

A Study to establish a proper Occlusal Plane to the Three Different head forms

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ABSTRACT

Background and Objectives : This study aims to compare and establish a proper occlusal plane to 3 different ala-tragal lines, namely the superior, middle and inferior lines, in individuals having different head forms and its relation to the Frankfort horizontal plane.

Methodology : The study comprised of three groups of subjects that is mesiocephalic, dolichocephalic and brachycephalic head forms who were evaluated separately. The sample size in each group were 25 subjects. Prior to making the lateral cephalogram 1 mm diameter lead sticker were placed on the superior, middle and inferior tragus points and on the inferior border of the ala of the nose.

The patients were positioned on the cephalostat & the cephalogram thus obtained were subjected to cephalometric tracing using standard protocols. Results were obtained using sample-t test and one way annova test.

Results : From the result obtained showed middle alatragal line (MAT) is more parallel to occlusal plane in mesiocephalic head form.

Conclusion : The present study it may be concluded that the middle ala-tragal line could be taken as a reference line to establish the occlusal plane in mesiocephalic head forms and the superior ala-tragal line as the reference line to establish the occlusal plane in dolichocephalic and brachycephalic head forms.

Key Words: Ala-Tragal Line, Occlusal Plane, Frankfort Horizontal Plane, Mesiocephalic Head Form, Dolichocephalic Head Form, Brachycephalic Head Form.

INTRODUCTION

Orientation of the occlusal plane is an essential part of clinical complete denture preparing procedures. Considering the importance of the accurate establishment of its location and the effect of its inclination on function, aesthetics and speech, a method to guarantee its conformity with the occlusal plane of the missing teeth seems necessary.^{1,2}

In all cases where stable contact of the dental arches has been lost, it is necessary to reconstruct intermaxillary relations in the vertical and horizontal dimension, and to establish the occlusal plane. The main consideration with regard to the occlusion of the artificial teeth is to find a compromise between biological requirements, which the prosthetic rehabilitation must satisfy as part of a live and dynamic area. At the end of the growth period the individual shape of occlusion forms, which is characteristic for each person. Such an occlusal complex is a presupposition for normal functioning of the whole system, particularly the function of mastication and speech. The basic neuromuscular activity in the stomatognathic system, conditioned by inheritance and determined throughout life, is maintained after loss of teeth. It is possible to restore the lost dentition or to construct denture with the previous, original plane of occlusion. Reconstruction of individual inclination of the occlusal plane, based on relations with the referent plane, is an essential precondition for successful therapy.³

There are several landmarks for establishing the occlusal plane in the process of fabricating a complete denture prosthesis. An accepted concept is that the occlusal plane should be parallel to a line drawn from the lowest point of the ala of the nose to the superior border of the external auditory meatus or tragus. Trapozzano used the upper border of the tragus as a reference point. Swenson and Prothero felt that the variations found there were so frequent that it cannot be relied upon. R. Hortono found it a

common practice to place the occlusal plane halfway between the maxillary and mandibular ridges parallel to the Frankfort plane. The orientation of the occlusal plane differs with different head forms. Brodie assumed that the face swings out from under the cranium with advanced age, and that great changes can take place in the facial structure during growth, which may have a marked influence on occlusion.⁴

According to Graber, dental arch form varies in different head forms. Brachycephalic head form has broad dental arch, Mesiocephalic head form has average dental arch and Dolichocephalic head form has long and narrow dental arch.⁵ The parallelism of occlusal plane to alatragal line may also thus vary in different head forms viz the mesocephalic, dolichocephalic and the brachycephalic.

Though Camper's line is the most commonly used extraoral landmark to establish occlusal plane, position of the alatragal line with relation to the tragus is still debatable and since there exists a definite alteration in the arch form in individuals having different head forms. This study attempts to verify if any of these ala-tragal lines could be taken as a definitive external reference, to establish the occlusal plane and to study if there exists any variation in their relationships among the various head forms, viz the mesiocephalic, dolichocephalic and the brachycephalic.

Since it is stated that the occlusal plane is set at an angle of approximately 10 degrees relative to the Frankfort horizontal plane, when viewed in the mid-sagittal plane,¹ this study also aims at cephalometrically evaluating the relationship of occlusal plane to the Frankfort horizontal plane in the three different head forms.

MATERIALS & METHODS

75 dentulous subjects were screened and selected from the outpatients and students of Coorg Institute of Dental Sciences, Virajpet

Inclusion criteria -Patients with full complement of teeth (third molar excluded) ,Age group of subjects between 18 to 25 years .Subjects were grouped according to their head forms, having an equal distribution of 25 each in three different groups namely- mesiocephalic, dolichocephalic and brachycephalic

Exclusion criteria -Subjects having undergone any orthodontic treatment. ,Malocclusion. ,Periodontal disease ,Tooth attrition.

