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EVALUATION OF DIFFERENT POINTS OF TRAGUS AS POSTERIOR REFERENCE POINT FOR CAMPER'S PLANE: A PHOTOGRAPHIC ANALYSIS.

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Abstract:

Aim and objectives: The study was undertaken to determine the most reliable ala-tragus line as a guide for the orientation of the occlusal plane in edentulous subjects.**Methodology:**Photographic analysis was made for 50 adult dentate patients using fox plane to determine the orientation of the occlusal plane.Three points were marked on tragus as T1, T2, T3, ala of nose as A, the fox plane was compared with these three lines to check the closest parallelism. The obtained results were subjected to ANOVA F test, Tukey'sHonestly significant difference test, followed by Karl Pearson coefficient of correlation test. *P* values of less than 0.05 were taken as statistically significant. **Results:**Occlusal plane was found more parallel to AT3(camper's III) plane that is to the inferior point of the tragus with the mean value of angle of 2.96° deviation from parallelism to occlusal plane.**Conclusion:**The line joining alaof the nose to the lower border of the tragus can be used as a reliable posterior reference point of Camper's plane to orient the occlusal plane in edentulous subjects.

INTRODUCTION:

Complete denture prosthodontics is challenging because rehabilitation of edentulous patients with complete dentures has to be done by consideration of various biological and mechanical factors while restoring the functions and health of the stomatognathic system. A proper occlusion with fulfillment of all the criteria plays a salient role in deciding the prognosis of completely edentulous patients[1].In both natural and artificial dentitions, the plane of occlusion plays an important role in fulfilling the function and esthetics. Occlusal plane is defined as the average plane established

by the incisal and occlusal surfaces of the teeth (GPT)[2]. Various intraoral and extra oral landmarks have been used to determine and orient the occlusal plane. Occlusal plane can be oriented to coincide with intraoral landmarks like the lower one-third of theretro molar pad[3]or lateral borders of the tongue[4].Other suggested theories include: occlusal plane should be at a distance of 2.56 mm below the parotid papilla[5];occlusal plane should be 1.37 mm above the commissural of lip[5]; occlusal plane can be established 0.94 mm above thebuccinators grooves [5];occlusal plane can be established parallel to Hamular-incisive-papilla plane[6]; and, one of the newer concepts of establishing occlusal plane suggest placing it parallel to and mid-way between the residualridges[7]. Extra-oral landmarks suggested include:Anteriorly, occlusal plane should be parallel tointerpupillary line and 1-3 mm below the resting upperlip[8]; Camper's line is an anthropologic measurement on skulls projected to the living head as a line passing from the alae of the nose to the center of the tragus of the external auditory meatus. Posterior; parallel to alatragal lines - a line running from the inferior border of the ala of the nose to some defined point on the tragus of the ear, usually considered to be the tip of the tragus. Ideally, the alatragusplane is considered to be parallel to the occlusalplane. Even though the alatragal line (Camper's line) isthe most commonly used landmark and the only extraorallandmark used to establish posterior occlusal planein edentulous subjects, its use still remains controversial. This controversy is primarily due to the disagreement on the exact point of reference on the tragus (superior, middle or inferior) to establish the alatragal line. Thus the present study was undertaken to establish the most reliable posterior reference point of ala-tragus line for its use as a reference plane for establishing plane of occlusion in edentulous subjects.

Material & Methods

Different prosthodontists have given opinion for and against the use of various methods to determine the occlusal plane and the ala-tragal line. In this study, photography was used to determine the occlusalplane in dentulous subjects. To fulfill the objective of this study and simplify the procedures, well-established landmarks, terminology and equipment have been used.

The study was conducted on subjects who were out patients and students of an institution. A total of 50 Indian subjects within the age group of 18-40 years were selected for the study. Selection Criteria include: Straight or orthognathic profile, no previous history of orthodontic treatment, no congenitally missing or extracted teeth, subjects with complete dentition without crowns, fixed or removable partial dentures or supernumerary teeth or retained teeth, no deciduous teeth, regular alignment of teeth without any supra-eruption or drifting i.e. well formed occlusion, no congenital or acquired defects in the head region, absence of advanced periodontal diseases and

associated tooth mobility, exclusion of TMJ disorder if any and a minimum of conservative treatment and that too not in incisors and molars.

