FUNDAMENTALS OF OCCLUSION

Fundamentals of Fixed Prosthodontics-Shillingburgh (Pp 11-23)

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IMPORTANCE OF OCCLUSION

• The long-term success of a restoration is dependent upon maintenance of occlusal harmony.
• Fabricate a restoration that will not create iatrogenic occlusal disease.
GOALS OF RESTORATIVE TREATMENT

• To create occlusal contacts in posterior teeth that stabilize instead of creating deflective contacts that may destabilize the mandibular position.

• The occlusion of a restoration should be made in harmony with the optimum condylar position – **CENTRIC RELATION**.
CENTRIC RELATION

An anteriorly, superiorly braced position along the articular eminence of the glenoid fossa, with the articular disc interposed between the condyle and eminence.
CENTRIC RELATION

• This position of the condyles in the glenoid fossae has been discussed and debated for many years.

• It is used in dentistry as a repeatable reference position for mounting casts.
CENTRIC RELATION

• Many methods used to guide the mandible into an ideal position.

• Earlier concepts of centric relation involved the most posterior condylar position in the fossa.

• The condyle was forcefully manipulated into the rearmost, uppermost and midmost position called the RUM position using the chin guidance technique.
PHYSIOLOGICAL POSITION

• The more recent concept describes a physiological position regarding the musculoskeletal relationship of the structures.

• It is not a forced position, but is gently guided by the operator using the bilateral method or by allowing the natural muscle action to place the condyle in a physiologically unstrained position.
MANDIBULAR MOVEMENT

Mandibular movement can be broken down into a series of motion that occur around three different axes.
Various mandibular movements are composed of motion occurring concurrently about one axis or more.
MANDIBULAR MOVEMENT

• The up and down motion of the mandible is a combination of two movements.

• A pure hinge movement occurs as a result of the condyles rotating in the lower compartment of the TMJ within a 10-13 degree arc which creates a 20-25 mm separation of the anterior teeth.
There is also some gliding (translation) movement in the upper compartment during maximum mouth opening.
MANDIBULAR MOVEMENT (Protrusive)

• When the mandible slides forward so that the maxillary and mandibular anterior teeth are in end-to-end relationship, it is in a **protrusive position**.

• Ideally the anterior segment of the mandible travel a path guided by the contacts between the anterior teeth, with **complete disocclusion of the posterior teeth**.
MANDIBULAR MOVEMENT
(Lateral excursion)

- Mandibular movement to one side will place it in working side and the other side will be the nonworking side.
- In this type of movement, the condyle on the NW side will **arc forward and medially**.
- The condyle on the working side will **shift laterally and slightly posteriorly**.
BENNETT MOVEMENT

- During lateral excursion, the bodily shift of the mandible in the direction of the working side was first described by BENNETT.

- The angle formed in the horizontal plane between the pathway of the NW condyle (the mandibular translation) and the sagittal plane is called the BENNETT ANGLE.
OBJECTIVES OF RESTORATIVE DENTISTRY

• One of the objectives of restorative dentistry is to place teeth in harmony with the TMJ.

• When teeth are not in harmony with the joints and with mandibular movement, an INTERFERENCE is said to exist.
OCCLUSAL INTERFERENCES

Interferences are undesirable occlusal contacts that may produce mandibular deviation during closure to maximum intercuspation or may hinder smooth passage to and from the intercuspal position.

There are four types of occlusal interferences:
1. Centric
2. Working
3. Nonworking
4. Protrusive.
OPTIMUM OCCLUSION

1. In closure, the condyle is in the most superoanterior position in the glenoid fossa. The posterior teeth are in solid and even contacts, and the anterior teeth are in slightly lighter contact.

