

# Prosthodontics

Lec. 9

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## DENTAL ARTICULATOR & FACE-BOW

### Definition:

It is a mechanical instrument that represents the temporo-mandibular joints and jaw members, to which maxillary and mandibular casts may be attached to simulate some or all mandibular movements.

### Functions:

1. It allows most of the prosthetic work to be done in the absence of the patient (diagnosis, treatment planning, setting-up of teeth and development of balanced articulation and waxing-up of dentures).
2. Maintain jaw relation record during setting-up of teeth.
3. Denture remounting after processing for correction of occlusal disharmony.

### Types of dental articulators:

1. Simple hinge articulators (*Class I*).
2. Mean value or fixed condylar path articulators (*Class II*).
3. Adjustable condylar path articulators.
  - a. Semi-adjustable condylar path articulators (*Class III*).
  - b. Fully-adjustable condylar path articulators (*Class IV*).
4. Digital computerized articulator programming.

## **1. Simple Hinge Articulators (plane line:**

### **Design:**

It consists of an upper and lower members held apart at a certain distance by a screw which acts at the back. The screw can be increased or decreased to change the distance between the two members, and permits only a hinge like movement as shown in **Figure 1**.

### **Possible movements:**

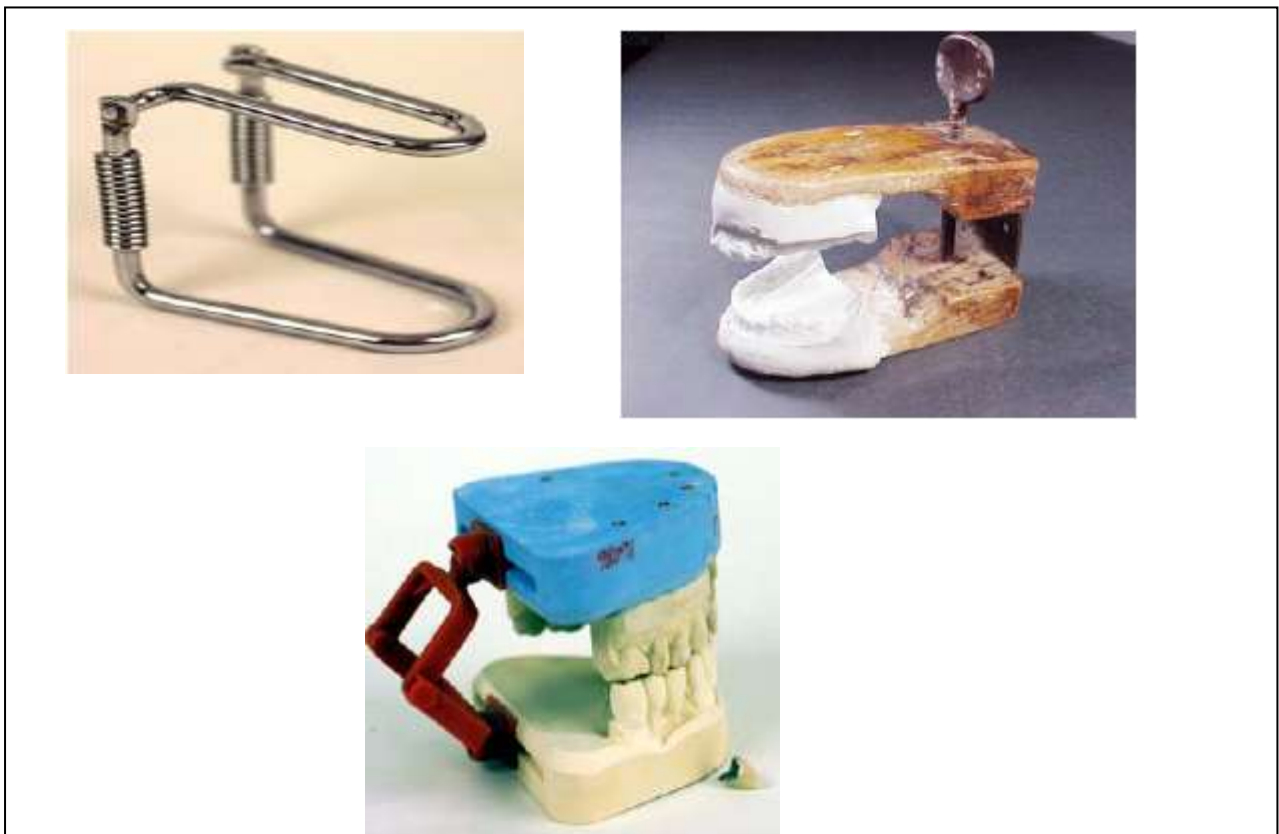
This type of articulators gives only opening and closing movements.

