

# A Clinical Evaluation of the Condylar Guidance using Orbitale & Incisal Notch as Anterior Points of Reference For Facebow Transfer on Edentulous Subjects

**Dr. Shilpa Khullar**  
Professor,  
Dept of Prosthodontics,  
IPDC, Ghaziabad, U.P

**Dr. Mariette D'souza**  
Professor & H.O.D.,  
Dept. of Prosthodontics,  
P. D. C. & Hospital, Udaipur.

**Dr. Anika Mittal**  
Professor & H.O.D. ,  
Dept. of Conservative Dentistry,  
I.P.D.C., Ghaziabad, U.P.

**Dr. Pankaj Datta**  
Professor & H.O.D.,  
Dept. of Prosthodontics,  
I.P.D.C., Ghaziabad, U.P

**Dr. Mohit Kumar**  
Professor ,  
Dept. of Prosthodontics,  
S.D.C., Ghaziabad, U.P

## Abstract

This study was carried out on ten edentulous subjects in the age group of 40-65 years, with no history of TMJ dysfunction or pain. It was conducted to evaluate, the difference in the condylar guidance readings obtained using two anterior reference points for orientation of maxillary cast. The two anterior reference points were the orbitale and the incisal reference notch, on the Hanau articulation H-2, 145 series.

Edentulous subjects were chosen, to prevent occlusal interference of the teeth during protrusive movements of the mandible as seen in dentulous patients.

Balanced occlusion and an accurate plane of occlusion are necessary for the stability of complete dentures, for the health of the oral tissues and good esthetics.

One part of occlusal rims were adjusted in the patients mouth for esthetics and phonetics. A facebow record was made using ear piece facebow, and the two maxillary casts were oriented on two Hanau articulators, one using orbitale as anterior point of reference and the other using incisal notch as anterior point of reference. Protrusive records obtained from the patient were used to adjust the condylar inclination on both semi-adjustable articulators.

**Key Words** : Balanced occlusion, anterior reference point, condylar guidance, facebow transfer

## Introduction

The maxilla has a definite three dimensional relationship, to all condylar motions of the mandible. The face-bow transfer is the first step in recording the relationship of the maxillary arch to the condylar paths. Once the maxillary cast is oriented on the articulator, the centric relation record completes the static or starting relationship between the maxilla and the condyles in the temporomandibular fossa. From this static starting position, dynamic eccentric condylar movements are imitated by means of eccentric interocclusal records or extra-oral tracings.

The two essential steps which are necessary to orientate the maxillary casts on the articulator are, firstly, the transverse hinge axis of the patient and secondly, an anterior point of orientation selected which forms a horizontal plane of reference when a line is drawn through this point and transverse hinge axis.

In facebow transfer, the anterior reference point (infraorbital notch) together with the two posterior opening axis reference points (hinge points) form the axis orbital plane. The facebow transfer allows the maxillary cast to be transferred to an articulator so that the occlusal plane has a relationship to the opening axis that is similar to that in the patient's skull, with the head of the subject oriented in the esthetic reference position.

Most articulator systems have incorporated this concept of orbital plane, being parallel to the reference horizontal into their design and use orbitale as the anterior reference point for transferring the vertical position of the maxillae to the articulator.

McCollum first introduced the Frankfort horizontal plane to prosthodontics in 1939 when orientation that he justified as being "horizontal or nearly so, when the body is erect". This plane has been cited as easily accessible, well defined and coinciding well with the true horizontal plane relative to natural head position. Natural head position is the position of the head most comfortable for a patient gazing at the horizon.

Variation exists in selection of the anterior point of orientation. Some techniques call for the use of an orbital pointer which is placed near the top of the articulator for maxillary cast mounting. Others use the incisal edge of the teeth or occlusal rim which can be made in level with the notch on the incisal guide pin on the Hanau articulator. According to Lawrence A. Weinberg<sup>26</sup> these various anterior points of reference raise or lower the anterior part of the face-bow. Lowering the occlusal

plane increases the condylar readings and elevation of the occlusal plane decreases the condylar readings.

## Aim

The aim of this study is to evaluate the difference in the condylar readings in an edentulous group of people using two anterior reference points; the orbitale and the incisal reference notch for facebow transfer in a Hanau semi adjustable articulator.