2. Occlusal forces are in long axes of teeth

3. In lateral excursion, working-side contacts (preferably on the canines) disocclude or separate the NW teeth instantly

4. In protrusive excursion, the anterior teeth contacts will disocclude the posterior teeth.

5. In an upright position, the posterior teeth contact more heavily than anterior teeth.
There are three recognized concepts that describe the manner in which teeth should and should not contact in the various functional and excursive positions of the mandible:

1. Bilateral balanced occlusion.
2. Unilateral balanced occlusion (group function).
BILATERAL BALANCED OCCLUSION

- It is a prosthodontic concept which dictates that a maximum number of teeth should contact in all excursive positions of the mandible.
- Particularly useful in complete denture construction.
- Difficult type of arrangement to achieve.
- Excessive frictional wear of teeth due to multiple contacts during excursive movements.
UNILATERAL BALANCED OCCLUSION

- Commonly known as group function.
- All teeth on the working side to be in contact during lateral excursion.
- Teeth on the nonworking side are contoured to be free of contact.
- Teeth on the working side distributes the occlusal load favorably.
- Absence of contact on the nonworking side prevents teeth from being subjected to destructive, obliquely directed forces.
MUTUALLY PROTECTED OCCLUSION

- Also known as canine protected occlusion.
- The anterior teeth bear all the load and the posterior teeth are disoccluded in any excursive position of the mandible.
- In the intercuspal position, the posterior teeth contact and relieve the anterior teeth.
An articulator is a mechanical device that simulates the movements of the mandible.
ARTICULATOR

• Principle employed in the use of articulator is the mechanical replication of the path of movement of the posterior determinants - the TMJ.

• The instrument is then used in the fabrication of dental restorations that are in harmony with those movements.
BORDER MOVEMENT

• The outer limit of all excursive movements made by the mandible – BORDER MOVEMENT.

• All functional movements are confined to the three dimensional envelope of movement.
BORDER MOVEMENT

• Limited by the ligaments

• Highly repeatable

• Useful in setting the various adjustments on the mechanical fossae of an articulator
Articulators vary widely in the accuracy with which they reproduce the movements of the mandible.

Classification:
1. Non-adjustable
2. Semi-adjustable
3. Fully-adjustable
NON-ADJUSTABLE ARTICULATOR

• Usually a small instrument.

• Capable of only a hinge movement.

• Distance between the teeth and the axis of rotation on the small instrument is shorter than it is in the skull with the resultant loss of accuracy.
SEMI-ADJUSTABLE ARTICULATOR

- Large size allows close approximation of the anatomic distance between the axis of rotation and the teeth.

- The radius of movement produced on the articulator will reproduce the tooth closure arc with relative accuracy.
SEMI-ADJUSTABLE ARTICULATOR

• Semi-adjustable articulator reproduces the direction and end point but not the immediate track of some condylar movements.

• Intercondylar distance are not totally adjustable.
FULLY-ADJUSTABLE ARTICULATOR

• Most accurate instrument.
• Designed to reproduce the entire character of border movement.
• Intercondylar distance is completely adjustable.
FULLY-ADJUSTABLE ARTICULATOR

- It is expensive and time-consuming.

- Demands high degree of skill.

- Primarily used for extensive treatment, requiring the reconstruction of the entire occlusion.
USES OF ARTICULATORS

• Diagnosis: accurate relation of diagnostic casts allow visual examination of the opposing jaw and tooth relation.

• Fabrication of restoration such as crowns, FPD, RPD and complete denture.
ARCON AND NON-ARCON ARTICULATORS

- There are two basic designs used in the fabrication of articulators:
  - ARCON
  - NON-ARCON
ARCON ARTICULATOR

• Condylar elements are placed in the lower member and the mechanical fossae in the upper member of the articulator simulating the human TMJ; e.g. :
WHIP-MIX ARTICULATOR
WHIP-MIX ARTICULATOR

• Semi-adjustable arcon articulator
There are two versions:

1. Old version - straight condylar housing with adjustable intercondylar width and Bennett angle
WHIP-MIX ARTICULATOR

2. New version- curved condylar housing with intercondylar width fixed at medium..
Adjustable immediate side shift
WHIP-MIX ARTICULATOR
WHIP-MIX ARTICULATOR
WHIP-MIX ARTICULATOR
THE TOOTH-TRANSVERSE HORIZONTAL AXIS RELATIONSHIP

