Sheet no. : 9
Refer to slides no. : 4 for Dr.Yara
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**Factors of Mandibular Movements
related to occlusal morphology**

* **{slide no.3}
Supporting cusps** are the functional cusps.
* **{slide no.4}**It’s important to know these relations in order to be able to check the accuracy of the technician’s placement of the supporting cusps when making a crown for example. Otherwise a wrong placement of these cusps might cause cheek biting or not enough overjet for the arch movement. **Guiding cusps** or **non-functional** cusps are closer to the outer surface.

If you remember when we used to carve posterior teeth, we used to determine the location of functional cusps then the non-functional cusp is 5/9 of the total bucco-lingual width. This is the relation we were talking about.

A function of the non-centric cusps:
**Minimize tissue impingement;** because they move the tongue & cheeks away from the position of function, where mastication occurs.
* **{slide no.5}**
* **Guiding inclines🡪** inclines that are located on non-functional cusps or if we have canine guidance, they’re located on the palatal surface of maxillary canines & buccal surface of mandibular canines.
* **Condylar guidance angle**🡪 if we put a horizontal plane while condyles are in the socket, and we know that during function condyles move downward & forward (translation), the angle that is formed between the horizontal plane and the movement of the condyle is the condylar guidance angle.
* **Cusp angle**🡪 the angle between the cusp & horizontal plane. We determine the horizontal plane by taking a line bisecting the cusp & then we take a line perpendicular to it, then we measure the angle between horizontal plane & cusp incline.
* **Curve of Spee🡪** If we look sagittally to the occlusal surfaces, they’re not straight, they’ve a curved plate & this curvature is really important because it causes the disocclusion between the posterior teeth during anterior movement.
* **{slide no.6}**
* **Plane of occlusion🡪** is an imaginary plane & NOT a line.
* **Curve of Wilson🡪** teeth have curves when looking sagittally & frontally because they're not set upright in the dental arches, they tend to have **angulations**:
1)Maxillary posterior teeth are **Buccally** inclined.
2)Mandibular posterior teeth are **lingually** inclined.

So if we draw a plane between **the functional cusps in maxillary or mandibular teeth**, we’ll have a curvature **convex** towards the mandible.
That’s why in mandibular posterior teeth the lingual cusps are higher by 1 mm from the buccal cusps even though the buccal cusps are the functional cusps and the lingual cusps are not in occlusion; this is due to the angulations mentioned before.

-The definitions mentioned in the slides help us in putting occlusal concepts.
* **Monson**🡪 Monson utilized Bonwill’s triangle & made it in 3 dimensions, he made that triangle part of a sphere, its radius is 4 inches.
It helped in designing some average value & semi-adjustable articulators based on readings & averages that were taken from human beings.
* **{slide no.7}**
Angle's classification of malocclusion is used in orthodontics.
The problem in Angel's classification is that it focuses on teeth separately without its relations to the TMJ.

Angle’s **class I** gives normal relationship between maxillary & mandibular arches.
**\***This does not mean that class II & class III don't have a stable occlusion.
People with class II have no abnormality in occlusion if stable and with no interferences, it’s NOT an abnormal relationship because it doesn’t cause problems in their TMJs, but it's an abnormal relationship of the maxillary & mandibular dental arches.
Explanation: for esthetic reasons & optimum function, the maxillary arch should be slightly larger than the mandibular, whereas in **class II or III** there’s an abnormal arches relationship; In class II the maxillary arch is significantly larger than the mandibular arch this is due to :
1. Maxillary arch is oversized.
2. Mandibular arch is undersized.
3. Combination of both.

 In **Class III**:

1. Mandibular arch is oversized.
2. Maxillary arch is undersized.
3. Combination of both.
* **{slide no.8}**
In Angle's class I, they considered the relationship between the teeth.
Class I as we mentioned is due to a significant size difference between maxillary & mandibular arches, a second reason is having too large maxillary incisors in Meiso-distal width in comparison to the mandibular incisors so mandibular teeth become more mesial in relation to maxillary counterparts.
* **{slide no.9}**
In Angle’s **class II**: **maxillary first molar** is more mesial in relation to **classI.**
* **{slide no.10}**

**Mandibular molar** is more mesial in relation to **class III.**

* **{slide no.11}**
A drawback in Angle's classification is that it has nothing to do with the fully seated position; it does not consider the TMJ.
Many times the patient has a class I, but the condylar heads are not fully seated in the fossae. So a patient may have class I with temporo-mandibular disorders.