## Materials And Methods

A total of ten patients who presented for routine treatment for complete maxillary and mandibular dentures were selected for this study. The subjects had no history of TMJ pain dysfunction syndrome, overt pathological conditions or history of any systemic diseases. They had an orthognathic ridge relationship with good ridge height and no significant undercuts.

Every subjects maxillary and mandibular edentulous master casts were duplicated into two sets, using Alginate (Zelgan, Dental Products of India) material. A set of maxillary and mandibular occlusal rims were made on the master casts with shellac baseplate and modelling wax. These rims were adjusted in the patients mouth for esthetics and phonetics. The occlusal plane was made parallel to the Camper's plane (a line extending from the middle of the tragus to the ala of the nose). Then, the mandibular occlusal rim was adjusted to uniformly contact the maxillary occlusal rim with an interocclusal distance of 2-3 mm.

## Earpiece facebow registration

The Hanau earpiece facebow, Cat. No. 153-5 was used to record the positional relation of the patient's maxillary ridge and condyles and transfer this relationship to the Hanau H-2, 145 series articulator.

The bitefork was attached to the maxillary occlusal rim with its midline coinciding with the midline of the patients face, marked on the rim and seated into the patients mouth.

The nylon earpieces of the facebow were made to enter the external auditory

meatus of the patients ears. The frame was slid laterally to symmetrically adjust the scales while maintaining a comfortable, yet secure suspension of the nylon earpieces in the meatus. Both the frame thumbscrews were tightened to maintain this symmetry of suspension. Also the bite clamp thumbscrew was tightened to lock the bite fork relationship, to the facebow.

Next the orbital pointer was inserted in the orbital clamp of facebow 153-5 and made to lightly touch the infra-orbital notch on the patient's face, tightening the thumbscrew to maintain this alignment.

The two frame thumbscrews were released and the scales with the nylon earpieces were withdrawn from the meatus. The entire facebow assembly was removed from the patient for an accurate transfer to the articulator.

#### **Articular preparation:**

Two Hanau H-2, 145 series articulator were used to accept the patient's facebow record. The horizontal inclination of both condylar guidance was adjusted to 700 and the thumbnuts tightened. Lateral inclination of both condylar posts and the incisal guide were adjusted to 00.

The earpiece facebow assembly was attached to the first articulator by equally adjusting the scales to attach the nylon earpieces securely over the auditory pins on the centric locks.

The anterior reference point used for this articulator for mounting the first maxillary cast was the orbital pointer by adjusting the elevating screw to raise or lower the facebow, until the orbital pointer was on a level with the orbital indicator.

The maxillary occlusal rim with the biteplane was supported with the Hanau cast support, Cat. No. 97-0 to carry the additional weight of the maxillary cast and dental plaster mounting media. The maxillary cast was then placed over the occlusal rim and mounted to the upper member of the articulator, using dental plaster.

Upon complete set of dental plaster mounting, the same facebow record was carried to the second articulator to mount the second maxillary cast using the incisal reference notch on the incisal pin as a reference point. The elevating screw was adjusted to align the incisal level of the maxillary occlusal rim with the incisal notch. Then, the master cast was placed

over the supported maxillary occlusal rim for mounting using dental plaster. Once the dental plaster mounting had completely set, the facebow assembly was detached from the articulator and the bite fork removed from the maxillary occlusal rim.

#### **Mounting Mandibular Cast**

The maxillary and mandibular occlusal rims were carried to the patients mouth and a tentative centric jaw relation record was made at the vertical dimension of occlusion.

The Hanau articulator was inverted on the Hanau plastering stand, Cat. No. 96-0 and the two occlusal rims placed over the maxillary cast, followed by placing the mandibular cast. A thin layer of petroleum jelly was applied on the keyways of the mandibular cast prior to its mounting to the lower member of the articulator.

#### **Fabrication of stabilized base plates**

One set of stabilized base plates using autopolymerizing acrylic resin were fabricated on the master cast, using "sprinkle-on" method. An intra-oral tracing device was attached to the record bases. The central bearing point was attached to the maxillary record base and the metal plate was attached to the mandibular occlusal rim made of impression compound. The plate was parallel to the maxillary record base and the bearing point was adjusted to gently touch the tracing plate at the same vertical dimension of occlusion.

#### **Registration of centric and protrusive records**

Inlay wax used as recording medium, was melted and a thin layer was smeared on the tracing table. The bases were then placed in the patients mouth. The patients went through a practice period during which they were guided into centric relation from which they made a right lateral, a left lateral and a protrusive mandibular movement to obtain a sharp arrow-point tracing on the tracing plate.

