

**Original Article****Determination of Relationship of Maxillary Occlusal Plane with Ala-Tragus Line: A Customised Approach in Aryan and Mongolian Ethnicity.****Pawan Mehta\* and Shanti Chhetri**

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Article Received: 12<sup>th</sup> September, 2019; Accepted: 18<sup>th</sup> December, 2019; Published: 31<sup>st</sup> December, 2019**DOI: <http://dx.doi.org/10.3126/jonmc.v8i2.26775>****Abstract****Background**

Determining occlusal plane is challenging and difficult aspect during complete removable partial denture prosthesis rehabilitation. Numerous soft tissue landmarks like commissures of the mouth by Gillis in 1933, parotid papilla by P. F. Foley and G. H. Latta in 1985, height of the retromolar pad, the lateral borders of the tongue etc. had been proposed to assist clinician for determining the occlusal plane. No universally accepted reliable anatomical measurement has been proposed to assist in determining of occlusion plane for different ethnic groups in context to Nepal.

**Material and Methods**

This cross-sectional study was conducted in the 60 dentate subjects visiting Nobel Medical College, Nepal, from February 2019 to July 2019. A customized occlusal plane relator was used to evaluate relative parallelism between occlusal plane and alatrugal line with respect to different borders of tragus. All the data were collected and statistically analyzed.

**Results**

Maxillary occlusal plane was found to be parallel with the line drawn from ala of the nose to the middle of tragus in 66.66%, followed by inferior border of tragus in 18.33% with the least parallelism in superior border of tragus 15%. Relationship of maxillary occlusal plane with alatrugal line was not statistically significant among Aryans and Mongolian ethnicity

**Conclusion**

This study showed line joining ala of the nose and middle border of tragus is parallel to maxillary occlusal plane. And no difference was found for Aryan & Mongolian ethnicity in relation to alatrugal line and maxillary occlusal plane.

**Keywords:** *Dental occlusion, Ethnicity, Maxilla*

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## Introduction

According to Glossary of Prosthodontic Terms, Occlusal plane is defined as “the average plane established by the incisal and occlusal surfaces of the teeth”. In general, maxillary occlusal plane is not a plane but it represents the planar mean of the curvature of the surfaces of teeth. Occlusal plane determination is one of the crucial and important clinical procedures in prosthodontic rehabilitation of edentulous patients. Faulty recording of the occlusal plane not only hampers the esthetics but also phonetics and mastication. Similarly, the stability of a complete denture may also be compromised and ultimately may result in increased alveolar bone resorption which is not desired.

Among various intraoral and extraoral landmarks used for location of level of occlusal plane, commonly used landmarks are parotid papilla, lip commissure and alartragal line. The most commonly used landmark is the ala tragus line and it orients the occlusal plane. The use of ala tragus line is however is not free from controversy. This controversy is mainly due to lack of agreement on the exact reference points for this line. Spratley [1] used a line running from the center of ala of the nose to the center of the tragus of ear. Similarly, Sharry [2] recommended the concept without illustrating or defining it. Also, Boucher defined Camper's line as an imaginary line that runs from the superior border of the tragus of the ear to the inferior border of the ala of the nose. These variations by different author necessitate the definite point on tragus to be located by recording ala tragus line.

Apart from these landmarks, the influences of other factors like age, sex, ethnicity to the position of the occlusal plane is also questionable. It is evident that various studies reported in literature allow variation in location of occlusion plane. Further, these measurements in various literatures were basically done in Americans [3], Irani [4], Jordanee [5], Indian [6] population only. Moreover only few studies have been done regarding the relation of these landmarks with occlusion plane for different ethnic group population in context of Nepal. Hence there is a need to determine the relationship of occlusion plane with these landmarks in different ethnic group.

## Materials and Methods

This study was conducted in Department of Prosthodontics & Maxillofacial Prosthetics, Nobel Medical College Teaching Hospital. Ethical approval for the study was obtained from Institutional

Review Board, NMCTH. The duration of study was six month. This was a cross sectional observational study. Purposive Sampling was done among students, staff, faculty and patients attending Nobel Medical College and Teaching Hospital. General screening was done on target population and subjects fulfilling the inclusion criteria were selected among them.