When we examine a patient we should pay attention to the path of mandible movement, is it smooth? One line? Or after closing his mouth he has to move his mandible right or left, forward or backward to achieve the maximum intercuspation? This is really important when doing occlusal examination, if class I is not in line with the completely seated position, **muscle hyperactivity** will result because muscles have to give more effort to get to maximum intercuspation, it’s not a normal function.

In class II & III may achieve optimum stability & equilibrium with joints & musculature because they may have no interferences & the function is smooth.
* **{slide no.12}**
Some researchers observed that **occlusal factors do contribute to TMJ disorders** & now this is a fact.
Occlusal analysis is a routine examination that should be applied on any patient that enters the clinic, we examine:
1. Occlusion
2. Muscles
3. TMJ.

Some patients live their whole life having occlusal interferences without having TMJ disorders, but as soon as we do a crown or a filling for them copying this interference in the new crown they'll face a problem for no apparent reason.
So before applying any procedure especially in crown & bridge work, we have to examine the occlusion & check it's interferences to decide whether we're going to copy this interference or adjust it.

* **{slide no.13}**
Intra-arch tooth alignment, as we've mentioned teeth are not in an upright position in the dental arch, they have angulations; bucco-lingual angulations & mesio-distal angulations.

All maxillary teeth & mandibular anterior teeth till the second premolar are buccally inclined.
Mandibular molars are lingually inclined. Also **mandibular canines** are slightly **lingually** inclined.

All teeth are mesially inclined except **maxillary posterior teeth** are **distally** inclined, the **maxillary canines** are **upright** (zero angulations).
* **{slide no.14}**
The total bucco-lingual width is taken from the crest of contour buccally&lingually.
Anything on occlusal table **lingual to the buccal cusp** & **buccal to the lingual cusp** is called "**Inner cuspal incline**".
The other incline towards the outer surface of the tooth is called "**Outer incline**".
Cuspal inclines can be further divided into mesial & distal inclines & it also can be named according to the cusp location, for example: mesial incline of the mesio-buccal cusp of the maxillary first molar & so on.
* **{slide no.15}**
Maxillary & mandibular arches occlude in a precise manner, when the two arches come in contact with each other, in class I each maxillary tooth occludes with **one tooth & the one that’s distal to it**.

**Arch length**: if we took a point mesial to maxillary second molar & drew a line on the occlusal surface, cusp tips & incisal edges, we reach the same point at the other side; this is what's called (arch length).

**Arch width**: the distance between two opposing teeth one on the right & the other on the left.
For Example: the distance between lingual surface of maxillary right second molar & the maxillary left second molar.
* **{slide no.16}**
Mandibular teeth occlude slightly lingually compared to maxillary teeth because the **length & width of the mandibular arch is less than those of the maxillary arch**.
Non-functioning cusps; buccal cusps of maxillary posterior teeth are more buccal, and lingual cusps of mandibular posterior teeth are more lingual.
This relation protects the surrounding soft tissues by keeping them away from the area of function.

Discrepancy in arch: when sometimes teeth are rotated, mesially inclined, distally inclined or missing.
This prevents us from having the ideal relation that we seek.
Cross bite usually occurs in class III where we have the maxillary arch smaller than the mandibular one.
* **{slide no.17}**
**Embrasure area:** is the area between the teeth beyond the contact point or area, teeth are curved & the area that contacts the adjacent tooth is the “contact point” or the “contact area” according to the age of the patient.
The space between the contact area and the other surfaces buccally, lingually & occlusally is called "embrasure”, gingivally it’s covered by the dental papilla.

When a cusp tip & a fossa are in contact with each other & not on the embrasure then we have:
A **convex surface** contacting a **concave surface**. The convex surface is not exactly the same as the concave surface so they don't have contact in the whole surface. Usually we prefer having three points of contact between the cusp tip & the opposing fossa & this contact is not on the cusp tip but on the cuspal inclines, this is the ideal contact "**tripodization of contact**”: three points of contact.

