

Frequency of Parallelism of Occlusal Plane to ALA-Tragus Line in Different age Groups: A Photographic Study

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ABSTRACT

Background: For the complete dentures to look, sound, fit, and feel their best, it is crucial that the occlusal plane be positioned correctly. There are a number of different anatomical landmarks that have been proposed to arbitrate the position of the occlusal plane, with the Ala-tragus line being the most commonly adopted by the professions.

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

Materials and methods: One hundred and seventy six patients (128 males and 48 females) having complete dentition were recruited in the study, and grouped according to their age. Patients' right lateral profiles were photographed after they had positioned the fox plane intraorally so that it was parallel to the occlusal plane. Images were taken with Canon camera model no. EOS 700 D with a resolution power of 18.0 Mega pixels, images produced were transferred to computer and traced using computer software AutoCAD 2014 and angle between Fox plane and superior, Middle and inferior borders of Ala-tragus and angle measured between three different lines. Data obtained was statistically analyzed using Pearson chi-square test.

Results: There was a statistically significant relationship between age and Ala-Tragus line height. When the middle tragal border was used as the posterior reference point in the analysis, the occlusal plane was also shown to be more parallel to the Ala-tragus line age groups A, C, and D, being 42.0% (74/176). The second common location was the superior line in age groups B and D, being 36.9% (65/176), and the least common location was found to be the inferior line in almost all age groups, being 21.0% (37/176).

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: Ala-tragus line, interpupillary line, occlusal plane

INTRODUCTION

The goal of prosthetic dentistry is to create an appliance that functions well with the patient's gnatho-facial structure. 1 Esthetics, phonetics, mastication, and comfort are the four cornerstones of a well-made denture. One of the methods used in complete denture manufacturing that helps meet these criteria is positioning the occlusal plane at the same height at which the natural dentition sat.²

An "occlusal plane" can be visualised by drawing a line from the incisal margins of the front teeth to the back occlusal surfaces. 1 It is contoured to mimic real teeth. When the occlusal plane of a fixed or removable prosthesis is not properly positioned, the tongue and buccinator muscle are unable to work together in harmony. 1 Proper food distribution and control buccolingually, tongue space, and buccal soft tissue support all depend on an occlusal plane that is the right height and width. 3 Both food accumulation in the sulci and cheek/tongue biting can come from an occlusal table that is too high or too low. 4 Occlusal planes have been arbitrated at various anatomical landmarks, including the lower border of the upper lip, the corners of the mouth, the lateral margin of the tongue, the buccinators grooves, the anterior 2/3 of the height of the Retromolar pad, 3.3 mm below the parotid papilla, parallel to the Ala-tragus line or Camper's plane, parallel to the interpupillary line, and so on.⁵

The Ala-tragus line (also known as Camper's line) is a line drawn from the nose's alar base to the tragus, and it is the most common method used to determine the occlusal plane. However, its usefulness in determining the occlusal plane has been debated for years. There has been some debate over which region of the tragus should be considered the occlusal plane, despite the fact that this relationship has been explored by a number of researchers (1, 2, 7, 8). taken into account as a backwards landmark when trying to figure out where the plane of occlusion is. Furthermore, previous research has not looked into how age affects the ala tragal line level. The lack of association between

age and ala tragus line height is tested as the null hypothesis (n0) in this study.

MATERIALS AND METHODS

Patients who visited the outpatient department (OPD) of the prosthodontics unit at the institute of dentistry at CMH Lahore medical college in Lahore, Pakistan, over a six-month period participated in this cross-sectional study. A total of 176 individuals were chosen, all of whom had full dentition (128 males and 48 females), and were divided into four age brackets. Those who didn't meet the exclusion criteria were:

Subjects with previous history of orthodontic treatment or a periodontal surgery

- 1 Grossly abraded or attritioned teeth
- 2 Supraeruption or drifting of teeth
- 3 Patients with malaligned/ supraerupted/ partially erupted/ buccoverversion or linguoverversion third molars
- 4 Interdental spacing or crowding
- 5 Facial trauma or surgery causing asymmetry of the eyes
- 6 Facial asymmetry and craniofacial anomaly
- 7 History of facial or TMJ surgeries
- 8 Age groups were:

- Group A: 25 to 35 yrs
- Group B: 36 to 45 yrs
- Group C: 46 to 55 yrs
- Group D: greater than 55 yrs

