

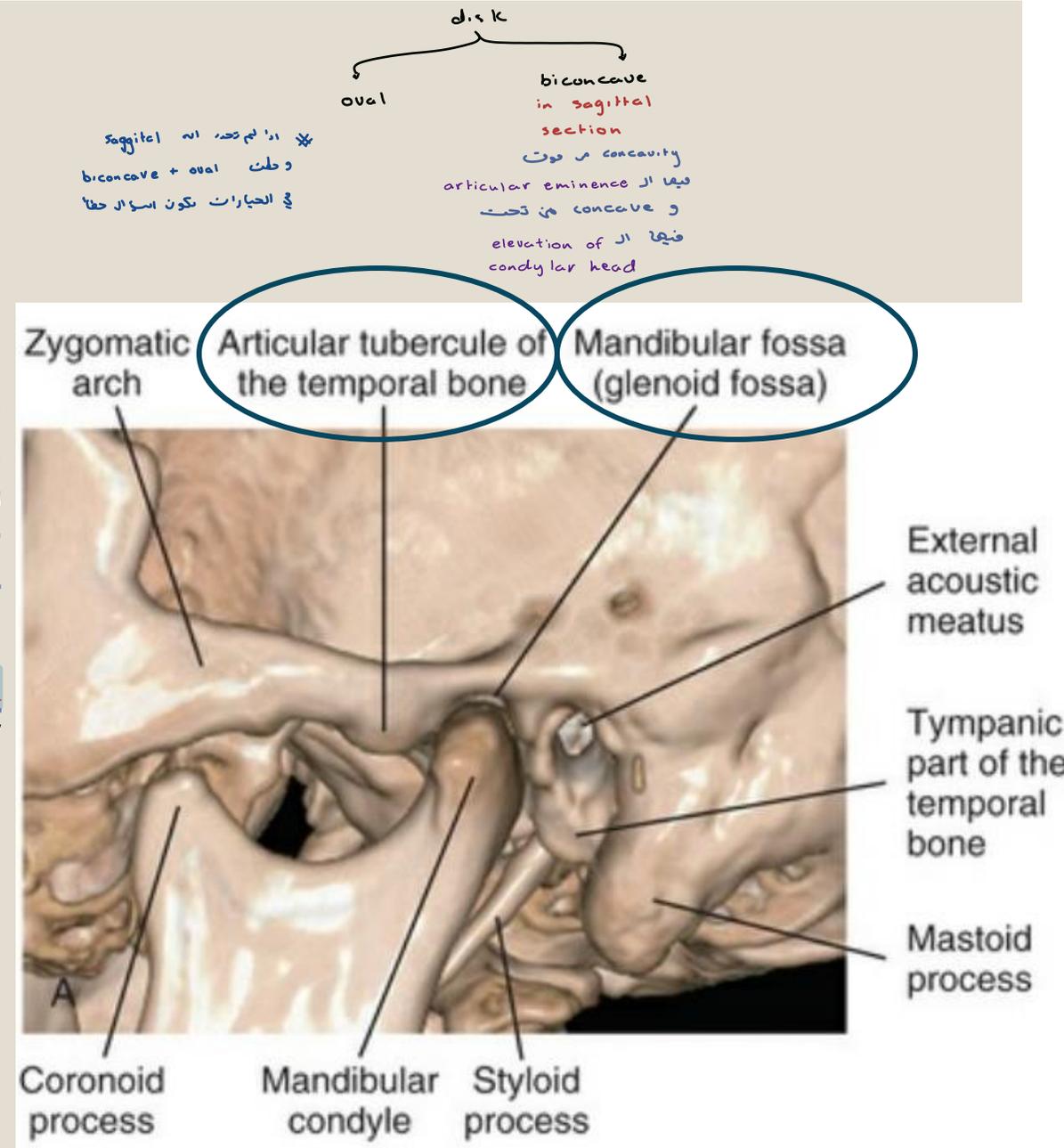


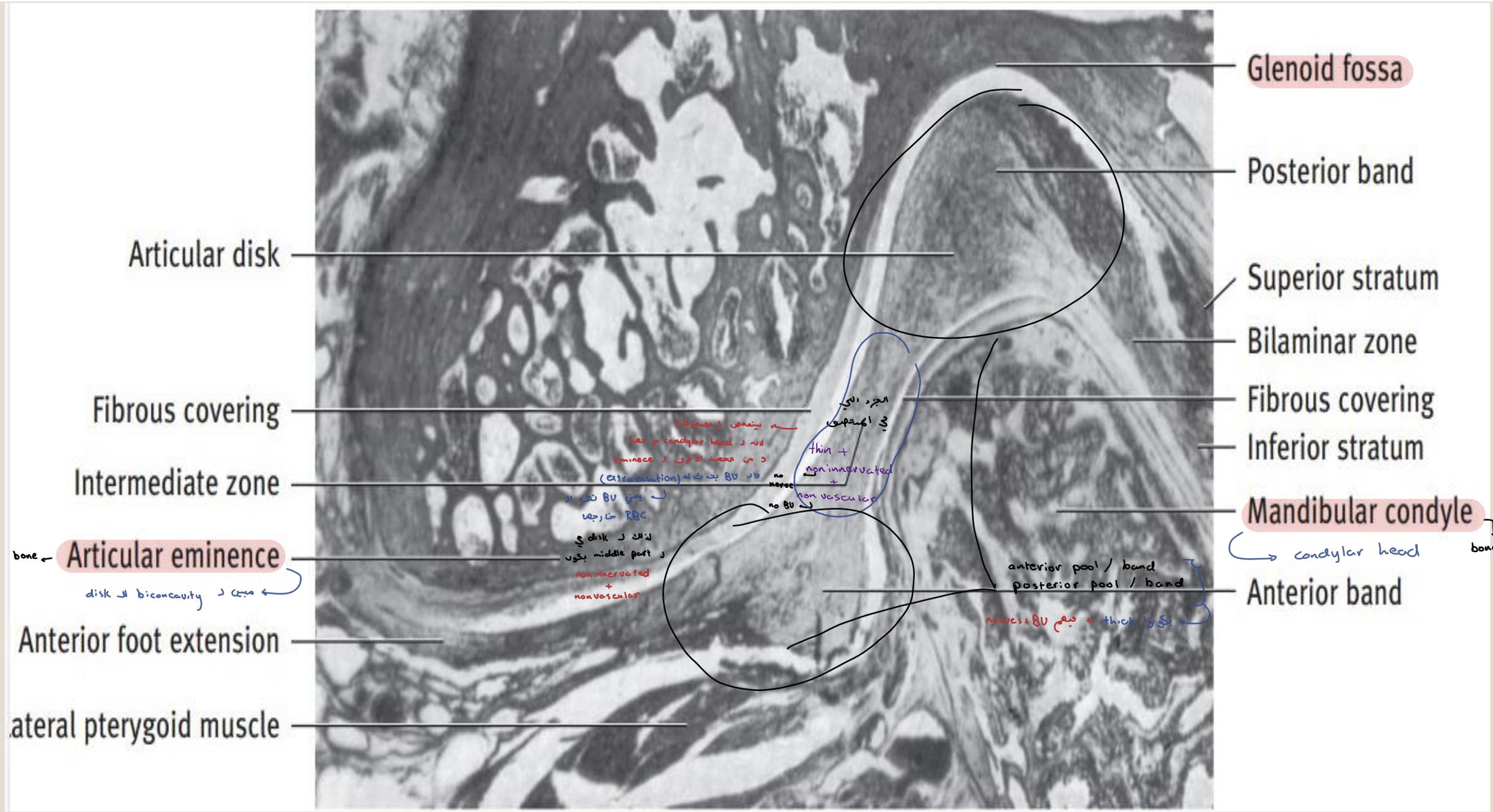
# **TEMPOROMANDIBULAR JOINT**

Omya meabed

# ANATOMY

- The temporomandibular joint (TMJ) is a bilateral synovial movable joint.
- formed by the articulation between the
  - articular eminence and the anterior part of the glenoid fossa of the squamous part of temporal bone above and the condylar head of the mandible below
- the TMJ contains a fibrous intra-articular disk that is interposed between the articular surfaces and functions as a shock absorber
- The disk is an oval, fibrous, avascular, noninnervated plate
- The disk is biconcave in sagittal section, with a thin intermediate zone, a thick anterior band, and a thick posterior band





Glenoid fossa

Posterior band

Superior stratum

Bilaminar zone

Fibrous covering

Inferior stratum

Mandibular condyle

condylar head

Anterior band

Articular disk

Fibrous covering

Intermediate zone

Articular eminence

disk & biconcavity

Anterior foot extension

lateral pterygoid muscle

bone

bone

الجزء الذي في المنتصف  
 يتمدد (ممتد)  
 وله 2 concave head من جهة eminence و من الجهة الأخرى 2 eminence  
 80% به BV (vascularization)  
 لا يحتوي BV  
 خارجها RBC  
 لذلك لا يدخل في middle part يكون non-vascularized + non-vascular

