

## RESULTS AND DISCUSSION

The tragus of the human ear which plays a significant role in the development of various reference planes has several variations like any of the other structures of the mouth viz. incisive papilla, vibrating line, palatal form, throat form and ridge form. It is basically classified as typical pointed tragus 16.4%, round tragus 60.7%, notched tragus 14%, and rudimentary tragus 8.4% (Fig. 3-6 / Table -I and Table III). Round tragus was the most common and the rudimentary tragus was least observed. These variations in tragal form should be considered while identifying the various tragal terminologies that are suggested to relate ala-tragal line and tragus-canthus lines. It also implies that these landmarks on the tragus cannot be randomly used as a reference.

**TABLE I**

Types of Tragus Forms

Type	Males (%)	Females (%)	Total (%)
Pointed tragus	15.8	17.9	16.4
Rounded tragus	57.3	63.8	60.7
Notched tragus	17.6	10.7	14
Rudimentary tragus	9.3	7.6	8.4

**TABLE II**

Shape of the Superior Border of Tragus

Shape of Superior Border	Males (%)	Females (%)	Total (%)
Ill-defined	7.3	12.0	9.8
Round	35.9	34.5	35.6
Notched	56.8	53.5	55.1

### Superior border tragus

The superior border of the tragus is one of the commonly recommended tragal reference to form the ala-tragal line and tragus-canthus line. Some of the landmarks related to the superior border are top, upper border, middle of superior edge, superior tragus notch, upper part, upper free margin and upper third. Many of these are not precisely definable landmarks and hence not easy to recognise. In order to ascertain the validity of using superior border of tragus, its shape was examined to determine

definability and preciseness. Three distinct types of superior border were noticed viz. notched, round and ill-defined (Fig. 7,8). The notched superior border can be an ideal reference landmark while the round could serve only to a limited extent as a satisfactory reference. Notched superior border was seen in 50% of the subjects. The superior border is therefore not always a definable landmark and hence its reference to ala-tragal line and tragus-canthus line is limited (Table II, Fig. 11).

**TABLE III**

Classification of Various Types of Tragus

	Type of Tragus	Type of Superior Border
I	Pointed	Defined Round Notched Ill-defined
II	Round	Defined Round Notched Ill-defined
III	Notched	Defined Round Notched Ill-defined
IV	Rudimentary	Defined Round Notched Ill-defined

### Middle of the tragus

The middle of the tragus can be located easily in the classical pointed tragus and to a certain extent in the round tragus. The middle position of tragus was not easily definable in rudimentary and notched tragus forms. The practice of using the middle of the tragus can not be justified in these tragus forms which were seen in 22.4%. The recommendation of some authors, who advocate the middle of the tragus as a reference cannot be routinely advocated (Fig. 10).

### Inferior border of the tragus

Inferior border of the tragus has also been mentioned as the posterior reference of ala-tragus line. The very low incidence of parallelism (2.3%) clearly shows that the inferior border of the tragus

is not a suitable posterior reference for ala-tragus line. Moreover it is difficult to locate and identify the lower border of the tragus (Fig. 9).

Among the three popularly recommended tragal references for ala-tragal line, the following is the order of preference. Middle of the tragus 21.8%, superior border of tragus 13.1% and inferior border 2.3% (Fig. 9-11). The Glossary of Prosthodontic Terms (GPT-7) recommends that Camper's plane should be drawn from the superior border of the tragus to the inferior border of the ala and this is suggested as a reference to form occlusal plane. In this study it was seen that in only 13.1% of the subjects occlusal plane was parallel to ala-tragus line when it was drawn from the superior border of the tragus. Therefore the suggestions made by the glossary is not common to all subjects.

In a few cases, tragus asymmetry was noticed between the left and right side. In such cases the tragal references were different between the right and left side.

