Inter occlusal Record (Bite Registration Record)

An imprint of the positional relation of opposing teeth or jaws to each other, made of the surfaces of occlusal rims or teeth with a bite registration material such as plaster of paris, wax, zinc oxide-eugenol paste, acrylic resin or Elastomers.

Objective of bite registration:

1) To transfer the relation between the upper and lower dental arches from the patient's mouth to the articulator we need bite registration. Proper interocclusal record is important to orient the die (s) of the same arch to the opposing arch.
2) An accurate interocclusal record and correct mounting of the casts on an articulator allow the laboratory technician to create proper contours and alignment of the metal substructure of the restoration as well as the proper contour and intercuspation of the teeth in porcelain.
3) Failure to capture an accurate interocclusal record will result in time-consuming chairside adjustments, the need for remounting casts and possible refabricating of the prosthesis

Accuracy of an interocclusal record Influenced by the following factors:

1) Material properties.
2) Recording technique.
3) Reliability of the mandibular position influenced by the occlusal contacts.
4) Muscular action.
5) Tissue changes within the joints.

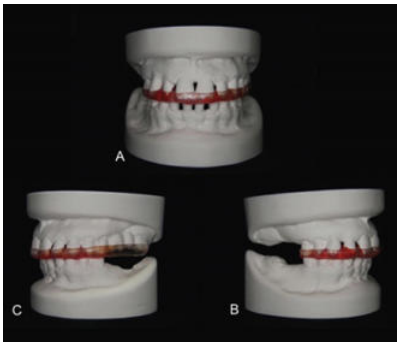
According to Dawson criteria for accuracy in making interocclusal records (requirements)

- The recording material must not cause any movement of teeth or displacement of soft tissues.
- The recording material must fit casts as accurately as it fits the teeth intra-orally.
- The accuracy of the jaw relation record should be checked in the mouth and on the casts.

Characteristics of ideal registration material:

To be ideal bite registration material must have the following properties;

1) Limited resistance before setting to avoid displacing teeth or mandible during closure.
2) Rigid after setting
3) Minimum dimensional change
4) Accurate record of incisal & occlusal surfaces
5) Easy to manipulate
6) No adverse effect on tissue
7) Records should be verifiable



Bite Registration Materials:

1) Impression plaster (soluble plaster)

- Type 1 modified with addition of accelerators to decrease setting time & setting expansion
- Records are accurate , rigid after setting , do not distort with extended storage ,
- Difficult to handle, record is brittle.
- Not used now

2) Bite registration waxes

- Ease of manipulation.
- High coefficient of thermal expansion
- High resistance to closure.
- Distortion of wax during removal is also very common.
- Dimensionally Inaccurate , may interfere with active & passive movements

It has been classified as most inaccurate material among the interocclusal records studied. Therefore, zinc oxide eugenol or resin was added to wax impression in a very thin layer to improve poor detail transfer and displacement of wax.

4) Zinc oxide eugenol paste

- Fluidity before setting – is a critical factor because it ensures minimal interferences with mandibular closure during recording.
- Adhesion to carriers
- Rigid and inelastic after setting
- Accuracy in recording occlusal and incisal surfaces
- High degree of reproducibility
- Brittle(vital portion may be lost by breakage)
- Sticks to tissues
- Unless trimmed ,flash around the teeth may prevent accurate seating of casts

5) Acrylic Resin

The most frequent application of acrylic resins for interocclusal records is in the fabrication of single stop centric occlusion records. Acrylic resin is both accurate and rigid after setting.

Disadvantages:

- Dimensional instability due to polymerization shrinkage.
- Rigidity of the material can damage plaster cast and dies during mounting on the articulator.

6) Elastomers for IOR (luxabite):

- Least error among the materials studied. They are easy to manipulate and offer little or no resistance to closure.
- Set to a consistency that makes them easy to trim without distortion, and accurately reproduce tooth details. Furthermore, among the elastomers, addition silicones exhibit least amount of distortion.
- The excellent dimensional stability of addition silicones is attributed to the fact that it sets by addition polymerization reaction. Therefore, no by-products and no loss of volatiles occur in addition silicones.
- Dimensional stability, accuracy and elastic recovery, with short working time

OCCLUSION

The contact of the opposing surfaces of teeth of the two jaws". It is a relationship of the mandibular and maxillary teeth when closed or during side to side movements of the mandible;when the teeth of the mandibular arch come in contact with the teeth of the maxillary arch in any functional or parafunctional relationship.

