

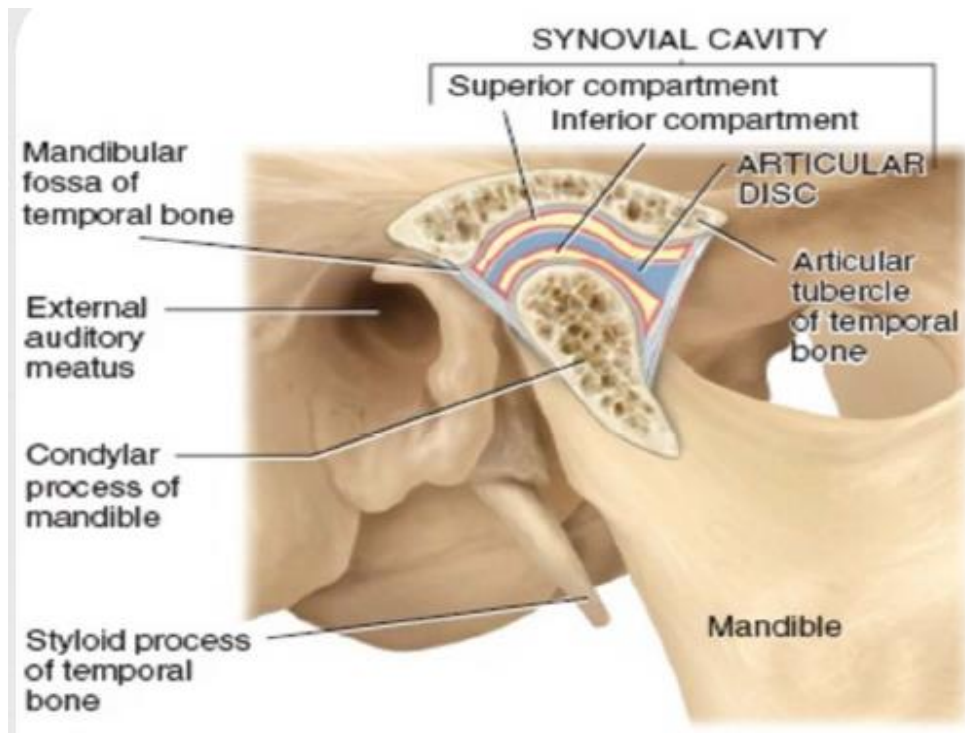
Anatomy and Physiology of Temporomandibular Joint

Temporomandibular joint (TMJ): It is the articulation of the condyle of the mandible, and the inter-articular disc; with the mandibular fossa (glenoid fossa) of the temporal bone. The joint has a capsule and an articulating disc. It is considered as a compound joint (a compound joint is one with more than two bones articulating); in TMJ, the articular disc acts like the third bone.

The TMJ consists of the following parts:

- 1- The glenoid fossa (mandibular fossa of temporal bone).
- 2- The condyle “head of the mandible”.
- 3- Synovial cavity.
- 4- The articular disk “meniscus”.

Meniscus is found between the condyle and the glenoid fossa. It divides the synovial joint or TMJ into upper and lower (superior and inferior) compartments. Each compartment acts as a separate joint during function. The presence of the meniscus also distinguishes the TMJ from most other joints in the body, making it a bone-to-tissue (*mandible to disc*) and tissue-to-bone (*disc to skull*) articulation.



