

# ANALYSES OF RELATION BETWEEN CAMPER'S PLANE AND NATURAL OCCLUSION PLANE IN INDIAN DENTULOUS SUBJECTS - A CLINICAL STUDY

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## Abstract

**Background:** To evaluate the relationship between Camper's plane and natural occlusal plane in normal Indian dentulous male and female subjects of age ranging from 19-29 years.

**Methods:** A total of 80 volunteers (40 male and 40 female) aged between 19 to 29 years with normal occlusion were selected for the study from undergraduate and postgraduate dental students of Bapuji dental college and hospital, Davangere. To standardize the selection of the subjects some inclusion and exclusion criteria were followed. Each subject was seated on a chair in a relaxed state with head oriented in natural horizontal position and Fox plane was clenched between the teeth. Two ink dots were marked on the inferior border of Ala of nose and tip of Tragus of ear. Photographs of lateral view were taken with the digital camera. The images obtained were transferred to a computer and Camper's-occlusal plane angle measurements were done by using computer software program Screen Protractor version 4.0. The data obtained was subjected to statistical analysis.

**Results:** Camper's plane showed a marked deviation from natural occlusal plane both in male and female subjects and this deviation was found to be statistically highly significant ( $p < 0.001$ ).

**Conclusion:** Study showed that Camper's plane was not parallel to natural occlusal plane in Indian subjects.

**Key words:** Ala-tragus line, Camper's-occlusal plane angle, Camper's plane, Natural occlusal plane, Natural Horizontal Position

## Introduction

As an established fact we know that the correct orientation of the occlusal plane plays a vital role in optimal function and esthetics.<sup>1</sup> Anteriorly orientation of plane is governed by aesthetic and phonetic requirements but posteriorly various biometric landmarks have been proposed and used by different authors for orientation of plane which include ala-tragus line, residual ridges, buccinator grooves and the commissure of lips, retromolar pad, condylar path, parotid papilla and the lateral border of the tongue.<sup>2-10</sup>

Camper's plane or Ala-tragus line was postulated in 1780 by the Dutch anatomist Peter Camper.<sup>11</sup> Glossary of Prosthodontic Terms-8 (2005) defines ala-tragus line 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 the tip of the tragus. It is frequently used, with a third point on the opposing tragus, for the purpose of establishing the ala tragus plane.<sup>12</sup> It is the most widely used landmark and is also the most commonly taught method in dental institutions for orientation of occlusal plane.<sup>4, 13</sup>

Some studies have shown that Ala-tragus line is not parallel to the natural occlusal plane.<sup>14, 15</sup> As the inclination of the occlusal plane does influence the biting efficiency the use of Camper's plane as a reference for prosthodontic reconstructive therapy may not be reliable.<sup>16</sup>

Hence, the following clinical study was planned with an aim to analyse the relation between Camper's plane and natural occlusal plane in normal Indian dentulous subjects.

## Materials & Methods

This cross-sectional descriptive in-vivo study was conducted in Department of Prosthodontics, Bapuji Dental College and Hospital, Davangere. The ethical clearance was obtained from the Ethical committee of the institution before starting the study.

A total of 80 volunteers (40 male and 40 female) aged between 19 to 29 years with normal occlusion were selected after screening 300 undergraduate and postgraduate dental students from Bapuji dental college and hospital, Davangere.

All the study subjects were informed and explained in detail about the nature of the research procedure in the language which they understand and a written consent was obtained from every volunteer for the photography and documenting for purposes of Advancing Dental/ Medical Education.

To standardize the selection of study subjects some inclusion and exclusion criteria were followed.

- **Inclusion criteria:** Subjects were included in the study if he/she was having fully erupted permanent dentition teeth (at least 28 teeth) in normal occlusion, bilateral Angle's class I molar relationship and anterior teeth with normal overjet and overbite
- **Exclusion criteria:** Subjects was excluded if he/she was having/ had undergone previous history of orthodontic treatment or craniofacial surgery/ trauma or TMJ disorders or any marked facial asymmetries or any gross occlusal or incisal wear or congenital facial defects or any irregular pattern of occlusion like crossbite etc.

Predefined proforma was used to record relevant information (i.e.; patient's data, criteria of selection, photographic measurements) from each individual subject selected.