DETERMINANTS OF OCCLUSION:

- ***Anterior Determinants of Occlusion***

  The teeth of the maxillary and mandibular arches represent the Anterior Determinants of Occlusion, it involves;

  1) *The anterior teeth: (canine to canine)*

  - ❑ Determine the movement of the anterior portion of the mandible (guide the mandible in right and left lateral excursive movements and in protrusive movements).
  - ❑ Anterior guidance is variable since it can be altered by: restorations, extractions, orthodontics, attrition, etc.

  2) *The posterior teeth:*

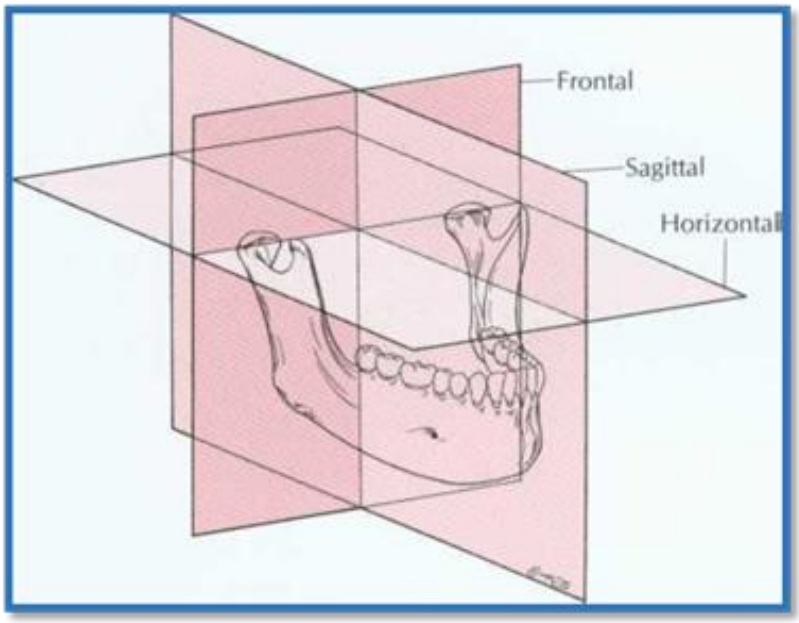
  - ❑ Vertical stops for mandibular closure.
  - ❑ Guide the mandible into the position of maximum intercuspation.

- ***Posterior Determinants of Occlusion***

  Temporomandibular joint, right and left, represent the posterior determents of occlusion. Condylar guidance is a fixed factor, and the TMJs are the posterior controlling factor in mandibular movement.

