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Original Research

An Evaluation of The Relative Parallelism Of The Occlusal Plane To The Ala And Different Tragal Levels In Dentulous Subjects

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ABSTRACT

Background: For a pair of successful complete dentures with optimum esthetics, occlusal balance and function correct orientation of occlusal plane is of utmost importance. However precise location of occlusal plane in an edentulous subject is a controversial issue. This study is done to determine which of the posterior reference point on tragus gives us a plane most parallel to natural occlusal plane. **Aims**: Use of ala tragus line to orient occlusal plane is controversial because of lack of agreement regarding the posterior reference point .This study aims at establishing the best posterior reference point on the ala tragus line. **Methods and Material**: The study comprised of 100 dentulous subjects with all healthy permanent teeth in normal arch form and alignment who were selected randomly and who agreed to participate in the study. A custom-made occlusal plane analyzer was used to check the parallelism between the ala-tragal line and the occlusal plane. The tragus was divided into three parts: superior, middle, and inferior. The instrument was placed in the subject's mouth, and the posterior points on the tragus were determined. **Statistical analysis used**: The readings were subjected to Pearson's Chi Square Test. **Results:** For the 100 dentate participants in this study ,the most common location of the posterior point on the tragus was the inferior part of tragus (67%).The second most common location of the tragus was the middle part (19%), followed by the superior location (8%). **Conclusion**: The results of this study indicated that the occlusal plane was found parallel to a line joining the ala of the nose and the inferior part of the tragus.

Introduction

For a pair of successful complete dentures that is compatible with the stomatognathic system occlusion is one of the key factors. The lost occlusal plane of orientation by edentulism should be relocated correctly .To aid in relocating occlusal plane numerous reference planes and landmarks have been suggested of which, Campers planes is the most commonly used but definitions of the ala-tragus line has created confusion. So a study was performed to find which of the three positions on tragus when joined with the inferior border of the ala of the nose give us a plane most parallel to the natural occlusal plane in dentulous subjects which can be used to determine the occlusal plane in edentulous patients.

Subjects and Methods:

For the study, the selection of subjects and source of data were as follows:

1. Students and patients from Regional Dental College, Guwahati
2. Age group-18 to 35 years
3. Angles class I molar relationship
4. Full complement of healthy and natural teeth
5. No history of orthodontic treatment

Criteria for selection of subjects:

A. Inclusion criteria:

1. Subjects with full complement of natural teeth

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2. Subjects not wearing orthodontic appliances
3. Subjects with occlusal surfaces of teeth free from caries

B**.** Exclusion criteria:

1. Subjects with missing, attrided or occlusally restored teeth.
2. Periodontally comprised teeth
3. Presence of fixed or removable partial dentures
4. Crowded teeth
5. Subjects with tmj pathology
6. Subjects with neuromuscular pathology
7. Subjects with apparent facial assymetry

A Custom made occlusal plane analyzer was fabricated using a Fox plane,2 rectangular plates and 2 tofflemires

Procedure

1. The patient is seated in the dental chair in an upright position.
2. Two lines are drawn on the superior most and inferior most points of tragus.(figure 1)
3. The distance between these two were measured with a digital callipers.(figure 2)
4. The value was divided by 3, and then the area between the Superiormost and Inferiormost points of tragus were divided into 3 areas.
5. The intra-oral part of custom made occlusal plane analyzer was placed in patient's mouth, so that it touched the incisal edges of the maxillary central incisors and the mesio palatal cusps of the 1st molars.(figure 3)
6. The instrument was held steadily with one hand and the knob of tofflemire was rotated anticlockwise so that the rectangular part moved up until the anterior portion coincided with the lower border of the ala of nose.

Figure 1: Two lines are drawn on the superior most and inferior most points of tragus.

Figure 2: The distance between these two were measured with a digital callipers

Figure 3: The intra-oral part of custom made occlusal plane analyzer was placed in patient's mouth, so that it touched the incisal edges of the maxillary central incisors and the mesiopalatal cusps of the 1st molars.

figure 4: The posterior point on the tragus was determined as to whether it coincided with the superior , middle or the anterior part of tragus.

