Reliability of various craniofacial reference planes with occlusal plane in Dravidian population

Shermila Ann Sherry, Ashish R. Jain*

ABSTRACT

Background: Besides, stability, optimum level, and inclination of the occlusal plane play an important role in biomechanics of craniomaxillary morphology. Although clinical application of cephalometry has been directed largely toward orthodontics, it is of special value to prosthodontist as significance of variations in the upper face has not been investigated for an ethnic Dravidian population. Aim: This study aims to evaluate the inclination of maxillary occlusal plane with reference to Frankfort horizontal plane (orbitale-porion) and Camper’s plane (ala-porion) and to correlate the degree of separation in Frankfort horizontal plane, Camper’s plane, and occlusal plane in two different ethnic groups with lateral cephalometry. Materials and Methods: The study was carried out on 20 lateral cephalometric radiographs of both male and female subjects of Dravidian population. Subjects were selected based on inclusion and exclusion criteria. The lateral cephalograms were calibrated and traced using FACAD (FACAD is a software program used for orthodontic tracing, cephalometric analysis, and visual diagnostic imaging, as well as for treatment planning with soft tissue profile prediction) software. Results: According to statistical analysis, there was no statistically significant difference between the two groups in this population; between the two parameters Frankfort horizontal plane – Occlusal plane (FH-OP) and Camper’s plane – Occlusal plane (CP-OP) at 5 % level of significance (P > 0.05) was observed. Conclusion: Based on the findings of the present study, it can be stated that the reliability of Camper’s plane as a guideline to simulate the natural occlusal plane in prosthodontics is questionable when compared to Frankfort’s horizontal plane and should be regarded as independent anthropometric entities.

KEY WORDS: Camper’s plane, Frankfort’s horizontal plane, Occlusal plane

INTRODUCTION

Complete dentures mainly restore the function of mastication along with esthetics and other functions. Although the retention of complete denture is one of the main concerns for the patient, it is the stability of complete denture during the functions that matter more to the operator. Various factors that affect the stability of complete denture are the proper location and arrangement of the artificial teeth, the size and form of the basal seat, the quality of the final impressions, and so on. Among these factors, the orientation or inclination of plane of occlusion is under operator’s control. However, establishment of the optimum level and inclination of the occlusal plane poses a dilemma in an edentulous mouth in the absence of definite guidelines. Besides, stability, optimum level, and inclination of the occlusal plane play an important role in biomechanics of craniomaxillary morphology.[1] According to contemporary concepts, the position of the occlusal plane in the denture wearers should be as close as possible to the position which was previously occupied by the occlusal plane of the natural teeth. There is a lot of evidence that such a position of the occlusal plane enhances denture stability and functional value.[2] The reconstruction of the “natural level” of the occlusal plane in the edentulous mouth enables the normal function of cheek and tongue muscles and other surrounding structures.[3] Although clinical application of cephalometry has been directed largely toward orthodontics, it is of special value to prosthodontics in that it can be used to reestablish the spatial position of lost structures such as the teeth. This is achieved by identifying predictable relationships between the teeth and other cranial landmarks that are not subject to postextraction changes.[4] The prosthodontic significance of variations in the upper face has not been investigated for an ethnic Dravidian population. Therefore, the aim of the study is to evaluate the inclination of maxillary occlusal

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plane with reference to Frankfort horizontal plane (orbitale-porion) and Camper’s plane (ala-porion) for Dravidian young adults separately and to correlate the degree of separation in Frankfort horizontal plane, Camper’s plane, and occlusal plane with the help of cephalometry.

MATERIALS AND METHODS

The study was carried out on 20 lateral cephalometric radiographs of both male and female subjects of Dravidian population. Subjects were selected based on inclusion criteria. The subjects were in an age group of 20–30 years in whom the facial growth has completed, the presence of full competent teeth with or without third molars had ideal dental arch form and alignment, stable centric occlusion with Angle’s Class I molar relationship, no previous history of orthodontic treatment, and orthognathic surgery, with no malocclusion and gross restorations. All subjects were instructed to remove jewelleries (earrings, etc.) from head region to avoid artifacts in identifying the landmarks. Subject’s head was positioned in the cephalostat with the Frankfort horizontal plane parallel to the floor. The subjects were asked to avoid motion during the exposure [Figure 1]. The radiographs were taken with teeth in intercuspal position. The film exposure was standardized for every patient. The cephalograms were digitized and calibrated using the software FACAD and traced. The principal investigator performed the tracing. Cephalometric tracing was to depict the angles between FH-OP and CP-OP.