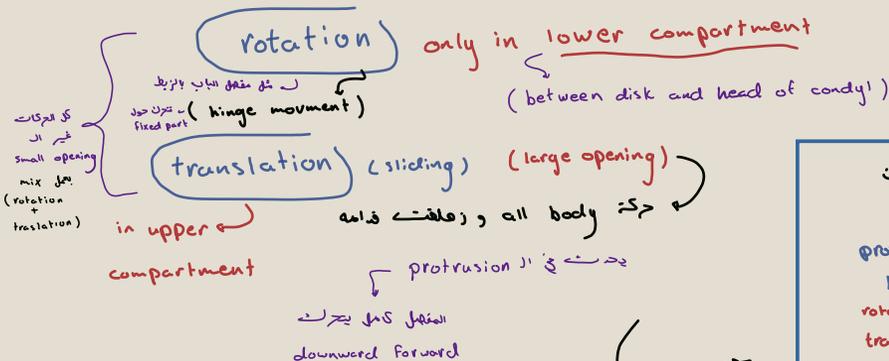
الجزء الذي في المنتصف  
 thin + non-vascularized + non-vascularized  
 no BV  
 لا

anterior pool / band  
 posterior pool / band

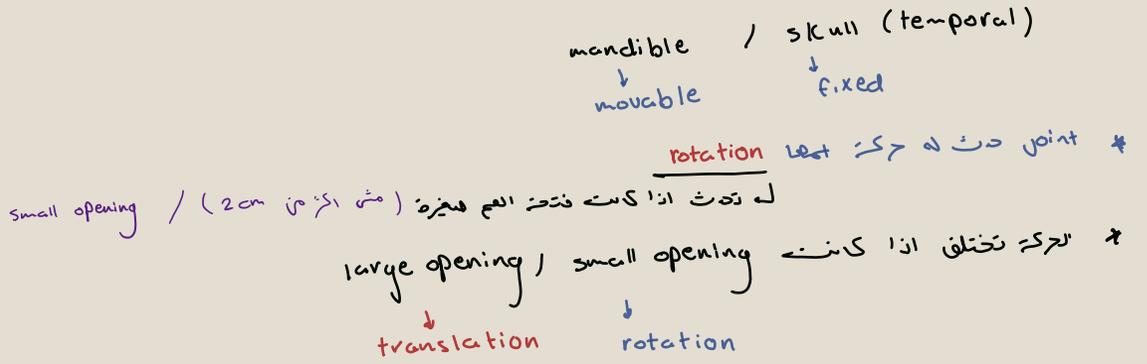
يكونا thick + يحتوي BV + nerves

❖ The disk divides the joint space into two compartments:

- a lower one between the condyle and the disk (condylodiskal)
- an upper one between the disk and the temporal bone (temporodiskal).
- The disk provide a movable articulation for the condyle
- In the lower joint space permits opening of the jaws; this is designated as a hinge movement.
- In the upper joint space, produce an anterior and inferior movement of the mandible.



لا يتي تاكي نحتاج ان  
 نعمل اكثر من حركة  
 protrusion, retrusion,  
 lateral movement  
 و نذلك بطلع من ال rotation  
 و يدخل حتى ال translation  
 ال ان ال condyle كله و يتحرك  
 حول ال eminence