ARMAMENTARIUM REQUIRED

Digital Extraoral Radiographic Machine (SironaOrhtophos xg5) , Lateral cephalogram X-ray film, Digital X-ray printer (KONIKA MINOLTA DRYPRO A32) ,2 mm diameter lead sticker- 4No's , Double sided adhesive tape ,Tracing sheet , Led pencil-0.3 ,Paper clips ,X-ray view box.

METHODOLOGY

Lateral cephalograms were made for each of the subjects in an open mouth position. Prior to making the lateral cephalogram 1mm diameter lead sticker were placed on the superior, middle and inferior tragus points and on the inferior border of the ala of the nose. The patients were positioned on the cephalostat as mentioned in its operator manual (color plate-1).Right side lateral cephalogram were made for each subject. The cephalogram thus obtained were subjected to cephalometric tracing using standard protocols and the following skeletal reference lines were traced.(color plate-2 and 3)

a) Frankfort horizontal plane (FH plane) – Line connecting the portion to orbitale. b) Occlusal plane (OP) - Line connecting the tip of the maxillary central incisor to the cusp tips of the maxillary first molar. c) Alatragal lines- Lines connecting the superior, middle and inferior points of the tragus to the ala of the nose, as established by the radiopaque markers.

SAT-Superior alatragal line.

MAT-Middle alatragal line.

IAT- Inferior alatragal line.

The relative parallelism between the occlusal plane to three different alatragal lines and Frankfort horizontal plane were studied by measuring the angle between them. The angles were measured with the help of a scale and protractor.



Color Plate - 1 : Subject positioned in Digital Extraoral Radiographic Machine (SIRONA ORHTOPHOS XG5)



Color Plate – 2 :
Cephalometric parameters



Color Plate – 3 : Cephalometric tracing on the lateral cephalometric radiograph

STATISTICAL ANALYSIS

Data was analyzed using one sample't' test and ANOVA test

RESULTS

The results obtained after analyzing the cephalometric tracing of the different samples are tabulated in table 1to 4.

STATISTICAL ANALYSIS

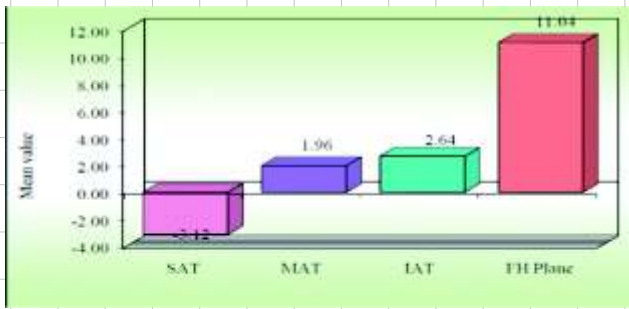
Null Hypothesis :The computed mean value is not significantly different from the given mean value i.e. $\mu = \mu_0$

Level of Significance : $\alpha = 0.05$

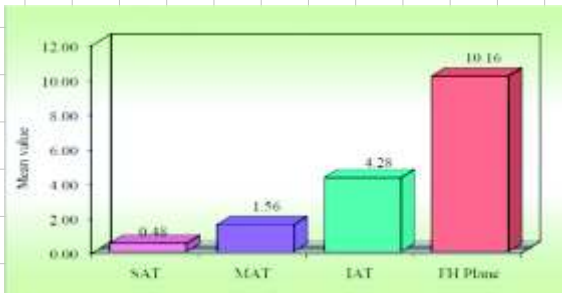
Statistical test used :One sample t- test and oneway ANOVA

Decision Criterion :We compare the P-Value with the level of significance. If $P < 0.05$, we reject the null hypothesis and accept the alternate hypothesis. If $P \geq 0.05$, we accept the null hypothesis.

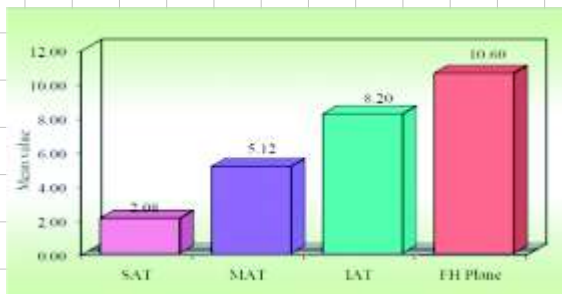
Note: Here, the mean value computed for each occlusal type is tested against a mean of zero and found whether the computed mean value significantly differs from zero. This is done because the mean of the plane is taken as zero. If $P \geq 0.05$, then that particular angle is very near to the plane.