A locking device made of a plastic disc with two holes drilled at a distance of 6 mm., was placed on the tracing table such that one hole corresponded to the apex of the tracing and the second one was on the protrusive pathway. Then, the patient was guided into centric relation, so that the central bearing point was locked at the same position, while the recording material was being injected.

A precision, extra-hard, addition curing silicone impression (Registrado, Voice,

Germany) was then injected in between the record bases and near the central bearing point. Once the centric record is retrieved, the patient is guide to a protrusive position, 6 mm anterior to the centre and the recording material was injected to obtain a protrusive record.

#### **Remounting Mandibular Casts**

The centric relation record was interposed between the stabilized record bases and luted with rubber base adhesive. The maxillary record base was seated on the maxillary cast and the mandibular cast was seated on the luted mandibular record base. A mixture of dental plaster was mixed and placed over the mandibular cast. The lower member was swung over to bring the incisal pin into contact with the incisal guide table.

The same procedure was repeated to remount the 2nd mandibular cast to the second articulator.

#### **Observations And Results**

All the readings after having been recorded were tabulated in Tables I to IV.

Table I shows a total number of 10 cases, of which six were men and four were women, with the oldest being 65 years and youngest 40 years of age. The condylar readings obtained from each subject on the right (RT1) and left (LT1) sides are shown using the incisal reference notch on the Hanau articulator, as an anterior reference point of orientation. The maximum reading was 40° on right side and 45° on left side. The minimum reading was 25° on both right and left sides.

Table II shows the condylar readings obtained from the same subjects on the right (RT2) and left (LT2) side using the orbitale as anterior reference point of orientation. The maximum reading was 55° on both right and left sides whereas the minimum reading was 40° on right and left sides.

Table III shows comparison of mean condylar readings, with standard deviation and standard error between variables RT1 and RT2. The t-value obtained was -6.78 and p value was less than 0.0001 which was found to be statistically significant.

Table IV shows comparison of mean condylar readings with standard deviation and standard error between variables LT1 and LT2. The t-value obtained was -10.38 and p value was less than 0.0001 which was found to be statistically significant.

The mean condylar readings on both right and left sides were lesser using the

incisal reference notch as anterior reference point when compared to the mean condylar readings on right and left sides using orbitale as anterior reference point of orientation.

**Table 1**  
Condylar readings using incisal notch as anterior reference point

Name	Age	RT1	LT1
KAMATH	63	40	40
BHARATHI	65	35	33
SUMATHI	53	25	30
SUBRAYA	56	40	35
ROBERT	47	40	30
LAWRENCE	60	35	25
PADMAVATHI	52	35	33
LEENA	40	37	45
SUNDAR	58	35	33
GURUDHAS	51	33	30

**Table II**  
Condylar readings using Orbitale as anterior reference point

Name	Age	RT2	LT2
KAMATH	63	55	50
BHARATHI	65	40	45
SUMATHI	53	52	50
SUBRAYA	56	50	45
ROBERT	47	48	46
LAWRENCE	60	52	40
PADMAVATHI	52	44	40
LEENA	40	52	55
SUNDAR	58	46	50
GURUDHAS	51	48	45

**Table III**  
Statistical Analysis comparing variables RT1 & RT2

Variable	Number of cases	Mean	SD	Standard error	t value	p value
RT1	10	35.5	4.478	1.416	-6.78	<0.0001
RT2	10	48.7	4.473	1.415		

**Table IV**  
Statistical Analysis comparing variables LT1 & LT2

Variable	Number of cases	Mean	SD	Standard error	t value	p value
LT1	10	33.4	5.641	1.784	-10.38	<0.0001
LT2	10	46.6	4.719	1.492		

## Discussion

The goal of the facebow transfer record is to record the anteroposterior and vertical relationship of the maxilla to the transverse horizontal axis and to transfer this relationship to the articulator. Failure to transfer accurately, the anteroposterior relationship can result in substantial errors in the final occlusion of a prosthesis while failure to transfer the correct vertical relationship can result in esthetic errors. In complete dentures this can result in an improperly oriented occlusal plane, denture instability and decreased masticatory efficiency<sup>5</sup>.

