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Evaluation of deviation of the occlusal plane to three different points of the ala-tragus line among different age group in South Indian population

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ABSTRACT

The aim of the study is to evaluate the deviation of the occlusal plane to three different points of the ala-tragus line among different age group in South Indian population. Incomplete denture prosthetics, there are four basic criteria that every satisfactory denture should achieve. They are aesthetics, phonetics, mastication and comfort. These requirements are attained by adopting proper techniques in complete denture construction. Thus, the exact determinations of the artificial occlusal plane in the upper occlusal rim while jaw registration procedures play an important role in attaining this objective. Considering the importance of the occlusal plane orientation in complete denture prostheses, planes which are steeper or inclined to the occlusal plane can be unaesthetic or cause difficulty in establishing balanced occlusion or centric occlusion, a study is done to evaluate the deviation of the occlusal plane to three different points of ala-tragus line among 15-20 years, 20-30 years, 30-40 years age group individuals. Comparison of OP angle measurements with CP1, CP2 and CP3 within the four age groups. In the 15-20 years & 30-40 years age group, CP1 measurement was closest to OP followed by CP2. In the 20-30 year age groups, CP2 measurement was closest to OP followed by CP1. In the 40-50 year age groups, CP2 measurement was closest to OP followed by CP3. This study indicates or younger individual who is less than 40 years when the complete denture is constructed a superior point of external auditory meatus has to be taken as reference point & in an individual who is above 40 middle-most points of external auditory should be taken as reference point.

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INTRODUCTION

Incomplete denture prosthetics, there are four basic criteria that every satisfactory denture should achieve. They are aesthetics, phonetics, mastication and comfort (Augsburger, 1953). These requirements are attained by adopting proper techniques in complete denture construction. Thus, the exact determinations of the artificial occlusal plane in the upper occlusal rim while jaw registration procedures play an important role in attaining this objective. Occlusal plane is the average plane determined by the incisal and occlusal surfaces of the teeth. It is not a plane, but it signifies the planar mean of

the curvature of these surfaces. Many methods of determining the occlusal plane have been reported in the literature but no method is accurate enough or significant enough to determine the plane. There are several studies in which the prosthetic and natural occlusal plane have been compared. Lips, commissures of mouth, residual ridges, retromolar pad, hamular notch, incisive papilla plane, lateral borders of the tongue, and the buccinator grooves are the most frequently used intraoral landmarks. While many other authors believe that even though intraoral structures during occlusal plane determination are very much valuable guides for the experienced clinicians however it might be difficult to follow for the students. Extraoral landmarks are also taken into consideration, the interpupillary line, Camper's line or ATL are said to orient to the occlusal plane. The orientation of the occlusal plane effect physiologic functions within the oral cavity. The adequate height and width of the occlusal plane are mandatory for the proper buccolingual exchange and regulation of food, speech articulation communicates with the tongue space, aesthetics and buccal soft tissue support. The occlusal table is strategically placed so that the tongue on the lingual side and the buccinator muscle on the buccal side are able to position the food bolus on to it and hold it in place while mastication takes place. Incorrect orientation of the occlusal plane will disrupt this communication between the tongue and buccinator muscle. If the occlusal table is too high, it will lead to food accumulation in the sulci. If it is too low, it will result in biting of the cheek or tongue (Boucher *et al.*, 1985). The occlusal plane should be oriented in such a way as to provide enough space for the tongue, as it plays a viable role in speech. The posterior level of the occlusal plane is important for mandibular function and maintenance of the temporomandibular joint. There is a strong clinical indication that TMJ problems occur when the posterior position of the occlusal plane is farthest from the midpoint of the ramus. Boucher (1963); Chaconas and Gonidis (1986) states that the teeth must be placed in exactly the same position as the natural teeth, which they are to replace. It is commonly accepted that in the anterior region, the vertical height of the occlusal plane is directed by aesthetics and less commonly by functional needs. On the other hand, there are diverging ideas in regard to the orientation of the occlusal plane in the posterior region (Hall, 1958). Many investigations have been carried out to study its orientation and various contrasting reports published. A common concept is that the occlusal plane must be parallel to a line originating from the lowest point of all of the nose to the external auditory meatus. This part of the external auditory meatus is usually not mentioned. This line is known as the Camper's line after Petrus Camper, a Dutch anatomist, (Kamath and Arun, 2016) who in 1786 positioned on skulls and living heads a line passing from the "Ala of the nose to the centre of the external auditory meatus". Depending upon this line is based upon an extensive number of years of clinical examination. Some dentists place the occlusal plane parallel to and midway in between the residual ridges (Chaconas and Gonidis, 1986; Karkazis and Polyzois, 1987, 1991). Still, other dentists suggest positioning the occlusal a plane so that it ends posteriorly at the medial 2/3rd of the retromolar pad (Chaconas and Gonidis, 1986; Karkazis and Polyzois, 1987; Kumar *et al.*, 2013). Thus, the contrasting belief exists even today regarding the most pertinent position of the occlusal plane and its correlation to the Camper's plane. Therefore the aim of this study is to evaluate the deviation of the occlusal plane to three different points of the ala-tragus line among different age group in South Indian population.

