and level of Ala-Tragus line. The occlusal plane was found to be more parallel to Ala-tragus line when inferior border of tragus was considered as posterior reference point in young adult age group (20-35 y). In older age groups, occlusal plane was found to be more parallel to Ala-tragus line when middle of tragus was considered as posterior reference point.

**Conclusion:** Within the limitations of this study, it can be concluded that a definite relationship exists in between age and level of ala tragus line.


**Keywords:** Campers plane, Complete denture, Occlusion

## INTRODUCTION

Complete denture construction is a product of biological sciences as well as sound mechanical principles. Construction of a prosthesis that is in harmony with patient's stomatognathic system is the ultimate aim of prosthetic dentistry. Full denture prosthesis places numerous factors which are associated with prosthesis and are in the control of operator. Though the operator is free of factors associated with natural teeth such as mobility, caries, tooth position etc. but he faces a new complex problem of designing prosthesis in harmony with tissues which can provide an accord in between function and aesthetics [1].

The glossary of prosthodontic terms-8 defines occlusal plane as "the average plane established by the incisal and occlusal surfaces of the teeth. Generally, it is not a plane but represents the planar mean of the curvature of these surfaces" [2].

Correct orientation of the occlusal plane plays a vital role in achieving optimal aesthetics, occlusal balance and function of complete dentures. Faulty orientation of occlusal plane in fixed or removable prostheses will affect the interaction between tongue and buccinator muscle resulting in food collection in sulcus and cheek or tongue biting [3]. Not only this, it can also lead to instability of dentures, tissue alteration and untimely bone resorption. Correct orientation of occlusal plane plays a vital role in optimal functional and aesthetic achievement [4]. When located correctly, occlusal plane will contribute a proper sense of balance in dental composition. Determination of correct occlusal plane poses a challenge to operator and if not done correctly can lead to aesthetically and functionally unacceptable dentures.

The occlusal plane is normally established anteriorly according to aesthetics of patient and posteriorly parallel to camper's plane [3]. GPT-8 defines campers plane as "a plane passing from the acanthion to the center of each bony external auditory meatus; called also acanthion-external auditory meatus plane" [2].

The use of ala tragus line for determination of occlusal plane has been a topic of debate over past many years. This is because various researchers cannot come to a consensus as to which tragal reference should be used for formation of ala tragal line. Also, the effect of age on level of ala tragal line has not been investigated in the past. This study evaluates the null hypothesis ($n^0$) that no correlation exists between different age groups and the level of ala tragus line.

## MATERIALS AND METHODS

This cross-sectional study was carried over a period of six months on patients who reported in OPD of Prosthodontics Department in SDM College of dental sciences and hospital, Dharwad, India. A total of 180 patients (90 males and 90 females) were selected with complete dentition and were grouped according to their age in three age groups with 60 subjects in each age group. Any patients who were indicated for dental restorative treatment were included in this study provided that they did not have any of the conditions mentioned in the exclusion criteria. Exclusion criteria followed were:

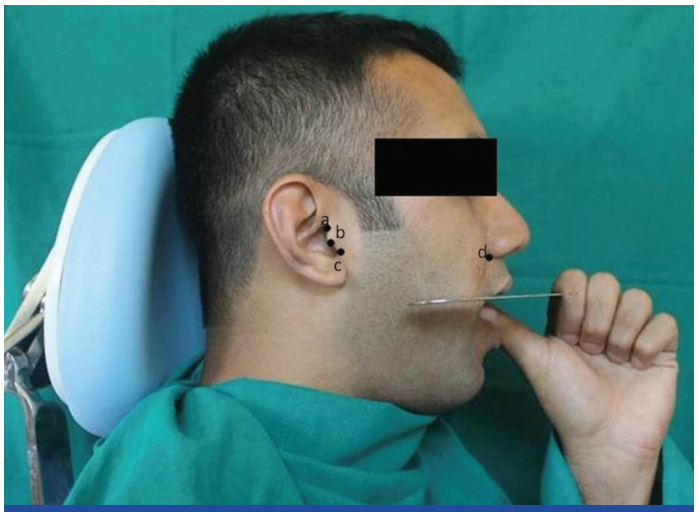
1. Previous history of orthodontic or orthognathic treatment
2. No posterior teeth present to aid in determining occlusal plane
3. History of facial or temporomandibular joint surgeries

4. Poor systemic health
5. Presence of bone or skin diseases
6. Congenitally missing teeth or extracted teeth
7. Supraeruption or drifting of teeth
8. Presence of advanced periodontal diseases.

