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International Journal of Current Research
Vol. 9, Issue, 08, pp.55939-55942, August, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

DETERMINATION OF EFFECT OF PROGRESSION OF AGE ON LOCATION OF OCCLUSAL PLANE – A CEPHALOMETRIC STUDY

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ARTICLE INFO

Article History:
Received 26th May, 2017
Received in revised form
05th June, 2017
Accepted 18th July, 2017
Published online 31st August, 2017

Key words:

Plane of occlusion,
Dentition,
Prosthodontics,
Cephalometric.

ABSTRACT

The plane of occlusion in both natural and artificial dentition plays an important role in fulfilling the criteria of function and aesthetics. As the concepts of prosthetic occlusion developed and were refined, it was natural to extend this to the natural dentition. With the establishment of concept of normal occlusion that incorporated the line of occlusion, by the early 1900s prosthodontics was no longer just replacement of missing teeth. One fundamental requirements in fabrication of successful dental prosthesis is the reestablishment of plane of occlusion. An accurate orientation of occlusal plane in its natural position is important for proper aesthetics, mastication, phonation and stability of denture. An accurate orientation of occlusal plane in its natural position is important for esthetics, mastication, phonation and stability of denture. It has been emphasized that occlusal plane of artificial denture should be positioned at the same level as that of natural dentition. Carefully conducted research has shown that occlusal plane tends more often to be parallel the naso mental line in early life than in adulthood. This study was performed to evaluate the effect of progression of age on plane of occlusion.

Citation: Sweta Pisulkar, Vikram Belkhode, Shreyas Gootorkar, Surekha Godbole, Seema Sathe and Pakhan, A.J. 2017. "Determination of effect of progression of Age on location of Occlusal Plane – A Cephalometric Study", *International Journal of Current Research*, 9, (08), 55939-55942.

INTRODUCTION

In the era when the intact dentition was rarity, the details of occlusal relationships were considered unimportant, and the prosthetic treatment provided was limited just to fill the space created by extracted teeth. To make good prosthesis it was necessary to develop a concept of occlusion, and this occurred in the late 1800s. As the concepts of prosthetic occlusion developed and were refined, it was natural to extend this to the natural dentition. With the establishment of concept of normal occlusion that incorporated the line of occlusion, by the early 1900s prosthodontics was no longer just replacement of missing teeth (Willim *et al.*). One of the fundamental requirements in fabrication of successful dental prosthesis is the reestablishment of plane of occlusion. An accurate orientation of occlusal plane in its natural position is important for properaesthetics, mastication, phonation and stability of denture (Roopa, 2003). Fish stated that "the occlusal plane of artificial denture should be positioned at the same level as that in natural dentition". Therefore, many theories and methods have been proposed over the years to facilitate correlation of the artificial occlusal plane to the natural one (Beresin Victor *et al.,* 1978; Williams, 1982).

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Some of the current concepts include:

- Establishing the occlusal plane according to aesthetic requirements anteriorly and parallel to Camper's line posteriorly (Abrahamsr and Carey, 1979; Lejoyeux, 1967; Sharry, 1974; Niekerk *et al.,* 1978; Karkazish *et al.,* 1986).
- Positioning the occlusal plane to terminate posteriorly at the middle or upper third of retromolarpad (Boucher, 1964; Hickey *et al.,* 1986).
- Parallel to and in the midway between the residual ridges (Boucher, 1964).
- Parallelto the lateral border of the tongue (Landa, 1957).
- Parallel to the buccinator grooves and the commissurae of the lips (Lündquist, 1970).
- In a specific relation to the parotid papilla (Foleypf and Latta, 1985).
- Establishing theocclusal plane according to the angle with the Frankfurt horizontal plane on the models mounted in an articulator (Fletcher, 1985).
- According to some cephalometric criteria Cephalometric analysis has served for many years in dental research and diagnosis.

All though its clinical application has been directed mainly toward orthodontics, some authors introduced it to prosthodontics to identify predictable relationships between the teeth and other, cranial landmarks that are not subjected topostextraction changes in order to re-establish spatial position of the lost teeth in partially and complete edentuloussubjects (Lestrange and Vigg, 1957; Monteith, 1985; Monteith, 1985 & 1985; Sinobad, 1988). Prosthodontic rehabilitation may be required in patients of any age. The values like occlusal plane angle may not remain constant throughout life; these changes in the values may be of significance when considering the outcome of the treatment at that particular age group. This study was performed to evaluate the effect of progression of age on plane of occlusion.

MATERIALS AND METHODS

A total of 40 patients were selected for the study. Out of 40 patients, 20 patients were of age group between 20-30 years (Group A) and rest20 patients of age group between 40-50 years (Group B). The main criteria for inclusion in the study was absence of gross derangement of the plane of occlusion due to long standing extraction of teeth, no temporo-mandibular joint disorder and subjects with no history of any orthodontic treatment. All the patients from each groups were subjected to the cephalometric analysis. All the cephalometric films were exposed keeping standard distance of 6 feet between the x- ray target and mid-sagital plane and 15 cm distance between mid-sagital plane and x-ray film. The cephalogram were shooted at physiologic rest position of mandible. Same cephalostat was used for all the patients (Fig. 1, 2).

Figure 1. Ceplalometric analysis of patients of Group A

Figure 2. Ceplalometric analysis of patients of Group B

After shooting of cephalographs the images thus obtained were evaluated using the software AutoCAD 2013 to minimize the manual errors while tracing. The machine porion (P) and the orbitale (O) were marked on image so as to obtain FH Plane. Occlusal plane designated by a line bisecting the intercuspated teeth was marked in the image. The AutoCAD 2013 software was used to determine the angle between the above mentioned lines (Fig. 3). The occlusal plain angle was determined for all the subjects, and the results thus obtained were tabulated group wise and subjected to statistical analysis.

