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Evaluation of Arc of Closure Using Arbitary Ear Piece Face Bow and Semi- Adjustable Articulator an Invivo Study.

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Abstract: The goal of the Face Bow transfer is to detect the anterior-posterior and vertical relationship of the maxilla to the terminal hinge axis and to transfer the relationship to the articulator. This study was conducted to evaluate the precision of few arbitrary methods of recording Hinge Axis and the arc of closure of ten Edentulous patients who are undergoing treatment for the complete denture for the first time. By using different arbitrary methods, the arc of tracings were recorded using the semi-adjustable articulator with customised attached tracing device.

Keywords: Arc of closure,Arbitrary methods of face bow transfer,semi adjustable articulator with customised tracing device.

INTRODUCTION

The modern face bow was introduced by SNOW at the turn of twentieth century. Face bow helps to relate the arc of closure or hinge axis of the mandible to the cranium. The transfer of face bow recoding to the semi adjustable articulator helps the articulator to simulate the jaw movements more accurately,which in turn enables the operator to establish the occlusal contact with high degree of accuracy.

The hinge axis is an imaginary line that passes through the centre of rotation of each condyle of mandible. Different methods have been advocated to locate and transfer the hinge axis to the articulator. Important of them which are in existence are Arbitrary and Kinematic. The importance of hinge axis location for different prosthodontic procedures has been reported and various methods,equipment and head gear have been devised to locate this axis. The arbitrary method is still the most common method of determining the axis.

This study is conducted to evaluate the precision of a few arbitrary methods of recording hinge axis and the arc of closure of ten edentulous subjects who are undergoing complete denture treatment for the first time. By using different arbitrary methods, thearcs of tracings were recorded using the semi-adjustable articulator with customised attached tracing device.

AIMS AND OBJECTIVES

a. To evaluate the arc of closure tracing of the patient on a semi adjustable articulator.
b. To evaluate the arc of closure tracing on a semi-adjustable articulator based on the bonwill concept of occlusion.
c. To evaluate the arc of closure tracing on a semi-adjustable articulator using denar reference point.
d. To compare the different arc of closure recorded with arbitrary face bow with patient's original arc of closure.

MATERIALS AND METHODS

A total number of ten completely edentulouspatients were selected from the outpatient department of prosthodontics Tamilnadu government dental college and hospital,Chennai. The nature of study was explained to each patient and an informed consent was obtained.

An ear piece face bow was used in this study. A flag with measured dimensions was fixed on the left side of Ushaped frame of the face bow. A graph sheet waspasted on the flag to record the arc of closure tracing of the patientas well as to record the arc of closure tracing using a semi adjustable articulator.

A bite fork with two prongs and a straight stem and a stylus to hold the pencil was designed. The pencil was secured tightly to the stylus by means of a screw. This customised bite fork was attached to the lower occlusal rim. The bite fork was designed and fabricated with the help of the lathe machine.

After the selection of the patients primary impression was made with impression compound and primary casts were made with type II gypsum product. Custom trays were fabricated with chemically activated denture base resin with 1.5mm wax spacer. Then border moulding was done and secondary impression was made with zinc oxide eugenol paste and casts were poured with type III dental stone. The denture base and occlusal rims were made with autopolymerising resin and modelling wax. A tentative jaw relation was recorded and it was followed by face bow recording.

The arc of closure tracings were done in four methods.
METHOD I :(face bow record with customised bite fork)

The patient is seated in a comfortable position and the parts of the face bow are assembled in the patient in a conventional manner with the bite fork attached to the maxillary occlusal rim.

A customised bite forkwith a pencil mounted stylus fixed to its stem is heated and inserted into the mandibular occlusal rim. The mandibular occlusal rim is then reinserted into patients mouth and guided to close in centric relation. After establishing the jaw relation the patient is asked to open and close the mouth from retrudedposition. The arc of closure is recorded on the device attached to the left side of the face bow. This is considered as the true arc of closure of the patient.

METHOD 2:(relating the patient to the articulator and using customised bite fork)
After the procedure, the ear piece clamps are loosened and the entire assembly is centred to the articulator with the help of the condylar rods and the orbital plane indicator to orient the proper plane. Now the maxillary cast is attached to the articulator with the help of plaster. Now the lower rim is assembled on the to the maxillary rim with the help of bite registration record and the lower cast is thus articulated. Now the entire face bow assembly is repositioned using maxillary occlusal rim.