This Table 2 shows the comparison of OP angle measurements with CP1, CP2 and CP3 within the four age groups. In the 15-20 years & 30-40 years age group, CP1 measurement was closest to OP followed by CP2. In the 20-30 year age groups, CP2 measurement was closest to OP followed by CP1. In the 40-50 year age groups, CP2 measurement was closest to OP followed by CP3.

This Table 3 shows the correlation of Occlusal plane with CP1, CP2 and CP3 in the different age groups. In all the age groups, OP had a positive correlation with CP1, CP2 and CP3. This indicates that as OP increases, CP1, CP2 and CP3 increases. In the 15-20 & 40-50 age group, OP and CP1 had the closest correlation. In the 20-30 & 30-40 age group, OP and CP2 had the closest correlation. However, only the positive correlation between OP and CP1 was statistically significant.

MATERIALS AND METHODS

20 Cephelographs of different age group between 15-50 age group i.e, five cephs from each age group 15 - 20; 20 - 30; 30 - 40; 40 - 50; was randomly selected and using tracing sheets standardised reference points of acanthion and three different markings on the external auditory meatus i.e, superiormost point of external auditory meatus, middlemost point on external auditory meatus inferior most point of external auditory meatus and the occlusal plane was drawn from one half of cusp of the first permanent molars and one half of the overbite of

the incisors along with this the Frankfurt's horizontal plane was traced using manual method (Monteith, 1985; Nagle and Sears, 1962) shown in Figure 1. These planes are extended and their angle formed with the Frankfurt's horizontal plane is measured using the protractor.