The EOS 700 D, a Canon camera with an impressive 18.0 Megapixels of resolution, was employed for this study. The camera was set at a fixed distance of one metre from the subject using an adjustable tripod platform. Intraorally inserted modified Trubyte occlusal plane plates (Fox's biting plane) contact the upper anterior incisal margins and posterior cusps. The images clearly showed the occlusal plane was located on the outer wings of the Fox's bite plane. Each person was photographed twice; once from the side and once from the front while sitting in an upright position on a

dentist chair and looking forward in a natural way. AutoCAD 2014 was used to digitally trace the images that were created. Lines ad, bd, and cd were also drawn to indicate the angle formed by the Fox plane and the upper, middle, and lower Ala-tragus borders, respectively (Figure 1). By comparing the angles of these three lines, we were able to establish the closest parallelism between the arms of the Fox plane (which stand in for the occlusal plane) and the ad, bd, and cd lines. All of this information was fed into SPSS 20.0 and analysed with a chi-square test developed by Pearson.



Figure 1: Occlusal plane parallelism with three different levels of the tragus of the ear to ala of the nose

Key:

- 1 The nose's lower Ala boundary (d)
- 2 The lateral border of the nose is the line that connects the tragus's upper and lower rims. (ad)
- 3 An I from the tragus's centre edge to the nose's bottom border. Nose rim abbreviation: bd. (cd)

RESULTS

Figure 2 explains the Age distribution of the patients, while Figure 3 shows the gender distribution of the participants of this study.

It was revealed that across all age groups, the occlusal plane was more parallel to the Ala-tragus line when the tragus's middle border was used as the posterior reference point A, C, and D, being 42.0% (74/176). The second common location was the superior line in age groups B and D, being 36.9% (65/176), and the least common location was found to be the inferior line in almost all age groups, being 21.0% (37/176). (Table 1)

Males were more likely to have an ear shaped like this: Superior border of the tragus (53 patients) followed by Middle border (50 patients) and least common was inferior border (25 patients), while in females, the result were slightly different i.e. the middle border was most common (24 patients) followed by equal frequency of superior and inferior border (12).

The stratification analysis shown in Tables 1 and 2 shows that the relationship between age and the angle of the Ala-tragus line with the occlusal plane is statistically significant ($p=0.016$), but that the relationship between gender and this angle is not ($p=0.08$).

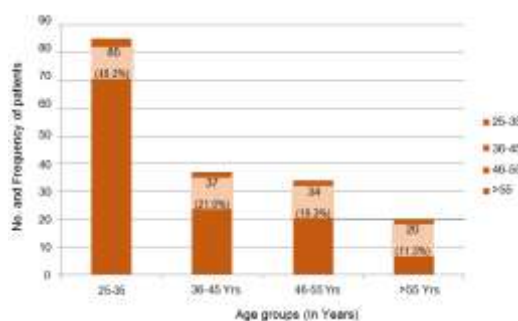


Figure 2: Distribution of Patients in Different Groups by Age

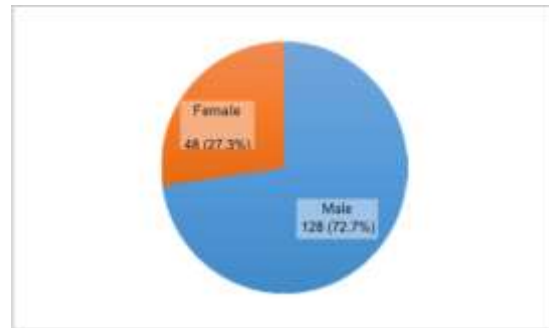


Figure 3: Gender Distribution of Patients

Table 1: Distribution of Parallelism of Different Levels of Ala-Tragus Line With Occlusal Plane in Dentate Patients by Age Groups

Age Groups (Years)	Levels of Ala-Tragus Line			Total
	Superior	Middle	Inferior	
Group A: 25-35 Years	35 (41.17%)	38 (44.70%)	12 (14.11%)	85
Group B: 36 to 45 Years	17 (45.94%)	13 (35.13%)	7 (18.91%)	37
Group C: 46 to 55 Years	6 (17.64%)	16 (47.05%)	12 (35.29%)	34
Group D: >55 Years	7 (35.00%)	7 (35.00%)	6 (30.00%)	20
Total	65 (36.93%)	74 (42.04%)	37 (21.02%)	176

$p=0.016$

Table 2: Parallelism between the Ala-Tragus and the Occlusal Plane in Dentate Patients: A Comparison of genders

Gender	Levels of Ala-Tragus Line			Total
	Superior	Middle	Inferior	
Male	53 (41.40%)	50 (39.06%)	25 (19.53%)	128
Female	12 (25.00%)	24 (50.00%)	12 (25.00%)	48
Total	65 (36.93%)	74 (42.04%)	37 (21.02%)	176

$p=0.083$

DISCUSSION

Complete denture rehabilitation is considered the most common treatment for edentulous patients,⁹ yet at the same time, Rehabilitation of edentulous patients who have complete dentures is difficult because of the many biological and mechanical elements that must be considered.¹⁰ The occlusal plane's orientation is a key consideration among these variables. Denture wearers who are edentulous must carefully reposition the denture's occlusal plane in order to restore normal function and aesthetics.