Age groups selected were:

- Group A: 20-35 y
- Group B: 36-50 y
- Group C: 51-65 y

In this study, a Sony digital camera model no DSC W830 with a resolution of 20.1 mega pixels was used which is adequate for computer analysis. Fox plane was placed intraorally so that it touched incisal edges of upper incisors and cusps of left and right upper first molars. This plane thus corresponded to the orientation plane used for construction of complete dentures. The subjects were asked to hold fox plane in this position. Right lateral profile photographs were taken with subjects sitting in natural head position with their back straight. Using an adjustable tripod, the height of camera was adjusted according to the patient and photographs were taken from a fixed distance of one metre from patients mid sagittal plane. Following landmarks were marked on photographs in computer shown in [Table/Fig-1,2].




**[Table/Fig-1]:** Various landmarks marked on the photograph. a-superior margin of the tragus ; b-middle margin of tragus; c- inferior margin of tragus; d- Inferior border of ala of nose


**[Table/Fig-2]:** Different levels of Ala-tragus plane

- The superior margin of the tragus (a)
- The middle margin of tragus (b)
- The inferior margin of tragus (c)
- Inferior border of ala of nose (d)
- Line joining superior margin of tragus to inferior border of ala of nose (ad)
- Line joining middle margin of tragus to inferior border of ala of nose (bd)
- Line joining inferior margin of tragus to inferior border of ala of nose (cd)
- Line corresponding to arms of fox plane representing occlusal plane.

These images were analysed using computer software Autocad 2009 and most parallel relationship was determined in between arms of fox plane (that represented occlusal plane) and three different levels of ala tragus line (ad, bd, cd).

Data thus obtained was subjected to statistical analysis using Pearson chi-square and Likelihood-ratio chi-square test.

## RESULTS

[Table/Fig-3] shows the distribution of participants according to the parallelism of their Ala tragus line to occlusal plane among different age groups. It can be seen from the table that as age advances, occlusal plane shifts more superiorly. The occlusal plane is more parallel to line CD i.e. lower border of tragus to inferior border of ala of nose in young adult age group (20-35 y).

| | 20-35 y | 36-50y | 51-65 y |
|---|---|---|---|
| Occlusal plane parallel to Line AD | 10 | 15 | 20 |
| Occlusal plane parallel to Line BD | 11 | 35 | 30 |
| Occlusal plane parallel to Line CD | 39 | 10 | 10 |

**[Table/Fig-3]:** Distribution of participants according to the parallelism of their Ala tragus line to occlusal plane

[Table/Fig-4] shows the p-value between the participants according to the parallelism of their Ala tragus line. It shows that there was no statistically significant difference between the number of participants having their occlusal plane parallel to line AD or line BD. But marked statistical significance (p=0.001) was observed between the participants with occlusal plane parallel to line BD and line CD and participants with occlusal plane parallel to line AD and line CD indicating relative constancy in orientation of occlusal plane as individual reaches middle age.

| | p-value |
|---|---|
| AD-BD | 0.399 |
| AD-CD | 0.001 |
| BD-CD | 0.001 |

**[Table/Fig-4]:** Comparison of parallelism of different Ala tragal lines to occlusal plane

[Table/Fig-5] shows the p value between participants based on their age group. It can be seen that there was a marked statistical difference between parallelism of occlusal plane to ala tragal line in the individuals in age Group A and individuals in the age Group B and C. But no statistical difference was observed between individuals in the age Group of B and C. This finding further reinforces previous observations. Therefore null hypotheses ($n_0$) can be rejected.

| | p value |
|---|---|
| Group A and Group B | 0.001 |
| Group A and Group C | 0.001 |
| Group B and Group C | 0.882 |

**[Table/Fig-5]:** Comparison of parallelism of occlusal plane and Ala tragal line among different age groups

## DISCUSSION

Relocation of occlusal plane in patients who has been rendered edentulous poses a challenge to clinician. It is more plausible to relate occlusal plane to maxillary plane during occlusal reconstruction

rather than mandibular plane because of independence of maxillary plane to dentoalveolar structures and its fixed orientation to various craniofacial planes. However this is not the case with mandibular plane because of mobile nature of mandible which changes the orientation of mandibular plane to craniofacial planes [5]. Also, the occlusal plane should be relocated in a position in which it had been situated previously [6]. This statement seems quite correct as stomatognathic system functions normally at this position and will continue functioning normally till it is altered. To aid in rehabilitation of occlusal plane numerous reference planes and landmarks have been suggested. Out of these, Campers planes is the most commonly used reference plane [3].