The objectives and method of obtaining the photographs were explained to each subject and an informed consent was obtained from them. Digital camera with 4× optical zoom was used which stores the photographs digitally that can be later transferred to the computer. The camera has resolution of 14.1 Mega pixels, which is more than adequate for computer analysis. The in-built zoom lens with an auto focus range to infinity ensured that the image were of high quality. A modified Trubyte occlusal plane plate (Fox Bite plane) was placed in the mouth in such a position that it touched the incisal edges of the upper central incisors, and the cusps of the left and right upper first molar. The plane was thus located in a position that is equivalent of the occlusal plane of orientation used in the construction of complete dentures. The fox plane was held in position by pressure of thumb. The outer wings of the plate indicate the position of the occlusal plane and these are readily seen in the photograph. The dots on superior, middle and inferior margins of the right tragus and lower point of ala of nose were directly marked on the image in computer (fig 1). Photographs were taken with the subject standing and in their natural head position.

The perpendicular distance between the subject's sagittal plane and lens of camera was standardized at 1.5 meters. A life-size lateral digital photograph of the face with fox bite plane in mouth with patient holding it in position by thumb was taken. The following points were then digitized on all the photographs on the computer.

• The superior margin of the Tragus (T1)

• The middle margin of the Tragus (T2)

• The lower margin of the Tragus (T3)

• Lowest part of the ala (A) of nose.

• Camper's plane or the ala-tragus line is a line drawn from the lowest part of the ala (A) to the tragus.

Three points on the tragus were marked and three lines were drawn accordingly i.e.

- From Ala (A) to upper margin of tragus (T1) i.e. AT1- Camper's I

- From Ala (A) to middle margin of tragus (T2) i.e. AT2- Camper's II

- From Ala (A) to lower margin of tragus (T3) i.e. AT3- Camper's III

• A line is drawn extending from the outer wing of fox plane, which is comparable to occlusal plane i.e. OP.

Of the three angles formed by the occlusal plane and the ala-tragal lines, the one closest to the angle formed between ala tragus line and occlusal plane (OP) was used to determine the occlusal plane of orientation(fig 2). The

computer software, AutoCAD 2004, was used to calculate the angles. The above points were digitized three times and the averages of the three readings were calculated. Comparison among the groups was done by ANOVA (analysis of variance) Fisher 'F' test. Inter comparison between the groups was done by Tukey'sHonestly significant difference test. The correlation between the groups was found out by using Karl Pearson coefficient of correlation test. *P* value was used to find out level of statistically significance where *P*<.05-significant, *P*<.01-highly significant. These were done using SPSS statistical package version 11.5.

Results

Table 1 show that the occlusal plane was most parallel in 50% subjects with AT3.

34% subjects had occlusal plane parallel to AT2. While coincidence with AT1 was found only in 16% subjects.

Table 2 shows Occlusal plane angle formed between the occlusal plane and Camper's plane had the lowest mean value in the angle formed with AT3, which represents the measure taken from the inferior border of tragus of the ear with a score of 2.94°. The highest mean angle was measured in the angle formed with AT1, with score of 5.06°, while the mean angle formed with AT2 was 3.76°. The differences between the three planes in relation to the occlusal plane were found to be significant.