• To achieve the highest degree of accuracy from an articulator, the casts mounted on it should be closing around an axis of rotation that is as close as possible to the transverse horizontal (hinge) axis of the patient’s mandible.
FACEBOW

• Transfers the relationship of the maxillary teeth, the transverse horizontal axis and a third reference point from the patient’s skull to the articulating device.
FACEBOW

• An instrument that records the spatial relationship and is used for the attachment of the maxillary cast to the articulator.
There are two types:

1. Arbitrary

2. Kinematic
ARBITRARY FACEBOW

• A facebow that employs an approximate location of the hinge axis based on anatomic average.

• There are numerous techniques used for arbitrarily locating the hinge axis to serve as a set of posterior reference points for the facebow.
QUICK MOUNT FACEBOW

• Used with Whip Mix Articulator.

• Caliper-style facebow.

• Designed to be self-centering so little time is wasted in centering the bite fork and adjusting individual side arms.
QUICK MOUNT FACEBOW

- Posterior reference points - External Auditory Meatus.
- Anterior reference point - Nasion
QUICK MOUNT FACEBOW

- Mounting maxillary cast- Horizontal Condylar Guidance set at “FB” position or 30 degrees

- Upper member of the articulator should rest on the transverse bar of the facebow.
KINEMATIC FACEBOW

• Utilizes the true hinge axis
It captures all the characteristics of the mandibular border movements from its retruded position to its most forward and most lateral position.
PANTOGRAPHIC RECORDING

- The tracing can be utilized to its fullest advantage when using the fully adjustable articulator.
MAXILLARY CUSTOM TRAY
MAXILLARY CUSTOM TRAY

- OCCLUSAL STOPS ON NON FUNCTIONAL CUSPS
- MINIMUM OF THREE STOPPERS
MANDIBULAR CUSTOM TRAY
CUSTOM TRAYS
ANTERIOR DETERMINANT OF OCCLUSION

Fundamentals of Fixed Prosthodontics
Shillingburg, et al 1997, 3rd edition,
pages 22,23 & 54, 55.

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Hanau’s Quint

By modifying the following five factors, a scheme of occlusion can be developed that will suit a particular patient best.

1. Condylar guidance
2. Incisal guidance
3. Occlusal plane orientation
4. Compensating curves
5. Height of the Cusp

Except for the condylar guidance, all other factors can be modified during the fabrication of a prosthesis and the anterior guidance plays a predominant role.
Condylar Guidance Vs Incisal / Anterior Guidance
Anterior Guidance

- The influence of contacting surfaces of anterior teeth on mandibular movements.

- The influence of contacting surfaces of the guide pin and anterior guide table on articulator movements.

- The fabrication of a relationship of the anterior teeth preventing the posterior tooth contact in all eccentric mandibular movements.
Protrusive Incisal Path

The track of the incisal edges of the mandibular teeth from maximum intercuspation to edge-to-edge occlusion.
Protrusive Incisal Path Angle

The angle formed by the protrusive incisal path and the horizontal reference plane is the protrusive incisal path inclination. It ranges from 50 – 70 degrees and is often 5-10° steeper than the sagittal condylar guidance.
Incisal Guide Angle

The angle formed by the horizontal plane of occlusion and a line in the sagittal plane between the incisal edges of maxillary & mandibular central incisors **when the teeth are in maximum intercuspsation.**

The angle formed in the sagittal plane between the horizontal plane and the slope of the incisal guide table.
Importance of Anterior Guidance

Opening and closing of the mandible is simply a rotation of the condyles in the articular fossae.
Importance of Anterior Guidance

As anterior guidance is normally steeper than the condylar guidance, the anterior teeth guide the mandible downwards during protrusive or lateral movement and ..
Importance of Anterior Guidance

(during protrusive movement)

.. produces dis-occlusion or separation of the posterior teeth.
Importance of Anterior Guidance

(during lateral movement)
importance of anterior guidance

Anterior guidance is linked to the combination of horizontal & vertical overlap of the anterior teeth and can affect the occlusal surface morphology of the posterior teeth.
Inter-relationship between Vertical & Horizontal Overlap of the Anterior teeth

Anterior guidance can be made steeper by either increasing the vertical overlap (overbite) ‘A-B’, or by reducing the horizontal overlap (over jet) ‘C-A’ of the anterior teeth.