Both the front teeth's incisal and the back teeth's occlusal edges form an imaginary plane called the occlusal plane, which follows the teeth's natural curvature. The perfect tooth arrangement relies on a properly positioned occlusal plane, which helps with breathing and swallowing and also improves the smile's aesthetics.¹¹ Denture wearers' occlusal planes should be set as closely as possible to the positions held by their original teeth.¹² Dentures may be more stable and effective if the occlusal plane is set up so that the tongue and cheek muscles can continue to function properly. Complete dentures are more likely to remain in place and function well if their replacement teeth are positioned in a position of the jaws that complements the patient's face.¹³

There is some disagreement about whether part of the tragus should be utilised as a posterior landmark when orienting the plane of occlusion, despite the fact that many authors propose utilising the ala-tragus line as a reference point for the posterior occlusal plane. Correct occlusal plane determination is a difficulty for the operator, and incorrect results might result in dentures that are unappealing both visually and functionally. The purpose of this research was to establish the anatomical markers necessary for a proper and clinically acceptable occlusal plane alignment.

In this study, patients of both the genders with mean age of 38.80 ± 0.881 years participated (Table 1). Age distribution of the patients was categorized (Figure 3), and majority of them was males with a percentage of 128 (72.7%) males, and 48 (27.3%) females (Figure 4). The dropouts of the study based on exclusion

criteria were compensated by enrolling more patients to achieve the estimated sample size of 176 subjects.

In a study conducted by Kumar S² showed that locations of posterior point of Ala-tragus line on the tragus was inferior point in 53.3% of the subjects, Middle Point in 26% of the subjects and superior point in 20.7% of the subjects. Similar study was done by Shetty S³ and concluded that locations of posterior point of ala-tragus line on the tragus was inferior point in 58.8% of the subjects, Middle Point in 24.7% of the subjects and superior point in 12.1% of the subjects.

The present study found that the posterior point of the Ala-tragus line most frequently occurred in the centre of the line (42.04% of the time), followed by the superior point (36.03% of the time), and finally the inferior point (21.02% of the time) (Figure 3). Similar results were observed by Shigli et al.¹⁴, Gupta et al.¹⁵, Solomon et al.¹⁶, and Bondekar.¹⁷ The occlusal plane was determined to be perpendicular to a line extending from the bottom of the Ala to the centre of the tragus in all of these studies.

The Ala-tragus line's angle with the occlusal plane was shown to vary significantly with age ($p=0.016$). These findings may be attribute to age-related changes in muscles tonicity, resorption patterns and physiological tooth wear. Gender was an insignificant for different levels of Ala-tragus line with occlusal plane ($p=0.083$) (Tables 2 and 3 respectively).

Literature research results revealed that multiple techniques have been utilised in determining how the occlusal plane intersects with the Ala-tragus line (i.e., occlusal plane analyzer,¹⁴⁻¹⁵ cephalometric radiographs,^{17,20-23} photography^{2,24} etc.) It's possible that the results are still accurate if the occlusal plane coincided with the tragus's superior and middle points. Occlusal planes in edentulous patients have been observed to be located at the retromolar pad, lateral margins of the tongue, buccinators grooves, commissure of the lips, and parotid papilla (5,18,25). Clinicians may find it helpful to establish an artificial occlusal plane by evaluating these landmarks in addition to the Ala-tragus line.

Based on these results, the occlusal plane should be oriented to the Ala-tragus line, and the middle third of the tragus should be employed as the posterior landmark when treating edentulous individuals. So, the clinician should achieve desire outcome with respect to comfort, esthetics, function, phonetics and ultimately, patient confidence.

The study comprised of a small sample size, which might have limited the observations, ultimately affecting the final results. . Had the study included a larger sample size or sample comprised of different age groups (As in our study almost 50% of sample size was in the age group 25 to 35 years), the results might have been different. Therefore, further studies on a larger scale should be conducted with increased number of recall appointments to clearly identify long term complications of removable partial dentures in general, so that preventive strategies and prosthesis design modifications can be implemented for improved quality of work with predictable outcomes.

CONCLUSION

The present investigation found that 42.0% of people had a posterior occlusal plane that was parallel to the tragus's middle section along the ala-tragus line.