This study considers 95% CI & 80% power to estimate the sample size. In this regard, the study consider mean & SD of middle border of tragus in Aryan & Mongolian were  $6.16 \pm 3.91$  &  $-5.64 \pm 3.94$  respectively. Now using the following formula  $n = 2SD (Z\alpha + Z\beta)^2 / (\mu_1 - \mu_2)^2$  Where  $SD = \sqrt{SD_1^2 + SD_2^2} / 2$ ,  $Z\alpha = 1.96$  at 95% CI &  $Z\beta = 0.842$  at 80% power. According to previous record of the department only 50 cases had reported last six month. Therefore corrected sample size formula to be used to estimate the sample size. Then actual sample size become for this study was 45. But this study consider all samples those meeting the inclusion criteria had enrolled 60 samples for the study.

## Inclusion Criteria of subjects

- Subjects with symmetrical alignment of maxillary dentition.
- Subjects with angle's class I maxillo-mandibular relationship.
- Subjects with the maxillary central incisors and the mesio-palatal cusp of the maxillary first molars contacting a flat occlusal plane indicator.
- Subjects with absence of any apparent defect, deformity or asymmetry of face.
- Subjects who agree for voluntary participation in the study.

## Exclusion Criteria of subjects

- Subjects with tooth agenesis, crowding, spacing, rotation, retained.
- Subjects with supernumerary dentition.
- Subjects with midline diastema.
- Subjects with gross attrition.
- Subjects with a history of Orthodontic, Prosthodontic, Restorative rehabilitation.
- Subjects with periodontal disease, tooth mobility, history of periodontal surgery.
- Subjects with congenital or acquired maxillary defects.

## Instrument and Equipment used

1. Digital vernier caliper (0.01mm accuracy)
2. Customized occlusal plane relator
3. Indelible pencil

**Selection of subjects:** Family history of each selected participants was taken. Then study



subjects were divided into Aryan and Mongolian group based on operational definition. There should be no history of inter-caste marriage for three generations in the respondent's family i.e. three generation pure. For all the selected participants informed consent was taken after purposive sampling. It was made clear to them that the decision to participate in the study was completely voluntary and participation or denial will have no effect on their status as a student, staff, faculty or a patient. All the procedures to be done were explained in detail showing the instruments and materials to be used on them. They were also assured that the procedures were painless, harmless and completely free of cost.

### Relationship of ala tragus line to the maxillary occlusal plane

To find out the relative parallelism of the ala tragus line with maxillary occlusal plane, customized occlusal plane relator was used which directly indicated the parallelism between the two planes. Customized occlusal plane relator consisted of two parts, upper and lower parts known as ala-tragal line indicator and occlusal plane indicator respectively. The subject was seated in an upright position on the dental chair. Three points on tragus was marked as superior T1, middle T2 and inferior T3 parts of the tragus on the subject with indelible pencil. The occlusal plane indicator was placed in patient mouth, contacting the incisal edges of central incisors and mesio-palatal cusp of maxillary 1st molar, then ala tragus line indicator was made coinciding anteriorly with ala of the nose to posteriorly with superior, middle and inferior border of tragus. Two readings on the ala tragus line indicator were measured anteriorly and posteriorly with a vernier caliper. This procedure was done for superior, middle and inferior border of tragus representing posterior reference point for ala-tragus lines. The difference of the two readings recorded for the superior, middle and inferior parts of the tragus was recorded separately on the subject's face to see the parallelism. The line, in which the difference between the two readings was least, was considered as plane closely parallel to the maxillary occlusal plane.

### Data collection & statistical analysis

Data was collected and entered in Microsoft Excel. The data was cleaned and coded. It was then transferred to Statistical Package of Social Sciences (SPSS) version 17.0 for further

analysis. The data was displayed using bar diagrams, pie charts and frequency distribution tables. Continuous variables were summarized using mean, standard deviation and range. Comparison of mean values of various measurements between the Aryans and the Mongolians were made with the help of Student's T test. The level of significance was set at 5%.