A chair was kept in a fixed position near a wall facing on one side for subject to sit and a mirror was placed at a fixed distance of 1.5 meters away from the chair and at a height such that the person sitting on the chair could see his/her image comfortably in the mirror. A metal plumb line was suspended under its own weight from ceiling to establish a true vertical line of reference. A digital camera mounted over a tripod stand was kept at a 1.5 meters of fixed distance on lateral side of chair to capture the images.

Subject was seated on a wooden chair in a relaxed state facing on one side with head oriented in natural horizontal position. To orient the head in natural horizontal position subject was asked to look at the reflection of his/her pupil in the mirror kept at a fixed distance from the chair. Two ink dots were marked on inferior border of ala of nose and tip of tragus of ear. Subjects were asked to clench passively on the inner arms of the Fox plane between maxillary and mandibular teeth. Outer extended arms of Fox plane were used as extra-oral representation of natural occlusal plane. The upper edge of the fox plane was considered as actual plane of occlusion because the maxillary cusps tips were touching the superior surface of the inner arm of Fox plane. Digital camera mounted over the tripod was adjusted up and down to bring it to the level of Fox plane (Figure 1).



Figure 1: - Showing subject sitting and head oriented in Natural horizontal position.

Photographs of lateral view with the patient head oriented in natural head position were taken with the digital camera from the same distance for all subjects.

All the lateral profile photographs of the subjects were transferred to computer system and measurements were carried on the (Figure 2 & 3) computer screen. The angle between Camper's plane and occlusal plane was measured by using computer programmed Screen Protractor version 4.0. For every individual three measurements were taken and their mean was calculated. Entire procedure was done by single operator to eliminate inter-operator bias.



Figure 2: Showing subject holding Fox plane clenched between maxillary and mandibular teeth

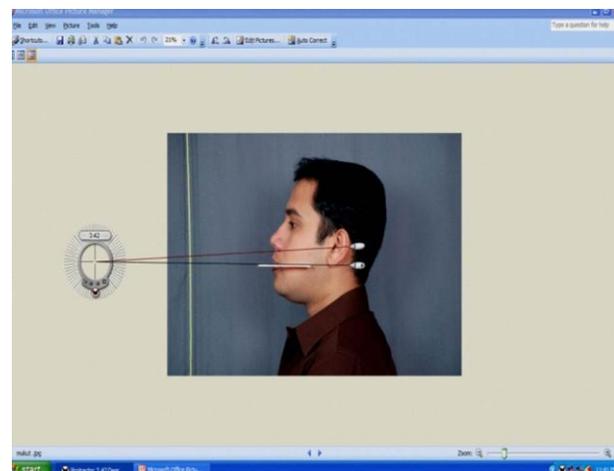


Figure 3: Showing measurement of Camper's-occlusal plane angle using Screen protractor

## Results

As shown in Table-1, the mean age of 40 male and 40 female subjects was 21.65 & 21.42 years respectively. On statistical analysis their ages were found to be similar ( $t=0.472$ ,  $p=0.638$ ) which allowed the comparison between the two groups. It was required to check the gender variation of camper's plane as related to natural occlusal plane.

As shown in Table-2, after measuring the Camper's-occlusal plane angle of 80 subjects (40 male & 40 female) the Camper's plane was found to be deviated from natural occlusal plane by a broad range of 0.18 to 9.7° with a mean of 3.503°. In 40 female subjects the deviation range was found to be 0.25 to 8.94° with a mean of 3.225° whereas in 40 males it was found to be 0.18 to 9.7° with a mean of 3.782°. When statistical evaluation was made using Student One Sample 't' test 'p' value was found to be highly significant ( $p < 0.001$  HS). It suggests that Camper's plane is not parallel to natural occlusal plane. This result confirms the finding of other studies.<sup>3, 13</sup>

Study group	Males (n= 40)	Females (n= 40)	t* Value	Significance
Mean	21.65	21.42	0.472	p=0.638 Not Significant
SD	2.167	2.099		

\* Student's Unpaired 't' Test.

Table 1: Showing comparison of mean age of male and female subjects (in years) using Student's Unpaired 't' Test.

Study Group	Range	Mean	SD	t* Value	Significance
Males (n= 40)	0.18 - 9.7	3.782	2.220	10.77	p< 0.001 HS
Females (n= 40)	0.25 - 8.94	3.225	2.230	9.14	p< 0.001 HS
Combined (n=80)	0.18 - 9.7	3.503	2.228	14.06	P< 0.001 HS

\* Student One Sample 't' Test.