However, use of ala-tragus line has been a topic of debate since past many years. Several clinical investigations have been conducted but still researchers cannot come to a consensus as to which part of tragus should be used for construction of occlusal plane in edentulous patients. Some authors suggest use of superior border of tragus as reference point whereas some authors suggest use of middle or inferior point of tragus for this line [7,8]. Therefore, it's quite evident that significant controversy exists in this matter. Till now, literature does not support age as an influencing factor on location of ala tragus line. Hence, aim of present study was to determine effect of age on location of ala tragus line.

To analyse level of ala-tragus line, various instruments have been devised and used. Bite plane leveler, J plane, Campers plane indicator, and more recently, occlusal plane analyser and occlusal plane orientor have been used to locate ala tragus line [4,9]. Fox plane is the simplest and most widely used instrument to aid in determining occlusal plane. But its use is error prone and is associated with inter examiner variability. Also there are chances of parallax error [4]. However, it's use is very rapid and simple. It is less bulky than other instruments and is more suitable for photographic purposes. The chances of parallax error are reduced when images are subjected to photometric analysis. Also, it is the most commonly used instrument for establishing occlusal plane in edentulous patients. Therefore, fox plane was used for the present study.

A study was conducted in which age group estimation was done using face angle. They estimated and classified human age groups according to facial features extracted from human facial digitized images [10,11]. Facial features and various other parameters were assessed on these images in detail and age groups were classified. These groups were.

- Child: till 17 y
- Young age: 18-25 y
- Young adult age: 20-35 y
- Mid age: 36-50 y
- Old age: more than 50 y

Since the present study deals with the possible effect of soft tissue changes on level of ala-tragus line, age group intervals were adopted from same study mentioned above Also, since most of the edentulous patients are above 20 y of age, adult, mid and old age groups were selected for present study. Number of completely edentulous patients encountered in young adult age group may be less as compared to other age groups, but in order to investigate relationship between age and ala tragus line, consideration of young adult age group was also required so that any soft tissue changes that are taking place which may affect the level of Ala-Tragus line can be considered.

According to the results of the present study, for age group A (18-25 y) ala tragus line was found to be parallel to occlusal plane when inferior border of tragus was taken as a reference point in most of the individuals. The results of this study for group A are in accordance with previous studies [7,8].

For group B and C, ala tragus line was found to be parallel to occlusal plane when middle border of tragus was considered as posterior reference point. The results obtained for group B and C are in accordance with some of the previous studies [7]. However, results of present study are contradicted by few researchers who advocated use of superior border of tragus as posterior reference point [7,9,12-14]. It was also found that sex had no significant influence on location of occlusal plane.

For maximum occlusal stability, occlusal plane should be oriented such that it is perpendicular to direction of occlusal forces. It has been well proven that in cases of excessive resorption, plane should be parallel and closer to lower edentulous ridge to decrease possible leverage. And this also has been shown that when occlusal plane is developed considering lower border of tragus as posterior reference point, occlusal plane is more parallel to lower ridge and is perpendicular to occlusal forces [3]. However, the occlusal plane should not be located near to mandibular ridge posteriorly for sake of attaining more mechanical stability. This places occlusal plane in a more adverse position relative to surrounding musculature and will hamper not only the function of the tongue but will also be harmful to functioning of entire stomatognathic system [15]. It will result in a compromise with both phonetics and aesthetics and will cause frequent tongue biting. Success of prosthesis is a combination of mechanical principles and harmony in between different components of stomatognathic system. Either one cannot be neglected at expense of other.

When occlusal plane is established such that it is high posteriorly, it follows the curvature of ramus and enables teeth to be set in such a way that there are least interferences during protrusive movements. These interferences if ignored can significantly decrease stability of dentures. It must be constantly kept in mind that occlusal plane is determined by dynamics of function and not by any particular static relationship [16]. This location of occlusal plane allows normal functioning of tongue, buccinator and other associated muscles and will add to aesthetic outcome of prosthesis.