Discussion

Determining the plane an occlusion is of utmost important step incomplete denture therapy as it influences the denture stability and hence balanced occlusion. The position of the occlusal plane of orientation also forms the basis for ideal tooth arrangement and fulfills the necessary mechanical, esthetic and phonetic requirements and aid respiration and deglutition. Standard facial measurements are essential for establishing the level of occlusal plane. There are no specific intraoral or extra oral anatomical landmarks available so itsdeterminations prone to subjective variation. Based on the biomechanical and physiological considerations, when teeth are present musculature of the tongue and cheeks are trained to function normally at this level and will again function correctly when the occlusal table is again organized at same level. This will stabilize the bolus of food at the same vertical position of the occlusal table as originally existed. The use of the ala-tragus line (Camper's line) as guideline has gained popularity within the profession since it is easily visualized, thus making the determination of plane of occlusion more convenient. Occlusal plane oriented with camper's plane favor esthetics, transmit the desired force on the ridge and permit comfortable control of food morsels by tongue and the cheeks. Faulty orientation of occlusal plane will hamper the balance between tongue and buccinators muscle resulting in food accumulation in sulcus and /or biting

of cheek or tongue. If occlusal plane is too high, then it forces the tongue in new position which causes rising of floor of the mouth. This creates undue pressure on border of the flange. Many studies have been carried out to determine the relationship between the plane of occlusion and the Camper's plane. Most of the controversy revolves around which tragus reference is to be considered as a posterior landmark during orientation of the plane of occlusion.

Glossary of Prosthodontic Terms states that the Camper's line runs from the inferior border of the ala of the nose to the superior border of the tragus. It is also called Bromell'splane or prosthetic plane[9].Solomon et at.[10]is in favor of superior point as the reference point. According to the findings of this study, superior border of the tragus is the most suitable landmark to orient the occlusal plane, forming a stop anteroposteriorly following the curve of the ramus of the mandible, and establishing a curve that would serve the artificial teeth to be set in a way to prevent any interferences that would dislodge the denture during protrusive movement, making the dentures more stable and ensuring satisfactory service. Most of the textbooks of prosthodontics and other authors like Pratley, Basker, Grant and Johnson, and Neill and Naim supported the center of tragus as the posterior landmark[11]. Ismail and Bowman[8] found that dentures constructed with center point in consideration have very low occlusal plane. Contradictory statement by Abrahams and Carey [12] stated that occlusal plane of complete dentures conforming to a line oriented to the superior border of the tragus results in the occlusal plane being leveled far too high posterior.

Clapp[13] (1910), Dalby[13] (1912), Wilson[13] (1917), Hartono[14] (1967), van Niekerk[15] (1985) and Karkazis and Polyzois[15] (1986) have concluded from their studies that inferior point of tragus is more reliable for adjusting occlusal plane.

It has been found (Nagle[16] and Sears[17]-1962 & Swenson [18]-1947) that in case of excessive resorption, the plane should be placed closer to the resorted ridge to reduce the leverage. It should be perpendicular to the forces of mastication and should be developed parallel to the lower ridge. If occlusal plane is parallel to the lower border of the tragus then the forces of mastication will be perpendicular to the occlusal plane and there will be less leverage on the lower residual ridge which is most commonly involved in resorption process (Jacobson and Karol [13]-1983) and results in denture stability. The occlusal plane placed high in relation to lower ridge result in additional leverage and denture instability (McGee[19]-1960). Photographic study was chosen as it is non-invasive and simple. In contradiction to cephalometric study, there is no radiation exposure and minimal magnification errors. The

simulation of occlusal plane in edentulous subjects, as is found in most of the dentate subjects can be used with reliability to confer adequate masticatory efficiency in edentulous patients.

Conclusion:

The inferior border of tragus can be used as a reliable posterior landmark for the orientation of posterior occlusal plane in edentulous subjects.

