

## Review Article

### Articulators

Renu Gupta<sup>1</sup>, Urmi Aggarwal<sup>2</sup>, Divy Vashisht<sup>3</sup>

<sup>1</sup>Professor and Head, Dept. of prosthodontics, H.P. Government Dental College, Shimla, H.P;

<sup>2</sup>3<sup>rd</sup> year PG student, Dept. of prosthodontics, H.P. Government Dental College, Shimla, H.P;

<sup>3</sup>Professor, Dept. of Prosthodontics, H.P. Government Dental College, Shimla, H.P

#### ABSTRACT:

Articulator is a mechanical device that represents the temporomandibular joints and the jaw members to which maxillary and mandibular casts may be attached to simulate some or all the mandibular movements. Many devices that are called articulators do not satisfy this definition. Some of these devices make no attempt to represent the temporomandibular joints (face bow transfer) or their paths of motion (eccentric registration). In the present review, we aim to summarize important aspects of articulators.

**Key words:** cardiogenic edema, conventional oxygen therapy, ventilation

Received: 15 August, 2021

Accepted: 27 August, 2021

**Corresponding author:** Urmi Aggarwal, 3<sup>rd</sup> year PG student, Dept. of prosthodontics, H.P. Government Dental College, Shimla, H.P

**This article may be cited as:** Gupta R, Aggarwal U, Vashisht D. Articulators. Int J Res Health Allied Sci 2021; 7(5):63-70.

#### INTRODUCTION

Articulator is a mechanical device that represents the temporomandibular joints and the jaw members to which maxillary and mandibular casts may be attached to simulate some or all the mandibular movements. Many devices that are called articulators do not satisfy this definition. Some of these devices make no attempt to represent the temporomandibular joints (face bow transfer) or their paths of motion (eccentric registration).<sup>(1)</sup> Some instruments allow eccentric motion determined by inadequate registrations (positional registration). Some utilize average or equivalent pathways. Some attempt to reproduce the eccentric pathways of the patient from three dimensional registrations. Some other articulators record even the fourth dimension, i.e., the timing of the Bennett movement. Articulators have been classified as arbitrary, positional, semi adjustable, and fully adjustable. The concepts associated with each articulator will be described and evaluated as well as the accuracy of the occlusion produced on the instrument.<sup>(2)</sup> For an analysis, the diagnostic casts need to be attached to an articulator.

Articulators simulate the movements of the condyle in their corresponding fossae.<sup>(3)</sup> Articulators generally consist of two opposing mechanical members, one of which is movable. Their methods of operation vary to conform to principles or concepts of design to reproduce or simulate mandibular movements. Articulating devices usually can be classified into one of the following categories: (1) the suspension type instrument with movements of the upper bow from a common point ; (2) the axis instrument which has a solid or a split shaft terminating in guiding mechanisms to allow for the movement of the upper member and (3) the tripod type device with three individually adjustable guiding mechanisms which are set to positional records of the relations of the mandible to the maxilla. The functions, and the common sources of error, of the three common types of articulators are analyzed. Since it is impossible to produce an instrument that is a geometric duplication of the skull for each patient, errors are inherent in simulated mechanisms. The dentist should understand what the instrument that he selects can accomplish,

and should make up for variables in the instrument by critical analysis and judgment. <sup>(4)</sup>