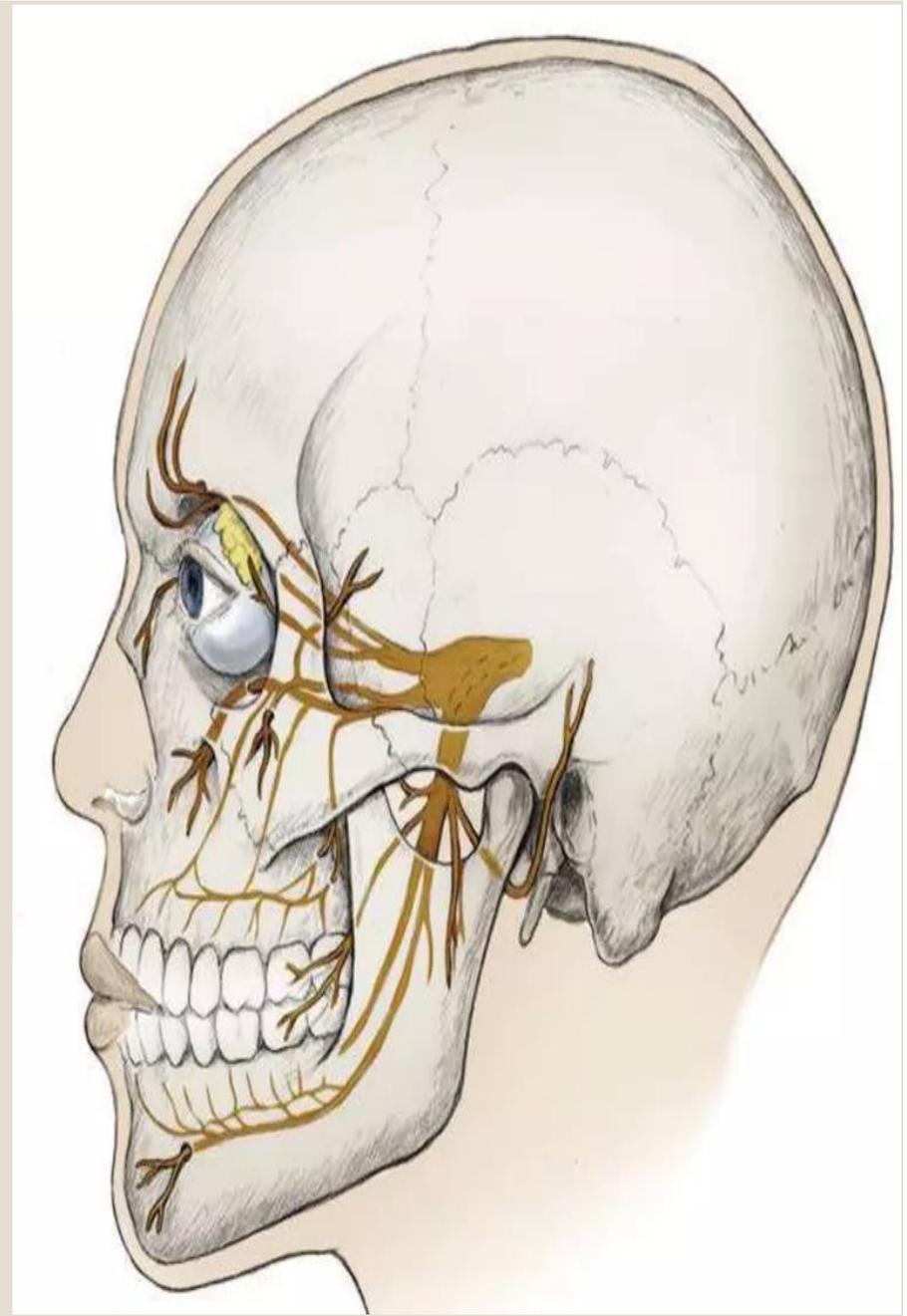
## ❖ TMJ INNERVATION

❖ Except for the avascular disk, the joint tissues are innervated by

- branches of the auriculotemporal branch of the mandibular nerve of the fifth cranial or trigeminal nerve.