#### Validity of tragal reference for ala-tragal line

Besides ascertaining which of the seven selected references for an ala-tragal line was parallel to the occlusal plane, the incidence of parallelism of these seven tragal references to the four basic types of tragi was determined. It was found that irrespective of the shape of tragus, in a majority of the subjects the tragal reference was between the middle and superior border of the tragus (Table - IV). The order of location of the posterior tragus reference point in the case of pointed tragus was between middle and superior border, at the middle and at the superior border of the tragus. In the other three namely round, notched and rudimentary the order of location was between middle and superior border, middle of the tragus and middle and inferior border of the tragus (Table - V).

For many years the ala-tragal line has been the most common guide to establish the occlusal plane for complete denture construction. The GPT 7

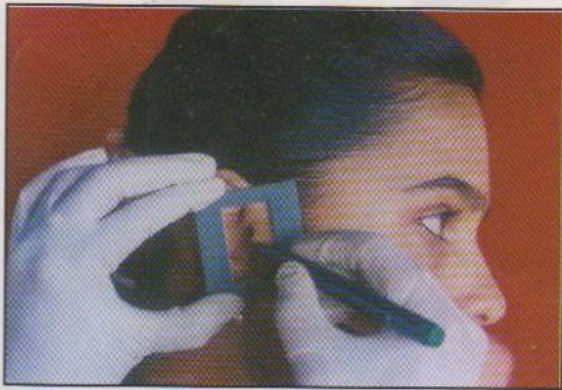
**TABLE IV**  
Tragal references used to orient ala-tragal plane parallel to occlusal plane

Tragal reference	Males (%)	Females (%)	Total Percentage
Above superior border of tragus	2.6	2.9	2.8
At superior border of tragus	11.4	14.5	13.1
Between superior border and middle of tragus	39.0	43.5	41.5
Middle of tragus	22.3	21.3	21.8
Inferior border of tragus	2.0	2.5	2.3
Between middle and inferior border of tragus	20.8	14.1	17.1
Below inferior border of tragus	1.5	0.8	1.8

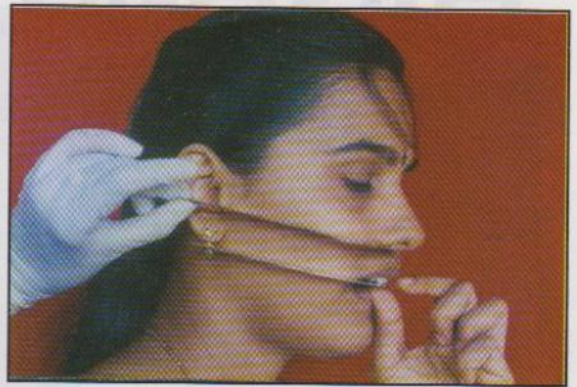
**TABLE V**  
Correlation between various tragus forms to the seven tragal references used to obtain parallelism between ala-tragus and occlusal plane

Tragal reference	Pointed (%)	Rounded (%)	Notched (%)	Rudimentary (%)
Above superior border of tragus	0.5	1.7	0.2	0.5
At superior border of tragus	1.7	8.6	1.5	0.5
Between superior border and middle of tragus	4.1	27.8	7.2	2.6
Middle of tragus	2.2	14.6	3.8	2.1
Inferior border of tragus	1.0	10.7	3.1	-
Between middle and inferior border of tragus	0.5	1.4	0.5	2.1
Below inferior border of tragus	-	0.3	0.5	0.2

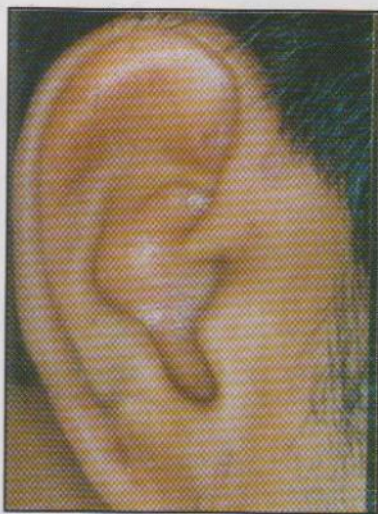




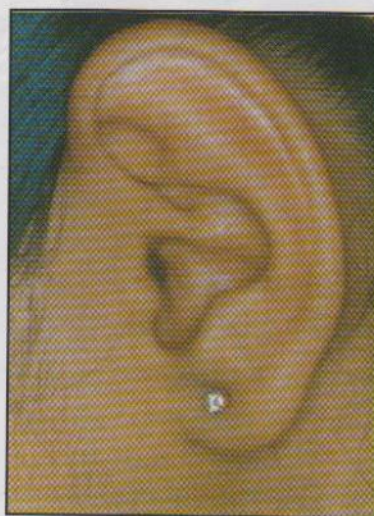
**Fig. 1 :** Outline form of tragus is traced on a transparent foil