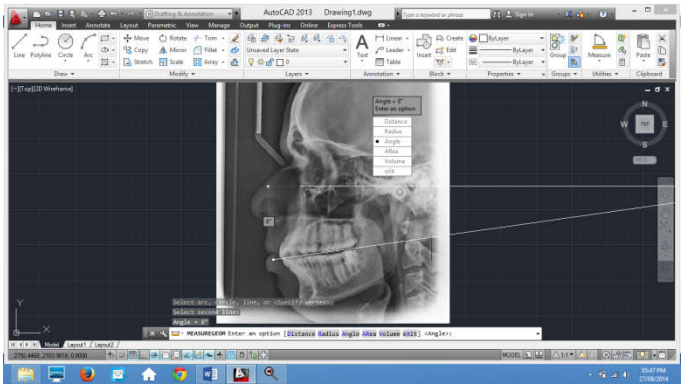


Figure 3. Auto CAD 2013 software to determine the angle

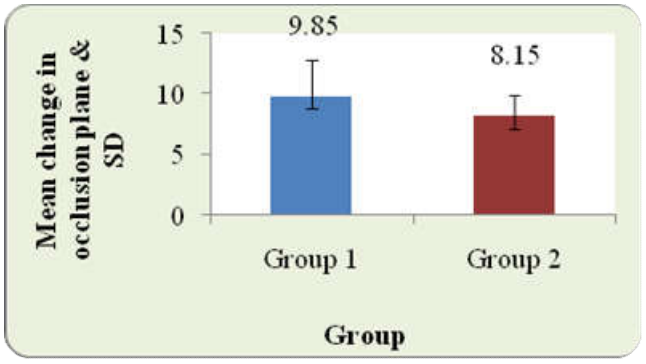
Observations and results

The mean occlusal plane angle values for both the age groups along with standard deviations (SD) are presented in Table 1.

Table 1. Mean occlusal plane angle values for both the age groups along with standard deviations (SD)

Sr. No	Group	Mean occlusal plane angle value (in degrees)	SD
1	Group A	9.85	2.89
2	Group B	8.15	1.80

Mean change in occlusion plane in group A was 9.85±2.89 and in group B it was 8.15±1.80. By using student's unpaired t test statistically significant difference was found in mean change in occlusion plane in two groups (t=2.22, p-value=0.032) (Graph 1)



Graph 1. Mean change in occlusion plane between Group A and Group B

DISCUSSION

One of the most beautiful examples of design that can be found in nature is configuration of occlusal plane. The conformity to that design by the other parts of stomatognathic system is so

suitable that it is often missed. However, the logic of these interrelationships is important to understand because even a slight variation from this intended configuration can lead to unexplained occlusal instability. The term plane of occlusion refers to an imaginary surface that theoretically touches the incisal edges of the incisors and the tip of occluding surfaces of posterior teeth. Because the term plane refers geometrically to a flat surface it is not entirely correct to describe the occlusal surface as following the true plane (Peter). The position of the dentition relative to the maxilla and mandible is influenced by the growth pattern of jaws (Willim *et al.,*). As the teeth erupts into the oral cavity and articulate with their opponents, the vector of forces delivered by the four paired muscle of mastication, functioning in accordance with the temperomandibular joint, manifests itself as a plane of occlusion (Meyer, 1950). Carefully conducted research has shown that the occlusal plane tends more often in early life to parallel the nasomeatal line than in adulthood. Due to growth pattern, differences of cranium and face revealed that the occlusal plane descends the same as it's posterior as it does at the anterior end, however the nasomeatal palne differs (Russell, 1953). The occlusal plane is one of the most important element involved in the occlusal reconstruction in restorative, prosthodontic and orthodontic treatment the presence or absence of posterior interferences depends primarily on the occlusal plane configuration. The relationship between the inclination of the occlusal plane involving the degree of curve of Spee and posterior disocclusion during forward and retrusive condylar movement were investigated in the study conducted by Hanashima *et al*. The result of their study indicated that increasing the inclination of occlusal plane provide posterior interference during protrusive mandibular movements, while posterior disocclusion is obtained during retrusive movement. Accentuation of curve of Spee prove elimination of posterior contact during retrusive condylar movements. Therefore, the occlusal plane inclination should be properly and carefully analysed and must be a part of thediagnosis and treatment planning prior to any occlusal reconstruction (Hanashima *et al.,* 2008). In the present study 40 patients were divided into two different age groups (Group A: 20-30yrs and Group B: 40-50yrs). All the patients were subjected to cephalometric analysis in order to evaluate the angle of plane of occlusion with respect to the Frankforts horizontal plane. The occlusal plane angles for all the studypatients were obtained using Auto-CAD 2013 software. Mean change in occlusion plane in group A was 9.85and in group B it was 8.15. The statistical analysis revealed significant difference in mean change in occlusion plane in two groups. In the present study AutoCAD 2013 software was used instead of manual cephalometric tracing method. The software is used widely in the field of Engineering for designing buildings which gives exact calculations of angles which is to be determined. Due to itsprecision, the software was recently introduced in the field of Orthodontics for determination of angle to reduce the manual errors while tracing.

Conclusion

- The plane of occlusion in the subjects of age group between 20-30 yrs by Cephalometric method showed a steep occlusal plane
- To plane of occlusion in the patients of age group between 40-50 yrs showed a reduced steepness in occlusal pane.
- Comparative analysis of plane of occlusion in above 2 groups showed a significant differnce in the steepness of occlusal plane as the age progresses the steepness in the plane of occlusion reduces.

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