The muscle that control the movement of mandible

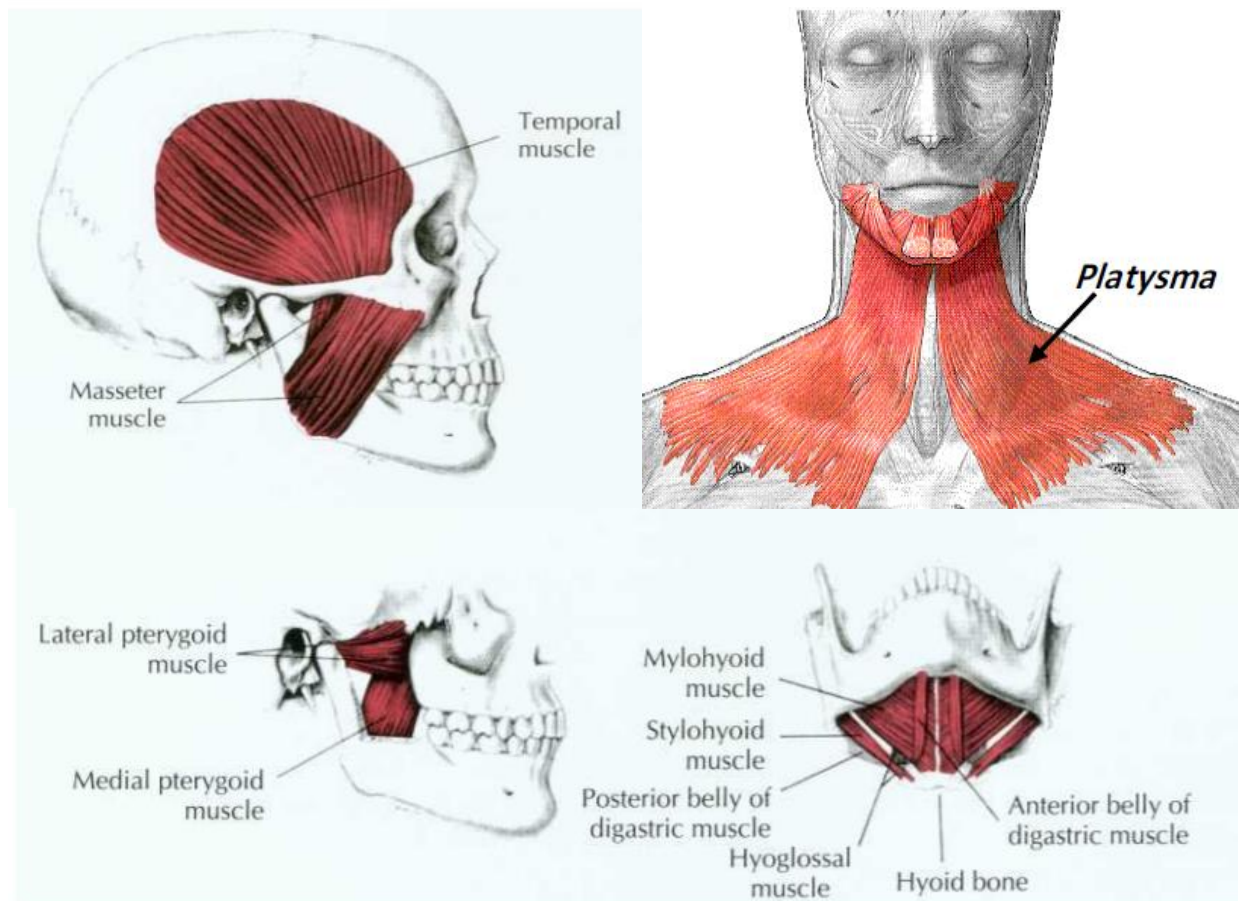
There are three groups of muscles:

1. Closing muscles. 2. Gliding muscles. 3. Opening muscles.

Closing muscles: The temporalis, masseter and medial pterygoid muscles supply the power for pulling the mandible against the maxilla (elevating and closing the mandible).