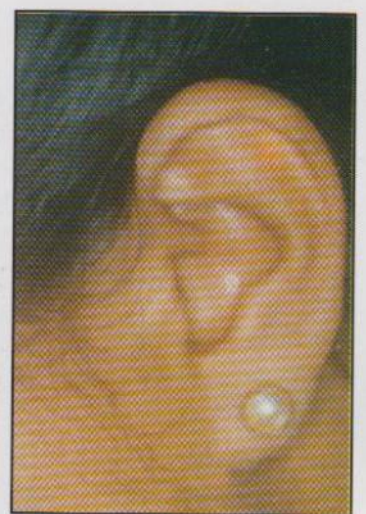
**Fig. 2 :** Tragal reference for A-T line is identified when both plates are parallel



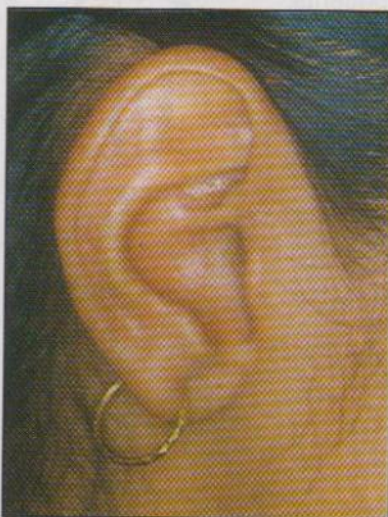
**Fig. 3 :** Classical pointed tragus with a defined superior border



