The Facar Concept

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Citation

N Gowri, N Gopichander, E Solomon. *The Facar Concept*. The Internet Journal of Dental Science. 2008 Volume 7 Number 2.

Abstract

The restorative procedures have an effect on the shape of occlusal surface. The greatest care is ensured in restoring the functional surfaces relative to the harmony of masticatory system. The use of different types of facebow, articulators in obtaining the static, dynamic contacts and synchronization with TMJ apparatus are always debatable. This article, the Facar concept evaluates and justifies the use of different types of facebow and articulators for the restorative procedures.

INTRODUCTION

Restorative dentistry requires a series of appropriate clinical laboratory procedures and a reliable armamentarium of instruments. Each single phase of these 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 natural teeth should also harmonize with the various jaw movements which are determined by the anatomical form of temporomandibular joint. Maxilla is stable in its relation to the cranium while the mandible is dynamic in its motion to maxilla since it is attached to the temporomandibular joint. The direction of mandibular movement is controlled by the neuromuscular system, the guiding influences of the contacting teeth, inter condylar path width, their inclination in relation to the masticatory surfaces and distance between the individual tooth's occlusal surfaces to the centers of movement. To be precise, the mandibular movements are dictated by the TMJ, occlusion of teeth and the neuromuscular mechanism. The prosthodontist must relate these biologic mandibular movements to clinical application during the treatment phase of patients

These biological factors are of greater relevance in the construction of fixed partial dentures as compared to complete dentures for the reason that the denture bearing tissues are resilient which makes the complete denture to move towards the alveolar ridge to nullify any minor occlusal discrepancy. Whereas in fixed partial denture the stresses from occlusal discrepancies are directed towards the periodontium, affecting its health. Therefore fixed partial restorations require greater precision in recording and transferring the maxillomandibular relationships.

DETERMINANTS AND KINETICS OF MANDIBULAR MOVEMENTS

The four determinants of mandibular movements are viz: the two posterior determinants, one anterior determinant and a neuromuscular determinant.

Posterior determinant: (invisible component)

The TMJ and its suspensory ligaments, centres of rotation, axes of rotation, translation of these centres.

Anterior determinant: (visible component)

The contacting areas of upper and lower teeth, inclines of cusps and nature of occlusion in centric relation and eccentric movements.

Neuromuscular determinant:

The role of muscle spindles, proprioceptive engram and neuromuscular response to prevailing occlusal condition.

The two posterior determinants are fixed. The third determinant namely occlusion can be modified by the dentist to certain limit. The fourth neuromuscular determinant can be reflexly modified by the dentist indirectly as he alters the third element viz. occlusion.

Mandibular movements occur in three cranial planes viz. sagittal, horizontal and frontal, around three axes.

Opening & closing movement – This takes place in the sagittal plane around the horizontal axis between both the condyles.

Lateral movement – Left and right side movement in horizontal plane takes place around the vertical axis extending through the rotating condyle of the working side(ipsilateral side) [3]

The third movement is the combination of opening and lateral movement which takes place in the coronal plane around the sagittal axis of the working condyle depending on the side to which the mandible is moved.

These various mandibular movements are motions which occur concurrently around one or more of the axes. Masticatory function is therefore a combination of all these movements in three facial planes which occur in three axes [8] . Some of the armamentarium required to capture and simulate these jaw movements is discussed.

FACAR is a term proposed to underscore the need for using face bow and articulators collectively in prosthodontics. This is an acronym for FAC (face bow) and AR (articulator). Each of these complements one another to the accuracy of restorative work. The use of articulators without face bow record is not complete and therefore face bow should be made mandatory.

FACE BOW

Centric relation is the starting position for all mandibular movements. The position of condyle in centric relation to the maxilla is required to orient the upper cast to the condylar elements (i.e) the condylar axis of the articulator. Face bow essentially records the positional relation of the maxilla to the condyles in centric relation and later transfers this relation to the articulator so that the maxillary cast is mounted in the same spatial relationship as seen in the mouth.