Sex		Coincident With				Total
		Inferior	Middle	Superior	None	
Female	Count	34	10	4	2	50
	Percent	68	20	8	4	100
Male	Count	33	9	4	4	50
	Percent	66	18	8	8	100

Total	Count	67	19	8	6	100
	Percent	67	19	8	6	100

Tables 1: This table shows the location of the posterior reference of custom made occlusal plane analyzer on the tragus in 100 subjects, 50 females and 50 males.

7. The posterior point on the tragus was determined as to whether it coincided with the superior , middle or the anterior part of tragus.(figure 4)

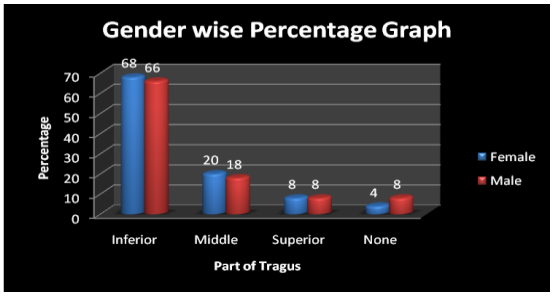
Disinfection of the instrument**:**

The occlusal plane analyzer should be sterilized between samples. After recording the orientation of ala tragus for a particular sample, the occlusal plane analyzer is kept under running water and then it is disinfected by immersing in 2 per cent glutarex ^{TM} 14 (glutaraldehyde) solution for fifteen minutes in a cold solution.

Results: The results obtained were subjected to statistical analysis. After cross tabulation these readings were subjected to Pearson's Chi Square Test. The results of this study showed that of the 100 subjects the most common location of the posterior end of ala tragal line was the inferior part of tragus, which accounted for 67 of the total. The second most common location was the middle part of tragus which accounted for 19 of the total. There was only 6 of the total tragi studied that did not coincided with any part of tragus (table 1) (Graph 2).

Within the limitations of the present in vivo study it was concluded that:

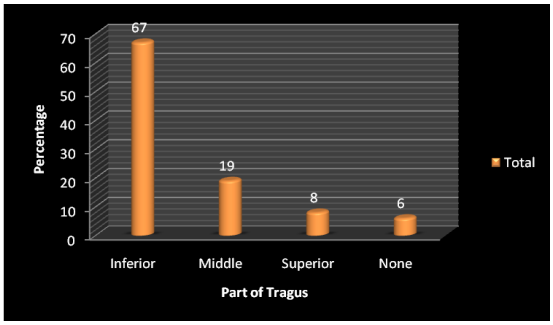
1. In majority of the subjects ,i.e 67 % the occlusal plane was found to be parallel to a line joining the inferior border of ala of nose and the inferior part of tragus.



Graph 1: Position of tragus in males and females (in percentage)

2. In 19 % the occlusal plane was found parallel to a line joining the inferior border of ala of nose and middle part of tragus.
3. In 8 % the occlusal plane was found parallel to a line joining the inferior border of ala of nose and superior part of tragus.
4. In 6 % the ala tragal line did not coincide with any part of tragus.
5. No significant gender difference was found regarding the posterior reference point on tragus (Graph 1).

Based on the results of the study it can be inferred that reliability of the ala tragal line as a guide line to simulate the natural occlusal plane is questionable. Using the ala tragal line alone will not suffice the determination of occlusal plane in edentulous patients. Hence other parameters such as the retromolar pad, the lateral border of tongue , lip height ,etc. should be taken into account for the location of occlusal plane in edentulous patients. However , when the ala tragal line is used,the inferior part should be considered, as in the present study in 67% of the tragi studied , the custom made occlusal plane analyzer coincided with the inferior part.



Graph 2: Position on all the tragi that was considered in the study (in percentage)

Discussion

The patient's reconstructive treatment is one of the most important factor for the stability of complete dentures and for the achievement of good esthetics, phonetics and masticatory function, as well as for patient's satisfaction. The position of the occlusal plane in denture wearers should be as close as possible to the plane, which was previously occupied by the natural teeth. Such position of the occlusal plane provides normal function of the tongue and cheek muscles ,thus enhancing the denture stability. A faulty orientation of occlusal plane will jeopardize the interaction between the tongue and the buccinator muscle .Where the occlusal plane is too high , the tongue cannot rest on the lingual cusps of the mandibular teeth and prevent its displacement. There is also tendency for accumulation of the food in the buccal and lingual sulci. An occlusal plane that is too low could lead to tongue and cheek biting.