**Fig. 4 :** Round tragus



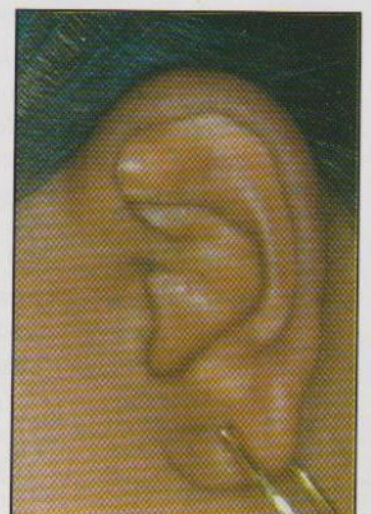
**Fig. 5 :** Notched tragus



**Fig. 6 :** Rudimentary tragus



**Fig. 7 :** Notched superior border

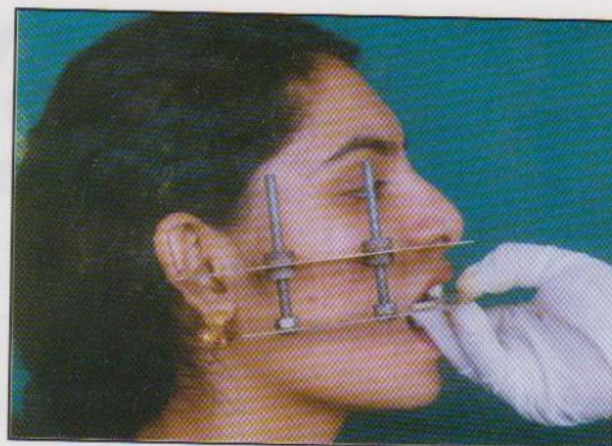


**Fig. 8 :** Round superior border

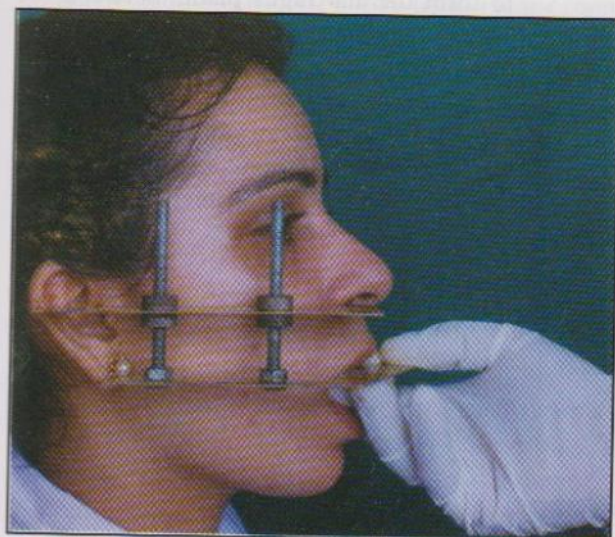




**Fig. 9 :** Tragal reference for A-T line located at the inferior border of tragus



**Fig. 10 :** Tragal reference for A-T line located at the middle of tragus



**Fig. 11 :** Tragal reference for A-T line located at the superior border of tragus

defines it as "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 tip of the tragus". One of the objectives of the study was to find a defined point on the tragus which will form the posterior reference for ala-tragus line. This study showed that only in 16.8% the tip of the tragus was noticeable. In the round, notched and rudimentary tragus the tip was not easily discernible. Some of the other defined points are shown in Table V.

The Glossary defines Camper's plane as a plane established by the inferior border of the right and left ala of the nose and superior border of the tragus

of both ears. The conflicting definitions of the A-T line and Camper's line/plane given in the Glossary is not explainable. It is a dilemma whether to accept the superior border or the tip of the tragus as posterior tragal reference for these identical planes.

When a reference plane is marked, it is mandatory that a line is drawn between two constant and easily identifiable landmarks. This has not been taken into consideration in defining ala-tragus line/plane. The inferior border of the ala of nose is a fairly definable landmark, while the tragus of the ear varies in its outline form and shape and therefore its role as a posterior reference in ala-tragus plane is critical. Some of the references recommended in text books and by other authors are not always recognisable. Further there is also the uncertainty in locating a few of these tragal references.

This is also true with the arbitrary location of hinge axis point. A number of posterior reference points for the eye-ear plane such as superior border of tragus, upper border, superior tragus notch, middle of superior edge, upper part, upper third, upper free margin, top of tragus, middle of tragus, posterior border of tragus, posterior border of middle of tragus, base, apex, foot, anterior margin, posterior margin, center of the ear are mentioned by various authors. Some of these are neither definable nor easy to recognise taking into account the several morphological variations seen in the tragus. The rationale of using some of these references for drawing the eye-ear plane to locate arbitrary hinge axis point is therefore questionable.



## CONCLUSIONS

1. Morphology of tragus is variable and several tragus outline forms were seen. Among the four basic tragus forms, rounded tragus was most commonly seen in both sexes and the rudimentary tragus was least observed. Females had a greater tendency for round and pointed tragus forms than males, while rudimentary and notched tragus was prevalent in males.
2. In view of the variations in the shape of tragus, shape and definability of the superior border, inferior border and middle of tragus, the various landmarks recommended for the ala-tragus plane is not always possible.
3. The commonly recommended superior border of tragus as a reference for Camper's plane and eye-ear plane is not always precisely definable. It was either ill defined, rounded or notched. Females showed a higher incidence of ill defined superior borders than in males.
4. The middle of the tragus was definable in the pointed tragus and in the classical round tragus. In other tragal forms,, middle of the tragus was not definable.
5. Appreciable differences were observed in the location of the middle of the tragus between the left and right side.
6. The tip of tragus recommended by Glossary of Prosthodontic Terms is identifiable only in pointed tragus.
7. Asymmetry in tragal form was noticeable.
8. Among the three commonly recommended tragal references for ala-tragus line., parallelism to occlusal plane was usually seen when middle of the tragus was taken to form the ala-tragus plane. Between the seven tragal references selected to orient ala-tragus plane to occlusal plane, parallelism was seen when the tragal reference was between superior border and the middle of the tragus (41.5%). Inferior border served as a poor reference 2.3%.