There are two types of face bows, the kinematic or the actual axis face bow and arbitrary axis face bow [9] . The kinematic face bow records the exact axis or centers of condylar rotation which occur during the hinge movement of the mandible [713] . Hinge axis transfer bow then relates the position of condylar axis to the jaws in centric relation. This face bow is also known as hinge axis face bow. The arbitrary face bow relates the approximate condylar axis to the maxilla [6] . The arbitrary face bow is available in two types, the facia face bow and the earpiece face bow.(Table .1)

While using the facia facebow, the center of condyle is arbitrarily marked 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. The condylar rods of the facebow is centered on it during facebow transfer. In the case of ear piece facebow it has a ear plug which fits in to the external auditory meatus to orient the facebow as the posterior reference. It has been found that on an average external auditory meatus is 6-6.5 mm posterior and 2.5mm superior to the actual hinge axis point [6] . Since the ear piece facebow has not been oriented to the arbitary hinge axis points as in case of facia face bow, during the transfer of ear piece facebow to the articulator, the ear plug is seated not on the condylar pins of the articulator but on the auditory pins of the articulator which have the same dimensional relation to the axis of the articulator as existing between the hinge axis and the external auditory meatus [12] .

Figure 1

Table 1

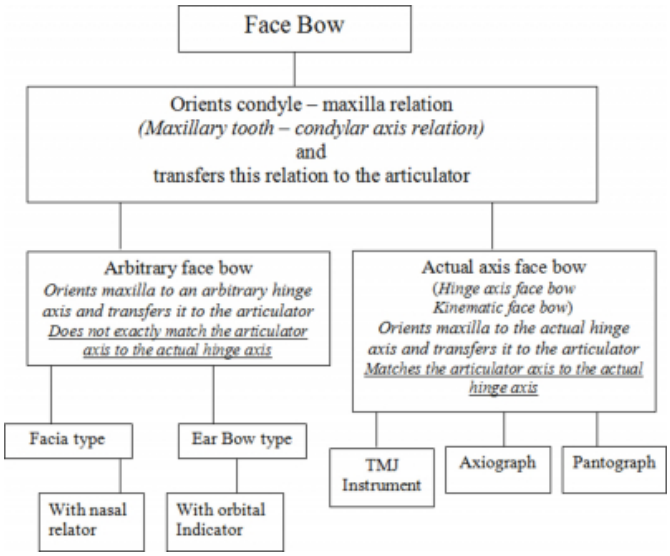
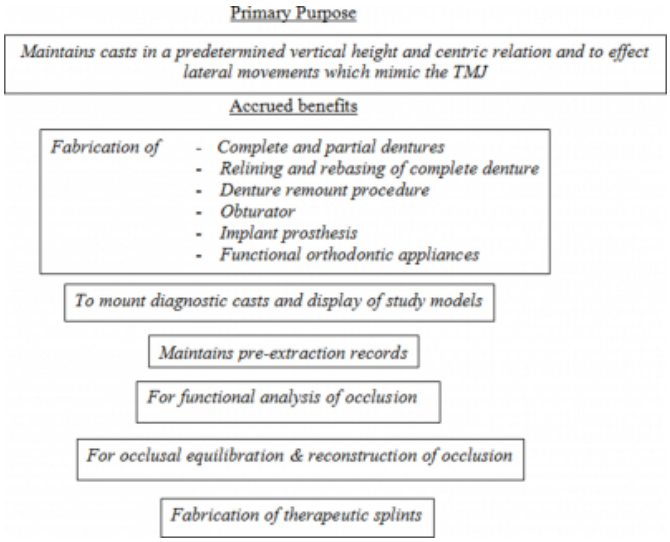


Figure 2



Some of the examples of face bows are given below

Hanau face bows are of three basic types; the Hanau facia face bow, the ear face bow and the twirl face bow (spring face bow).

The Whipmix quick mount bow was the first ear piece face bow. A special nasion relator assembly or an infra orbital pointer can also be added to the face bow.

The Denar face bow can be modified as an ear bow or a facia bow. There is also a Denar kinematic face bow which is used in conjunction with fully adjustable Denar D5A articulator.

Panadent face bows are available in three different types. The facia face bow, ear piece face bow and the Panadent kinematic face bow.

There is also the TMJ face bow which is a kinematic type and is probably one of the best kinematic type face bow available. It is used with the TMJ articulator.