### REQUIREMENTS OF AN ARTICULATOR

<u>MINIMAL ARTICULATOR REQUIREMENTS</u>	<u>ADDITIONAL ARTICULATOR REQUIREMENTS</u>
<ul style="list-style-type: none"> <li>• The articulator must accurately maintain centric position.</li> <li>• The patient's casts must be easily removable and attachable to the articulator without losing their correct horizontal and vertical relationship.</li> <li>• The articulator should have an incisal guide pin with a positive stop that is adjustable and calibrated.</li> <li>• The articulator should be able to open and close in a hinge-like fashion.</li> <li>• The articulator should accept facebow transfer utilizing an anterior reference point.</li> <li>• The construction should be accurate rigid and of a non-corrosive material.</li> <li>• The articulator should be stable on the laboratory bench and not too bulky and heavy.</li> <li>• The design should be such that there is adequate distance between the upper and lower members and that vision is not obscured from the rear.</li> </ul>	<ul style="list-style-type: none"> <li>• The condylar guides should allow right lateral, left lateral, and protrusive movements.</li> <li>• The condylar guides should be adjustable horizontally.</li> <li>• The articulator should have provisions for adjustment of Bennett movement.</li> <li>• The incisal guide table should be a mechanical table that can be adjusted in the sagittal and frontal planes.</li> <li>• The condylar elements as a part of the lower frame and the condylar guides as a part of the upper frame.</li> <li>• A mechanism to accept a third reference point from a facebow transfer record.</li> <li>• A terminal hinge position locking device.</li> <li>• Adjustable intercondylar width of the elements, when graphic tracings to be used to set and/or select condylar guidance. <sup>(5)</sup></li> </ul>

### CLASSIFICATION OF ARTICULATORS

<p><u>GILLIS, BOUCHER and KINGERY (1926)</u> classified the articulators into</p> <ol style="list-style-type: none"> <li>1. Nonadjustable</li> <li>2. Adjustable</li> </ol>	<p><u>BOUCHER'S CLASSIFICATION (1934):</u></p> <ul style="list-style-type: none"> <li>• Nonadjustable</li> <li>• Adjustable</li> </ul> <ol style="list-style-type: none"> <li>1. two-dimensional instrument</li> <li>2. three-dimensional instrument</li> </ol>
<p><u>KINGERY'S CLASSIFICATION (1934):</u></p> <ul style="list-style-type: none"> <li>• Simple articulators</li> <li>• Adaptable(or)adjustable articulators</li> </ul>	<p><u>BECK'S (1962)</u> categories were</p> <ul style="list-style-type: none"> <li>• Suspension instrument</li> <li>• Axis instrument and</li> <li>• Tripod instrument</li> </ul>
<p><u>WEINBERG (1963)</u> classified the articulators into arbitrary, positional, semi adjustable, and fully adjustable.</p> <ol style="list-style-type: none"> <li>1. <i>Arbitrary</i>- this type of articulator followed Monson Spherical theory.</li> <li>2. <i>Positional</i>- this one followed Stanbery tripod concept.</li> <li>3. <i>Semi adjustable and Fully adjustable</i>- these two classes are based on the amount they mimic the mandibular movements. <sup>(5)</sup></li> </ol>	<p><u>POSSELT'S (1968)</u> classified the articulators into three types:</p> <ol style="list-style-type: none"> <li>1. Plain Line</li> <li>2. Mean value</li> <li>3. Adjustable <sup>(6)</sup></li> </ol>

**INTERNATIONAL PROSTHODONTICS WORKSHOP (UNIVERSITY OF MICHIGAN IN 1972)**

**Class I** – Simple holding instrument capable of accepting a single static registration. Vertical motion is possible, but only for convenience.

Egs: Slab Articulator, Gariot’s Articulator, Barn Door hinge articulator.

**Class II-** Instrument that permit horizontal as well as vertical motion but do not orient the motion to the temporomandibular joints via facebow transfer.

1. **II A-** Instruments in this class permit eccentric motion based on averages and will not accept a facebow transfer. Condyles are on the lower member and inclined at 15 degrees.

A typical example is Gritman articulator, Gysi Simplex.

2. **II B-** Instrument in this class permit eccentric motion based on arbitrary theories of motion and will not accept a facebow transfer.

Example is Maxillo-Mandibular instrument designed by monson.

3. **II C-** Instruments in this class permit eccentric motion based on engraved records obtained from the patient, and will not accept a facebow transfer.

Example being the House Articulator designed by M.M. House.

**Class III-** Instruments that simulate condylar pathways by using average or mechanical equivalents for all or part of the motion. These instruments allow for joint orientation of the casts via a facebow

transfer. Don’t accept static, protrusive or lateral movements., incisal. It has two subclasses A and B.

- **III A-** Instruments in the class accept a facebow transfer and a protrusive interocclusal record. Egs: Hanau Model H articulator, Dentatus articulator.