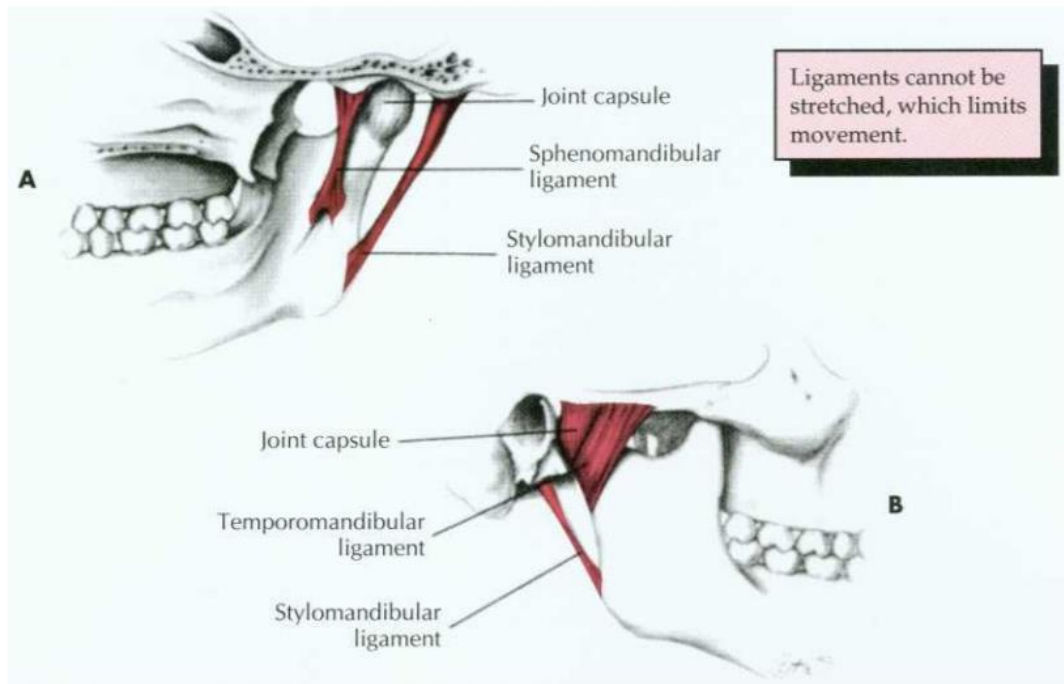
Gliding muscles: The lateral pterygoid muscle connects the mandible to the lateral pterygoid plate in such a way as to act as the steering mechanism for the mandible and act to protrude the jaw or to move it laterally.

Opening muscles: The muscles that depress (open) mandible consist of three groups, suprahyoid muscles, infrahyoid muscles, and platysma.



The ligaments affect the movement of mandible:

1. Temporomandibular and capsular ligaments.
2. Sphenomandibular ligament.
3. Stylomandibular ligament.



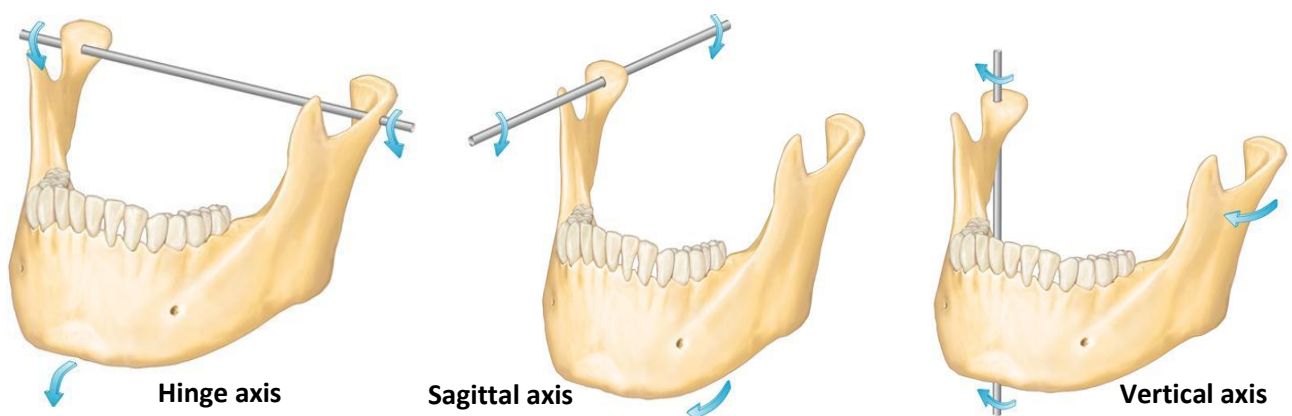
Mandibular axes and Mandibular movement

Mandibular axes: There are three axes around which the mandibular movements take place; the mandibular movements are related to three planes of skull (sagittal, transverse (horizontal), and coronal (frontal)).