REFERENCES

1. Sheikh SA, Lekha K, and Mathur G. Relationship between occlusal plane and three levels of ala tragus line in dentulous and partially

2. dentulous patients in different age groups: a pilot study. *J Clin Diagn Res* 2015; 9(2): 39-42.
2. 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: A photographic study. *J Adv Prosthodont* 2013; 5(1): 9-15.
3. Shetty S, Zargar NM, Shenoy K, Rekha V. Occlusal Plane location in edentulous patients: A review. *J Ind Prosthodont Soc* 2013; 13(3): 142-8.
4. Jain R, Shigli K. An in vivo study to correlate the relationship of the extraoral and intraoral anatomical landmarks with the occlusal plane in the dentulous subjects. *Ind J Dent Res* 2015; 26(3): 136-43.
5. Singh K, Lakhshmi N, Agnithori Y, et al. Three-dimensional analysis to compare parallelism of occlusal plane to the humular notch-incisive papilla plane in dentulous and edentulous subjects. *Eur J Gen Dent* 2013; 2(3): 286-91.
6. Shetty S, Shenoy KK, Ninan J, Mahaseth P. An evaluation of relation between the relative parallelism of occlusal plane to ala- tragal line and variation in the angulation of Po-Na-ANS angle in dentulous subjects: A cephalometric study. *J Ind Prosthodont Soc* 2015; 15(2): 168-72.
7. Gupta R, Aeren H, Singh SP. Relationship of anatomical landmarks with occlusal plane. *J Indian Prosthodontic Soc* 2016; 9(3): 142-7.
8. Hindocha AD, Vertak VN, Bhandari AJ, Dudani MT. A cephalometric study to determine the plane of occlusion in completely edentulous patient. *Indian J Dent Res* 2013; 24(6): 669- 73.
9. Kadam I. Restoring Smiles with Conventional Immediate Denture: A Case Report. *Int J Recent Sci Res* 2018; 9(6): 27503-8.
10. Hartono R. The Occlusal plane in relation to facial types. *J Prosthet Dent* 1967; 17(6): 249-58.
11. Inamdar AM, Dange SP, Mahale KM, Khalikar SA. A device for occlusal plane determination. *J Indian Prosthodont Soc* 2019; 19(1): 93-6.
12. 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(3): 233-6.
13. Roberts AL. The effects of outline and form upon denture stability and retention. *Med Clin North Am* 1960; 4: 293-303.
14. Shigli K, Chetal B, Jabade J. Validity of soft tissue landmarks in determining the occlusal plane. *J Indian Prosthodont Soc* 2005; 5(3): 139-45.
15. Gupta RH, Singh SP. Relationship of anatomical landmarks with occlusal plane. *J Indian Prosthodont Soc* 2009; 9(3): 142-7.
16. Solomon EGR, Shetty S, Marla V. Reliability of Tragus morphology and its reference to establish Camper's plane. *J Indian Prosthodont Soc* 2000; 11(1): 16-22.
17. Bondekar V, Waugh SB, Attal PN, Pandey VR. Evaluation of relation between occlusal plane and ala-tragus line with the help of cephalometry. *J Adv Med and Dent Sci Res* 2015; 3(6): S43-8.
18. Malafaia FM, Garbossa MF, Neves ACC, Da Silva-Concilio LR, and Neisser MP. *J Esthet Restor Dent* 2009; 21(5): 318-23.
19. Silva BP, Jiménez-Castellanos E, Finkel S, Macias IR, Chu SJ. *J Prosth Dent* 2017; 117(4):513-6.
20. Al Quran FA, Hazza'a A, Al Nahass N. The position of the occlusal plane in natural and artificial dentitions as related tooth to craniofacial planes. *J Prosthodont* 2010; 19(8): 601-5.
21. Karkazis HC, Polyzois GL, Zissis AJ. Relationship between ala-tragus line and natural occlusal plane implication in Denture Prosthodontics. *Quintessence Intl* 1986; 17(4): 253-5.
22. Hindocha AD et al. A cephalometric study to determine the plane of occlusion in completely edentulous patients: part I. *J Indian Prosthodont Soc* 2010; 10(4): 203-7.
23. Hartono R. The occlusal plane in relation to facial types. *J Prosthet Dent* 1967; 17(6): 549-58.
24. Sadr K, Sadr M. A study of parallelism of the occlusal plane and ala-tragus line. *J Dent Res Dent Clin Dent Prospect* 2009; 3(4): 107-9.
25. Jain R, Shigli K. An in vivo study to correlate the relationship of the extraoral and intraoral anatomical landmarks with the occlusal plane in dentulous subjects. *Indian J Dent Res* 2015; 26:136-43.