- **III B-** Instruments in this class accept protrusive interocclusal records. Egs: Gysi Trubyte articulator, Stansberry articulator, Ney articulator, Whipmix articulator, Denar Mark II articulator, Penadent.

**Class IV-** Instruments that will accept three dimensional dynamic registrations. These instruments allow for joint orientation of the casts via a facebow transfer.

•**Class IV A**

The condylar pathways are formed by registration engraved by the patient.

e.g. Denar Combi articulator, TMJ-Stereographic instrument.

•**Class IV B**

Instruments that have condylar pathways that can be selectively angled and customized. e.g. Stuart Articulator, Denar D5 articulator.<sup>(6)</sup>

**BOUCHER** classified the articulators based on

1. The theories of occlusion and
2. The types of records used for their adjustment.

**1.) BASED ON THE THEORIES OF OCCLUSION BOUCHER CLASSIFIED THE ARTICULATOR INTO THREE:**

<u>The Bonwill’s Theory Of Occlusion</u>	<u>The Conical Theory Of Occlusion</u>	<u>The Spherical Theory Of Occlusion (MONSON)</u>
<ul style="list-style-type: none"> <li>• Proposed that the teeth move in relation to each other as guided by the condylar controls and the incisal point and there was a 4-inch distance between the condyles and between each condyle and the incisor point.</li> <li>• This theory was known as the Theory Of Equilateral Triangle.</li> <li>• The articulator designed by Bonwill allows lateral movements only.</li> </ul>	<ul style="list-style-type: none"> <li>• Proposed that the lower teeth move over the surfaces of the upper teeth as over the surface of a cone, generating an angle of 45 degrees, with the central axis of the cone tipped 45 degrees to the occlusal plane.</li> <li>• The Hall articulator designed by R.E. Hall confirms this theory.</li> </ul>	<ul style="list-style-type: none"> <li>• Proposed that the lower teeth moving over the surface of the upper teeth as over the surface of a sphere with a diameter of 8 inches.</li> <li>• The center of the sphere was located in the region of the glabella, and the surface of the sphere passed through the glenoid fossa along or concentric with articulating eminences. <sup>(6)</sup></li> </ul>

2.) **Based on the type of record used for their adjustment, the articulators are classified into three:**

1. **Those utilizing the Interocclusal records.** These records may be made in wax, plaster of Paris, ZnOE paste or cold-curing acrylic resin.
2. **Those using the graphic record adjustment.** These instruments are more complicated than the previous one.
3. **Those utilizing hinge-axis location for adjusting the articulator** <sup>(6)</sup>

**BASED ON CONDYLAR ELEMENT ATTACHMENT-BERGSTORM**

- A] Arcon
- B] Non Arcon

**Arcon:** Articulator and condyle The condylar element is attached to the lower member and guidance to the upper member. Eg.-Whip mix

**Non arcon:** condylar element on upper member and guidance on the lower member. Eg.- Hanau H2 series, Dentatus. <sup>(6)</sup>

**CHARLES M. HEARTWELL Jr.**, classified the articulators into two classes.

**Class I** These instruments receive and reproduce three dimensional graphic tracings. These can be adjusted to permit individual condylar movement in three planes and can reproduce timing of the side shift of the orbiting side and its direction on the rotating side. These are called four dimensional instruments. Egs: Stuart Gnathologic instrument, TMJ articulator, Hanau Modular system, Denar D5A.

**Class II** These instruments will not receive three dimensional graphic recording. Some have fixed controls; others are adjustable in no more than two planes. Most are set to anatomic averages or with some type of positional records. Condylar fossa analogs are used. The class II is subdivided into four types:

**Type I ( Hinge )** can open and close in a hinge movement. Few permit limited excursive movements. They do not accept facebows. Examples are Stephans, Galetti, Trubyte simplex, Gariot, Bonwill.

**Type 2 ( Arbitrary )** These articulators are designed to adapt to specific theories of occlusion or are oriented to a specific technique.

Examples :Verticulator, Monson, Transograph.

**Type 3 ( average )** are designed to provide condylar element guidance by means of averages, positional records, or mini recorder systems. Most permit adjustments of both horizontal and lateral guidance. Accept facebow transfer.