### **Records required:**

- a. Vertical dimension of occlusion.
- b. Centric relation records.

### **Disadvantages:**

These articulators do not represent the temporomandibular joint and the dynamic mandibular movements.

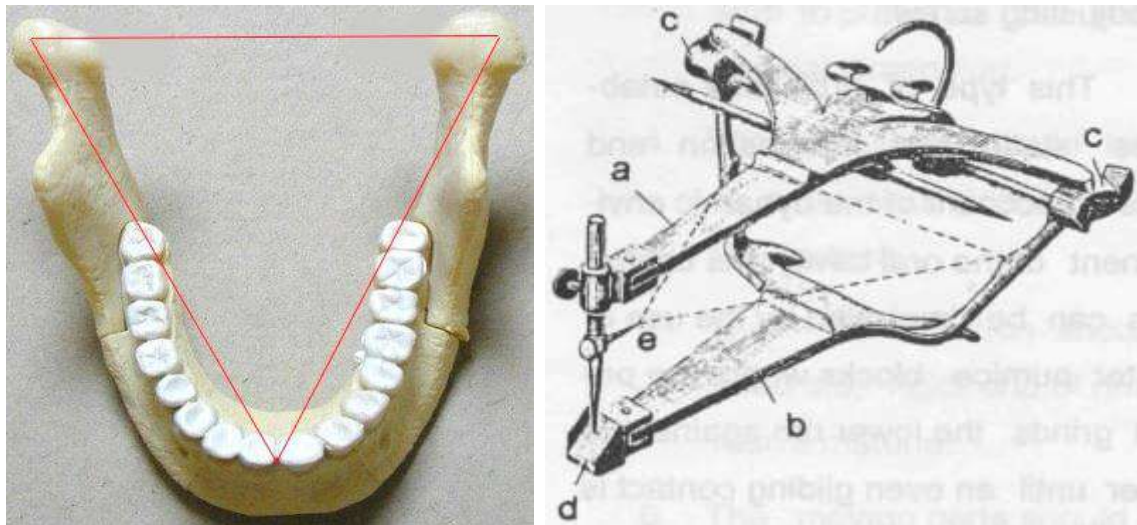


**Figure 1:** The simple hinge articulators

## 2. Mean Value or Fixed Condylar Path Articulators:

### Design:

The two members of these articulators are joined together by two joints which represent the TMJ. The horizontal condylar path is fixed at a certain angle that ranges from 30-40 which is the average of the most patients. The incisal guide table is also fixed at a certain angle from horizontal.



**Figure 2:** Left; Bonwill triangle. Right; Fixed condylar path articulator. Mounting of maxillary cast according to Bonwill triangle (dotted line)

### Possible movements:

1. Opening and closing.
2. Protrusive movement at a fixed condylar path angle.

### Records required:

- a. Vertical dimension of occlusion.
- b. Centric relation record.
- c. Face-bow record: In some designs of these articulators, the upper cast can be mounted by a face bow transfer.