Over the last century, investigators have used various methods and advocated many anatomical landmarks to set a correct occlusal plane orientation and position to be able to set the artificial teeth appropriately. Definitions of the ala tragus line by different authors are a cause of confusion due to disagreement on the exact point of reference , on the ala and the tragus , for this line and many studies have been conducted regarding this. Ghosn et al, [1] Koller et al. , [2] Rostamkhani et al. [3] and Sharifi and Rostamkhani[4] in their study found out that the occlusal plane had a stronger tendency to be parallel to the line joining the ala of the nose and inferior border of the tragus.

Braun et al. in their study of the human dental arch form concluded that Camper's plane was found to be parallel to the occlusal plane when the tragal reference point was situated between the superior border and the middle of the tragus [5] . Miller, [6] Kumar et al., [7] Sadr and Sadr [8] defined it as a line running from the inferior border of the ala of the nose to the superior border of the tragus. Alquran et al carried out an analysis of prosthodontically related craniofacial reference lines and angles of lateral cephalograms, they concluded that superior border was most accurate in orienting occlusal plane[9]. GUPTA ET AL[10] and Shigli et al[11] in separate studies concluded that occlusal plane was parallel to camper's plane with the anterior reference point as ala of nose and posterior reference as middle part of tragus. Karkazis and Polyzois Chaturvedi et al,[12] Van niekerk et al[13] and Hartano[14] through separate studies advocate the use of inferior border of tragus as a posterior landmark. Cephalometric studies done by Hindocha et al[15] found that the study population was more toward the inferior of tragus.

Apparently the precise location of occlusal plane in an edentulous subject is rather controversial issue and more controversial is the exact definition of ala tragus line. However this extra oral landmark is reliable as both its ends do not change with age. Thus as per present literature, no single tragal

reference could safely be considered as a posterior landmark.

The purpose of this study is to determine which of the three positions on the tragus, that is superior , middle or inferior , when joined with the inferior border of the ala of the nose enables us to establish an ala tragal line that is most parallel to the natural occlusal plane, in dentulous subjects, so that this reference can be used to determine the occlusal plane in edentulous patients during the fabrication of dentures. The results of this study showed that in majority of tragi studied , i.e 67 % of the total , the occlusal plane was found parallel to a line joining the inferior border of ala of nose and the inferior part of tragus.

The result of this study is in agreement with a study done by van Niekerk, Rostamkhani et al and Sharif et al and another study done by Hartono which concluded that the line connecting the lowest part of ala to the inferior margin of tragus can be used as a guide to the orientation of the occlusal plane. However in a study done by Shigli et al showed that only 24.7% of the tragi studied, the occlusal plane was found to be parallel to a line joining the inferior border of ala of nose and the middle part of tragus. Also In a study of 2048 tragi forms,Solomon et al found that the Camper's plane was parallel to the occlusal plane when the tragus reference point was situated between the superior border and the middle of the tragus[16].Gupta et al in their study concluded that the in maximum number of subjects , the occlusal plane was parallel to the Camper's plane with the anterior reference point as the ala of the nose and the posterior reference point as the superior part of tragus . In studies don e by Shigli et al and Gupta et al, an occlusal plane analyzer similar to the one used in the study ,was used to check the parallelism of occlusal plane to the ala tragal line . However for checking the parallelism a vernier caliper was used to check if the distance between the upper and lower plates ,in the anterior and posterior portions , are the same. This could account for the difference of results . In the present study ,in 6% of the tragi studied , the posterior reference did not fall on any part within the tragus. It fell either above or below the tragus .This could be due to the difference in the skeletal growth amongst the subjects. Based on the results of the study it can be inferred that reliability of the ala tragal line as a guide line to simulate the natural occlusal plane is questionable. Using the ala tragal line alone will not suffice the determination of occlusal plane in edentulous patients. Hence other parameters such as the retromolar pad , the lateral border of tongue , lip height ,etc. should be taken into account for the location of occlusal plane in edentulous patients. However , when the ala tragal line is used, the inferior part should be considered, as in the present study in 67% of the tragi studied , the custom made occlusal plane analyzer coincided with the inferior part.

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