Examples : Dentatus , Hanau , Whip mix, Denar, Penadent, SAM.

**Type 4 ( Special )** This type is designed and used primarily for complete dentures.

Examples: Stansberry Tripod, Kile Dentograph.

**NEW SYSTEM CLASSIFICATION BY RIHANI (1980)**

- A. **Nonadjustable** - A simple holding instrument capable of accepting single static registration. Only vertical motion is acceptable.
- B. **Semi adjustable** – An instrument that simulates condylar pathways by using average or mechanical equivalents for all or part of the motion. These instruments allow for orientation of casts relative to the joints and may be arcon or non-arcon instrument.
- C. **Fully adjustable** – An instrument that will accept three dimensional dynamic registration. These instruments allow for orientation of the casts to the T.M.J. and replication of all mandibular movements. <sup>(6)</sup>

**SELECTION OF AN ARTICULATOR**

If the dentist's only concern is the relationship of the antagonist teeth at the point of maximum intercuspation, the design and the use of an articulator will be greatly simplified. In this scenario, the articulator capable of simple hinge movement will be sufficient for the designing of the prosthesis. But, the mandible does not act as a simple hinge; rather, it is capable of rotating around axes in three planes. The occlusal surface of any prosthesis for the mouth must accommodate the free passage of the antagonist teeth without any interference. Hence, selection of the suitable articulator plays a pivotal role in the designing of virtual articulator by this approach <sup>(7)</sup>.

**HANAU H2-O ARTICULATOR (Programming the Articulator)**

<u>MOUNTING THE MAXILLARY CAST</u>	<u>MOUNTING THE MANDIBULAR CAST</u>
<ul style="list-style-type: none"> <li>• The posterior reference points are located arbitrarily by inserting the plastic earpiece into the patient's external auditory canals.</li> <li>• The axis orbital plane is established by connecting the posterior reference points to the anterior reference plane.</li> <li>• The orbital indicator is positioned on the patient's right side to contact the right orbital point.</li> <li>• The prongs of the registration fork are warmed over a flame and inserted into the wax occlusal rim.</li> <li>• Maintain the symmetry of the mounted maxillary cast. Before mounting the casts, the articulator should be adjusted.</li> <li>• The protrusive condylar guidances are set to 30 degree, the lateral condylar posts to 15 degree, the incisal pin to 0, and the incisal table is locked in a horizontal position.</li> <li>• Both centric locks should be tightened so that the condylar elements do not move.</li> <li>• After transferring the facebow to the articulator, the condylar rods are adjusted equally to engage the condylar posts.</li> <li>• The tip of the orbital pointer is brought into contact with the undersurface of the axis-orbital plait indicator attached to the upper articulator frame.</li> <li>• The facebow height is adjusted by turning the elevating screw under the lock clamp for the registration fork.</li> <li>• A cast support is adjusted to protect the occlusal fork from any distortion due to the weight of the maxillary cast and the mounting stone.</li> <li>• Minimal expansion slurry activated stone is added to the cast to complete the mounting procedure.</li> </ul>	<ul style="list-style-type: none"> <li>• The tentative centric relation registration is made with a pressureless impression paste such as zinc oxide eugenol.</li> <li>• Initially, the upper wax rim is indexed with several V-shaped notches.</li> <li>• The lower wax rim is reduced approximately 1.5 to 2mm and then cross hatched with a blade to form undercuts on the wax surface.</li> <li>• After the registration is made, both baseplates are removed and seated on their respective casts.</li> <li>• The incisal pin is set to 0 and both casts are related through the zinc oxide paste record.</li> <li>• Minimal expansion stone is added to the base of the mandibular cast and the articulator is closed.<sup>(11)</sup></li> </ul>

**ADJUSTMENT OF THE ARTICULATOR**

- The protrusive occlusal record is used to set the instrument guides. An extra-oral tracer can be attached to the wax occlusion rims with the central bearing plates set at the desired vertical dimension.
- The patient is encouraged to make protrusive and right and left lateral border movements while the pin touches the recording plate with light pressure.
- With the extra-oral tracing assembly, the clinician can visualize the apex created that indicates centric relation.
- An accurate record can be made by injecting quick setting stone between the occlusion rims while the patient maintains the centric relation position.
- This record can be used to verify the tentative centric relation or for remounting to a new relation.
- The protrusive occlusal record is also made with stone as the patient maintains the mandible approximately 6 mm forward of centric relation as determined by the tracing. The record is used to relate the split maxillary cast to its mounting stone base.

