

Significance of Facebow for Dental Restorations

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Abstract: An accurate determination, recording and transfer of jaw relation records from patients to the articulator is essential for the dental restoration function, facial appearance and maintenance of patient's oral health. As unsatisfactory maxilla-mandibular relationship will eventually lead to failure of complete dentures and necessitate time consuming and costly repairs. Facebow plays an integral part of this maxilla-mandibular relationship transfer from the patient mouth to that of the articulator. Thus, this article attempts to discuss the facebow and its significance in dental restoration treatment.

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 craniomaxillary complex is articulated with a moving bone, which is the mandible. The opening movement to bring the jaw from occlusal to rest position is almost a pure hinge movement. Here the mandible moves on an arc of a circle with a definite radius from the temporomandibular joint. This path of the condyle is determined by the curvature of the condylar head and the curvature of glenoid fossa.¹

Since the radius is not constant for all the patients, it has to be determined for every individual patient, i.e., the relation of maxilla to the opening and closing axis has to be determined. The upper jaw in the human skull is positioned uniquely to the lower jaw. This position is different for every person. Also, the anatomy of maxilla and the temporomandibular joint varies from persons to persons. Thus, recording of the orientation jaw relationship is very important which is done with the help of facebow record.^{2,3}

Certain terminologies (according to GPT-8) are important to know the importance of facebow.⁴

Hinge axis defined as an imaginary line passing through the two mandibular condyles around which the mandible rotates without translatory movement. Gnathological society defines it as imaginary line connecting the center of one condyle to the center of rotation of the other. Like centric relation, hinge axis is Stable, Learnable, Recordable, Reproducible and Repeatable.

Terminal hinge axis defined as when the condyles are in their most superior position in the articular fossa and the mouth is purely rotated open, the axis around which movement occurs is called as Terminal hinge axis. Clinical Use Of Terminal Hinge Axis is firstly is the location of the transverse hinge axis serves only to orientate the maxilla and to record the static starting point for functional mandibular movements. It does not record centric relation or condylar movements. Secondly it allows the transfer of the opening axis of jaws to the articulator so that occlusion would be on the same arc of closure as in the patients mouth.

Therefore it is used as an important reference in mounting casts in the articulator, so that the opening axis of the articulator coincides with the terminal hinge axis of the patient. And this axis can be located when the mandible is in its most posterior unstrained position by means of a Face bow.

I. Face Bow

The face bow is a caliper like device that is used to record the relationship of the jaws to the temporomandibular joints or the opening axis of the jaws and to orient the casts in the same relationship to the opening axis of the articulator. The term, "face bow," probably evolved from a statement by A.D. Gritman, who described the "implement devised by Prof. Snow. as a bow of metal (that) reaches around the face."³

Face bow record is used in balanced occlusion in complete denture, in edentulous Class I & II cases, Open anterior bite or end to end relationship, Single restoration on II molar not for premolar and I molar, Segmental restoration, Anterior restoration and restoration of entire quadrant

II. Parts Of Face Bow

It is constructed in 3 bars, 1 anterior, 2 lateral.

TABLE-1 PARTS OF FACEBOW

PARTS	DESCRIPTION
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 the 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 piece 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.
LOCKING DEVICE	.T-his part of the face bow helps to fix the bite fork to the U-shaped frame firmly after recording the orientation relation.
THIRD REFERENCE POINT	It is used to orient the face bow assembly to a 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.

III. 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 the anterior and posterior reference points is called plane of orientation.

Prior to aligning the face bow on the face, the posterior reference points and the anterior reference point must be located and marked.

The position of the terminal hinge axis on either side of the face is generally taken as the posterior reference points. Anterior point of the triangular spatial plane determines which plane in the head will become the plane of reference when the prosthesis is being fabricated. When three points are used the position can be repeated. To visualize the anterior teeth and their occlusion in the articulator in same frame of reference that would be used when looking at the patient.^{5,6}

Table-2 Points Of Orientation

POSTERIOR REFERENCE POINTS	ANTERIOR POINT OF REFERENCE
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.	Orbitale-In the skull, orbitale is the lowest point of the infra orbital rim. On a patient it can be palpated through the overlying tissue and the skin. One orbitale and the two posterior points that determine the horizontal axis of rotation will define the axis orbital plane.
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.	Orbitale minus 7mm-This plane represents Frankfort Horizontal plane
Gysi point- it is the most common point lies 13mm in front of the most upper part of the external auditory meatus on a line passing to the outer canthus of the eye. This method was proposed by Gysi, Hanau, Snow and Gilmer and is the point used today.	Nasion minus 23mm- it lies on the Deepest part of the midline depression just below the level of the eyebrows. The nasion guide, or positioner, of the face bow fits into this depression, designed to be used with whip mix articulator. This guide can be moved in and out, but not up and down, from its attachment
Other posterior points are which are less frequently used and less accurate.-13 mm in front of anterior margin of meatus, 13 mm from foot of tragus to canthus ,Ear axis.	Ala of the nose-The right or left ala is marked on the patient and the anterior reference pointer of the face-bow is set.This method uses the Campers Plane as the plane of orientation
	43 mm superior from lower border of upper lip- this plane represents Denar reference plane.Denar face bow uses this reference point

CLASSIFICATION OF FACEBOW-



TABLE-3- CLASSIFICATION OF FACEBOW

IV. Arbitrary Face Bow

The hinge axis is approximately located in this type of face bow. It is commonly used for complete denture construction. This type of face bows generally locate the true Hinge axis within a range of 5 mm. Uses arbitrary or approximate points on the face as the posterior points and condylar rods are positioned on these point. It is further classified as fascia and ear piece type depending on the third point of reference.