The customised bite fork with a pencil mounted stylus is positioned to the lower occlusal rim. Now the upper member of the articulator is moved upwards and backwardsin an arc. The arc of closure tracing is recorded on the graph sheeton the flag attached to the left side of the u shaped frame.

METHOD III: (based on Bonwill concept of occlusion):
According to Bonwill's theory teeth move in relation to each other as guided by the condylar and incisal guidances. According to this theory the distance between the condyles is equal to the distance between condyle and the midpoint o the mandibular incisors.

The face record is repeated for the patient as usual and transferred to the articulator but utilising the central mark on the incisal rod to orient the anterior occlusal plane. Articulations of maxillary and mandibular rims are done in a regular way as said earlier. The arc of closure recording is also done with the help of the customised bite fork.

METHOD III (based on Denar reference plane locator):
A denar reference plane locator is used to locate the anterior reference plane which is marked 43mm above the upper bite block in the edentulous patient. The lower orbital margin of the patient is palpated and marked. The distance between the lower orbital region mark and the base of the occlusal plane is measured using Vernier callipers,and this distance is marked in the articulator from the base to a point on the incisal rod. This point here will establish the plane of orientation for the maxillary occlusal rim.

The face record is repeated for the patient as usual and transferred to the articulator but utilising the mark of Denar reference plane on the incisal rod to orient the anterior occlusal plane. Articulation of maxillary and mandibular rims is done in a regular way as said earlier and the arc of closure recording is also done with the help of the customised bite fork.

The original arc of closure of the patient scribed is taken as reference and the other three arc of closure using three different arbitrary methods are compared.

RESULTS

In this study the proximity of arc of closure tracings obtained were compared and the results were analysed statistically using one way Annova test to assess the significant difference between groups. The results were statistically significant at 1% level.

The Newman Keuls multiple comparison testsdepicts the different groups were statistically significant at 1% level

DISCUSSION

This study was conducted to evaluate the precision of a few arbitrary methods of recording hinge axis and the arc of closure .three types of arbitrary methods were used in this study viz meatus type arbitrary face bow using infra orbital notch as anterior reference point,the bonwill concept of occlusion and the denar reference point.

While it is desirable to place an arbitrary axis as close as possible to the kinematic one,the results obtained indicate that none of the arbitrary methods used were ideal for locating the hinge axis. The findings suggested that the palpation method can be accepted for locating the condylar axis.

The most common plane used as reference for the face bow transfer is the Frankfurt plane (porion- orbitale) some systems use this point to determine a new plane (axis orbitale). It has been assumed that this plane and the hard tissue Frankfurt plane were roughly coincidental.

Alignment of the maxillary cast according to the Frankfurt horizontal and the axis-orbitale plane therefore implies inadequate mounting in the articulators with a design assumption that places the axis and the orbitale on a plane parallel to the horizontal. The result is an overly steep angulation of the occlusal plane with the incisal edges of the maxillary anteriors placed too inferiorly when compared to NHP. The use of NHP in conjunction with the horizontal plane can limit individual an racial variations that have been commonly described for the classic intracranial reference planes and eliminate the described orientation errors that occur when the maxillary casts are mounted in the articulator.

The relative position of anatomically defined landmarks is influenced by racial variation, gender differences and operator expertise in the identification of markers.in addition, the arbitrary landmarks and measurements used are based on average values designated on the basis of normative data, which may be unsuitable for subjects with large differences in size or shape as a result of age, gender, or facial asymmetry. The conventional face-bow recording relates a maxillary cast to the condylar assemblies of an

articulator and the Frankfurt plane, and is assumed to reproduce the spatial orientation of the patient's maxilla.

SUMMARY AND CONCLUSION

This study demonstrated a significant statistical difference between the arc of closure recorded using an ear piece face-bow and the arc of closure recorded, based on a few arbitrary methods, with the help of a semi adjustable articulator from the results of the study. The arc of closure tracings recorded in the method and categorized under group B was found to be more nearer to the original of arc of closure scribed by the patient on the recording device attached to the ear piece face-bow.

