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A COMPARISON OF THE SAGITTAL INCLINATION OF OCCLUSAL PLANE OF EDENTULOUS CASTS MOUNTED ON HANAU WIDE-VUE SEMI-ADJUSTABLE ARTICULATOR AND MEAN VALUE ARTICULATOR.

Dental Science

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ABSTRACT

The aim of this study was to determine the accuracy of sagittal inclinations of occlusal plane of maxillary edentulous casts mounted on Mean Value articulator in comparison with Hanau Wide-Vue semi-adjustable articulator. The sagittal inclinations of the occlusal plane of edentulous casts mounted on Hanau Wide-Vue varied from 4.5˚ to 16.8˚ with a mean of 11.41±3.07˚ and on Mean Value articulators varied from a 0.4˚ to 1.9˚ with a mean of 1.22± 0.35. The difference between the mean values of the sagittal inclinations as measured on both these articulators is highly significant ($p<0.01$) using the paired t-test for statistical analysis It can be concluded from this study that the Mean Value articulator is significantly inaccurate in reproducing the sagittal inclination of occlusal plane of edentulous casts in comparison with Hanau Wide-Vue articulator.

KEYWORDS

Occlusal plane, Mean value articulator, Hanau Wide-Vue, Facebow

Introduction

The orientation of occlusal plane is an important factor in patients rendered edentulous and should be relocated if complete dentures are to be aesthetic and to function satisfactorily. The orientation of occlusal plane is guided by the maxilla which is present in a specific position in relation to the condyles. A facebow transfer allows the maxillary cast to be placed in an equivalent relationship of the maxilla to the hinge axis on an articulator, using three points of reference, two being posterior to the maxilla and one anterior to it.[1] The use of a facebow to record the position of the occlusal plane in relation to the hinge axis in the patient and transferring the same to the articulator is an essential link for achieving the functional and aesthetic goals of treatment. Gross inaccuracies in the orientation of the casts on the articulator, in the absence of a facebow transfer, will manifest as interferences in occlusion during the mandibular movements. These prematurities will warrant additional efforts by the clinician to be corrected at the time of denture insertion.[2]

Two classes of articulators were considered in this study. One which accepts a facebow transfer i.e the Hanau Wide-Vue semi-adjustable articulator and the one that does not accept a facebow transfer i.e the Mean Value articulator.

Hanau Springbow is a facebow that uses orbitale as the third point of reference and its transfer is accepted by Hanau Wide-Vue semi-adjustable articulator. It is found that the sagittal inclination of the occlusal plane of edentulous casts mounted on Hanau Wide-Vue semi-adjustable articulator gives values closest to that of cephalometry which is considered the gold standard in measuring the occlusal cant radiographically.[3,4,5,6]

On the other hand, Mean Value articulators or "Free Plane Articulators" or "Three Point Articulators" are simple, non-adjustable type of articulators, designed using fixed dimensions of the average values of condylar and incisal guidance of the population that do not accept a facebow transfer based on Bonwill's theory of occlusion[7] These articulators neither accept a facebow record, nor do they allow any condylar or incisal adjustments thereby not permitting an anatomical articulation. Despite all these disadvantages, the Mean Value articulator continues to be one of the most popular articulators used for the fabrication of complete dentures.

In this study an attempt is made to measure and compare the sagittal plane inclinations of the occlusal plane as given by maxillary casts mounted on Hanau Wide-Vue semi-adjustable articulator and Mean Value articulator, thereby, to determine the accuracy of Mean Value articulator in reproducing the occlusal cant, without the use of facebow, in comparison with Hanau Wide-Vue semi-adjustable articulator in edentulous patients for fabrication of complete dentures.

Subjects and methods:

Thirty completely edentulous patients reporting to the Department of Prosthodontics of Yenepoya Dental College were selected for the study

1. Mounting the maxillary edentulous cast on Hanau Wide-Vue semi adjustable articulator:

- The maxillary denture base with the occlusal rim was inserted into the mouth of the patient sitting upright without head support and adjusted for visibility and lip fullness followed by orienting the occlusal rim such that anteriorly, the occlusal plane was parallel to the interpupillary line and posteriorly, parallel to the ala-tragal line.
- After ascertaining the correctness of the maxillary occlusal rim, bite fork of the Springbow (Hanau™ Spring Bow™ 010328. Made in USA) facebow was inserted into the occlusal rim 3mm above and parallel to the occlusal plane and then the facebow record was made using orbitale as the third point of reference on the patient's face.(Fig.1)



Fig. 1: Facebow record made using orbitale as the third point of reference on the patient's face

This record was subsequently transferred to a Hanau Wide-Vue semi-adjustable articulator (Hanau™ Wide-Vue 010885-000. Made in USA) according to manufacturer's instructions. The maxillary cast was mounted with dental plaster (Kaldent plaster, Kala Bhai Pvt Ltd., Mumbai, India) following this facebow transfer. The angle between the occlusal plane and the upper member of articulator was measured by Wixey's digital angle gauge (Wixey ™ Digital Angle Gauge with level (WR365). Made in China) such that it rests on the custom made iron plate which was in flush contact with the occlusal plane of the mounted maxillary edentulous cast. Wixey's digital angle gauge is a digital protractor with a range of +/- 180 degrees and a resolution of 0.1 degree that measures the degree of tilt of a level plane from a given reference plane. Hence, the reading on Wixey's digital angle gauge indicates the occlusal cant in the sagittal plane. (Fig.2)



Fig. 2: Measuring the sagittal inclination of occlusal plane using Wixey's Digital Angle gauge on Hanau Wide-Vue semi-adjustable articulator.