- The condylar thumbscrews are loosened and the incisal pin is raised.
- The slope of the condylar path is adjusted until the cast is accurately keyed to the mounting base.
- After recording the horizontal condylar guidance, the formula  $L = H/8 + 12$  is used to calculate the lateral condylar guidance.
- In this formula,
  - $L$  = lateral condylar inclination in degrees,
  - $H$  = horizontal condylar inclination in degrees
- As established by a protrusive relation record. The lateral condylar posts are rotated to the desired angulation in degrees and this position is maintained by tightening the thumbscrews. The approximate Bennett angle is determined and recorded.<sup>(12)</sup>

**WHIP MIX ARTICULATORS**

- The Whip Mix Articulator was developed by Charles E. Stuart in 1964.
- It is a semi adjustable arcon type which is a simplified version of Stuart's fully adjustable articulator.
- The condylar element of Whip Mix articulator is adjustable about the vertical and horizontal axis but not the sagittal axis.<sup>(13)</sup>

<u>MOUNTING THE MAXILLARY CAST</u>	<u>MOUNTING THE MANDIBULAR CAST</u>
<ul style="list-style-type: none"> <li>• The facebow of the Whip Mix articulator is termed the Quick Mount Facebow.</li> <li>• <i>The posterior reference points</i> are located by inserting the plastic ear-piece of both ends of the facebow into the patient's external auditory canals.</li> <li>• <i>The anterior reference point</i> can be simply located, using the axis orbital plane, by resting the nasion relator on the patient's nose.</li> <li>• The patient is asked to close lightly into softened modelling compound that has been placed around the facebow fork.</li> <li>• The ear-pieces are inserted in the external auditory canals and the nasion relator is placed on the cross assembly of facebow to secure the nose piece on the patient's</li> </ul>	<ul style="list-style-type: none"> <li>• In mounting the mandibular cast, an interocclusal registration is required.</li> <li>• Depending upon the treatment method, it may be made either in the centric relation position or in the inter-cuspal position.</li> <li>• Regardless of the position selected, the interocclusal registration procedure must be accomplished in a precise manner. <sup>(13)</sup></li> </ul>

**ADJUSTING THE ARTICULATOR (PROGRAMMING THE ARTICULATOR)**

The guidance programmed for the Whip Mix articulator is adjusted by a check bite technique that records selected mandibular movements. The instrument is adjusted by the following steps:

<u>ADJUSTMENT OF HORIZONTAL CONDYLAR INCLINATION</u>	<u>ADJUSTMENT OF LATERAL CONDYLAR INCLINATION</u>
<ul style="list-style-type: none"> <li>• Lock the inclination of both horizontal condylar guides to 0 degree and slide the left and right side shift guides medially to 45 degrees.</li> <li>• Place the protrusive interocclusal record over the mandibular cast and seat the maxillary cast in the record.</li> <li>• At this time the condylar element will be positioned forward to the rear fossa wall and downward to the superior wall.</li> <li>• Loosen the condylar guide lock screw slightly, and establish the inclination of the horizontal condylar path by rotating the superior fossa wall until it contacts the top of the condyle lightly.</li> <li>• The same procedure is repeated for the opposite side. Read the articulator settings and note them on the patient's record.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjustment of the lateral paths of the proper angle will allow the condylar element on the non-working side to move forward, downward and inward.</li> <li>• The operator can start on either side.</li> <li>• Place the lateral interocclusal record over the mandibular cast and seat the maxillary cast on the record.</li> <li>• The condyle should be positioned forward and medially within the fossa box.</li> <li>• A space will be evident between the condyle and the superior fossa wall.</li> <li>• This is the Fischer angle, generated between the horizontal protrusive condylar path inclination and the horizontal lateral condylar path.</li> <li>• The horizontal lateral condylar path inclination can be adjusted by increasing the inclination until the superior fossa wall contacts the top of the condyle in the same manner as it did when the protrusive condylar path was adjusted.</li> <li>• The horizontal protrusive condylar path inclination is most frequently used in setting the guidance for lateral movements because it is not as steep as the horizontal lateral condylar path.</li> <li>• The difference in angulation is approximately 5 degrees.</li> <li>• The medial wall of the condylar housing is moved medially until it contacts the condyle.</li> <li>• The angulation of the horizontal lateral condylar path (Bennett angle) is set by tightening the side shift locking screw.</li> <li>• It may be difficult for the operator to determine the precise angulation of the horizontal lateral condylar path. In these situations, it is advisable to set the angulation at the larger value.</li> <li>• The greater the Bennett angle, the shorter the cusp must be which will make disocclusion easier. <sup>(14)</sup></li> </ul>

