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FACEBOW

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RUNNING TITLE: FACEBOW
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ABSTRACT
Hinge axis is defined as an imaginary line passing through the two mandibular condyles around which the mandible rotates without translatory movement. Face bow helps to relate the arc of closure or hinge axis of the mandible to the cranium. It records the opening & closing path of movement. Face bow transfer is an integral part in analyzing & studying the occlusion. Face bow record helps in securing anteroposterior positioning of cast in relation to condyles. It also helps in achieving the exact anteroposterior or vertical positioning of cast in relation to condyles.

Keywords; Facebow, complete denture, hinge axis, occlusal plane, maxilla-mandibular movement.

1. INTRODUCTION

Restorative dentistry always requires a series of appropriate clinical laboratory procedures and a reliable armamentarium of instruments for successful treatment given to the patient. Each single phase of these procedure should be executed with accuracy, skill and speed to comply with the biological conditions of the patient. A prosthesis which has the closest resemblance to the oral cavity should also harmonize with the various jaw movements which are determined by the anatomical form of temporomandibular joint[1].
Complete denture prosthesis involves important factors in the control of the operator. The operator is concerned with the determination of the incisal guidance, plane of orientation and condylar guidance. Maxilla is a part of the cranium and is a fixed entity. When the teeth of both jaws come in contact, maxilla becomes related to the mandible so that entire cranio-maxillary complex is articulated with a moving bone, which is the mandible. Hinge axis is defined as an imaginary line passing through the two mandibular condyles around which the mandible rotates without translatory movement[2].
Face bow helps to relate the arc of closure or hinge axis of the mandible to the cranium. It helps to records the opening and closing path of movement. Face bow transfer is an integral part in analyzing and studying the occlusion[3].

2. DEFINITION

An instrument used to record the spatial relationship of the maxillary arch to some anatomic reference point or points and then transfer this relationship to an articulator, it orients the dental cast in the same relationship to the opening axis of the articulator, customarily the anatomic references are the mandibular transverse horizontal axis and one other selected anterior reference point[4]. - GPT 9

3. SIGNIFICANCE OF FACEBOW

- It permits a more accurate use of lateral rotational points for arrangement of teeth.
- It aids in securing antero-posterior positioning of the cast in relation to the condyles. A correct horizontal plane is established.

- The facebow transfer record is an integral part in analyzing and studying the occlusion of the natural teeth.
- Therefore, the incisor plane is also properly established and finally it helps in vertical positioning of the casts in articulators.
- It should be used for mounting the upper cast on any articulator that has a fixed axis of opening[2].

4. CLASSIFICATION OF FACEBOW

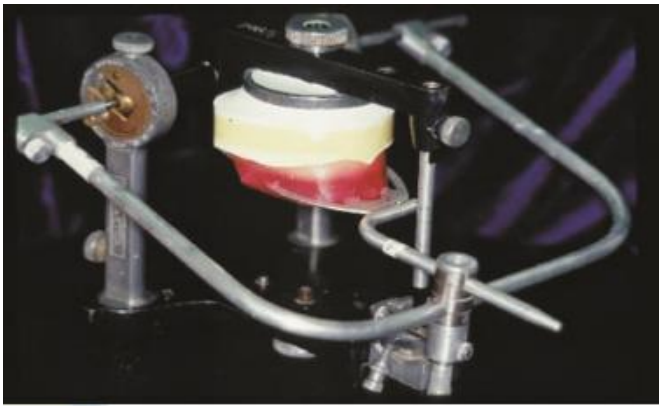
- Arbitrary
  - Fascia – Nasal relator
  - Ear Piece – orbital indicator
- Kinematic

ARBITRARY FACEBOW

Arbitrary type of facebow approximately located the hinge axis. It is commonly used for complete denture construction. This type of face bow generally located the true Hinge axis within a range of 5 mm. It uses arbitrary or approximate points on the face as the posterior points and condylar rods are positioned on these points. It is further classified as fascia and ear piece type of facebow.

FASCIA TYPE

The fascia type of face bow utilizes approximate points on the skin over the TMJ as the posterior reference points. These reference points are located by measuring from certain anatomical landmarks on the face. While using the facia facebow, the center of condyle is arbitrarily located on the side of the face 11-13 mm anterior to the tragus on a line connecting the superior border of the tragus and the outer canthus of eye. It has a disadvantage that it is placed on the skin which is movable and so there is a tendency for the condylar rods to displace. It also requires an assistant to hold the face bow in place. Eg: Hanau **132-25m and Hanau 132-2c**



EAR PIECE TYPE

These facebow uses the external auditory meatus as an arbitrary reference point which is aligned with ear pieces similar to those on a stethoscope. It helps to accurate relationship for most diagnostic and restorative procedures. It has an advantage that it is simple to use, does not require measurements on face. It is as accurate as other face bows and it provides an average anatomic dimension between the external auditory meatus and horizontal axis of mandible. Ex: **Hanau 164-2 twirl bow.**