1. Mounting the maxillary edentulous cast on Mean Value articulator:

- The maxillary denture base with the occlusal rim was then repositioned in the patient's mouth along with the mandibular denture base and occlusal rim and vertical dimension of occlusion was adjusted to provide for 3-4 mm of freeway space and centric jaw relation was recorded.
- This maxillo-mandibular jaw relation was transferred to the Mean Value articulator (4" Disc Type Three point Articulator, Jabbar & Co, UP, India) keeping in mind the protocols to be followed i.e. the bilateral thread relation and the incisal pin relation, following which the edentulous maxillary cast was mounted. The sagittal inclination of the occlusal plane on this articulator was measured using Wixey's digital angle gauge in a similar manner as described for Hanau Wide-Vue semi-adjustable articulator.(Fig.3)



Fig. 3: Measuring the sagittal inclination of occlusal plane using Wixey's Digital Angle gauge on Mean Value articulator.

- The measurements of the sagittal inclinations of edentulous casts mounted on both the Mean Value articulator and Hanau Wide-Vue articulator were recorded. This procedure was repeated for all the 30 patients who were included in the study.

Results:

In Hanau Wide-Vue group the sagittal inclinations of occlusal plane of maxillary edentulous casts varied from a maximum of 16.8˚ to a minimum of 4.5˚ with a mean of 11.41±3.07˚. In Mean Value group the sagittal inclinations of occlusal plane of maxillary edentulous casts varied from a maximum of 1.9˚ to a minimum of 0.4˚ with a mean of 1.22± 0.35(Table1).

The difference in the mean values of the sagittal inclination of occlusal plane of edentulous maxillary casts mounted on Hanau Wide-Vue articulator and Mean Value articulator by the use of paired t-test. This difference is highly significant ($p<0.01$) (Table 2).

Discussion

The maxillary cast in the articulator is the baseline from which all occlusal relationships start.

Therefore it should be positioned in space by identifying three points of which two points are located posterior to the maxillae and one point located anterior to it. The anatomy of maxilla and the temporo-mandibular joint varies from person to person. Thus, recording of the orientation jaw relationship is very important which is done with the help of facebow record which helps in customizing the articulation of casts according to the patient's anatomy.[8,9]

It has been concluded by various studies[3,4,5,6] that Hanau articulators showed values closest to that given by cephalometry when determining the occlusal plane. In this study, the mean of the sagittal inclinations of occlusal plane as measured on Hanau Wide-Vue articulator is 11.4˚ which is similar to the results of the cephalometric study conducted by Seifert et al[10] and Ow et al[11] that shows the occlusal cant in reference to the Frankfort horizontal plane has mean values of 11.4˚ and 11.2˚ respectively.

On the other hand, the mean of the sagittal inclinations of occlusal plane measured on Mean Value articulator in this study is 1.22˚. This value, when compared with the mean value given by Hanau Wide-Vue semi-adjustable articulator (11.4˚), the difference is highly significant as determined by the statistical analysis done using paired t-test. The reason for this difference between the two articulators is based on the use of a facebow transfer. If the maxillary cast is positioned on articulator without the use of a facebow record, opening and closing movements in the articulator will not mimic the movements of the patient. An occlusion that is fabricated to an incorrect arc of closure or opening will show interferences in tooth contact.[4] According to a study by Morneburg et al[12] the occlusal errors evoked by the use of Mean Value articulator was shown to be ≥440 μm.

Similar results were shown according to a study by Proschel13 , where the occlusal errors in a Mean Value articulator exceeded 200 μ m at second molar in 16% of subjects and 300 μ m in 6% of subjects whereas the use of facebow reduced these rates to 1.3% and 0.3% respectively. These prematurities will warrant additional efforts by the clinician to be corrected at the time of denture insertion.

The Mean Value articulator is one of the commonly used articulators because it is presumed to be accurate as it is fabricated based on the average values taken from the population. As seen in this study, none of the 30 values of sagittal inclination of occlusal plane as measured on Mean Value articulator were even remotely close to Hanau Wide-Vue which gives values closest to the gold standard of cephalometry in recording the orientation of occlusal plane. Hence, the results of this study display the high level of inaccuracy of Mean Value articulator in reproducing the occlusal plane. Thus, it is imperative that the Mean Value articulators be modified in design in such a way that the cant of occlusal plane can be simulated as close to the average range as possible so as to allow the development of a satisfactory occlusion.

Conclusion

Within the limitations of this study, it can be concluded that the Mean Value articulator is significantly inaccurate in reproducing the sagittal inclination of occlusal plane of edentulous casts in comparison with Hanau Wide-Vue articulator, which gives values closest to the gold standard of cephalometry in determining the orientation of occlusal plane. Thus, the use of Mean Value articulator for the prosthetic

rehabilitation of an edentulous patient has to be limited unless modified in design to simulate the occlusal cant correctly.

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