**FABRICATION OF A CUSTOMIZED INCISAL TABLE**

Place the incisal pin in the recess at the center of the plastic incisal table and work the articulator through various eccentric mandibular movements to observe contacts between the maxillary and mandibular teeth.

Apply petroleum jelly at the rounded tip of the pin and place an appropriate amount of self-cure acrylic resin mix on the incisal table. Close the articulator and move it through right and left lateral movements until the maxillary and mandibular canines reach an edge to edge occlusion. Next, move the articulator through the protrusive movement until the maxillary and mandibular incisors come to an edge to edge occlusion. Final refinements are made in the hard resin with a bur. <sup>(15)</sup>

## EVOLUTION OF DIGITAL ARTICULATORS

<u><i>Szenpetery's virtual articulator</i></u>	<u><i>Virtual articulator of Kordass and Gartner</i></u>	<u><i>Virtual Articulator based on mechanical dental articulator</i></u>
It was introduced by Szenpetery in 1999. It is based on a mathematical simulation of articular movements. It is a fully adjustable 3D virtual dental articulator capable of reproducing the movement of an articulator. It offers possibilities that are not offered by some of the mechanical articulators as curved Bennet angle movements which make it more versatile than mechanical articulator.	It was introduced by Kordass and Gartner in 2003, based on the exact registration of mandibular movement with the help of jaw movement analyzer. This virtual articulator system requires digital 3D representation of the jaws as input data generates an animation of the jaw movement and delivers a dynamic and tailored visualization of the collision points.	The project was focused on developing a different virtual articulator based on the mechanical dental articulator, knowing which setting parameters can be registered and transferred to the patients. The main advantage of this approach is that the user can choose the most suitable articulator to use in the simulation. <sup>(8)</sup>

## PROGRAMMING OF THE VIRTUAL ARTICULATOR

The programming and adjustment methods of virtual articulator were described by Kordass and Gartner in 1999. The input data entry is done as follows:

- **Scanning/Digitalisation-** The scanner projects a vertical laser beam onto the surface of the object. A digital camera equipped with a charge coupled device (CCD) registers the beam reflected from the object and transmits the digital signals to an electronic processing system. The processed image data are stored as digital matrix brightness values, ready for use by the scanner software and for on screen visualization and computerized manipulation. <sup>(9)</sup>

The scanning can be done in 2 ways:

**Direct Digitising-** done directly from the patient's mouth using an intraoral scanner.

**Indirect Digitising-** done outside on the patient's master cast obtained after making the final impression. <sup>(9)</sup>

<u><b>ADVANTAGES</b></u>	<u><b>DISADVANTAGES</b></u>
<ul style="list-style-type: none"> <li>• Provides best quality of communication between the dentist and the dental technician.</li> <li>• Simulating real patient specific data.</li> <li>• Analyses both static and dynamic occlusions.</li> <li>• Analyses gnathic and joint conditions.</li> <li>• Acts as a 3D navigator. <sup>(9)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Cost effective as it requires the digital scanners, digital sensors, software's and different types of virtual articulator models.</li> <li>• Knowledge about the CAD/CAM technology, mechanical articulators, designing and modelling of virtual articulators <sup>(9)</sup></li> </ul>

## SUMMARY AND CONCLUSION

A large number of different designs of articulator available and the wide range of adjustment possibilities in these articulators can have the operator

quite confused when one must be chosen. The choice of articulator must be made on the basis of what is expected of it. If occlusal contacts are to be perfected in centric occlusion only, a simple, hinge type of

articulator without provision for lateral or protrusive movements could be selected. This type of instrument has been called one dimensional instrument because only one interocclusal record is necessary for its adjustment and use.