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## Book Review

### Implant Prosthodontics

### Clinical and Laboratory Procedures

(Second Edition) (Mosby Publishing)

Authors : Stevens Fredrickson

**T**he book gives a coverage of the history of implants, the emergence of Branemark system and the evolution of other dental implant systems. It also covers clinical and laboratory procedures in a sequential manner. The colour photographs spread throughout the book makes the understanding of Clinical Procedures and Prosthodontic steps easier.

The Cer Adapt abutment System is an all ceramic alternative to metal abutments. It is premachined, Precision milled abutment made to fit the implant hex. This book also covers Procera Abutment: Computer generated customised prosthetic abutment. Chapter on Restorative considerations of wide diameter implant, elaborates the advantages of a wide platform when length to be used is questionable and at the same time it discusses the design of occlusion as conservatively as possible in such cases. The last two chapters - 'Problems, Complications, Solutions' & 'Hygiene and Maintenance guidelines' make interesting reading and provide practical tips.

# Part 3 : Definability of Tragus Morphology as a Reference Landmark in Edentulous Subjects

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## ABSTRACT

*An investigation in edentulous subjects showed that there was no appreciable change in the basic types of tragus morphology and the three distinct shapes of the superior border of tragus. Chronological senile changes were observed as vertical lines in the skin in front of the tragus. A study was also conducted to relate A-T line parallel to occlusal plane on various dentulous age groups to ascertain the tragal reference point of A-T line.*

## INTRODUCTION

There are several landmarks on the face commonly used as reference and for the purpose of anthropometric measurements with the belief that their morphology and the relationship between them is fairly constant. Its validity is doubtful, if changes occur with aging. The human tragus is one such landmark which is often used by prosthodontists to locate various planes. Since most of the denture wearers are in the fifth and sixth decade of life, it will be beneficial to know whether senile changes which take place in the face with the aging process affect the tragus morphology and the definability of the post tragal reference landmarks for A-T line.

Tragus forms in edentulous subjects between 40-80 years of age were studied together with

another parallel study in dentulous subjects with different age groups to ascertain the tragal reference for an A-T line which was parallel to occlusal plane.

## RESULTS

Shape of tragus in edentulous subjects varied from pointed, round, notched and rudimentary types which were generally seen in the young dentulous individuals (Fig. 1-3). No significant differences in tragus form was noticeable as age advances except for a few changes occurring in the skin. There is a tendency for the superior border to become more straight (Fig. 4). Rudimentary tragus was more prevalent in the edentulous age group.

Senile changes in the skin in front of the tragus occur concomitant with the skin of the surrounding structures of the face. Tragus is a cartilaginous structure which maintains its shape, no wrinkles appear on it. However with age, the skin covering around it loses its elasticity to produce vertical wrinkles and folds which appear along with anterior border of the tragus. When excessive, then there is a change in the tragus form due to forward slant of the tragus. The other senile change noticed was the profuse hair growth along the borders of the tragus mostly in the inferior and middle border in male subjects usually above 50 years (Fig. 5). In a few, it was scanty while in some profuse copious hair growth was seen. The hair follicles which remain dormant during the early life span become active in the later years due to changes in hormonal function. The profuse hair growth in tragus makes it cumbersome to identify and mark the various tragal landmarks.