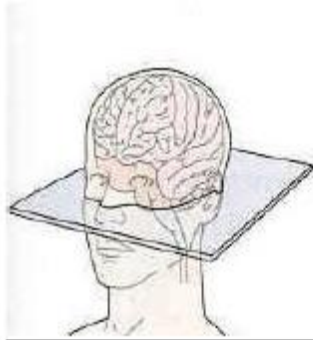
1- Hinge axis or transverse axis It is an imaginary line around which the mandible may rotate within the sagittal plane (during opening and closing movement).

2- Sagittal axis of the mandible It is an imaginary anteroposterior line around which the mandible may rotate within the frontal plane.

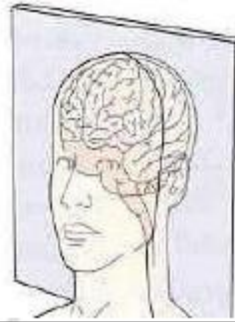
3- Vertical axis of the mandible It is an imaginary line around which the mandible may rotate through the horizontal plane.



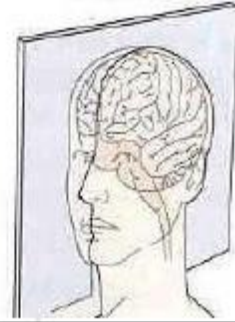
Transverse plane



Coronal plane



Sagittal plane



Mandibular movement

The mandibular movement can be divided as the following:

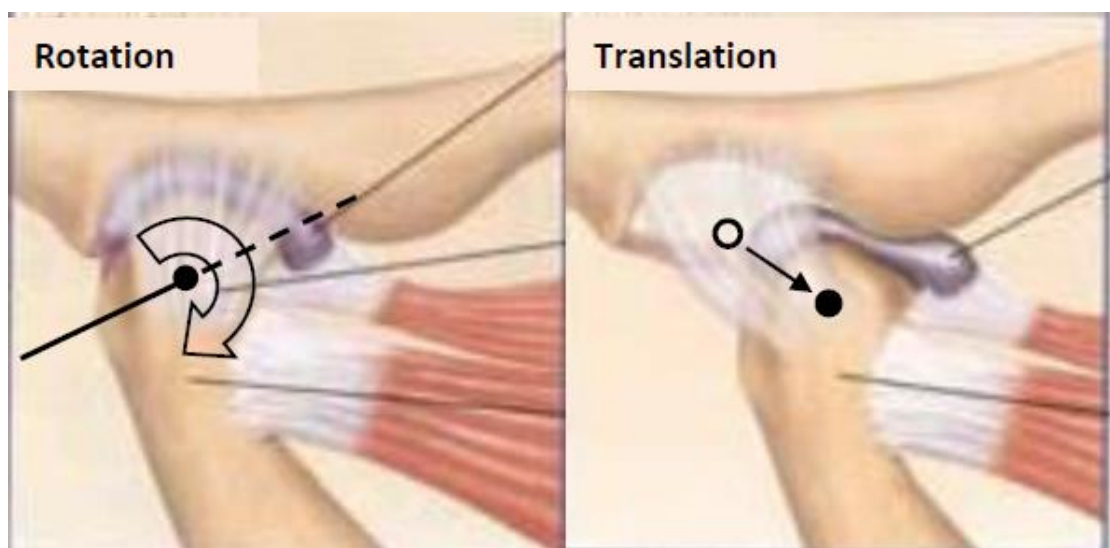
Based on the dimension involved in the movement

1- Rotational

- a- Rotation around the transverse or hinge axis.
- b- Rotation around the anteroposterior or sagittal axis.
- c- Rotation around the vertical axis.

2- Translational or gliding

They are considered as **basic movements** of the mandible.



The upper compartment shows anteroposterior gliding movement, when this movement takes place, the condyle and the disc move as a single unit against the glenoid fossa.

The lower compartment shows hinge movement, during hinge movement the condyle moves against the articular disc and the glenoid fossa, which together act as a single unit. True condylar rotation is 12° with the maximum incisal separation of 22 mm.

Based on the type of movement

1- Hinge movement.

2- Protrusive movement.

3- Retrusive movement.

4- Lateral movement.

a- Lateral rotation or (laterotrusion).