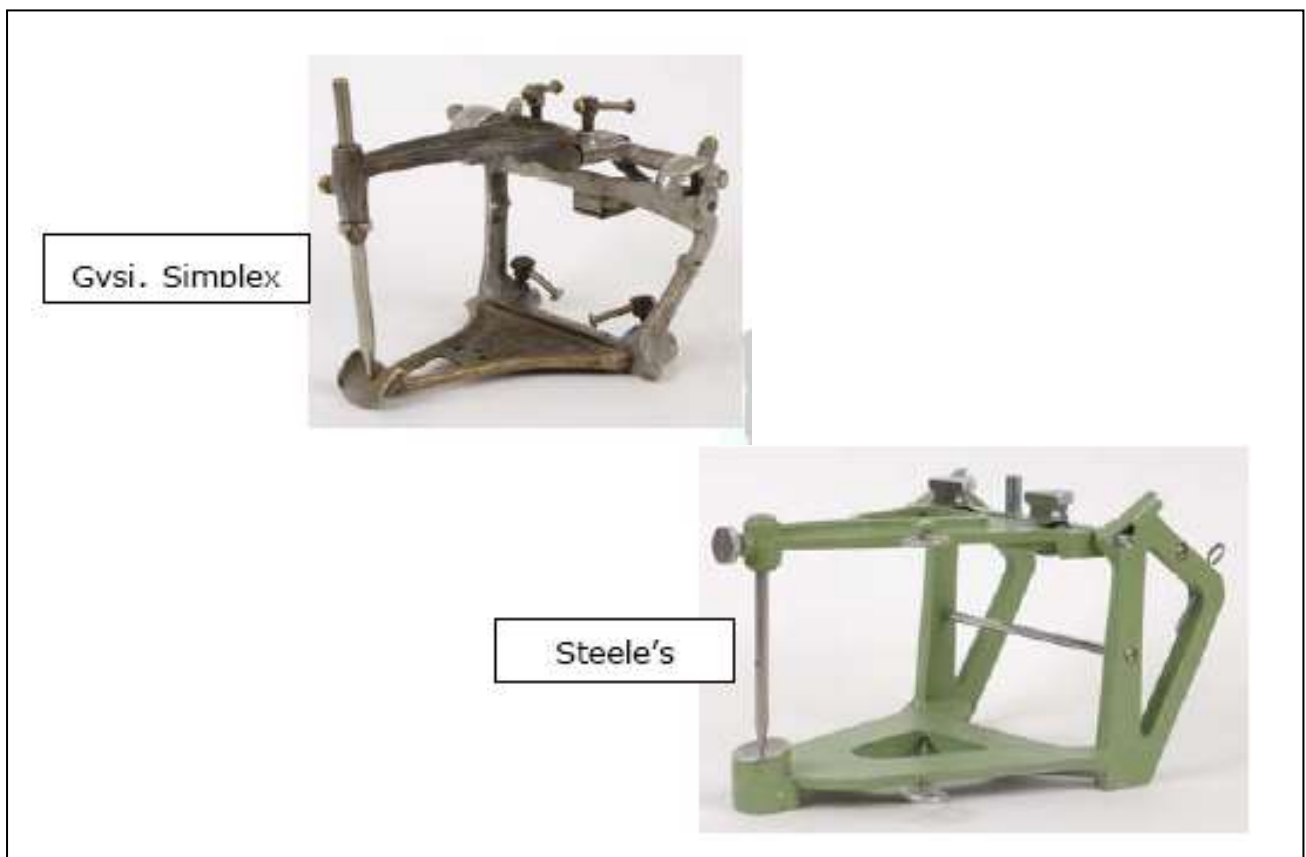
When the articulators do not accept face-bow record, the mounting is made according to Bonwill triangle.

Bonwill found in mandibles that the inter-condyle distance as well as the distance from each condyle to the contact point of the lower central incisors was 4 inches equilateral triangle (**Figure 2**). An anterior pointer is attached to the incisal pin of the articulator to locate the tip of the occlusion rim labially and thus to orient cast in relation on the Bonwill triangle.

On the fixed and most condylar path articulators the upper members are movable (the condyle) and the lower members are non-movable, as seen in (**Figure 3**).

**Disadvantages:**

- a. Most of these articulators do not accept face-bow record.
- b. The condylar path moves to a fixed angle and it is successful in patients whose condylar angle approximates that of the articulator.
- c. No lateral movements.



**Figure 3: The mean value articulators**

### 3. Adjustable Condylar Path Articulators:

These types of articulators differ from the fixed condylar path articulators in that it has adjustable condylar and incisal guidances. They can be adjusted so that the movements of its jaw members closely resemble all movements of the mandible for each individual patient.

#### A- Semi-adjustable condylar path articulators:

##### Design:

In these articulators (e.g. Hanau's articulator **Figures 4, 5**) the horizontal condylar path is adjusted by a protrusive record obtained from the patient.

The lateral condylar path inclination is adjusted according to the Hanau's formula:  $L = H / 8 + 12$ .

Where; L= The lateral condylar path. H= The horizontal condylar path.

Some semi-adjustable articulators are Non-Arcon as in **Figure 4**, while others are Arcon (**Figure 5**). The term Arcon is commonly used to indicate an instrument that has its condyles on the lower member and the condylar guides on the upper member.



**Figure 4: Non-Arcon semi-adjustable articulators**



**Figure 5: Arcon semi-adjustable articulators**

**Possible movements:**

- a. Opening and closing.
- b. Protrusive movement according to the horizontal condylar path angle determined from the patient.
- c. Lateral movement to the angle estimated from the Hanau`s formula.
- d. Some types have Bennett movement (immediate side shift).

**Records required:**

- a. A Maxillary face bow record to mount the upper cast.

Some of the semi-adjustable articulators have orbital plane guides. The orbital plane guide allows the casts to be mounted in relation to the orbital plane axis of the patient and orients the casts on the articulator in the same relationship to the dental arches as in the patient.

- b. Centric occluding relation record (vertical dimension and centric relation) to mount the lower cast.

c. Protrusive record to adjust the horizontal condylar path inclination of the articulator.