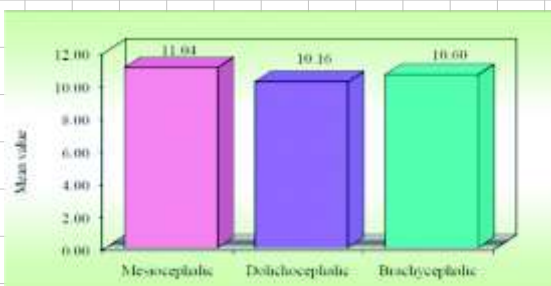
Graph – 1 :Comparison of the angular relationship of occlusal plane to SAT, MAT, IAT and FH plane in Mesocephalic head form.



Graph – 2 :Comparison of the angular relationship of occlusal plane to SAT, MAT, IAT and FH plane in Dolichocephalic head form



Graph – 3 :Comparison of the angular relationship of occlusal plane to SAT, MAT, IAT and FH plane in Brachycephalic head form.



Graph – 4 : Comparison of the angular relationship of occlusal plane to FH plane in three different head form.

DISCUSSION

The rehabilitation of edentulous patient with complete denture has to be done by considering various biological and mechanical factors to restore the function and health of the stomatognathic system.

There are several landmarks for establishing the occlusal plane in the process of fabricating a complete denture prosthesis. A common concept is that the occlusal plane should be parallel to a line drawn from the lowest point of the ala of the nose to the superior border of the external auditory meatus or tragus. Richard K.K and Trapozzano used the upper border of the tragus as a reference point. Swenson and Prothero felt that the variations found there were so frequent that it cannot be relied upon. In a similar study Roberts found it a common practice to place the occlusal plane halfway between the maxillary and mandibular ridges parallel to the Frankfort plane. Brodie assumed that the face swings out from under the cranium with advanced age, and that great changes can take place in the facial structure during growth, which may have a marked influence on occlusion⁶.

Though Camper's line is the most commonly used extraoral landmark to establish occlusal plane in edentulous subjects, it still remains controversial.

Dental arch form varies in different head forms. Brachycephalic head form has broad dental arch, mesocephalic head form has average dental arch and Dolichocephalic headform has long and narrow dental arch. These arch forms in turn are related to occlusal plane⁵.

The parallelism of occlusal plane to alar tragal line may also thus vary in different head forms viz the mesocephalic, dolichocephalic and the brachycephalic. Thus this study was aimed at comparing the relationship of the occlusal plane to 3 different ala-tragal lines, (SAT, MAT and IAT) to evaluate the alar tragal line that is most parallel to occlusal plane in individuals having different head forms and to verify the relation of the occlusal plane to the Frankfort horizontal plane.

The study comprised of three groups of subjects viz mesocephalic, dolichocephalic and brachycephalic head forms who were evaluated separately. The sample size in each group were 25 subjects. The subject who met all the inclusion and exclusion criteria were included in the study. Students and the patients from OPD of Coorg Institute of Dental Sciences, were selected and grouped according to their head forms, viz- mesocephalic, brachycephalic and dolichocephalic.

The cephalic index for each of these head forms was calculated. Cephalic index is the ratio of the maximum width to maximum length of the head multiplied by 100. For dolichocephalic headform, the cephalic index should be less than 75.9mm. 76.0mm to 80.9mm for mesocephalic head form and 81.0 to 85.4 for brachycephalic head form⁵

Right side lateral cephalograms were made for each subject and Cephalometric X-rays were traced on acetate tracing paper using a 3mm led pencil.

To determine the parallelism of different alaragral lines to occlusal plane and parallelism of occlusal plane to Frankfort horizontal plane, a constant plane was deemed necessary. Occlusal plane was hence kept constant and the angles, formed by various alaragral lines (SAT, MAT, IAT AND FH plane) to occlusal plane were measured

The results from the cephalometric analysis to determine relative parallelism of occlusal plane to three different alaragral line and occlusal plane to Frankfort horizontal plane in three different head forms were as follows.

Analysis for mesiocephalic head form -The mean angulation between SAT and occlusal plane was -3.12 degrees, MAT to occlusal plane was 1.96 degrees and IAT to occlusal plane was 2.64 degrees. the mean angulation of occlusal plane to FH plane was 11.04 degrees.

From the result obtained it may be concluded that, the middle alaragral line (MAT) is more parallel to occlusal plane in mesiocephalic head form and the average angulation between occlusal plane to FH plane is 11.04 degrees. These results were statistically significant.

Analysis for dolichocephalic head form - The mean angulation between SAT and occlusal plane was 0.48 degrees, MAT to occlusal plane was 1.56 degrees and IAT to occlusal plane was 4.28 degrees. The mean angulation of occlusal plane to FH plane was 10.16 degrees.