Anterior guidance can be made shallow by either decreasing the overbite ‘B-A’ or increasing the over jet ‘A-C’ of the anterior teeth.
Condylar Guidance & Posterior tooth Morphology

(without considering the role of A.G.)

Shallow condylar guidance normally requires shallow cusp angle or short cusp height and steeper condylar guidance requires steep cusp angle or longer cusp height.
Condylar side-shift & Posterior tooth Morphology

(without considering the role of A.G.)

Similarly, in the presence of an immediate lateral side shift during lateral movement (Bennett’s movement) the cusp height and cusp angle should be shallow.

‘side shift +’  ‘No side shift’
Influence of Anterior Guidance on Posterior tooth Morphology
Influence of A.G. on Posterior tooth Morphology
(Effect of Overbite)

Greater overbite produces more disocclusion hence permits longer cusp height

Less overbite - less disocclusion - shorter Cusp height
Influence of A.G. on Posterior tooth Morphology

(Effect of Over jet)

Greater over jet necessitates short cusp height

Less over jet needs long cusp height
Influence of A.G. on Posterior tooth Morphology

Summarizing,

greater anterior guidance allows posterior teeth to have longer cusp height

&

smaller anterior guidance allows posterior teeth to have shorter cusp height.
Fabrication of Custom Incisal Guide Table

“Preservation of the Anterior Guidance of the Natural Teeth for its Reproduction in the Fixed Prosthesis”
To preserve and then to reproduce the anterior guidance provided by the natural teeth in the waxed up crowns, custom incisal guide table should be fabricated.
Steps in the Fabrication of Custom Anterior Guide Table

1. The mounted study casts should be examined on the articulator to assess the anterior guidance and to remove any nonworking side interference so that the articulator moves freely.
Steps in the Fabrication of Custom Anterior Guide Table

2. If the anterior guidance provided by the remaining teeth is inadequate, restore it to an optimal form with inlay wax, or denture tooth on the cast.
3. Raise the incisal pin (round end down) so that it will miss the plastic incisal table by at least 1mm during all movements.
Steps in the Fabrication of Custom Anterior Guide Table

4. Place one or two drops of auto-polymerizing acrylic resin monomer on the plastic incisal table.
Steps in the Fabrication of Custom Anterior Guide Table

5. Mix one half scoop of self curing acrylic resin polymer with monomer and place a small amount on the plastic table. As the resin develops more body, additional material is added until there is 6mm or ¼ inch of resin on the plastic table.
Steps in the Fabrication of Custom Anterior Guide Table

6. Lubricate the round end of the incisal pin and the functioning surfaces of the anterior teeth with petrolatum jelly.

Close the articulator in centric occlusion so that the incisal guide pin penetrates into the soft resin.
Steps in the Fabrication of Custom Anterior Guide Table

7. Move the articulator repeatedly through all mandibular movements (protrusive and both laterals)
Steps in the Fabrication of Custom Anterior Guide Table

The tip of the incisal pin molds the resin to conform to all the movements of the articulator. These movements should be repeated until the resin has polymerized.
8. Trim off the excess acrylic resin with a bur after it has polymerized completely.
Steps in the Fabrication of Custom Anterior Guide Table

The tip of the incisal pin has acted as a stylus in forming the registration of the anterior guidance.

It will now be possible to duplicate the influence of the anterior teeth on the movement of the casts, even though the anterior teeth are now prepared and the incisal edges shortened.