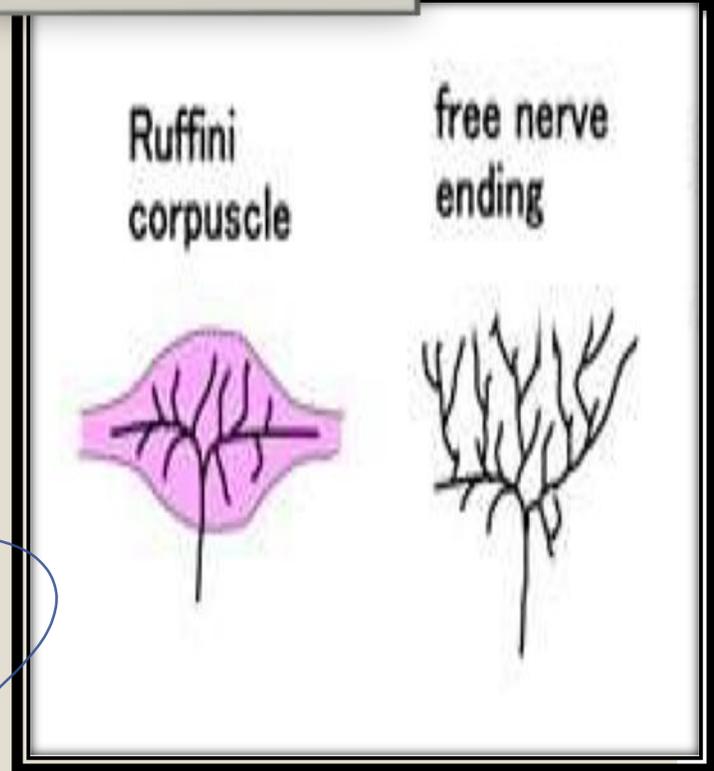
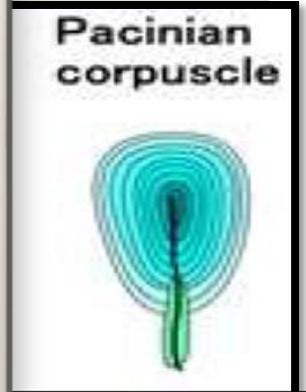
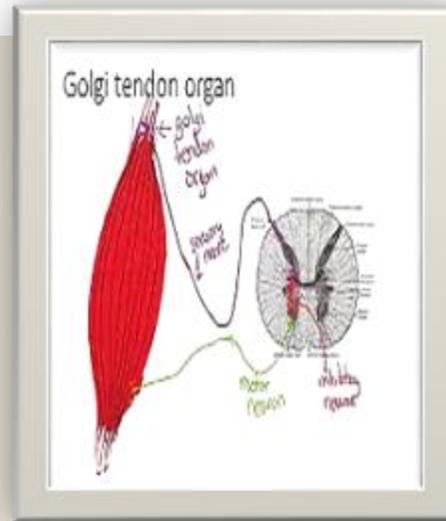
❖ **The arterial supply to the joint**

is through branches of the maxillary and superficial temporal arteries



# There are four types of nerve endings in the TM joint.

- The Ruffini's corpuscles**, present in the capsule are the proprioceptors and sense the changes in the joint when the joint is static.
- The pacinian corpuscles**, also present in the capsule, act as mechanoreceptors to signal the rapidity and slowness of the joint movement.
- The Golgi tendon**, present in the TMJ ligament, functions as a mechanoreceptor to protect the joint when joint movements become excessive.
- The free nerve endings** which are nociceptors (receptors for pain), are the most numerous and widely distributed; protect the joint from excessive movements, by causing pain and curtailing the movement.



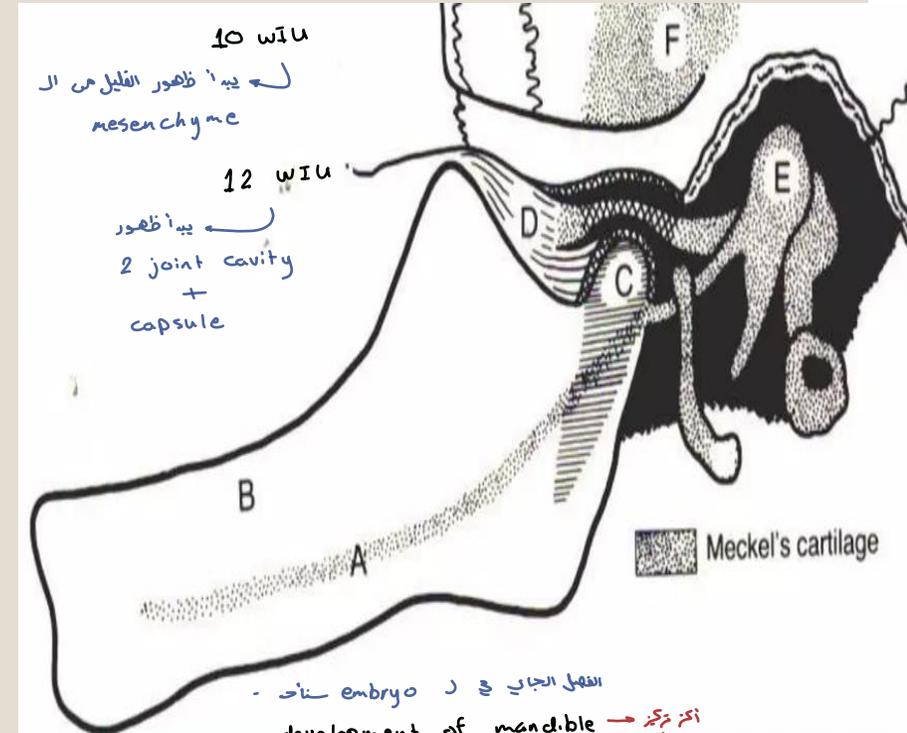
تحتي لثقل من ل excessive movement  
من طرفي تحبب او تثليل او تثليل الحركة (↓ movement)