Furthermore, the arbitrary ear piece face bow method is not accurate in transferring the face bow recordings and arc of closure. The usage of arbitrary face-bow in complete denture patients has been executed successfully for so many years. Hence the Arbitrary face bows can be used successfully within their limitations.

FACE-BOW RECORDING

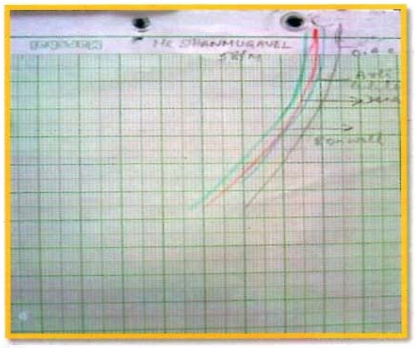
DENAR REFERENCE POINT MEASURED

DIGITAL VERNIER CALIPER

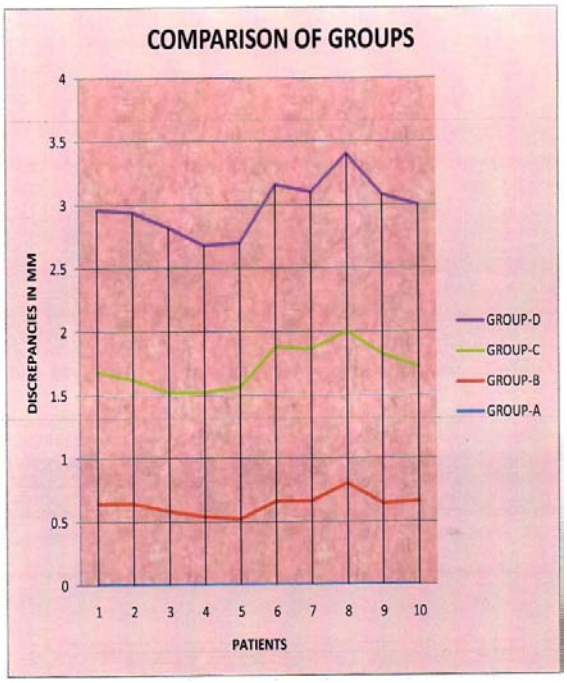
RELATING THE PATIENT TO THE ARTICULATOR

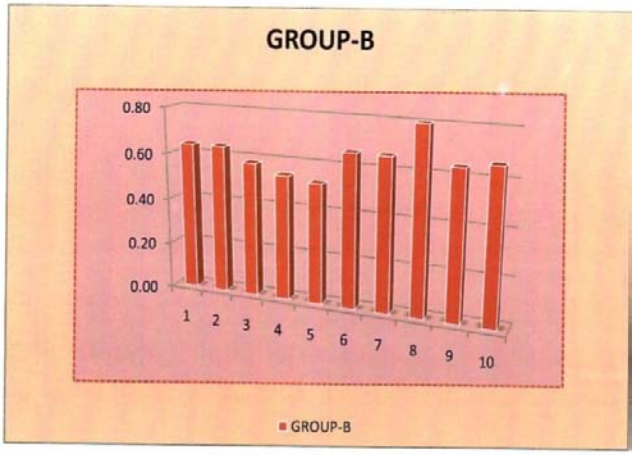
RELATING THE PATIENT TO THE ARTICULATOR BASED ON BONWILL CONCEPT

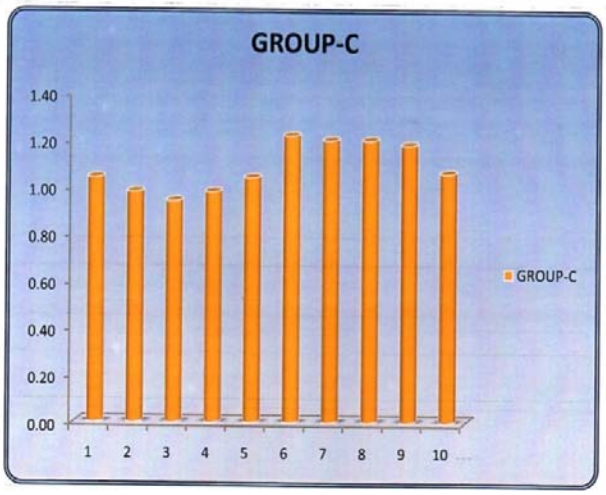
DENAR CONCEPT



ARC OF CLOSURE TRACINGS







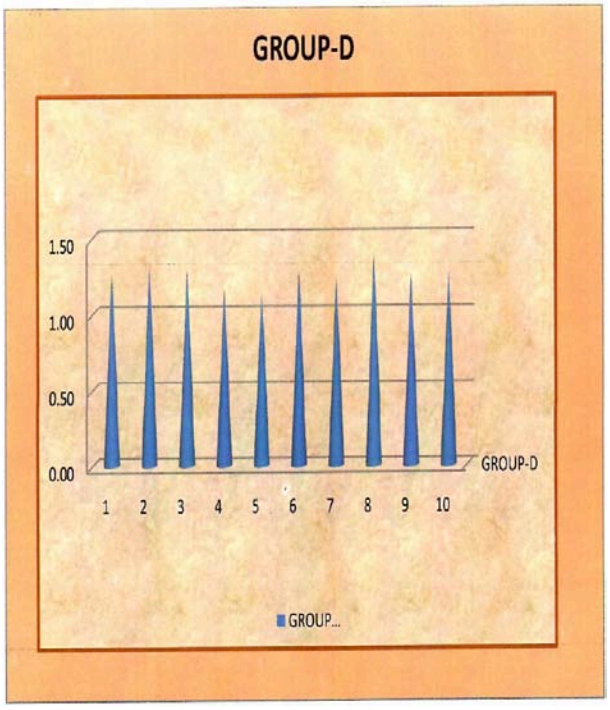


Table – II : Mean and standard deviation of different measurement locations among various groups.

GROUP-A		GROUP-B		GROUP-C		GROUP-D	
MEAN (mm)	S.D (mm)	MEAN (mm)	S.D (mm)	MEAN (mm)	S.D (mm)	MEAN (mm)	S.D (mm)