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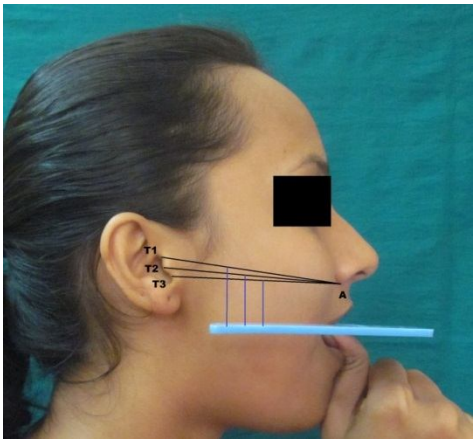


FIGURE 1- Showing most parallelism of occlusal plane with AT3 plane

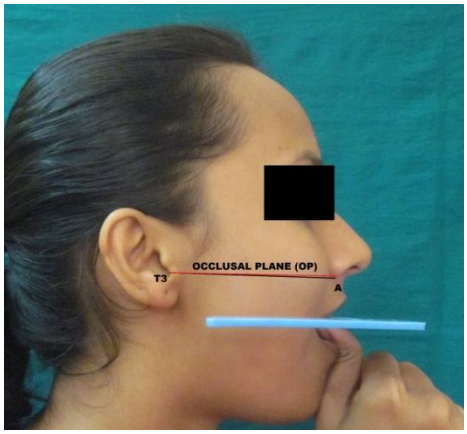


FIGURE 2- Showing deviation of occlusal plane with AT3 plane

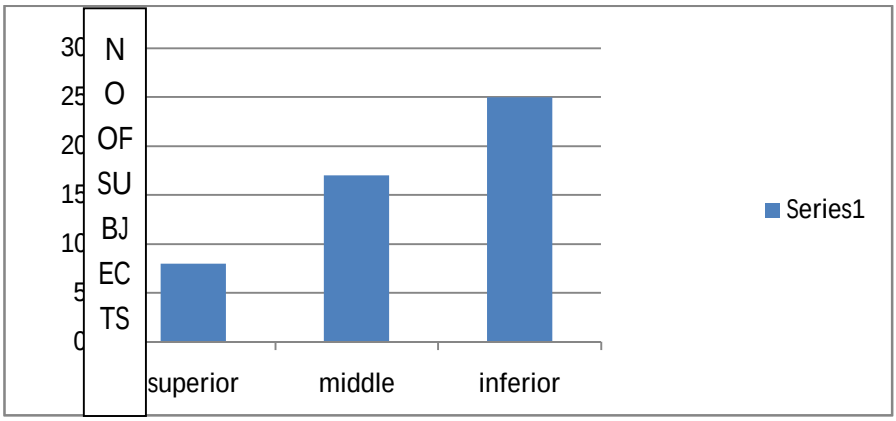
TABLE 1

No of subjects	Superior	Middle	Inferior
50 (100%)	8(16%)	17 (34%)	25 (50%)
P value	<.05	<.05	<.05

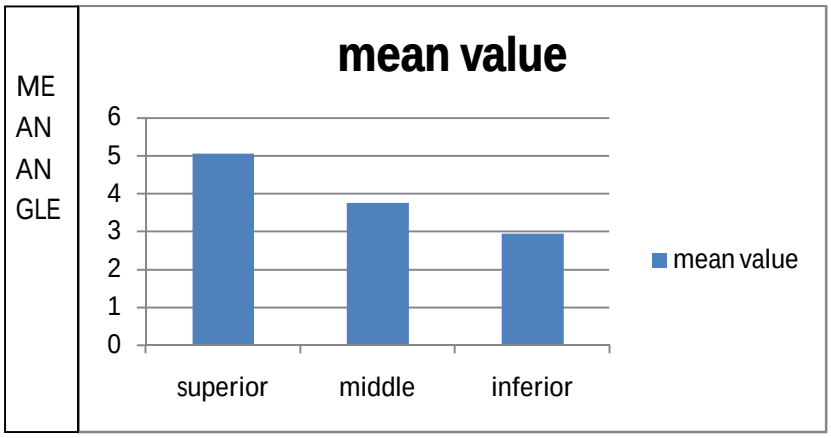
TABLE 2

	Mean	Maximum	Minimum	numbers
AT1	5.06	12	1	50
AT2	3.76	13	0	50
AT3	2.94	9	0	50

HISTOGRAM 1



HISTOGRAM 2



Mean value of angle between occlusal plane and three ala tragus lines.