According to Lawrence A. Weinberg these anterior points of orientation raise or lower the anterior part of the facebow within 16 mm. This raising or lowering of

the facebow mounting has no effect on centric occlusion but does effect the eccentric condylar readings which influence cusp inclines. He concluded that, elevation of the occlusal plane decreases the condylar readings whereas lowering the occlusal plane increases them. The study was carried out on dentulous subjects<sup>7</sup>.

Therefore, to correlate the results obtained by Lawrence A. Weinberg, this study was carried out on edentulous subjects to evaluate the difference in the condylar readings obtained, using two anterior reference points; orbitale and incisal referene notch for facebow transfer on a Hanau articulator.

The topography of the condyle and glenoid fossa can effect the condylar guidance since the condylar path is determined by the distal slope of the articular eminence. Flatter the curvature of the condyles, lesser will be the horizontal condylar guidance<sup>8</sup>. The condylar guidance of a patient will remain constant, if there is no TMJ dysfunction or flattening of the condyles or malocclusion. The condylar guidance is also influenced, by the muscles,

ligaments and soft tissues of TMJ.

An ear facebow was used to record the relationship of the maxillary arch and to transfer it to the articulator. The ear facebow technique has clear advantages over the most widely used methods of arbitrary axis location. The accuracy, speed of handling and simplicity of orienting maxillary casts are recommendations for its use<sup>9</sup>.

In this study only one set of occlusal rims and one set of autopolymerizing acrylic resin record bases made to standardize the method. Needle point tracing or Gothic Arch tracing procedure was considered to be a reliable procedure to record the centric and eccentric movements of the mandible, as it could be accurately reproduced. Also, because, the needle point tracings at a given vertical dimension of jaw separation, under

the same controlled conditions, on the same individual, at the same sitting, were no significantly different. The interocclusal record used for this study was a silicone based impression material. It has properties of rigidity, dimensional stability and extra hardness. It is accurate than zinc-oxide eugenol pastes or recording waxes which were consistently unreliable<sup>3</sup>.

The results of this study showed that using the orbitale as anterior reference point resulted in a steep anteroposterior angulation. The condylar readings obtained were 40° to 50° instead of the expected 30° 40°. These results were similar to the findings reported by John H. Pitchford<sup>5</sup> and Lundeen<sup>8</sup>. The condylar readings obtained using the incisal reference notch as anterior point of reference were 30° 40° among the same subjects. The readings on the right and left sides of the same subject were not significantly different, using one method.

As supported by Bailley JO and Nowlin TP<sup>1</sup>, it was seen in this study that, using Orbitale as anterior reference point to orient the maxillary cast, places the maxillary cast too far inferiorly on the articulator resulting in steepening of the horizontal condylar guidance angle, making the mounting of mandibular cast difficult in a short mount Hanau articulator.

In studies done dentulous subjects, it was relatively easier to orient the maxillary cast in accordance to the incisal reference notch, as maxillary anteriors were made in level to the notch. But this study has a limitation of having an operator variable to orient the maxillary occlusal rim in level with the incisal notch, as the height of occlusal rim set for esthetics and phonetics will vary with each operator.

## Summary And Conclusion

From the results obtained it was concluded that:

1. The condylar inclination obtained by both the methods were significantly different from each other. The condylar inclinations obtained using the orbitale method were relatively steeper (40° 50°) than those obtained from incisal notch method (30° 40°).
2. Orbitale used as an anterior point of reference, oriented the maxillary cast too far inferiorly on the articulator thus making the mandibular cast mounting difficult



**Referances**

1. Bailey JO, Nowlin TP: Evaluation of the third point of reference for mounting maxillary casts on the Hanau articulator; J. Prosthet. Dent 1984; 51:199-201.
2. El-Aramany MA, George A. Scott RH: Evaluation of the needle point tracing as a method of determining centric relation; J. Prosthet. Dent 1965; 15: 1043-1053.
3. Fattoere, Malone, Sandrik, Mazur, Hart: Clinical evaluation of the accuracy of interocclusal recording material; J. Prosthet. Dent 1984; 51:152-157.
4. Gonzalez, Kingery RH: Evaluation of planes of reference for orienting maxillary casts on articulators; J. Am. Dent. Assoc 1968; 76:329.