Hinge axis recording with kinematic face bow will give the precise positional relation of the casts to each other in the articulator [7]. This is because upon removal of check bites after mounting of casts will give accurate closing of the casts in centric relation, minimizing the occlusal errors commonly seen when casts are mounted with the check bites using the arbitrary face bow.

To sum up the benefits, the use of face bow gives better occlusion in centric relation and also reduces the occlusal interferences in lateral jaw movements.

ARTICULATORS

A brief review of articulator, its capability and its value in the fabrication of various types of prosthesis is presented.

Articulators are instruments that attempt to reproduce the range of jaw movements mentioned earlier. It is a mechanical device designed to simulate the TMJ. Maxillary and mandibular casts are attached to the articulator so that the functional and parafunctional contact relations between the teeth can be studied for diagnosis, occlusal rehabilitation and equilibration. Besides this, it is also useful in the fabrication of occlusal surfaces in fixed partial dentures and arrangement of teeth in removable partial dentures. Articulators are also required to establish occlusion in maxillo facial prosthesis and for the fabrication of occlusal splints. It should be mentioned that no articulator exactly reproduces the full range of jaw movements nor is the precise reproduction of jaw movement is required for every type of prosthesis. Therefore an understanding of capability of the instrument, as well as the various treatment objectives of the patient is desirable.

Summary of the uses of articulator:

Figure 3

Table 2: BASIS FOR CLASSIFICATION OF ARTICULATORS

Movement in Humans			***Movement in mechanical equivalents***	
Articular movements (Condylar Path / Condylar guidance)	Mandibular movements	Movements at incisior teeth (Anterior guidance)	Articulators are mechanical devices to mimic these condylar & mandibular movements. (These instruments attempt to reproduce the range of condylar and mandibular movement)	
Rotation Translation Protrusive condylar path Progressive Condylar path laturotrusive condyler path Mediotrusive Condylar path Condylar path angle Bennett angle Bennett movement	Hinge Protrusion Left & right Lateral Movement (Bennetts mandibular side shift)	Incisal path Incisal path angle.	**Condyle fossa assembly** Articulator equivalent of condylar path (condylar slot / fossa box or condylar housing	**Incisal table Assembly** Articulator equivalent of incisal path (Incisal table)
			1. Simple articulator - Hinge movement 2. Non adjustable articulator Mean value condylar path (Average) 3.Adjustable condylar path (i)Semi adjustable CP Articulator - Arcon type - non arcon type (ii) Fully adjustable CP articulator (nearly anatomical articulator)	1. Fixed or non adjustable 2. Mean value in wall table 3. Adjustable incisal table (a) in sagiltal plane (b) in frontal plane 4. Customized incisal table.

CLASSIFICATION

Among the numerous articulators are available, the selection of an articulator is based on the type of restoration to be fabricated, type of inter occlusal record used, its capability for condylar and incisal adjustments and the user's skill. (Table 2)

Articulators can be basically classified as non arcon and arcon type [125] . In non arcon articulators the condylar slot is located in the lower member of the articulator and the condylar sphere in the upper member, whereas in the arcon type the condylar fossa is situated in the upper member and the condylar sphere is in the lower member. Early articulators irrespective of their type were of non arcon type. Non arcon articulators do not truly represent the articular fossa – condyle mechanism in the TMJ, while in arcon articulators the condyle fossa mechanism is reversed and is similar to what is seen in TMJ. The arcon principle AR (articulator) CON (condyle) was first introduced by Bergstorm [4] when he first designed the Bergstorm articulator in 1950. Present day articulators are mostly of arcon type.