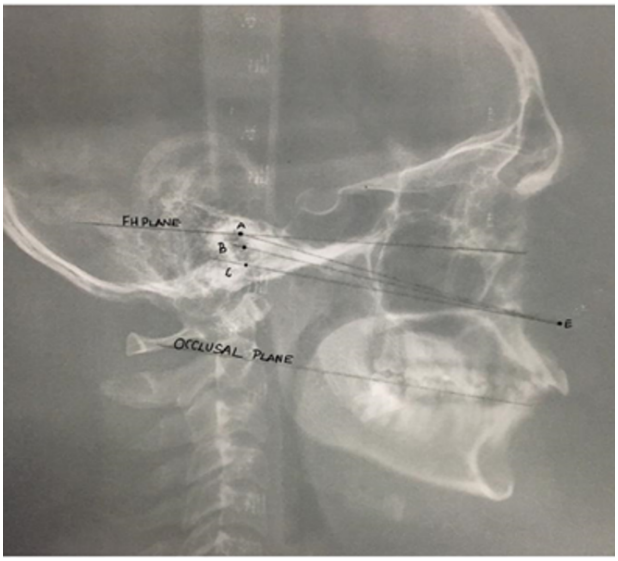

Figure 1: Frankfurt's horizontal plane method

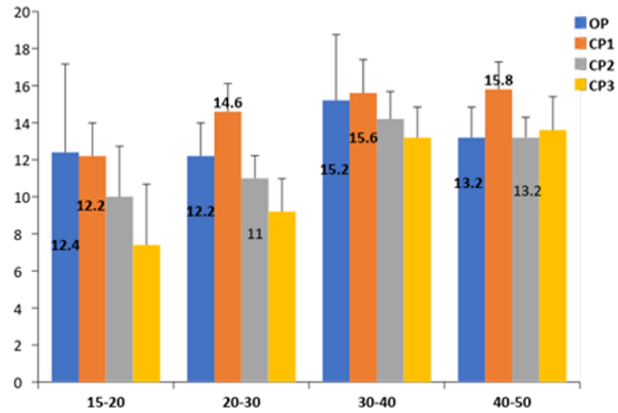

Figure 2: Comparison of OP angle with CP1, CP2 and CP3 within four groups

RESULTS

Angle obtained from the cephalographs were subjected to statistical analysis. The Normality tests Kolmogorov-Smirnov and Shapiro-Wilks tests results reveal that all variables follow Normal distribution. Therefore the parametric test are applied to analyse the data. To compare the mean values between groups one way ANOVA and Post hoc analysis is applied. To compare the correlation between $CP_{1,}$ CP2, CP_3 and Occlusal plane within the different age groups, the Pearson correlation is applied. To analyse the data SPSS (IBM SPSS Statistics for Windows, Version 20.0) is used. Significance level is fixed at 5% (α = 0.05), Figure 2 shows.

DISCUSSION

Based on the certain study the inferior point of external auditory meatus is the most commonly accepted point, the purpose of this study was to verify if this point can be used in South Indian population. Spratley described it as running from the centre of the ala to the centre (middle) of the tragus (Nandeeshwar, 2014). Boucher defines it as "The line is running from the inferior border of the ala of the nose to the superior border of the tragus of the ear (Chaconas and Gonidis, 1986; Hall, 1958)." van Niekerk *et al.* (1985) used the inferior border of tragus as the posterior end of the ala-tragus line because it could provide sufficient space for the arrangement of posterior maxillary teeth (Rostamkhani *et al.*, 2005). In our study, Tables 4 and 1 while comparing the mean angles among different age groups, the p-value is considered significant at the 0.05 level which is seen in age group 15-20 & 30-40. In Gandhi et L. Karkazis and Polysois showed in a cephalometric study that natural and artificial occlusal planes are not parallel to the ala-tragus line (Siefert, 2000). Dentulous individuals were evaluated to establish the definite correlation between camper's plane and occlusal plane so that a similar relationship could be established in edentulous individuals (Kumar *et al.*, 2013). Photographic study suggested the majority of the camper's line from ala-point of the inferior border of Tragus (53%) as parallel to the OP. Superior most point and the middlemost point of the tragus & the inferior border of ala was parallel to the OP by 20.7% and 26 % respectively. A study carried out by Karkazis and Polyzois (1991) also uses the inferior border of tragus as a posterior landmark. Their cephalometric study estimated that the Camper's line extending from the lower margin of the ala to the inferior border of the external auditory meatus presented the nearest relationship to the natural occlusal plane. A Cephalometric study carried out by Nandeeshwar (2014); Solomon (2000) concluded that ATL with inferior border of tragus as a posterior reference point can be used as a standardised occlusal plane in completely edentulous patients. Spratley (1980) carried out a cephalometric study in patients with Angles class III Malocclusion and also determined that the inferior border of the tragus is recommended as the posterior point for ATL orientation. However the findings of Terrell (1958) and Sadr and Sinha (2009); van Niekerk *et al.* (1985) estimated that there is no parallelism exist between the occlusal plane and ala-tragus plane, but the camper's plane was estimated to be nearly par-

Table 1: Comparison of mean angle (in degrees) within four groups

Variable	CP1	CP2	CP3	OP	F	p-value
Group 1	12.20±1.78	10.00±2.73	7.40±3.28	12.40±4.77	2.462	0.100
Group 2	14.60±1.51	11.00±1.22	9.20±1.78	12.20±1.78	10.059	0.001
Group 3	15.60±1.81	14.20±1.48	13.20±1.64	15.20±3.56	1.107	0.375
Group 4	15.80±1.48	13.20±1.09	13.60±1.81	13.20±1.64	3.312	0.047