5. John H Pitchford: A reevaluation of the axis-orbitale plane and the use of orbitale in a facebow transfer record; J. Prosthet. Dent 1991; 66:349-355.
6. Klein IE, Soni: Stabilized record bases for complete dentures; J. Prosthet. Dent 1979; 42:584-587.
7. Lawrence A. Weinberg: An evaluation of the facebow mounting; J. Prosthet. Dent. 1961; 11:32-42.
8. Lundeen HC: Mandibular movement recordings and articulator adjustments simplified. Den. Clin. North Am. 1979; 23:231-241.
9. Walter Teteruck, Harry Lundeen: The accuracy of an ear facebow; J. Prosthet. Dent 1966; 16:1039-1045.

**Legends**

- Fig. 1 Materials Used
- Fig. 2 Armamentarium
- Fig. 3 Facebow recording on a patient
- Fig. 4 Facebow record transferred to the articulator using Incisal notch as anterior reference point
- Fig. 5 Facebow record transferred to the articulator using Orbitale as anterior reference point
- Fig. 6 Lateral view of the Facebow mounting using Orbitale as anterior reference point
- Fig. 7 Lateral view of the Facebow mounting using Incisal notch as anterior reference point
- Fig. 8 Interocclusal record
- Fig. 9 Horizontal condylar reading (35°) using Incisal notch as anterior reference point



Fig. 1

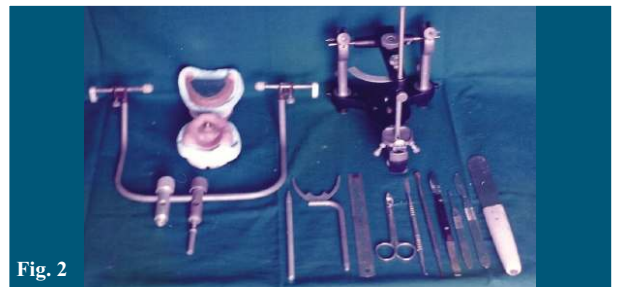


Fig. 2



Fig. 3

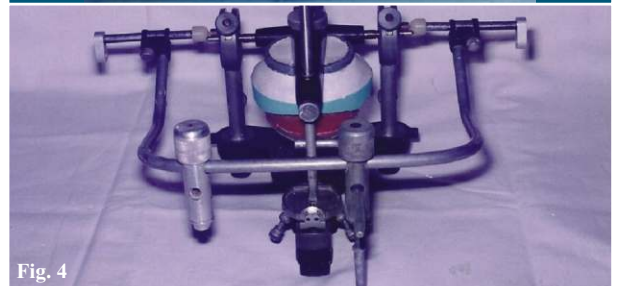


Fig. 4

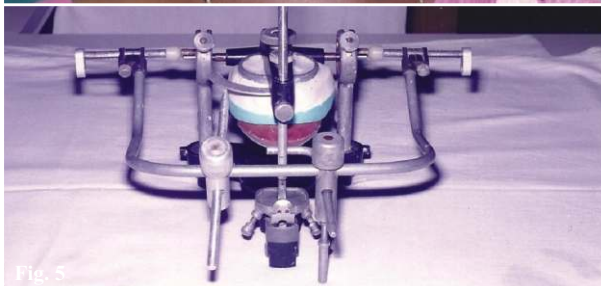


Fig. 5

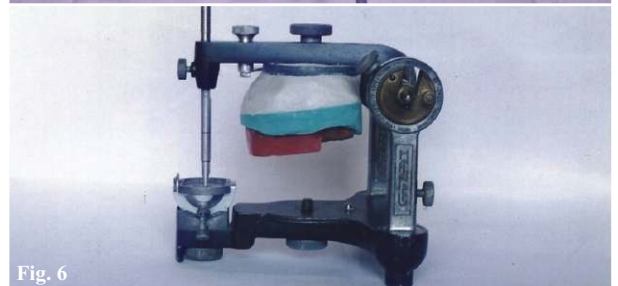


Fig. 6



Fig. 7

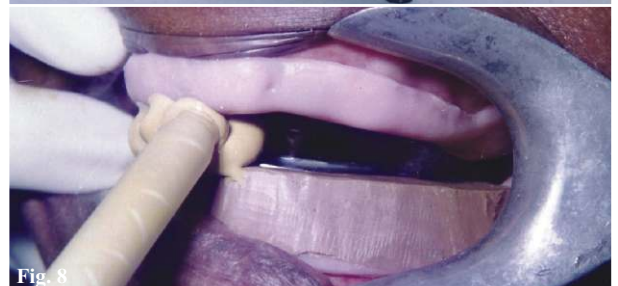


Fig. 8



Fig. 9



Fig. 10