I. Right.

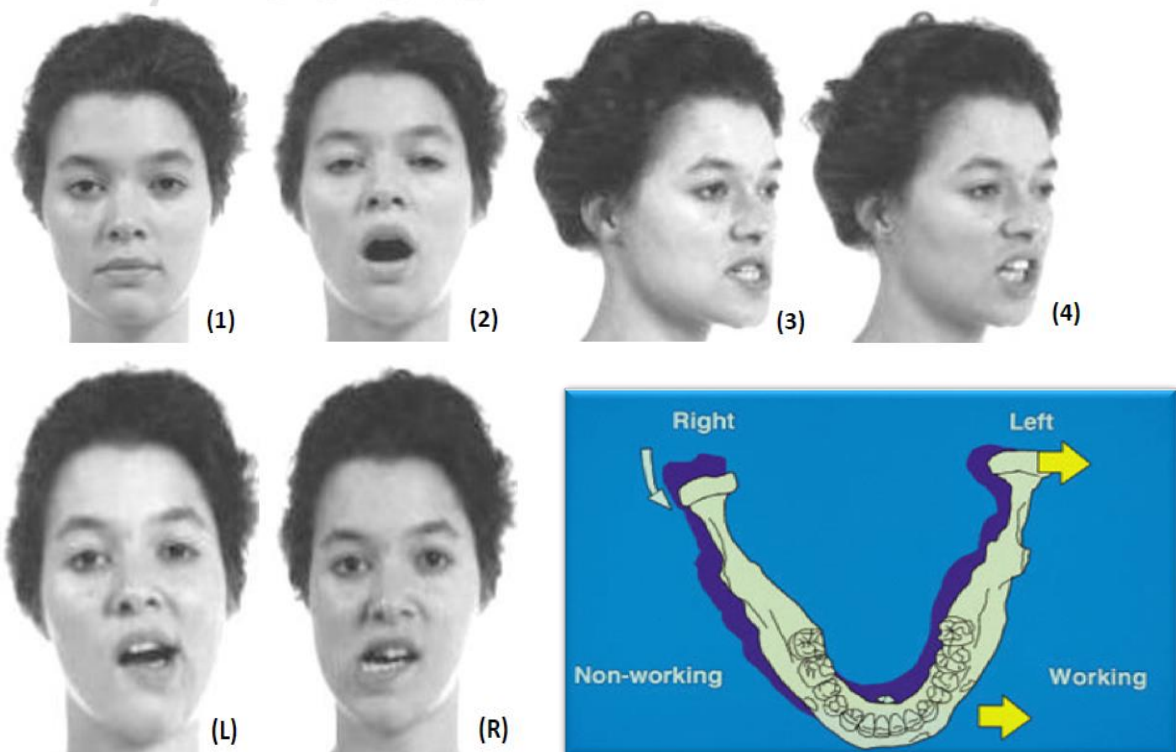
II. Left.

b- Lateral translation or (Bennett movement) is classified according to the timing of the shift in relation to the forward movement of the non-working condyle:

I. Immediate side shift

II. Progressive side shift.

III. Precurrent side shift.

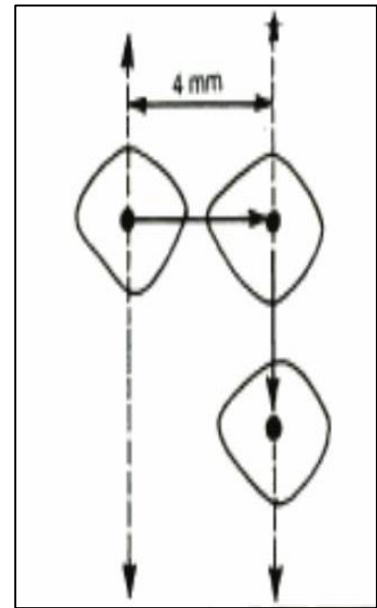


1- Closed mouth. 2- Hinge movement. 3- Protrusion. 4- Retrusion. 5- Laterotrusion (left and right). 6- Bennett movement.

Immediate side shift: Lateral translation occurs before forward movement of the non-working condyle .