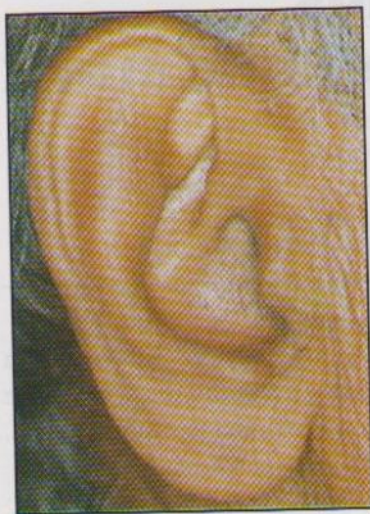
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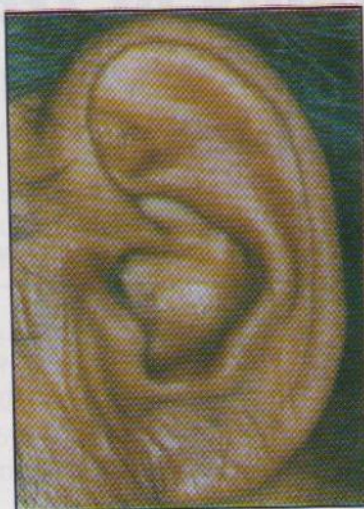
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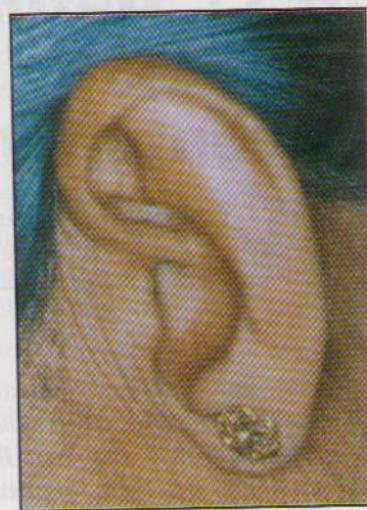




**Fig. 1 :** Pointed tragus seen in the very elderly



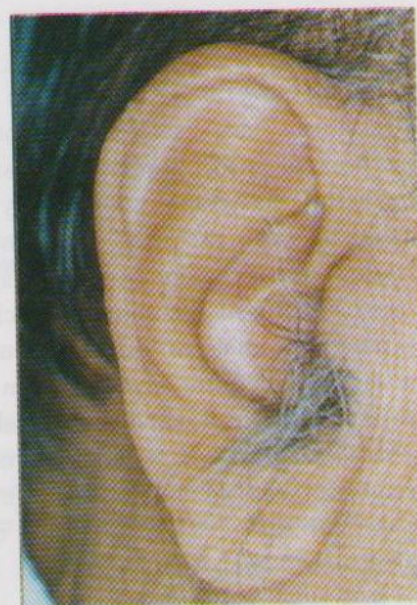
**Fig. 2 :** Round tragus seen in the very elderly



**Fig. 3 :** Rudimentary notched tragus



**Fig. 4 :** Ill defined straight superior border of tragus (poor reference)



**Fig. 5 :** Profuse hair growth along the borders of tragus. Note the notched superior border

Generally the superior border or the middle of the tragus are selected as landmarks to locate the posterior reference for Camper's plane but there is no guideline for preference between them. This study showed that A-T line in dentulous varied according to the age. As age advances, the tragal reference is located superiorly as compared with the younger age group where it is mostly located below the superior border.

*Author's Conclusion :* Next time you look at the tragus, think of the various aberrations and intricacies of this tiny structure. Thus, the importance of inclusion of the tragus in patient examination & diagnosis chart has been emphasised.

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## *A Practical Tip*

### **Corrective Impression Wax - A simple formula**

Dr. R.D. Das, Lecturer, Dr. S.J. Nagda, Professor and Head Dept. of Prosthodontics, N.H.D.C., Mumbai.

**A** number of dental students appear to be having difficulty in obtaining corrective impression wax and it is likely that dental practitioners are having similar problems in obtaining supplies.

This tip is a simple formula (given by McCrorie using easily obtainable ingredients) which would produce a satisfactory corrective impression wax for clinical use.

A Corrective impression wax can be produced from mixtures of yellow bees wax and paraffin wax with flow characteristics at 37 degrees centigrade similar to those of Korecta wax 2, 3 & 4.

Wax mixtures	percentage flow at 37°C	type of Korecta wax
75% yellow bees wax 25% paraffin wax	80	no. 2 (hard)
50% yellow bees wax 50% paraffin wax	85	no. 3 (soft)
25% yellow bees wax 75% paraffin wax	90	no. 4 (extra soft)

These waxes are of good aid in various prosthesis viz. post damming of complete dentures, developing functionally created polished surface of complete dentures, functional impression for removable appliances, functional contouring of speech bulbs etc.