**Disadvantages:**

- a. The lateral condylar path angle is determined from the formula.
- b. Most of these articulators have no Bennett movement.

**B- Fully-adjustable articulators:**

They differ from the semi-adjustable articulators in that the lateral condylar path inclinations are adjusted according to records taken from the patient (Figure 6).



**Figure 6: Fully-adjustable articulators**

**Possible movements:**

The same movements of the semi-adjustable articulators. In addition they have Bennett movement.

**Records required:**

- a. A maxillary face bow record to mount the upper cast.
- b. Centric occluding relation record to mount the lower cast.
- c. Protrusive record to adjust the horizontal condylar path inclination.
- d. Right lateral record to adjust the left lateral condylar path inclination.
- e. Left lateral record to adjust the right lateral condylar path inclination.

**Disadvantages:**

Multiple records are required with the possibility of errors. Therefore, the semi-adjustable articulators are usually enough for complete denture construction.

**4. Digital computerized articulator programming:**

The virtual articulators are able to design prostheses kinematically. They are capable of:

- simulating human mandibular movements.
- moving digitalized occlusal surfaces against each other according to these movements.
- correcting digitalized occlusal surfaces to enable smooth and collision-free movements.

There are two types of digital articulators. One is Completely Adjustable Articulators, another is Mathematically Simulated Articulator.

- **Completely adjustable articulators (motion analyzer):-** It was designed by Kordass and Gaertner. It records/reproduces exact movement paths of the mandible using an electronic jaw registration system called Jaw Motion Analyzer (JMA).

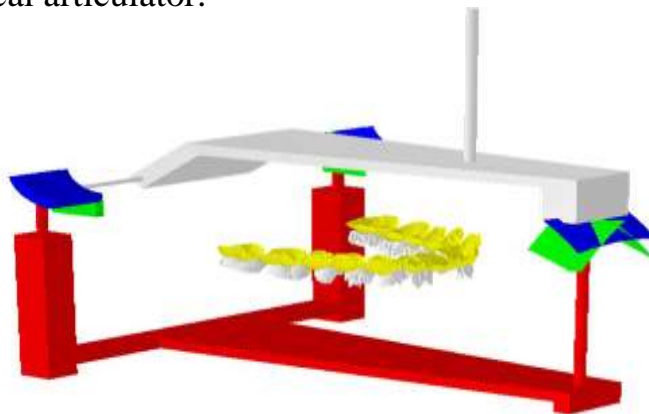


Jaw Motion Analyzer is device for tracking the jaw of patient. It consists of face bow with receiver sensors, lower jaw and pointer sensor, occlusal adapter and software.



**Figure 7: Kordass' Virtual Articulators**

- **Mathematically simulated articulator (motion parameter):-** It is designed by Szentpétery. It is based on a mathematical simulation of the articulator movements. It is a fully adjustable three dimensional virtual articulator capable of reproducing the movements of a mechanical articulator.



**Figure 8: Szentpétery's Virtual Articulators**

## **FACE-BOW**

The face-bow is a caliper- like device that is used to record the relationship of the maxilla to the temporomandibular joints or the opening axis of the jaws and to orient the casts in this same relationship to the opening axis of the articulators.

### **The face-bow consist of :**

1. U- shaped frame or assembly.
2. The condyle rods.
3. The fork.

### **Types of face-bow:**

There are two basic types of face-bow; the kinematic, and the maxillary.

#### **1. The kinematic ( mandibular, hinge axis locator) face-bow:**

It is used to locate the kinematic (true or terminal) transverse hinge axis.

The transverse hinge axis is an imaginary line, in which the mandible rotates during opening and closing for about 20 mm.