MANDIBULAR MOVEMENT

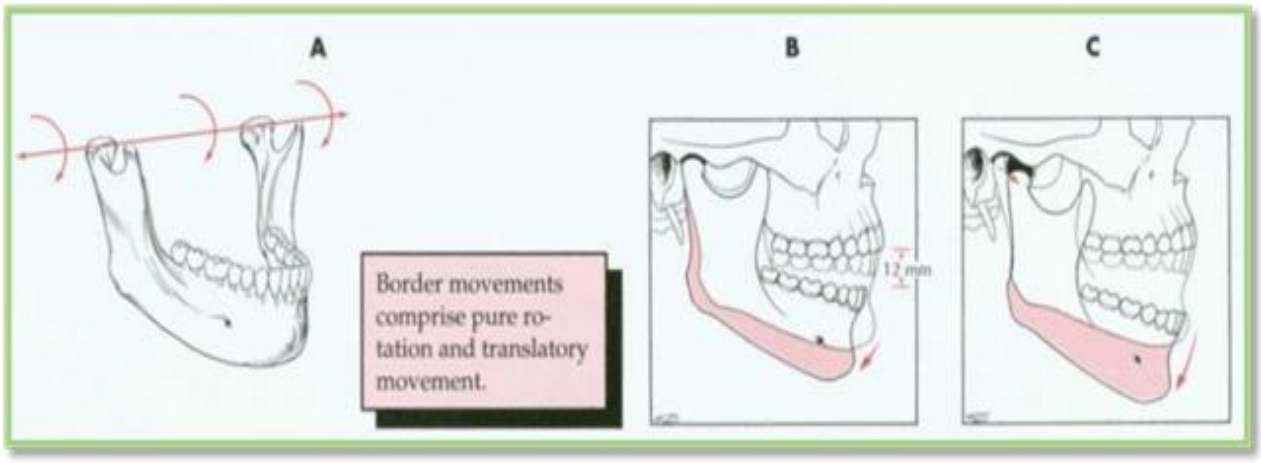
As for any other movement in space, complex three-dimensional mandibular movement can be broken down into two basic components: translation, when all points within a body have identical motion, and rotation, when the body is turning about an axis. Every possible three-dimensional movement can be described in terms of these two components, so, *It is easier to understand mandibular movement if we broke it into in three perpendicular planes: sagittal, horizontal, and frontal; or can be broken into series of motions that occurs around three axes*



Reference Plans of mandibular movements

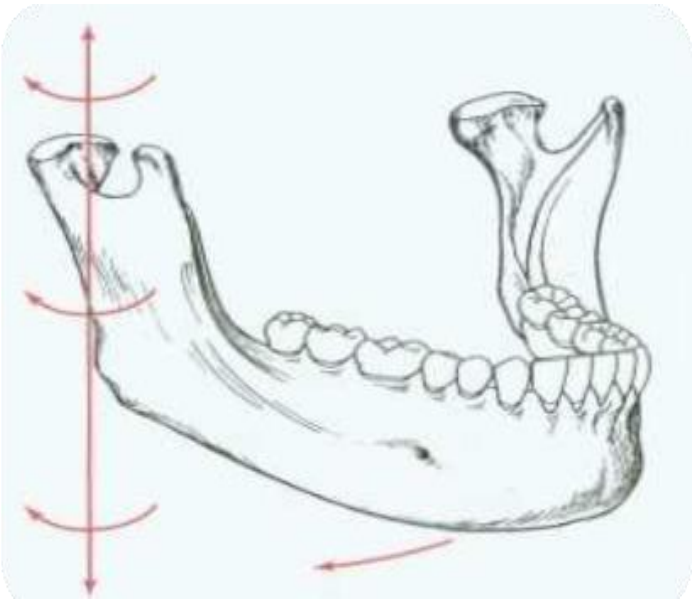
1) Sagittal Plane

In this plane, **the mandible is capable of a purely rotational movement as well as translation**. Rotation *occurs around the terminal hinge axis*; an imaginary horizontal line through the rotational centers of the left and right condylar processes. **The rotational movement** is limited to about **12 mm** of incisor separation **before the temperomandibular ligaments** structures anterior to the mastoid process **force the mandible to translate.** The initial rotation or hinging motion is between the condyle and the articular disk. During translation, the lateral pterygoid muscle contracts and moves the condyle-disk assembly forward along the posterior incline of the tubercle. Condylar movement is similar during protrusive mandibular movement.



2) Horizontal Plane

In the horizontal plane, the mandible is capable of rotation around several vertical axes. For example, lateral movement consists of rotation around an axis situated in the working (laterotrusive) condylar process with relatively little concurrent translation. The orbiting (nonworking) condyle travels forward and medially as limited by the medial aspect of the mandibular fossa and the temporomandibular ligament. Finally, the mandible can make a straight protrusive movement.