From the result obtained it may be concluded that, the superior alaragral line (SAT) is more parallel to occlusal plane in dolichocephalic head form and the average angulation between occlusal plane to FH plane is 10.16 degrees and these results were statistically significant

Analysis for brachycephalic head form -The mean angulation between SAT and occlusal plane was 2.08 degrees, MAT to occlusal plane was 5.12 degrees and IAT to occlusal plane was 8.20 degrees. The mean angulation of occlusal plane to FH plane was 10.60 degrees.

From the result obtained it may be concluded that, the superior alaragral line (SAT) is more parallel to occlusal plane in brachycephalic head form and the average angulation between occlusal plane to FH plane is 10.60 degrees and these results were statistically significant.

Hence from the present study it may be concluded that the middle alaragral line could be taken as a reference line to establish the occlusal plane in mesiocephalic head forms and the superior alaragral line as the reference line to establish the occlusal plane in dolichocephalic and brachycephalic head forms. The mean angulations of occlusal plane to FH plane is 11.04°, 10.16° and 10.60° in mesiocephalic, dolichocephalic and brachycephalic head forms respectively and there was no statistically significant difference in how FH plane was related to occlusal plane in three different head forms.

Consolidating all the data obtained from the subjects irrespective of their head forms. Superior alaragral line was found to be most

parallel to the occlusal plane in majority of the subjects

The Glossary of Prosthodontics Terms states that the ala-tragus line runs from the inferior border of the ala of the nose to some defined point on the tragus of the ear, usually considered to the tip of the tragus. i.e. MAT. This is in accordance with the findings of the present study on mesiocephalic head forms

Zarb and Bolender⁹ advocate that the occlusal plane should be parallel to the ala-tragus line posteriorly without defining or illustrating it. However, texts by Winkler¹⁰, Rahn and Heartwell¹¹, and Boucher¹² describe it as a line running at the inferior border of the ala of the nose to the superior border of tragus of the ear.

In a study by Downs on variations in facial relationships indicates that the cant of the occlusal plane, the angular relation between the occlusal plane and the Frankfort plane (eye-ear plane), ranged from +14 to +1.5 degrees, with a mean of +9.5 degrees⁷. In the present study the mean value of occlusal plane to FH plane was 11.04 degrees in mesiocephalic head form, 10.16 degrees in dolichocephalic head form and 10.60 in brachycephalic head form, all of which fall within the range of 14° to 1.5°. Through statistical analysis it may be concluded that the angular relationship between FH plane and occlusal plane do not vary much in three different head forms, which is taken as a referral line to orient the maxilla

A similar study was conducted by R. Hartona, on the occlusal plane in relation to facial types. the results of which were contradictory to the results of the present study. In this study the method employed had two purposes one was to determine the part of tragus to be used for marking the ala-tragus line and the other was to define the relation of different facial types to the position of occlusal plane. Data in this study indicated that, among the different facial types studied, the line connecting the lowest point of ala of the nose to the inferior margin of the tragus is nearly parallel to the occlusal plane⁶.

Similar conclusion were derived in a Cephalometric study done to establish the relationship between the occlusal plane, ala-tragus and Camper's lines, in patients with Angel's class III malocclusion by F. Rostamkhani et al. The authors concluded that the inferior border of the tragus could be suggested as the posterior reference points for ala tragus line orientation².

In contradiction to the result obtained in this study Van Niekerk et al, in their study on 33 complete dentures, found the mean value of the angle between the occlusal line (OL) and ala tragus (AT) line as (2.24) degrees, which was general for all the head form⁸. However in the present study the mean values were different for different head forms.

The current study was in partial accordance with the studies done by different authors in the orientation alaragral lines to occlusal plane. As the study was done to verify the variation in the alaragral lines to the occlusal plane in individuals with different head form, this could provide a benchmark in suggesting which of the alaragral line could be selected to establish the occlusal plane after verifying the the individual head form viz- mesiocephalic

,dolichocephalic and brachycephalic, as the study suggests,the middle alatragal line may be considered as a reference plane in establishing occlusal plane in mesiocephalic head form and superior alatragaline may be considered as a reference plane in establishing occlusal plane in dolichocephalic and brachycephalic head forms. However the relationship between the Frankforts horizontal plane and occlusal plane did not show any significant variation in the different head form, suggesting Frankforts horizontal plane can be a standard reference plane in orienting the maxilla to cranium in all head forms.

CONCLUSION

The study concludes that the middle alatragal line can be used as a reference for the mesiocephalic head form and the superior alatragal line for the dolichocephalic and brachycephalic head form as a reference to establish the occlusalplane . The relationship between occlusal plane and Frankfort horizontal plane which is considered a reference line in orienting the maxilla does not vary much in the three different head forms.

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