## Results

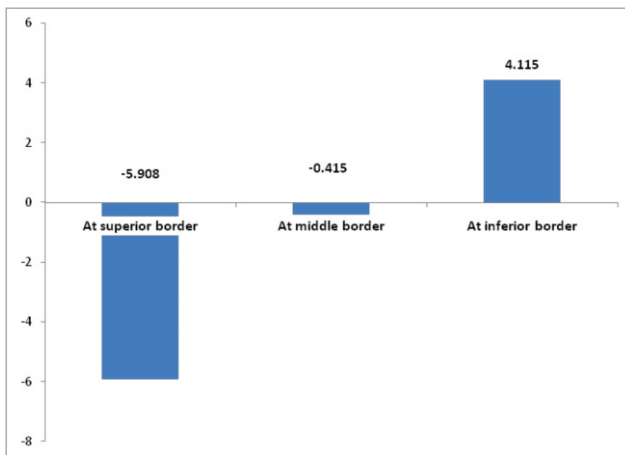
**Table 1: Descriptive statistics for distances between maxillary occlusal plane and other landmarks.**

Landmarks	Mean (mm)	Std. deviation	Range	
			Minimum	Maximum
Superior border of tragus (Anterior)	29.686	3.743	16.29	35.26
Superior border of tragus (Posterior)	35.594	5.127	18.06	52.11
Superior border (Anterior-Posterior)	-5.908	3.906	-16.85	.91
Middle border of tragus (Anterior)	29.686	3.743	16.29	35.26
Middle border of tragus (Posterior)	30.10	5.32	13.0	47.2
Middle border (Anterior-Posterior)	-0.415	4.162	-11.97	8.52
Inferior border of tragus (Anterior)	29.691	3.720	16.29	35.26
Inferior border of tragus (Posterior)	25.576	5.770	9.1	41.4
Inferior border (Anterior-Posterior)	4.115	4.752	-10.24	14.45

Table 1 describes all the continuous variables related to measurement of the current study. The anterior and posterior measurement of distance between the occlusal plane with ala and superior border of tragus ranged from 16.29 - 35.26mm and 18.06mm - 52.11mm respectively. The difference in the measurement was -5.908 indicating anterior measurement was higher than posterior measurement. While measurement at middle border of tragus, the average anterior and posterior measurement was similar i.e. 29.68mm and 30.10mm with difference of only -0.415mm. In case of inferior border of tragus, the difference in anterior and posterior measurement was +4.115 indicating anterior is higher than the posterior.

In the current study, the parallelism between the maxillary occlusal plane with ala-tragus line was determined by the difference between the anterior and the posterior measurement. The landmark which shows the lowest difference has the highest parallelism. Thus, we can see that the difference when the distance is measured at the middle border of tragus is lowest at -0.415 followed by





**Chart 1: Parallelism (A-P measurement) of the maxillary occlusal plane with ala and various levels of tragus border.**

inferior border at +4.115 and the maximum difference was seen when the distance was measured at superior border of tragus. Thus, the best extra oral soft tissue landmark for parallelism to maxillary occlusal plane is line drawn from ala of the nose to middle border of tragus.

**Table 2: Comparison of difference in anterior and posterior measurement of ala-tragus and maxillary occlusal plane between Aryans and Mongoloids.**

Difference of anterior and posterior measurement of maxillary occlusion plane and Ala with tragus	Aryans (mean $\pm$ sd)	Mongoloids (mean $\pm$ sd)	Mean diff.	95% CI of mean diff.		P
				Lower	Upper	
At superior border of tragus	-5.64 $\pm$ 3.94	-6.16 $\pm$ 3.91	0.520	-1.511	2.551	0.610
At middle border of tragus	-0.32 $\pm$ 4.00	-0.51 $\pm$ 4.38	0.194	-1.974	2.364	0.858
At inferior border of tragus	4.31 $\pm$ 5.03	3.92 $\pm$ 4.53	0.387	-2.088	2.862	0.755

We tried to compare the distance between occlusal plane with the ala of nose when measurements were made at different borders of tragus. The mean difference of the anterior and posterior measurements was compared between Aryans and Mongoloids to see if there is any ethnic difference in the measurements. The results showed that the mean values for Mongoloids were higher when the measurements were made at superior and inferior border of tragus however, the mean values of differences between A-P measurement was higher for Aryans when the measurement was made at inferior border of tragus. However, this difference between Aryans and Mongoloids failed to reach statistical significance with p value  $>0.05$ . This signifies that there is no difference in between these two ethnic groups in terms of deciding soft

tissue landmarks which are parallel to maxillary occlusal plane. (Table 2)