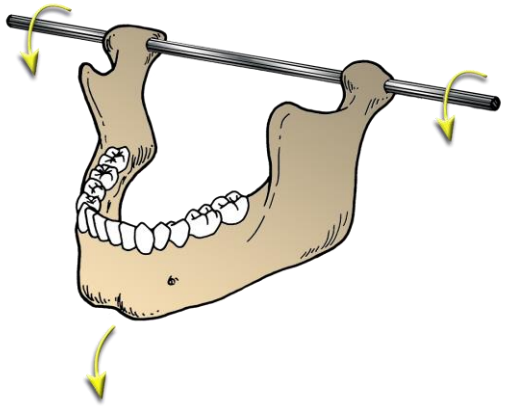
3) Frontal Plane

When observing a lateral movement in the frontal plane, the mediotrusive (or nonworking) condyle moves down and medially while the laterotrusive (or working) condyle rotates around the sagittal axis perpendicular to this plane.

According to the axes mandibular movements can broke into :-

1) Horizontal axis:

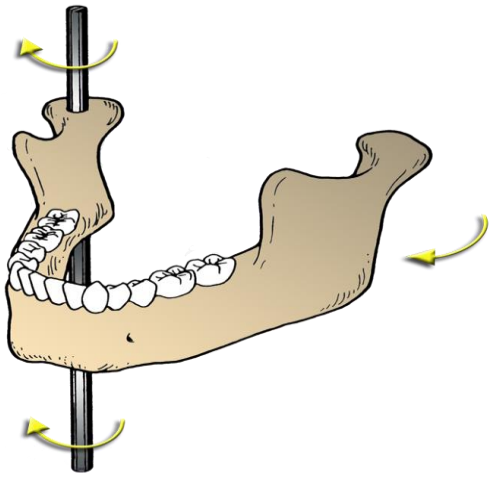
This movement, in the sagittal plane, happens when the mandible in centric relation makes a purely rotational opening and closing border movement around the transverse horizontal axis, which extend through both condyles.



The mandible moves around a horizontal axis,as seen in a hing axis opening

2) Vertical axis:

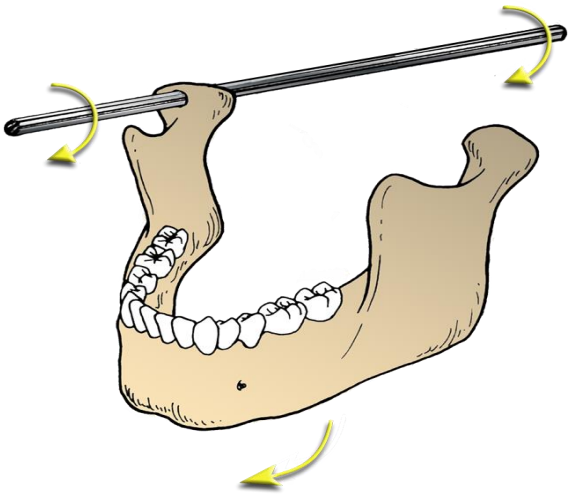
This movement occurs in the horizontal plane when the mandible moves into a lateral excursion. The center for this rotation is a vertical axis extending through the rotating or working side condyle .



The mandible moves around a vertical axis, during a lateral excursion.

3) Sagittal axis:

When the mandible moves to one side, the condyle on the side opposite from the direction of movement travel forward (Fig. 18). (Shillingburg et al, 1997)



The mandible also rotates around a sagittal axis, when one side drops down during a lateral excursion.

CLASSIFICATION OF OCCLUSION

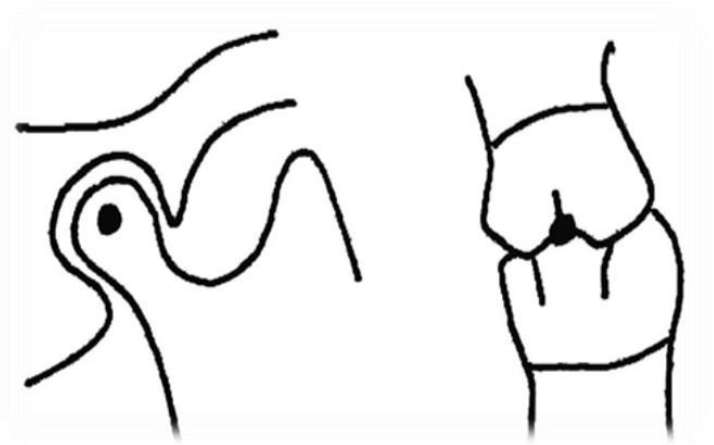
1. BASED ON MANDIBULAR POSITION

According to the position of mandible occlusion can be divided into two main subdivision centric and eccentric occlusion.