RESULTS

The descriptive statistics of the parameters studied by the examiner were tabulated [Table 1]. According to the statistical test, there was no statistically significant difference between the two groups in this population; between all two parameters (FH-OP and CP-OP) at 5% level of significance (P > 0.05) was observed.

DISCUSSION

According to Boucher, if the soft tissues surrounding the dentures are to function as they did for natural teeth, the occlusal plane should be oriented exactly as it was when the natural teeth were present. However, to locate an occlusal plane high or low to favor, the weaker of the two ridges can cause both esthetics and mechanical trouble. It becomes questionable how to discover which position was occupied by the natural occlusal plane after the loss of the natural teeth. Many studies have been conducted in the past to locate the lost occlusal plane in edentulous patients considering Camper’s plane. Similarly, in cephalometric studies, the upper border of the porion, the middle of the porion, and the lower border of the porion have been used as the posterior reference point of Camper’s plane. In majority of these cases, Camper’s plane connects the anterior nasal spine with the superior border of porion. Further, there is much controversy concerning the coincidence of Camper’s plane defined radiographically and ala-tragus line defined by skin points. Some authors advocate the ala-tragus line and never mention Camper’s plane and many others consider the two to be the same and still others make a clear distinction between Camper’s plane and the ala-tragus line.

Thus, it is obvious that to reestablish the occlusal plane in edentulous patients; it is desired to obtain certain craniofacial reference planes so as to relate it to the occlusal plane. It has been pointed out by many authors that the level and inclination of occlusal plane varies with respect to different skeletal configurations. Study conducted by Patil and Sachdev in 1998 suggest that there is a difference in inclination of occlusal plane with respect to various skeletal jaw relationships in Indian population. European studies have indicated comparable mean angular values across the samples measured between Frankfort horizontal line (orbital-porion) and reference lines such as Camper’s line (ala-porion). According to Ow et al. and Cooke et al., there is certain variation in Chinese and British Caucasian population in occlusal plane and the various craniofacial reference planes such as Frankfort horizontal plane and Camper’s plane. Ethnic and racial variability in various anatomic landmarks

![Figure 1](image.png)

(a-d) Cephalometric tracing comparing the two planes using the software (FACAD)

Table 1: Descriptive statistics of the parameters studied

<table>
<thead>
<tr>
<th>Population</th>
<th>Parameter</th>
<th>Mean±SD</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dravidian</td>
<td>FH-OP</td>
<td>13.43±1.8</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Dravidian</td>
<td>CP-OP</td>
<td>0.56±0.6</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

SD: Standard deviation, FH-OP: Frankfort horizontal plane – Occlusal plane, CP-OP: Camper’s plane – Occlusal plane
causes differences in the norms established for specific groups. Cephalometric studies have been chosen as a method of investigation to examine the possibility of ethnic variations in cranial reference planes since other methods are not very reliable. The absolute parallelism between the natural occlusal plane and Camper’s plane has not been proven either in Dravidian subjects involved in this study. This significantly reduces the reference values of these planes in prosthodontics. The inclination of maxillary occlusal plane exhibited a significantly shallower cant.

CONCLUSION
In cephalometric studies, the upper border of the porion, the middle of the porion, and the lower border of the porion have been used as the posterior reference point of Camper’s plane. Frankfort’s horizontal plane is a stable cranial base plane which connects the orbitale and the upper border of the porion just above the condyle. Based on the findings of the present study, it can be stated that the reliability of Camper’s plane as a guideline to simulate the natural occlusal plane in prosthodontics is questionable when compared to Frankfort’s horizontal plane and should be regarded as independent anthropometric entities.

REFERENCES