## Discussion

Determining normal occlusal plane in edentulous patients which poses a challenge to the clinician. The clinician should always try to relocate the occlusal plane of the edentulous patients in a position as previously positioned [7]. Hence, the position of the occlusal plane should not only form the basis for ideal teeth arrangement but also should fulfill the necessary functional and esthetic requirements [8].

Furthermore, the use of ala-tragus line to determine occlusal plane had been a topic of discussion till date. In spite of various attempts there is no unanimous consensus as to which part of tragus should be used for determining the occlusal plane. Both the use of superior border of tragus as well as middle or inferior point of tragus was used for this line [9-10]. Therefore, it's quite evident that controversy exists in this matter of selection of landmarks. Apart from these extraoral and intraoral landmarks, the influences of other factors like age, sex, ethnicity to the position of occlusal plane is also questionable. Although some studies had been done for age and sex as influencing factor on level of occlusal plane but influence of ethnicity on location of ala tragus line for occlusal plane determination had not been done. Hence, aim of the present study was to compare the relationship of maxillary occlusal plane with ala tragus line in Aryan & Mongolian ethnicity.

To analyze the level of ala-tragus line, various instruments had been devised and used. Bite plane leveler, J plane, Campers plane indicator, fox plane and more recently, cephalometric method, photographic method has been used to locate ala tragus line [6-11]. Customized occlusal plane relator is the simplest and most widely used instrument to aid in determining occlusal plane. Though it is bulky than other instruments, its use is very rapid and simple. The chances of error prone, inter examiner variability, parallax error [11] and exposure to radiation are minimal. Therefore, customized occlusal plane relator was used for the present study for determining ala tragus line.

The results of this study demonstrated that among the total subjects, the occlusal planes were parallel to the lines joining the inferior borders of the ala of the nose with the middle point of the tragus in 66.66%, with the superior point of the tragus in 15%, and in 18.33% with the inferior point of tragus. The results of this study are in agreement



with a study done by Shigli et al[12], Ismail and Bowman [13], Spratley *et al.*[1], Solomon et al.[9], Lahoree M. *et al.*[14], Bondekar V *et al.* [15], Gupta and Singh *et al.* [6] who concluded that the line drawn from middle of the tragus, to the ala of the nose was found to be parallel to the maxillary occlusal plane.

On the other hand, the results of this study were not in agreement with other studies done by other researchers who concluded that the occlusal plane was parallel to the superior part of the tragus. However, studies done by Quran et al. [5], Sadr k *et al.* [4], concluded that the superior border of the tragus when joined with the ala of the nose were parallel to the occlusal plane. Similarly, Van Niekerk *et al.*[16], and many others including Rostamkhani *et al.*[10], Hindocha *et al.* [17], Chaturvedi and Thombare [18], Hartono [19] and Kumar *et al.* [20] concluded that the inferior border of the tragus when joined with the ala of the nose were parallel to the occlusal plane.

A statistically significant association was not found between ethnicity (Aryans & Mongoloids) and posterior occlusal plane positions of the tragus ( $p = >0.05$ ). Therefore, according to the results of this study, for both Aryan & Mongoloid ethnicities, the middle point of tragus may be considered to be the standard reference. Though this study has been conducted, the limitation of this study is that the participants were below 30yrs, but the results will be in favour of edentulous patients who are usually older age groups. Morphological changes within the tragus and ala of the nose with time period were not considered. The results of ethnic variation had been achieved with limited number of samples. Therefore, further study in a larger group of subjects is needed to verify the validity of this method to be used during fabrication of complete dentures.

## Conclusion

According to present study, Maxillary occlusal plane was found to be more parallel with the line drawn from ala of the nose to the middle of tragus, followed by inferior border of tragus with the least parallelism in superior border of tragus. Relationship of maxillary occlusal plane with alatragal line was not statistically significant among Aryans and Mongolian ethnicity.

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