A. Centric Occlusion (CO):

The occlusion of teeth as the mandible closes in centric relation.

- It's a tooth-to-tooth relation.
- It is a reference point from which all other relations are eccentric.





Centric relation (CR)

Centric relation is a bone-to-bone relation. It is the relation between the maxilla and the mandible when the condyles are in the rear most upper most mid most in the glenoid fossae.

Maximum Intercuspation (MI):

It Is The Most Closed Complete Interdigitation Of Mandibular And Maxillary Teeth Irrespective Of Condylar Centricity. In Other Words, Maximum Intercuspation May or May Not Coincide With Centric Occlusion, Depending On the Position Of The Condyle.

If maximum intercuspation occurs with the condyles being out of centricity, then both positions would not coincide, with the maximum intercuspation in that case, referred to as the ***habitual or physiological occlusion or closure***, and is considered as an eccentric position. On other hand, low percentage of population have their maximum intercuspation coincide with centric occlusion (condyles centricity) such a case referred as ***ideal occlusion*****.**

You should keep in your mind the following points:

1) Centric relation should not be confused with the centric occlusion.

2) Centric relation is not a relation about teeth. (The edentulous mandible is in centric relation if the condyle-disk assemblies are completely seated.)

3) Centric relation is not just a convenience position that is used because it is repeatable. It is the universally accepted jaw position because: ***It is physiologically and biomechanically correct. Secondly it is the only jaw position that permits an interference-free occlusion.***

B. Eccentric Occlusion:

Occlusion other than centric occlusion refer to contact of teeth that occurs during movement of mandible.

Lateral occlusion: (working or functional side occlusion)

It is defined as the contact between opposing teeth (canines and posterior teeth) when the mandible is moved right or left of the midsagittal plane. The contacts occur on the sides towards which the mandible moves (working side).

PROTRUDED OCCLUSION

The occlusion of the teeth when the mandible is protruded (It includes eccentric contacts that occur when the mandible moves forward). The position of the mandible is anterior to centric relation. Ideally the six maxillary anterior teeth contact along the lingual inclines of the mandibular anterior teeth while the posteriors disocclude.

Balancing (nonfunctional) side occlusion

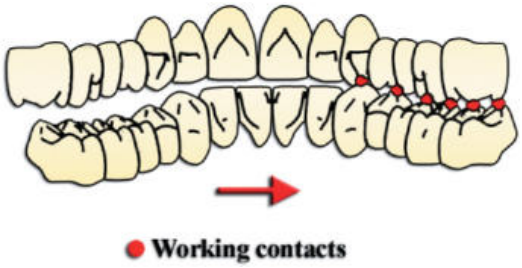
They are tooth contacts that occur in the segment away from which the mandible moves. For example if the mandible is moved to the left side, contact occur on right side.

2. BASED ON THE ORGANIZATION OF OCCLUSION

According to the pattern of occlusal relation of opposing teeth during lateral movement of mandible, occlusion can be divided into

A. Unilateral Balanced Occlusion:(Group Function)

Simultaneous contact of maxillary and mandibular teeth on working side as they glide over each other during lateral movement mandible movement from centric relation to the right or left side acting as a group to share & distribute forces ,however , teeth on the balancing side (non working) are free from any contact. It is widely accepted and used concept in fixed restorative dentistry



B. Bilateral Balanced Occlusion

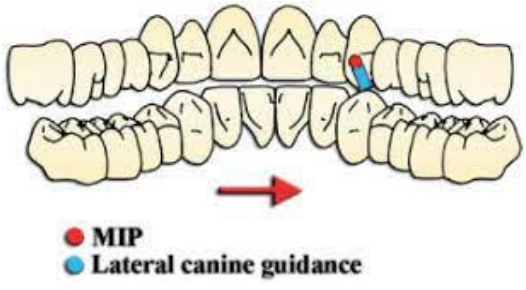
The simultaneous contact of maxillary and mandibular teeth on working and balancing side as they glide over each other on the right and left , in anterior and posterior occlusal area when the mandible moved from centric relation to eccentric occlusal relations (balanced and equal contacts are maintained throughout the entire arch during all excursions of mandible). This type of occlusion rarely found in natural dentition, however, generally consider necessary for denture stability.