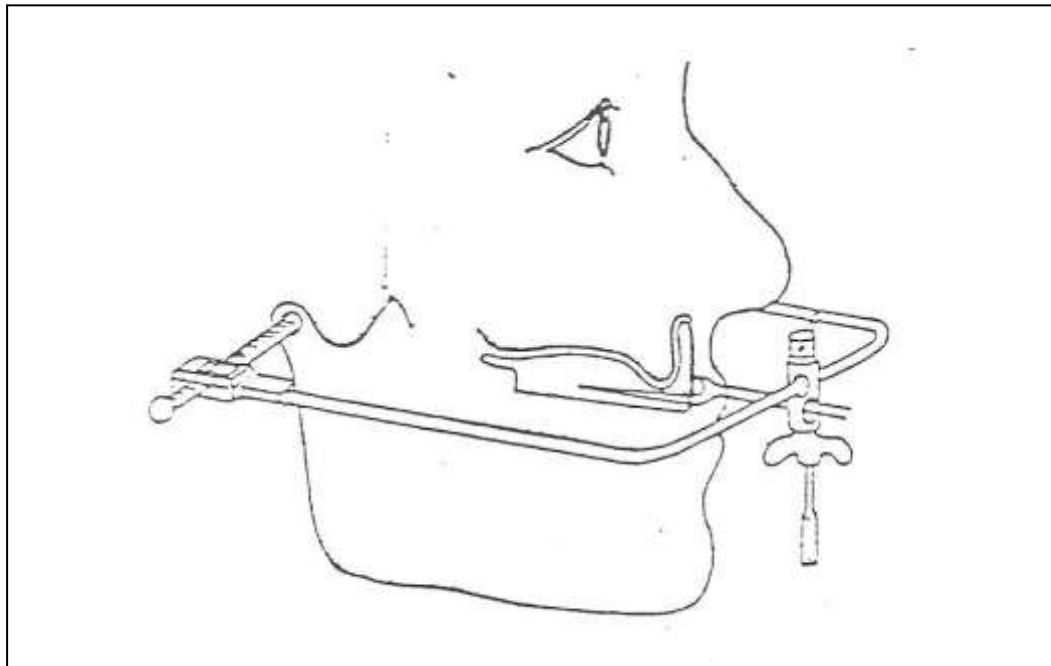
#### **2. The maxillary face-bow:**

It is used to record the position of the upper jaw in relation to the hinge axis and transferring the relation to the articulator (**Figures 9, 10**).

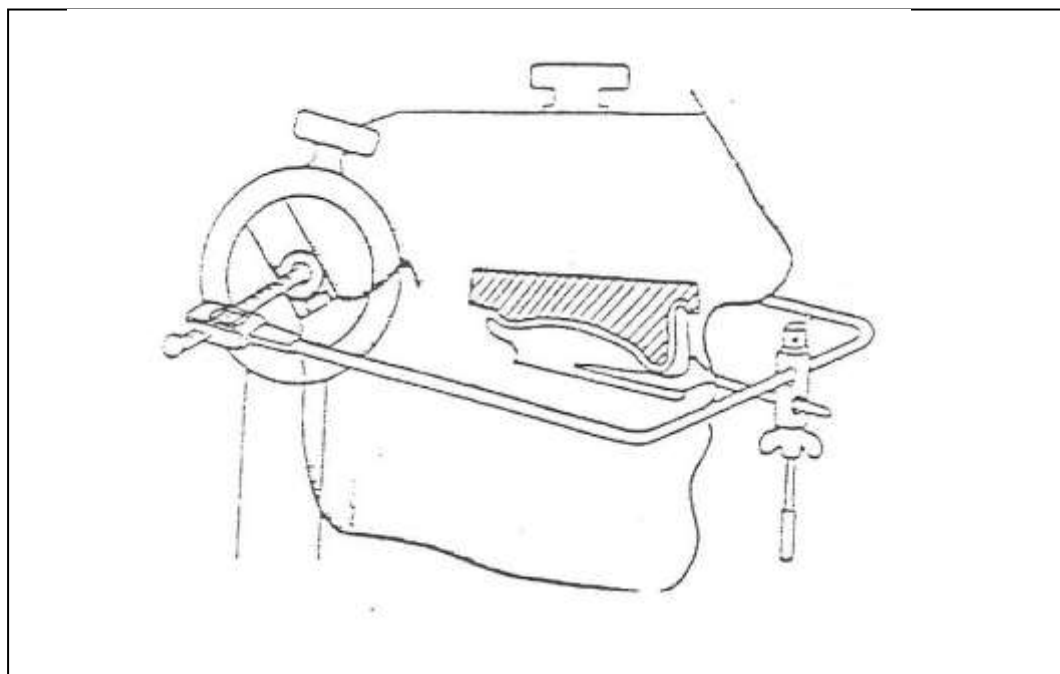
The maxillary face-bow is oriented to the kinematic or arbitrary hinge axis.

The arbitrary axis is positioned on a line extending from the outer canthus of the eye to the middle of the tragus of the ear and approximately 13 mm in front of the external auditory meatus.

The ear face-bows are designed to utilize an arbitrary axis by fitting into the external auditory meatus.



**Figure 9: The maxillary face-bow on the patient**



**Figure 10: The maxillary face-bow on the articulator**

**Important of the face-bow:**

1. An arbitrary mounting of the maxillary cast without a face-bow transfer can introduce errors in the occlusion of the finished denture.
2. A face-bow transfer allows minor changes in the occlusal vertical dimension on the articulator without having to make new maxillo-mandibular records.
3. It is helpful in supporting maxillary cast while it is being mounted on the articulator.