The critical component in an articulator is the analogue or the mechanical equivalent of the articular fossa and condyle of the TMJ which is generally referred as condyle fossa assembly. The condyle fossa assembly is either in the form of an adjustable condylar track or a slot, fossa box or condylar housing. In more advanced articulator system it can also be in the form of a preformed or customized fossa moulding, fossa insert or fossa analogue against which the condylar spheres articulate

One of the most comprehensive methods of classifying articulators is follows

Simple articulator or cast relator. They are of hinge articulator, fork articulator and plain line articulator types. (ex) Gariot articulator, Evans articulator

Non adjustable articulator or mean value articulator – (condylar path not adjustable) (ex) Gysi simplex articulator, Ash three point articulator

Adjustable articulator (condylar path adjustable)

(a) Semi adjustable articulator (ex) Hanau Model H articulator, Dentatus ARL articulator, Whipmix articulator, Bergstorm Arcon articulator, SAM articulator, Denar Mark II type, Artex- Girbach, Gerber's condylator, Kavo protar

(b) Fully adjustable articulator (ex) TMJ articulator, DenarD5A articulator, Stuart gnathoscope.

SIMPLE ARTICULATOR

These are initial group of articulators which are simple holding instrument capable of accepting single static registration. Only vertical motion is acceptable. These articulators are used for single crowns and simple bridges, relining and rebasing complete denture which does not require protrusive and excursive movements.

NON ADJUSTABLE ARTICULATOR

Construction of this type of articulator is based on average measurements of lateral movement and they move in a fixed pattern, since the inclination mechanism of condylar path in the articulator is fixed. Most of the complete denture and partial denture work especially preclinical denture construction is done with this type of articulator. Since the human condylar path movements are variable, it is not justifiable that the lateral movement in an articulator is limited to a mean value. Further the distance between the hinges and the tooth to be restored is also significantly less in a non adjustable articulator. Therefore it has a smaller radius closure path, resulting in a steeper arc than seen clinically thereby forming premature contacts on the restoration requiring time consuming intra oral corrections. Further this articulator cannot accept face bow record. For these reasons its use is limited only to procedures described above. This has resulted in the necessity to develop articulators which have condylar inclination that can be adjusted and led to the development of semiadjustable articulators.

SEMI ADJUSTABLE ARTICULATOR

This instrument attempts to simulate patient's condylar path by using mechanical equivalents which are capable of imitating all or part of its motion. This articulator is commonly used where some degree of precision work is required. While using this articulator the occlusal adjustments during insertion phase is diminished. This does not require an inordinate amount of time or expertise as when using fully adjustable articulator. Casts mounted in this articulator have about the same spatial dimension as the condyle to the teeth, thus discrepancies in the difference in the radius of arc of closure is minimized [14] . This has a considerable clinical significance as occlusal corrections in the finished restoration are minimal.

When a face bow record is made, semi adjustable articulator is mandatory. A semi adjustable articulator does not fully serve its function in the absence of a face bow record. In conjunction with face bow this articulator is indicated for diagnostic evaluation of study casts, occlusal analysis, occlusal correction & rehabilitation. It is ideal to use a semi adjustable articulator with face bow for complete denture construction to minimize occlusal errors. Further it is the articulator of choice for denture remount procedures.

FULLY ADJUSTABLE ARTICULATOR

This articulator accepts three dimensional dynamic registrations, as compared to semi adjustable articulator which can accept only in two dimensions. It allows orientation of the casts to the TMJ and reproduction of all mandibular movements in a more precise manner [1516] . The range of movements can be set to follow a patient's border movements. Customized fossa moulding is possible with this range of articulators. These articulators can also accept pantographic tracing of the patient. The ability of these instruments to track functional pathways of movement throughout entire trajectories permits the fabrication of complex restorations requiring very minimal occlusal adjustment [1114] . However the accuracy of this articulator depends on skill of the operator in transferring the various three dimensional records taken from the patient. Therefore the capabilities of the operator play a considerable role while using these articulators.

Mounting casts on this articulator and adjusting them can be time consuming. For these reasons they are required in highly specialized practice requiring full mouth reconstruction [510] . Obviously all the other indications for the use of semi adjustable articulator is also applicable to fully adjustable articulators but with a greater degree of precision.

CONCLUSION

In proposing the FACAR concept the functional range of mandibular movements have been highlighted with a view to emphasis the scope and desirability of face bows and selection of appropriate articulators. When judiciously used they become essential components of the prosthodontic armamentarium.

ACKNOWLEDGEMENT

We acknowledge the Dr.M.Vasantakumar M.D.S., Principal and Head of Prosthodontics Department, SRM Dental College, Ramapuram, Chennai- 89 for his suggestion and input in the manuscript.

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