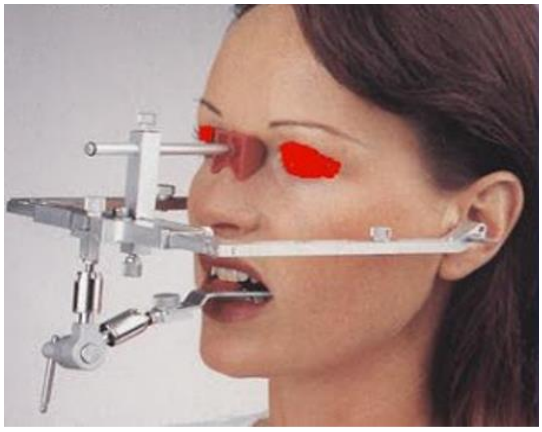
Ear piece facebow is further classified as

- **Spring bow type**
- **Whip mix face bow**

KINEMATIC FACE BOW

Kinematic facebow is used to determine and locate the exact hinge axis. This facebow is generally used in the fabrication of FPD and FMR cases. The hinge axis of the mandible can be determined by a clutch - a

segmented impression tray like device attached onto the mandibular teeth with a suitable rigid material such as impression compound. It is indicated in when it is critical to precisely reproduce the exact opening and closing movement of the patient to the articulator, but it had disadvantage that it is expensive, require extensive chairside assistance[2].



PARTS OF FACE BOW

- U-shaped frame
- Condylar rods
- Bite fork
- Locking device
- Third reference point marker

U-SHAPED FRAME

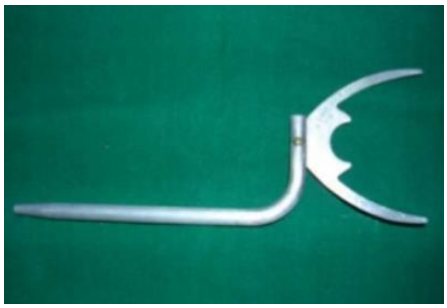
It forms the main frame of the face bow. All other components are attached to this frame. It extends from the region of TMJ on one side to another side without contacting the face

CONDYLAR RODS

Two small metallic rods on either side of the free end of the U-shaped frame that contact the skin over the TMJ. They are used to locate the hinge axis and then transfer it to the articulator. Some face bows have ear pieces that fit into the external auditory meatus instead of condylar rods

BITE FORK

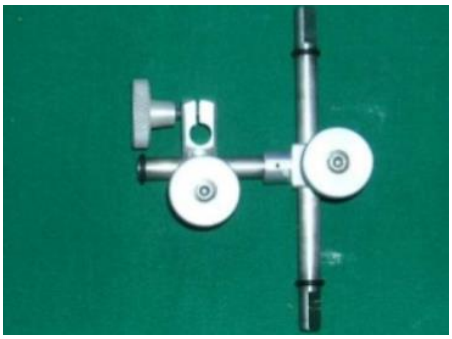
"U" shaped plate, which is attached to the occlusal rims, used while recording the orientation relation. It is attached to the frame with the help of a rod called the stem. The bite fork should be inserted about 3mm below the occlusal surface within the occlusal rim.



LOCKING DEVICE

This part of the face bow helps to fix the bite fork to the U-shaped frame firmly after recording the orientation relation. This also supports the facebow, occlusal rims and the casts during articulation. It consists of a transfer rod and a transverse rod. The U-shaped frame is attached to the vertical transfer rod. The position of this transfer rod can be locked with a thumb screw.

The horizontal transverse rod connects the transfer rod with the stem of the bite fork. After positioning the U-shaped frame and the bite fork, the horizontal transverse rod is positioned. It can be positioned automatically by attaching to the transfer rod and the bite fork and tapping it. This type of assembly where the transverse rod gets automatically positioned when tapped is an auto-adjusting or self-centering assembly.



THIRD REFERENCE POINT MARKER

It is used to orient the face bow assembly to an anatomical reference point on the face along with the two condylar reference points. It varies in the different face bows, example orbital pointer - orbitale, Nose piece – Nasion etc[5].

THE PLANE OF ORIENTATION

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 posterior points are referred to as the posterior points of reference and the anterior one is known as the anterior point of reference. The spatial plane formed by joining both the anterior and posterior reference points is called **Plane of orientation**[2]**.**

5. ANTERIOR REFERENCE POINTS

ORBITALE

Orbitale is the lowest point of the infraorbital rim of skull which can be palpated on the patient through the overlying the skin. One orbitale and the two posterior points determine the horizontal axis of rotation will define the axis – orbital plane. Orbitale and the two posterior landmarks are transferred from the patient to the articulator with the facebow. The articulator must have the orbital indicator guide that is in the same plane as the hinge of the articulator.