C. Canine guided (protected) Occlusion

During lateral mandibular movements, the opposing upper and lower canines of the working side contact there by causing disclusion of all posterior teeth on the working and balancing sides (The anterior teeth protecting the posterior teeth in all mandibular excursions and the posterior teeth protecting the anterior teeth at the intercuspal position). It is widely accepted, easy fabricated & greater tolerance by patients





3. Based on relationship of first maxillary permanent molar

a) **Class I : Neutro Occlusion**

Mesiobuccal cusps of the upper first permanent molar occludes with the mesiobuccal groove of the lower first permanent molar. This is called the key of occlusion

b) **Class II : Disto Occlusion**

Condition in which the mandibular first Permanent molar is placed posterior in relation to the normal class I condition

- *Division I*
- *Division II*

c) **Class III : Mesio Occlusion**

Condition in which the mandibular first Permanent molar is placed anterior in relation to the normal class I condition

Types of Interocclusal Records

Basically, there are three main categories of interocclusal registration:

- *Centric intercuspal records (centric occlusion or maximum intercuspation)*
- *Centric interocclual record (centric relation)*
- *Eccentric interocclusal records.*
  - *lateral inter occlusal records*
  - *protrusive inter occlusal records*

What we need to record in fixed prosthodontics? Centric relation CR or CO or IP ????

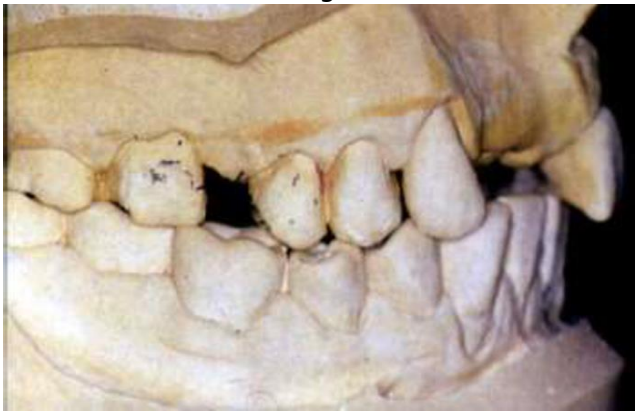
Most of time, in fixed prosthodontics, If the patient has a stable intercuspal position (weather it coincide with centric occlusion or not) and the treatment is restricted to the restoration area while all the remaining teeth didn't not involve in the treatment plan with no signs and symptoms of trauma to the occlusion, the goal of treatment should be directed toward maintaining pre-treatment intercuspation and occlusal vertical dimension (OVD) .

However In cases of occlusal reconstruction or complete mouth rehabelation treatment furthermore if the patient have un stable intercuspal position, with signs and symptoms of trauma from occlusion , the goal of treatment should be directed toward using centric relation as treatment position

Recording centric occlusion or maximum intercuspal position

If the patient has an adequate number of teeth and a stable intercuspal position, no signs and symptoms of trauma to the occlusion and the goal of treatment is to maintain pre-treatment intercuspation and occlusal vertical dimension (OVD). Most accurate method of articulation is to occlude opposing casts by hand, without intervening bite registration material.

Recording material placed between teeth in this case often prevents casts from maximal intercuspation and an interocclusal record is registered at an increased OVD.