Table 2: Showing comparison of Camper's-occlusal plane angle values (in degrees) of male and female subjects with hypothesis value using Student One Sample 't' Test.

There are other studies which contradict the findings of this study and such studies states that Camper's plane is parallel to natural occlusion plane. But either these studies were not conducted in subjects of different races or researchers have taken different point of posterior reference like superior or inferior point on tragus of ear for evaluating Camper's plane parallelism.<sup>17, 2</sup> Hence it may be said that either redefining of universal point of reference for Camper's plane is required or further studies should be conducted on different races and accordingly the point of references should be established because different races have different skeletal and morphological makeup.

Study Gp	Males (n=40)	Females (n=40)	Mean Difference	t* Value	Significance
Mean	3.782	3.225	0.5565	0.11	p=0.26 Not Significant
SD	2.220	2.230			

\* Student's Unpaired 't' Test

Table 3: Showing comparison of Camper's-occlusal plane angle (in degrees) between values obtained from male and female subjects using Student's Unpaired 't' Test

As shown in Table-3, when comparison of deviation of camper's plane with natural occlusal plane was made between male and female subjects it was found that mean difference was (3.782°-3.225°=) 0.5565° and on applying Student's Unpaired 't' test this difference was statistically insignificant (t=0.11, p=0.26). Hence, it can be said that the natural occlusal plane orientation in male and female subjects is similar and there is no gender variation.

As shown in Table-4, among 40 male subjects occlusion plane was inclined anteriorly in 12 subjects (30%) and

posteriorly in 28 subjects (70%). Whereas, out of 40 female subjects 22 subjects (55%) were having anterior inclination and 18 subjects (45%) were having posterior inclination of natural occlusal plane in relation to Camper's plane. This different pattern of occlusal plane inclination may be associated with different horizontal and vertical growth patterns of an individual. This kind of antero-posterior inclination was also seen in other studies.<sup>15</sup>

Antero-posterior inclination	Males (n = 40)	Females (n = 40)
Down Anteriorly	12 (30%)	22 (55%)
Down Posteriorly	28 (70%)	18 (45%)

$\chi^2 = 4.14, p < 0.05$  Significant.

Table 4: Showing the incidence of anteroposterior inclination of natural occlusal plane in relation to Camper's plane (in percentage) using Chi-Square test.

## Discussion

In the present study, Inferior point of ala of nose and tip of the tragus was considered as anterior and posterior point of reference of Camper's plane respectively.<sup>12</sup> Photographic technique was given preference over cephalometric investigation as cephalometry involves exposure to radiations and inherited errors due to distortion of image.<sup>18</sup>

The screen caliper which was used in the study is a unique on-screen measurement tools. Pixel-perfect accuracy is ensured every time simply by aligning the Screen Caliper's pointers around an image. They resemble real life calipers in both form and function. Originally created for graphics and web professionals, the Screen Calipers are currently being used extensively for cephalometry.<sup>18</sup>

Hence, it can be stated that Camper's plane is not parallel to natural occlusal plane in Indians and if it is taken as a reference for orientation of occlusal plane in edentulous patients its inclination should also be given a consideration for prosthodontic rehabilitation. Because studies have shown that even minor deviation of occlusal plane from the normal orientation can affect masticatory efficiency and it was seen that contribution of the inclination of the occlusal plane to masticatory movement was greater than that of the occlusal guidance.<sup>4</sup> Hence, in relation to Indian population further study is required to find out other methods of orientation of occlusal plane in edentulous patients and determination of inclination of Camper's plane in relation to natural occlusal plane.

## Conclusion

Within the limitations of this in-vivo study and from the results obtained the following conclusions can be drawn:

1. Camper's plane was found to be not parallel to the natural occlusal plane.
2. Deviation of Camper's plane with natural occlusal plane was similar in both male and female subjects.
3. In relation to Camper's plane, the natural occlusal plane was not oriented in the same pattern in all the

subjects. In some subjects it was found inclined anteriorly and in others it was inclined posteriorly.

4. Computer software program Screen protractor version 4.0 was found to be a very useful tool for anthropometric studies.

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