Each tooth occludes with two opposing teeth except:

1. Mandibular central incisors
2. Maxillary third molars.

The force of one tooth is distributed on the two opposing teeth & through the contact area it’s distributed on the whole arch.

* **{slide no.18}**If maxillary teeth are inclined more than 12-28 degrees then we have **EXCESSIVE PROCLINATION**.
If the opposite then it's **RETROCLINATION**.

Normally, maxillary incisors cover two thirds of mandibular incisors, at the same time the mandibular incisal edges are contacting the tip of the cingulum when it’s in junction with the lingual fossa.

Anterior guidance causes posterior disocclusion during function.

Incision of food occurs on the anterior teeth, also many letters are pronounced by them.
* **{slide no.19}**
In class II, overjetis **larger** & overbite in class II is **deeper.**
Deep or impinging overbite: when mandibular Incisal edges contact on soft tissue of the palate.

When we have no overlap between anterior teeth in overjet or overbite, we call it "**open bite**".

In class III, overjet is reversed or edge-to-edge.
-All the relations we took earlier are in static occlusion.
* **{slide no.20}**
Three planes: vertically, laterally & forward-backward.

Protrusive: forward movement.
Retrusive: backward movement.
Latero-trusive: right & left movements.
* **{slide no.21}**No additional information.
* **{slide no.22 & 29}**
Latero-trusive movement relations:
**canine guidance:**  relation between palatal surface of the maxillary canine & buccal surface of mandibular canine on the working side with disocclusion of posterior teeth on the same side & teeth on the other side.

**Group function guidance**: we have contact between premolars; first & second premolars till the mesio-buccal cusp of the maxillary first molar. Farther or more posterior than that we'll have occlusal interferences.

We’re talking about the working side in normal dentition; on the non-working side we have **complete disocclusion**.
* **{slide no.24}**
Retrousive movement:
From the maximum intercuspation or from the protrusive movement, the mandible goes back into MIC or retruded contact position.
* **{slide no.26}**
Lighter contact should exist on the anterior teeth in mandibular closure.
Tripodization does **NOT** include the cusp tip itself.
* **{slides no.27-28}**
We need all forces to be **vertical** but we have some horizontal movements that are applied to the teeth and teeth can withstand them by:
Horizontal forces are directed toward the canines during lateral movements. Ideally, posterior teeth have no lateral forces, the canine can withstand lateral forces for many reasons like:

1) Having a long cusp and a large root
2) Dense Bone surrounding them
3) Their location on the corners of the mouth.
In addition to this TMJ works as a lever system (nut cracker); forces are the strongest closer to the center, if we go away from the center, the forces will be less, so anterior teeth can withstand those forces (away from the center).
Anterior teeth have some angulations so in centric occlusion if we have some forces on the anterior teeth, those forces won't be along the long axis of the teeth because teeth are buccally inclined.
4) Fewer muscles are active when canines contact during centric movement than when posterior teeth contact.
* **{slide no.30}**
**Posterior bite collapse**: when posterior teeth are missing, anterior teeth come in contact more than normal, so with time anterior teeth become more proclined and exposed to more forces & the vertical dimension of lower face becomes less.
* **{slide no.31}**
Control of mandibular movements by :
1) TMJ
2) Teeth that come in contact with each other
3) Occlusal morphology
4) Angulations
5) Teeth relations in the dental arches to each other
* **{slide no.33}**
When we talk about determinants of occlusal morphology we're not talking about the normal situation when we have sound teeth structure.
Here it’s concerning the case when we're willing to change in teeth and the things that should be taken into consideration when we're designing the shape of the teeth (the five effects mentioned in the slide).
* **{slide no.40}**
Horizontal determinants of occlusal morphology, where to put the mesial & distal cusps & grooves between them, this has some effects during horizontal movements.
* **{slide no.45}**
Posselt's envelope of motion.
CR: centric Relation, posterior to the centric occlusion by 1-2 mm.
F: maximum protrusion
E: maximum opening
R: rest position
B: end of hinge movement & beginning of translation
* **{slide no.46}**
Posterior border of Posselt's envelope differs in different stages of life of the human being.
Those changes may be; missing anterior teeth, filling in the anterior teeth, crowns.

NOTE: Only information additional to the slides was written here.

Best Wishes