Indications for Interocclusal Records

1) *When a segmental restorative is planned & remaining teeth are insufficient to produce hand articulation of the casts An interocclusal record is needed (as there is insufficient horizontal stability of the casts for hand articulation and mounting,for opposing casts to occlude accurately, a tripod of vertical support and horizontal stability must exist between the casts. The patient's pre-treatment maximum intercuspal position (MIP) is usually maintained.*



2) *When a unilateral fixed partial denture (FPD) involving terminal teeth is prepared, the dentist must fabricate an interocclusal record to recapture the lost leg and create a tripod of vertical support to mount casts accurately.*



3) *Interocclusal record is capture after construction of bit rim when fixed partial denture (FPD) planned for a patient have*

- *Missing poster teeth (Free end saddle) & need to restore the anterior teeth.*
- *Insufficient teeth to obtain accurate interocclusal record.*

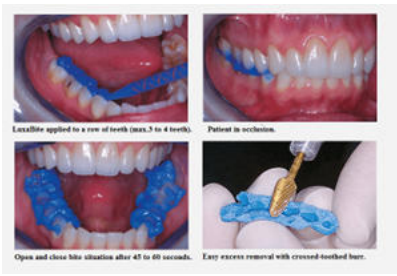


Factors that influence inter occlusal record procedure;

- Amount and equalization of pressure, which depends on uniform consistency of recording material.
- Comfort of patient, which depends on stability & compatibility of record bases. Artificial teeth are more compatible to mandibular movements than occlusion rims.
- An inter occlusal record with multiple points of references made by stylus pen on cusp tips is more satisfactory than with occluding surfaces of wax or non-cusp form teeth.

How TO Record

Whatever the material used to record the relation, you have to guide the mandible to the required relation (centric or eccentric). So ask the patient to close and guide him, put reference point (occlusion of the teeth opposite to the side of treatment), then put the record material and register the relation. *The recording material should place over the area between the prepared teeth only*. The most widely used material to record the occlusal relation is pink base plate wax or elastomer. The procedure is by softening the wax at first, then apply the soft wax over the occlusal surface of the prepared teeth, then, ask the patient to bite on it, keeping in your mind that you have to guide the mandible of the patient to the reference point that you mark it, to have the correct registration. The patient is asked then to mold the wax at the lingual area by his tongue, while by your finger adapt the wax on the labial side. In case of using elastomer you can ask the patient to close, then you can inject the material at the area of treatment. After complete setting remove the record from the patient mouth, trim the excess and attach it to the cast and transfer it to the articulator.









Interocclusal record is capture after construction of bit rim

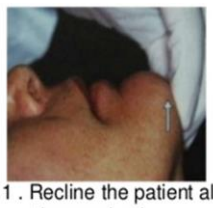
Recording centric relation

- **Dawson Technique *(Bimanual manipulation technique).***

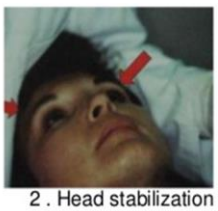
He used bilateral manipulation to guide the mandible to centric relation and used following recording techniques:

How to record?

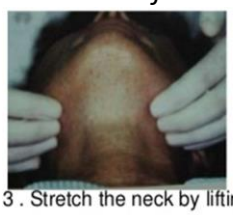
Dowson in 1914 suggest to place dental chair in reclined position and the patient s head fixed by dentist standing behind the patient with both thumbs on chin and the figures resting on the inferior border of the mandible *(Bimanual manipulation technique), then, by gentle downward pressure by thumbs and upward pressure by fingers, the patient mandible will bring into centric, ask the patient to bite on the bite registration material. After complete setting remove the record from the patient mouth, trim the excess and attach it to the cast and transfer it to the articulator.*



1 . Recline the patient all the way back



2 . Head stabilization



3 . Stretch the neck by lifting the patient's chin



4 . Place the four fingers on lower border of the mandible



5 . Bring the thumbs together to form a 'c' with each hand

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- **anterior- jig programmer**

Procedure for making an interocclusal record without the use of record bases. It involve Separation of the posterior teeth immediately prior to centric relation record fabrication using anterior- jig programmer, mostly Acrylic resin anterior stop, This results in the patient "forgetting" established protective reflexes that are reinforced each time the teeth come together, making mandibular hinge movements easier to reproduce. Acrylic resin anterior stop (anterior- jig programmer) is used to hold the desired vertical dimension of occlusion. Pink Base plate Wax or elastomer inter occlusal recording paste can be used then to record inter occlusal relation. If properly executed, use of a deprogramming device allows the patient to close into an operator-defined repeatable position unassisted.