Fascia type-The fascia type of face bow utilizes approximate points on the skin over the temporomandibular region as the posterior reference points. These points are located by measuring from certain anatomical landmarks on the face. It has a disadvantage that it is placed on the skin which is movable there is a tendency for the condylar rods to displace. Also requires an assistant to hold the face bow in place.

Ear piece type- It uses the external auditory meatus as an arbitrary reference point which is aligned with ear pieces similar to those on a stethoscope. Accurate relationship for most diagnostic and restorative procedures. It has a advantage that it is simple to use, do not require measurements on face, as accurate as other face bows and it provides an average anatomic dimension between the external auditory meatus and horizontal axis of mandible. But ,it also have disadvantages that regardless of which arbitrary position is chosen an error of 0.2 mm from the axis can be expected and when coupled with the use of a thick inter occlusal record made at an increased vertical dimension. This factor can lead to considerable inaccuracy. Ear piece facebow have further classified as-

- **Spring bow Type -**It is an earpiece face bow made of spring steel and simply springs open and close to various head widths. Most commonly used face bow.This instrument is designed to orient the occlusal plane to the Frankfort horizontal plane by means for a third point of reference. It is indicated in cases when it is critical to precisely reproduce the exact opening and closing movement of the patient to the articulator. But has draw backs like extensive chair side assistance is required. It is expensive and it is rarely indicated for routine articulators with prosthodontic procedures. It has advantages that the one piece design of bow eliminates the moving parts and maintenance problems encountered with other models. It is easy and efficient to use. Parts of sterilazable parts and can be direct/indirectly mounting capability. it further has disadvantage of inability to measure inter condylar distance.
- **Whip mix face bow-** it is also a ear piece type of face bow. It has a built in hinge axis locator. It automatically locates the hinge axis when the ear pieces are placed in the external auditory meatus. It has a nasion relator assembly with a plastic nose piece. It is Indicated when it is critical to precisely reproduce the exact opening and closing movement of the patient to the articulator. It has Draw backs like extensive chair side, Expensive and rarely indicated for routine articulators with prosthodontic procedures.

V. Kinematic Face Bow

It is used to determine and locate the exact hinge axis points. Though hinge axis of the mandible can be determined by a clutch i.e., a segmented impression tray like device attached onto the mandibular teeth with a suitable rigid material such as impression plaster. 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 has a added disadvantage that it is expensive, require extensive cahirside assistance. Thus is rarely indicated for routine articulators with prosthodontic procedures.

VI. Significance O Facebow:-

The value of the face bow has been the topic of considerable discussion and controversy in prosthesis dentistry for many years. Logan considered it indispensable; Craddock and Symmons also considered it as futile exercise. While Stansberry stated that a technique of positioned records and told that use of face bow was useless.

Lazzari set forth the advantages of using a facebow as 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. Therefore the incisor plane is also properly established and finally it helps in vertical positioning of the cast in articulators.

Face bow transfer is not required in following conditions -the articulators developed not to receive facebow transfer. When monoplane teeth are arranged in a occlusal balance. No alteration of occluding surfaces of the teeth that necessitates the changes in vertical dimension. No interocclusion check reports that would be of different thickness.

But when we analyze the above said facts it is very clear that by simply stating that the articulator is not designed to accept the face bow, we cannot forget the step of facebow transfer and incorporate the errors due to blind orientation of the casts on the articulator and we cannot have single predetermined scheme of occlusal for all patients and we cannot use mono plane teeth for all cases in fact when we are cusped form of teeth facebow transfer becomes a must to achieve balance in entire positions.

Changes do occur in vertical dimensions in complete dentures due to processing and dimensional changes and if remounting in such cases shows change is there in occlusal records then, it needs a facebow transfer, as vertical dimension desired and planned on articulator require facebow transfer. Since, cuspal inclination varies when the casts are placed at different levels in articulators of course the changes may not be so great in positions but changes do occur.

The overall opinion to which majority of the prosthodontics agree in put forward by the academy of denture prosthodontics favoring the use facebow and concluded that "a facebow should be used for mounting the upper cast on any articulator that has a fixed axis of opening". As correct orientation of the occlusal plane and the inclination of the plane that we develop had effect on the masticatory performance.⁷⁻¹³

VII. Conclusion

Failure to use the facebow leads to error in occlusion. Hinge axis forms a major component of every masticatory movement of the mandible and therefore cannot be disregarded that hinge axis should be accurately captured and transferred to the articulator, so that it becomes a fine representative of the patient and biologically acceptable restoration is possible. Thus, the use of facebow should form a integral part of one prosthodontic treatment.

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