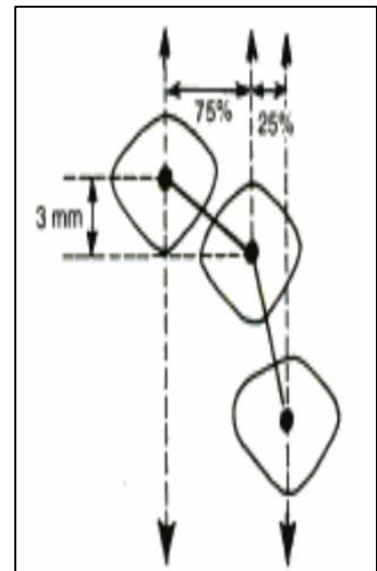
Here the mandible shifts before the forward movement of the non-working condyle occurs.

This movement occurs in 86% of the condyles studied. This shift ranges 1 to rarely 4 mm (average 0.75 mm) in dimension.



Precurrent side shift: Major quotient of the lateral translation occurs during the first 2-3 mm of forward movement of the non-working condyle.

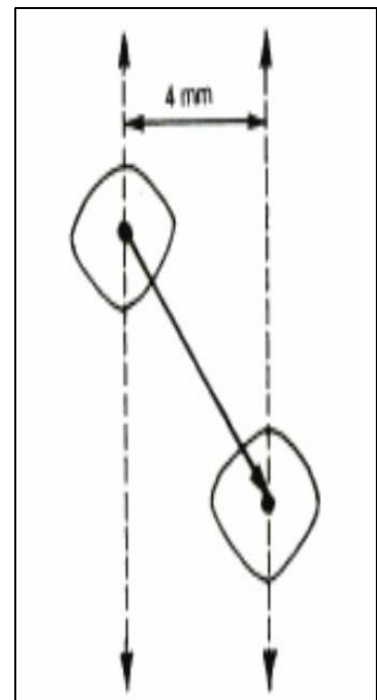
The mandible begins to shift rapidly during the first 2-3 mm (lateral movement) and then continues to shift in a less rapid fashion.



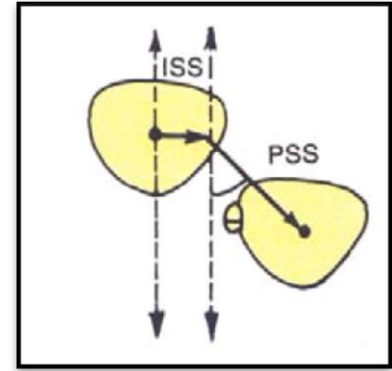
Progressive side shift or Bennett side shift: Lateral translation that continues linearly after 2-3 mm of forward movement of the non-working condyle .

The shift of the mandible is gradual and does not change with time.

In most patients, the progressive side shift scales gradually and linearly along with laterotrusion. But in some patients, there may be immediate side shift for about **1 mm** before lateral movement followed by progressive side shift along with lateral movement.



Bennett angle: the angle formed between the progressive lateral path (the average path of the advancing condyle) and the sagittal plane as viewed in the horizontal plane during lateral mandibular movements. (Note there is immediate side shift ISS followed by progressive side shift PSS)



Based on the extent of movement

1- Border movement

- a- Extreme movement in the sagittal plane.
- b- Extreme movement in the horizontal plane.
- c- Extreme movement in the frontal plane.
- d- Envelope of motion.

2- Intra-border movement

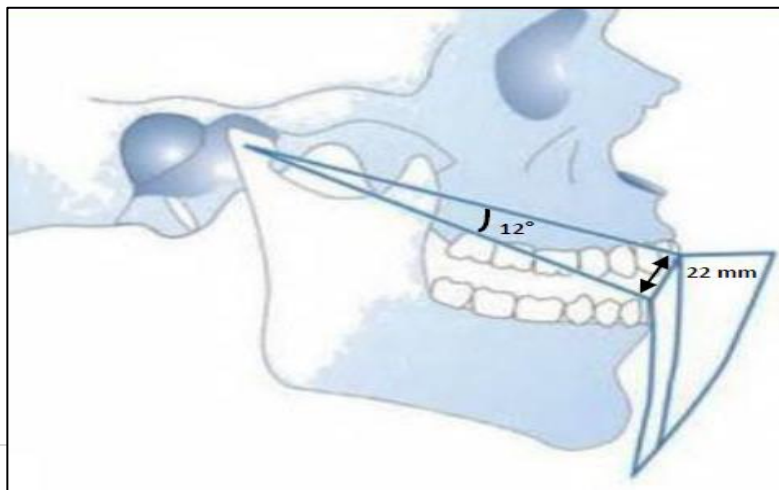
a- Functional movement.