How to record?

When the mandible is closed, the lower incisors strikes against a stop that is precisely fitted against the upper incisors. ***The stop should be thin enough so that the first point of tooth contact barely misses but under no circumstances should any posterior tooth be allowed to contact when the anterior stop is in place.*** *A firm setting bite registration paste is injected between the posterior teeth and allowed to set.*



Bite registrations for CAD/CAM procedures

Bite registration can be digitally recorded in the same way as that used for digital impression, both procedures are employed in conjunction with the computer-aided design/computer-aided manufacturing (CAD/CAM). Digital Bite registration are taken either:

- ❑ Indirectly using extra oral scanner (In lab).
- ❑ Directly in the mouth at chairside using an intraoral digital camera (In office).

In order to determine the occlusal relationship, for indirect scanning technique, an antagonist bite registration is required. Being able to directly capture images of this bite record with a scanning device or camera without having to apply a contrast medium, while for direct technique, in order to determine the occlusal relationship, the image of occlusal relation of opposing dental arch is capture directly from the inside of patient s mouth using intra oral digital camera without the need for of any material for bite registration record

Mounting of maxillary and mandibular arch

It is procedure of attaching the maxillary and mandibular casts to the articulator in their recorded jaw relation. The maxillary cast is first mount to the articulator using facebow record and then the mandibular cast is articulate (mount)after recording centric jaw relation.

FACEBOW

Dental instrument that used to records the relationship of the maxilla to the hinge axis of rotation axis of the mandible and transfer it to the articulator. It allows the maxillary cast to be placed in an equivalent relationship on the articulator i.e. it aid in mounting maxillary cast on the articulator In order to identify true hinge axis, hinge axis locator and hinge axis face bow are necessary. Facebow either kinematic (orient maxilla to actual hinge axis) or arbitrary (orient maxilla on arbitrary hinge axis).

Articulators

Articulator is a mechanical device which represents the temporomandibular joints and the jaw members to which maxillary and mandibular casts may be attached to simulate jaw movements.

PURPOSE OF AN ARTICULATORS

1) *To hold the maxillary and mandibular casts in a determined fixed relationship.*
2) *To simulate the jaw movements like opening and closing.*
3) *To produce border movements (extreme lateral and protrusive movements) and intra border movements (within the border movement) of the teeth similar to those in the mouth.*

USES OF AN ARTICULATOR

- *To diagnose the state of occlusion in both the natural and artificial dentition.*
- *To plan dental procedures based on the relationship between opposing natural and artificial teeth eg; evaluation of the possibility of balanced occlusion.*
- *To aid in fabrication of restorations and prosthodontic replacement.*
- *To correct and modify completed restoration.*
- *To arrange artificial teeth.*

TYPE OF ARTICULATORS;

1. **Nonadjustable articulator;**
   - *They can open and close in a fixed horizontal axis.*
   - *Have a fixed condylar path along which the condylar ball can be moved to simulate lateral and protrusive jaw movement.*
2. **Semi adjustable articulator**

   They have adjustable condylar path, adjustable lateral condylar paths, adjustable incisal guide tables and adjustable intercondylar distances.

   Semi adjustable articulator types:

   Arcon vs. Nonarcon
   - **Arcon:** *in this type the condylar element (condylar spheres) is attached to the lower member of the articulator and the condylar guidance (mechanical fossae) is attached to the upper member. This articulator resembles TMJ.*
   - **Nonarcon:** *in these, the articulators have the condylar guidance (mechanical fossae representing glenoid fossae) attached to the lower member, condylar element (condylar spheres) on the upper. This articulator is reverse of the TMJ.*
3. **Fully adjustable articulator**

   Capable of being adjusted to follow the mandible movement in all direction. These articulators have a number of readings which can be customized for each patient. They do not have condylar guidance, instead have receptacles in which acrylic dough can be contoured to form a customized condylar and incisal guidance.