## CONCLUSION

Within the limitations of this study, it can be concluded that a definite relationship exists in between age groups and level of ala tragus line. In young adult age group, occlusal plane is found to be more parallel to Ala-Tragus line when inferior border of tragus is considered as posterior reference point and hence should be used as a posterior reference point in establishing occlusal plane in completely edentulous patients in young age group. In middle age and old age group, both middle and superior border of tragus can be taken as posterior reference point while orienting the occlusal plane for these age groups. However, further research has to be conducted to determine exact cause and relationship between age and level of occlusal plane. Also, one particular level of Ala-Tragus line should not be used while establishing occlusal plane for completely edentulous patients. According to age, different level of ala tragus line should be considered.

## REFERENCES

[1] Sloane RB, Cook J. A guide to the orientation of the plane of occlusion. *J Prosthet Dent.* 1953;3(1):53-65.
[2] Glossary of prosthodontic terms. *J Prosthet Dent.* 2005;94:10-92.
[3] Kumar S, Garg S, Gupta S. A determination of occlusal plane comparing different levels of the tragus to form ala-tragal line or Camper's line. *J Adv Prosthodont.* 2013;5:9-15.
[4] Kuniyal H, Katoch N, Rao PL. Occlusal plane orienter: An innovative and efficient device for occlusal plane orientation. *J Indian Prosthodont Soc.* 2012;12(2):78-80.
[5] L Estrange PR, Vig PS. A comparative study of the occlusal plane in dentulous and edentulous subjects. *J Prosthet Dent.* 1975;33(5):495-503.
[6] Lammie GA. Full dentures, Oxford, 1956, Blackwell Scientific Publications. Pp.118-122.
[7] Solomon EGR. The Morphology of Tragus Part 1: The Confusion About Tragus Terminology. *J Indian Prosthodont Soc.* 2000;11(1):11-15.
[8] Rostamkhani F, Sahafian A, Kermani H. A cephalometric study on the relationship between the Occlusal Plane, Ala-Tragus and Camper's Lines, in patients with Angle's class III malocclusion. *J Prosthet Dent.* 2005;2:46-49.

[9] Gupta R, Aeran H, Singh SP. Relationship of anatomic landmarks with occlusal plane. *J Indian Prosthodont Soc.* 2009;9(3):142-47.
[10] Jana R, Pal H, Chowdhury AR. Age Group Estimation Using Face Angle. *IOSRJCE.* 2012;(5):35-39.
[11] Jana R, Datta D, Saha R. Age Group Estimation using Face Features. *IJEIT.* 2013;3(2):130-34.
[12] Zarb GA, Bolender CL. Prosthodontic Treatment for Edentulous Patients: Complete Dentures and Implant Supported Prostheses, 12th ed. St. Louis:Mosby;2004:262.
[13] Rahn AO, Heartwell CM. Textbook of complete dentures. 5th ed. Wolters Kluwer Co; 1986.
[14] Boucher CO. Current clinical dental terminology, 3rd ed. St. Louis: CV Mosby, 1982:175.
[15] Hartono R. The occlusal plane in relation to facial types. *J Prosthet Dent.* 1967;17:549-58.
[16] Al Quran FAM, Hazza'a A, Al Nahass F. The Position of the Occlusal Plane in Natural and Artificial Dentitions as Related to Other Craniofacial Planes. *J Prosthodont.* 2010;19:601-05.

**PARTICULARS OF CONTRIBUTORS:**
1. Associate Professor, Department of Prosthodontics, SDM College of Dental Sciences and Hospital, Sattur, Dharwad, Karnataka, India.
2. Head and Professor, Department of Prosthodontics, SDM College of Dental Sciences and Hospital, Sattur, Dharwad, Karnataka, India.
3. Post Graduate Student, Department of Prosthodontics, SDM College of Dental Sciences and Hospital, Sattur, Dharwad, Karnataka, India.

**NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:**
Dr. Gaurav Mathur,
Post Graduate Student, Department of Prosthodontics, SDM College of Dental Sciences and Hospital,
Sattur, Dharwad-580009, Karnataka, India.
E-mail: gauravmathur.june@gmail.co

**FINANCIAL OR OTHER COMPETING INTERESTS:** None.

Date of Submission: **Oct 27, 2014**
Date of Peer Review: **Nov 21, 2014**
Date of Acceptance: **Dec 18, 2014**
Date of Publishing: **Feb 01, 2015**