ORBITALE MINUS 7 mm

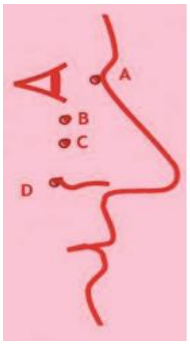
The Frankfort horizontal plane (FH) passes through both the porion and one orbital point. Because porion is a skeletal landmark, Sicher recommended to use the midpoint of the upper border of the external auditory meatus as the posterior reference point on a patient. Later on Bergstrom developed Arcon articulator that automatically compensates for this error by placing the orbital index 7 mm higher than the condylar horizontal axis.

NASION MINUS 23 mm

This reference point is most widely used in Whip Mix Face Bow. The nasion can be approximately located in the head - the deepest part of the midline depression just below the level of the eyebrows. The nasion guide, or positioner, or relator of the Quick Mount facebow, which is specially designed to be used with the Whip-Mix Articulator, fits into this depression.

ALAE OF THE NOSE

In most of the conventional complete denture techniques it is imperative to make tentative or the actual occlusal plane that should be parallel with the horizontal plane. This relationship can be achieved as a line marked from the ala of the nose to the center of the auditory meatus that describes Camper's line[6].

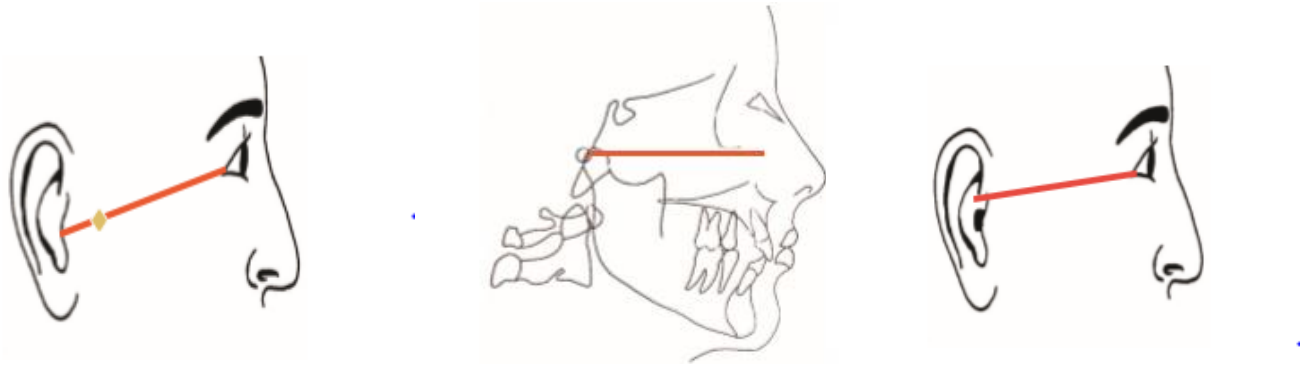


POSTERIOR REFERENCE POINTS

Beyron Point - 13mm anterior to the posterior margin of the tragus of the ear on a line from the center of tragus extending to the corner of the eye.

Bergstrom Point - 10mm anterior to the center of the spherical insert for the external auditory meatus and 7mm below the Frankfort horizontal plane. Bergstrom point is found to be most frequently closest to the hinge axis and Beyron point is the next most accurate posterior point of reference.

Gysi Point - it is the most commonly used point and lies 13mm in front of the upper most part of the external auditory meatus on a line passing to the outer canthus of the eye[7].



OTHER POSTERIOR

6. REFERENCE POINT

- Brandrup Wognsen point
- Lauritzen and Bodner's point
- Teteruck And Lundeen's Point
- Beck's point
- Schlosser's point
- Prothero's point
- Weinberg's point
- Lundeen’s point
- Simpson’s point
- Swenson point

7. RECENT ADVANCES

VIRTUAL FACE BOW

The Virtual Facebow has been developed as an advancement of open-source tablet application that provides an alternative option to the conventional facebow for the mounting of maxillary casts to an articulator. The Virtual Facebow implements several design features that helps to minimize errors, provides accurate mounting and reinforces the anatomical considerations associated with articulators.

The Virtual Facebow is an effective, efficient and accessible digital companion to dental diagnoses and treatment planning. To support proper mounting of patient casts, a face bow, which aligns the maxilla to relative cranial planes, can be utilized.

The virtual facebow was developed to locate the maxillary digital cast of the patient in a cranial coordinate system. The Virtual Facebow has been developed as a digital substitute to the conventional facebow to address the shortcomings[8].

8. CONCLUSION

- Despite lot of controversies in facebow usage, Hinge axis location and establishing the plane of orientation is an important component for recording mandibular movement.
- Facebow, a caliper like device, should accurately capture the hinge axis and transfer to the articulator whenever required.
- Face bow record helps in securing anteroposterior positioning of cast in relation to condyles. It also helps in achieving the exact anteroposterior or vertical positioning of cast in relation to condyles.
- The virtual facebow is a recent advancement technique developed to overcome the problem of transferring data from the patient simulation to the virtual articulators. The virtual technique can align

digital casts directly onto the virtual articulator. This virtual facebow was developed to locate the maxillary digital cast of the patient in a cranial coordinate system.

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