*. The p-value is considered statistically significant at the 0.05 level

Table 2: Comparison of OP angle with CP1, CP2 and CP3 within four groups

Dependent Variable		Angles	Mean Difference	Std. Error	Sig.
Group 1 (15-20)	OP	CP1	0.20	2.10	1.000
		CP2	2.40	2.10	0.671
		CP3	5.00	2.10	0.122
Group 2 (20-30)	OP	CP1	-2.40	1.00	0.122
		CP2	1.20	1.00	0.643
		CP3	3.00	1.00	0.040
Group 3 (30-40)	OP	CP1	-0.40	1.44	0.992
		CP2	1.00	1.44	0.899
		CP3	2.00	1.44	0.527
Group 4 (40-50)	OP	CP1	-2.60	0.96	0.070
		CP2	0.00	0.96	1.000
		CP3	-0.40	0.96	0.976

*. The mean difference is significant at the 0.05 level.

Table 3: Correlation of OP with CP1, CP2 and CP3 in different age groups

	Occlusal Plane	CP1	CP2	CP3
15-20	Pearson Correlation	0.925	0.765	0.625
	Sig. (2-tailed)	0.024	0.132	0.260
		CP1	CP2	CP3
20-30	Pearson Correlation	0.129	0.685	0.453
	Sig. (2-tailed)	0.836	0.202	0.443
		CP1	CP2	CP3
30-40	Pearson Correlation	0.672	0.700	0.675
	Sig. (2-tailed)	0.214	0.188	0.212
		CP1	CP2	CP3
40-50	Pearson Correlation	0.739	0.111	0.369
	Sig. (2-tailed)	0.154	0.859	0.542

**.Correlation is significant at the 0.01 level (2-tailed).
*.Correlation is significant at the 0.05 level (2-tailed).

Table 4: Comparison of the mean angle (in degrees) between four groups

Variable	Group 1	Group 2	Group 3	Group 4	F	p-value
CP1	12.20±1.78	14.60±1.51	15.60±1.81	15.80±1.48	4.964	0.013
CP2	10.00±2.73	11.00±1.22	14.20±1.48	13.20±1.09	6.043	0.006
CP3	7.40±3.28	9.20±1.78	13.20±1.64	13.60±1.81	9.237	0.001
OP	12.40±4.77	12.20±1.78	15.20±3.56	13.20±1.64	0.907	0.460

*.The p-value is considered statistically significant at the 0.05 level.

allel to the occlusal plane when the tragal reference plane was located between the superior border and middle of the tragus. Siefert (2000); Yasaki (1961) and Sadr and Sinha (2009); Kumar *et al.* (2013) reinforced that there is a relative consistency in the angle between OP-FH plane in dentulous subjects with Angle's Class I jaw relationship. These findings have a bearing in the arena of complete denture therapy since they can be correlated aiding in establishing an accurate method for OP determination in orthognathic completely edentulous individuals. It was inferred from the current study that angle formed between inferior ala-tragus line and Frankfort plane (IFH) has a maximum correlation with COP confirming that inferior point on tragus gives the closest value of IFH that correlated to COP in Angle's Class I jaw relationship.

A study was done by Gandhi, et al. Based on the results of this study, it can be concluded that: Ala-tragus line passing through the inferior part of the tragus is the most parallel line to OP among Punjab population. In this study, the OP was parallel to the ala-tragus line passing through the inferior border of the tragus in 53% participants. It can be used as a guideline for orienting OP among Angles Class I population, this study shows no relevance at all to our study. In our present study, 50% of the study population with younger age group had a superior-most point of external auditory meatus to be more parallel to OP & 40% of the older individual has a middlemost point of external auditory meatus more parallel to the OP.

CONCLUSION

Among younger age groups OP was more parallel from acanthion to the superior point of external auditory meatus whereas, the occlusal plane was more parallel to the plane from acanthion to middle of the external auditory meatus in 40-50 age group. This study indicates or younger individual who is less than 40 years when the complete denture is constructed a superior point of external auditory meatus has to be taken as reference point & in an individual who is above 40 middlemost points of external auditory should be taken as reference point.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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