Contrary to that belief, others state that the articulator is the best means of developing the occlusal scheme because (1) visibility is best outside of the mouth where not influenced by intraoral factors such as saliva, poor light, and patient cooperation, (2) the patient's closure and eccentric movements can be repeatedly controlled, and (3) time spent doing intraoral adjustment is greatly minimized, saving both the dentist and patient frustrating moments.

In complete denture prosthesis – Semi Adjustable articulator suffice the purpose, as it is difficult to manor fully adjustable articulators in CD patients because the clutches used to obtain the hinge axis and condylar movements are more cumbersome to be used in edentulous patients, which in turn does not provide accurate records. The success or failure of the final restoration is more dependent on the operator of the Articulator than on the Articulator itself. In other words, a semi adjustable articulator in the hands of a knowledgeable clinician may be of greater assistance in treatment than may a fully adjustable articulator in the hands of an inexperienced operator.

The Late Carl O Boucher summed up the articulator controversy by stating, "It must be recognized that the person operating the instrument is more important than the instrument. If dentists understand articulators and their deficiencies, they can compensate for their inherent in adequacies".

## REFERENCES

1. Verma AK, Ali Mariyam, Chaturvedi Saurabh, Ahmad Naeem and Rai Amrit: Articulators- A review article. I. Journal of applied Research; 2014;1(1):06-08.
2. Weinberg LA: An evaluation of basic articulator and their concepts. Part II Arbitrary, Positional, Semi-adjustable articulators. J. Prosthet Dent 1963; 13:645-663.
3. Dr. Yogesh Rao, Dr. Pankaj Yadav, Dr. Amit Kalra, Dr. Manjunath BAdni, Dr. Sheetal Kumar Sagari, Dr. Atul Bhandari: Articulators in dentistry. IJDSR volume 30(3) July2012.
4. Beck H.O.: Choosing the articulator. JADA 1962;64; 468-475.
5. Boucher CO: Complete Denture Prosthodontics- the state of the art. J Prosthet Dent. 1975; 34; 372-383.
6. Yeshwante B, Baig N, Patil V, Rathod R, Shinde S. : A classification of articulators- A Review article: Int J Dent Health Sci 2017,4(3):674-683.
7. Singh N, Dandekeri S, Shenoy K, Bhat V. Digital Articulators: A promising technology. Int J Dent Med Res 2014;1(2):98-102.
8. Padmaja BI, Madan B, Himabindu G, Manasa C: Virtual articulators in dentistry- A review; Int J Med Appl Sci, E-ISSN:2320-3137.
9. Korlakunte PR, Aljanakh M. The role of virtual articulator in prosthetic and restorative dentistry. J. Clin Diagnost Res 2014 Jul;8(7): ZE25-ZE-28.
10. Boucher, C.O.: Swenson's Complete Dentures, ed 6. Sr. Louis, 1970, The C.V. Mosby Company, pp 272-291.
11. Dental Industry Developments, Memorabilia of the Hanau Articulator. J Acad Gen Dent 19:38, 1971.
12. Instructions for the use of the Hanau H2 Articulator. Hanau Engineering Company, Buffalo, N.Y.
13. Whip-Mix Corporation: Instruction Manual for the Whip-Mix articulator and quick mount face bow. Louisville,Kentucky.
14. Stansbery, C.J.: Functional Position Checkbite Technique, J.A.D.A. 16:421-440. 1929.
15. Lee RL: Jaw movements engraved in solid plastic for articulator controls. Part I, Recordings apparatus. J Prosthet Dent 1969;22; 209-224.