I. Chewing cycle. II. Swallowing. III. Yawing. IV. Speech.

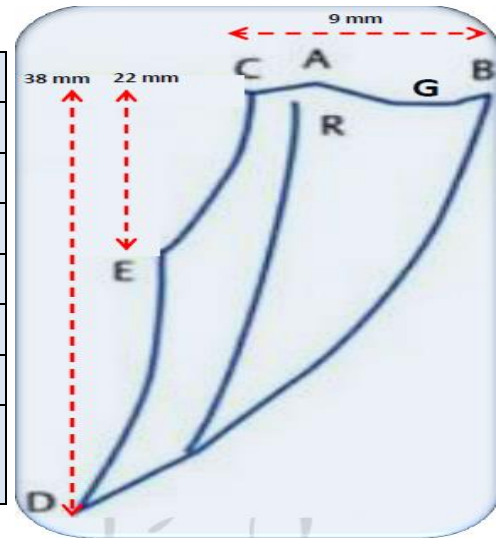
b- Para-functional movement. I. Clenching. II. Bruxism.

III. Other habitual movements.

Extreme movement in the sagittal plane (Beak tracing)

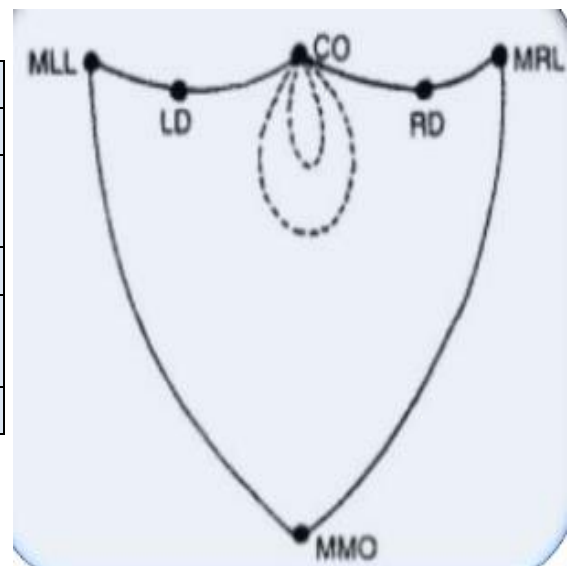


C	Centric relation.
A	Centric occlusion.
G	Edge to edge relationship.
B	Maximum protrusion.
D	Maximum mandibular opening.
C-E	Hinge motion.
E-D	Gliding.
R	Resting position.



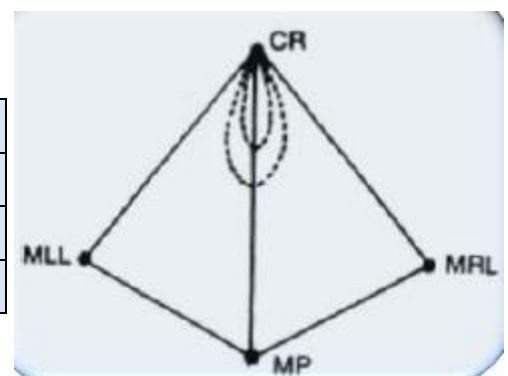
Extreme movement in the frontal plane (Shield tracing)

CO	Centric occlusion.
RD	Right disocclusion..
MRL.	Maximum right lateral position.
MMO	Maximum mouth opening..
MLL.	Maximum left lateral position.
LD	Left disocclusion.



Extreme movement in the horizontal plane (Diamond tracing)

CR	Centric relation.
MRL	Maximum right lateral position.
MP	Maximum protrusion.
MLL	Maximum left lateral position.



Envelope of motion: is the combination of the border movements in all the three planes, we get a three dimensional space within which mandibular movements is possible.