0	0	0.51	0.11	0.94	0.18	1.24	0.14
0	0	0.56	0.11	1	0.12	1.2	0.11
0	0	0.69	0.12	1.11	0.17	1.27	0.10
0	0	0.32	0.25	0.52	0.44	0.56	0.55
0	0	0.35	0.21	0.56	0.34	0.62	0.42

TABLE-III : SUMMARY OF ANOVA TEST RESULTS

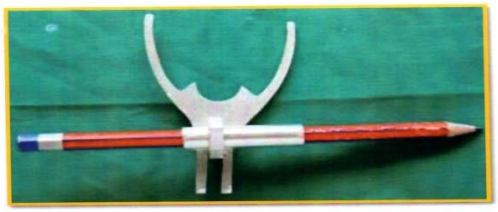
ANOVA TABLE	SS	DF	MS	PVALUE
TREATMENT BETWEEN COLUMNS	9.537	3	3.179	P<0.0001
REIDUAL (WITHIN COLUMNS)	0.2063	36	0.005731	
TOTAL	9.743	39		
NEWMANKEUELS MULTIPLE COMPARISON TEST	MEAN DIFFERENCE	q	SIGNIFICANT	
GROUP-A Vs GROUP-D	-1.266	52.88	***	
GROUP-A Vs GROUP-C	-1.084	45.28	***	
GROUP-A Vs GROUP-B	-.634	26.48	***	
GROUP B Vs GROUP-D	-.632	26.40	***	
GROUP-B Vs GROUP-C	-.45	18.80	***	
GROUP-C Vs GROUP-D	-.182	7.60	***	

*** -DENOTES SIGNIFICANT AT 1% LEVEL

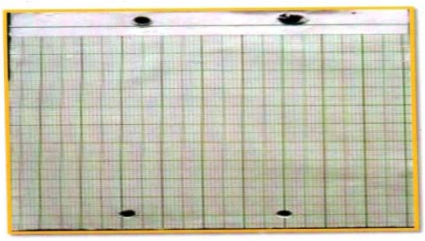
ARMAMENTARIUM

FACE-BOW WITH ATTACHED FLAG

CUSTOMIZED LOWER BITE FORK



CUSTOMIZED BITE FORK WITH TRACING STYLUS



GRAPH SHEET PASTED ON THE FLAG TO RECORD TRACING

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