مكي نوال بالاصحاح  
The most numerous nerve ending type (free nerve ending)

# DEVELOPMENT OF THE JOINT

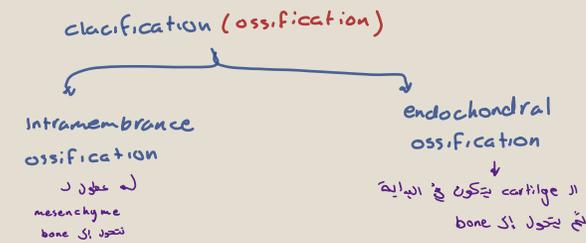
← قبل الولادة

- At approximately **10 wiu** the components of the fetus' future joint become evident in **the mesenchyme** between the condylar cartilage of the mandible and the developing temporal bone.
- **Two slit-like joint cavities** and **an intervening disk** make their appearance in this region by **12 wiu**. The mesenchyme around the joint begins to form the fibrous joint capsule



- development of embryo في ر الجنين الجاني في ر
- development of mandible → أكثر تميزاً
- development of condyle في البداية يظهرها كأنهم
- development of temporal bone ← في البداية يظهرها كأنهم بعد وقت يحدث لهم ossification  
 ① mesenchyme  
 ② ossification  
 ← أولاً لا temporal bone (endochondral ossification) ثم للـ condylar head

← يبدأ ظهور 2 joint cavity + capsule

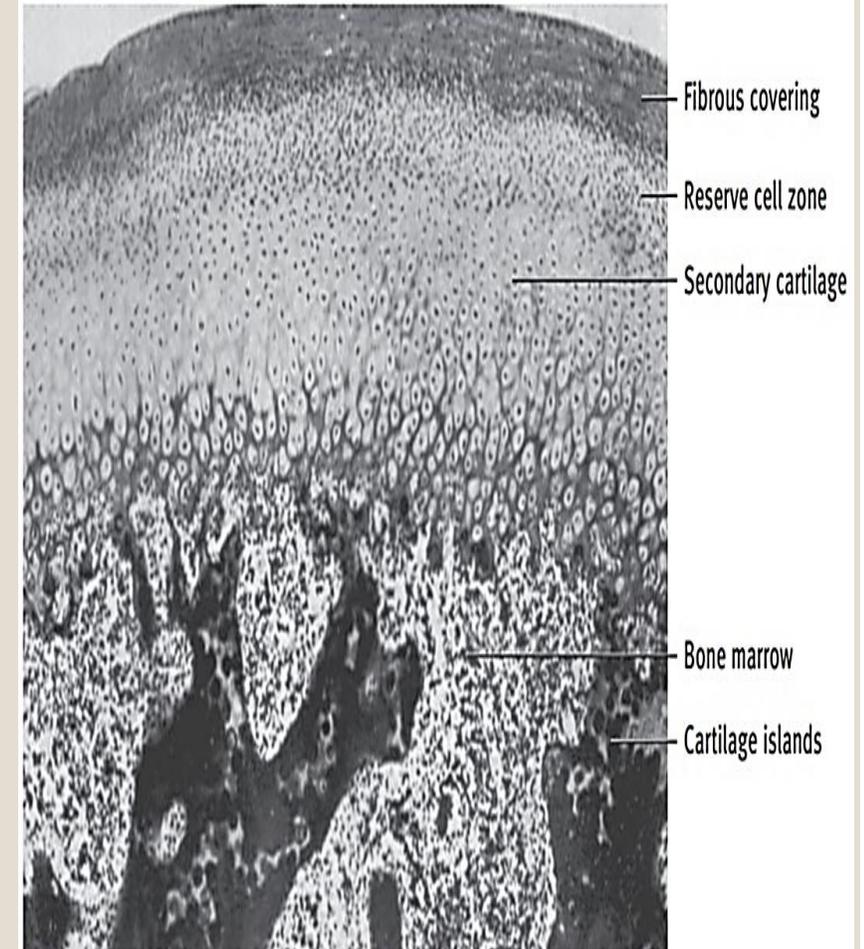


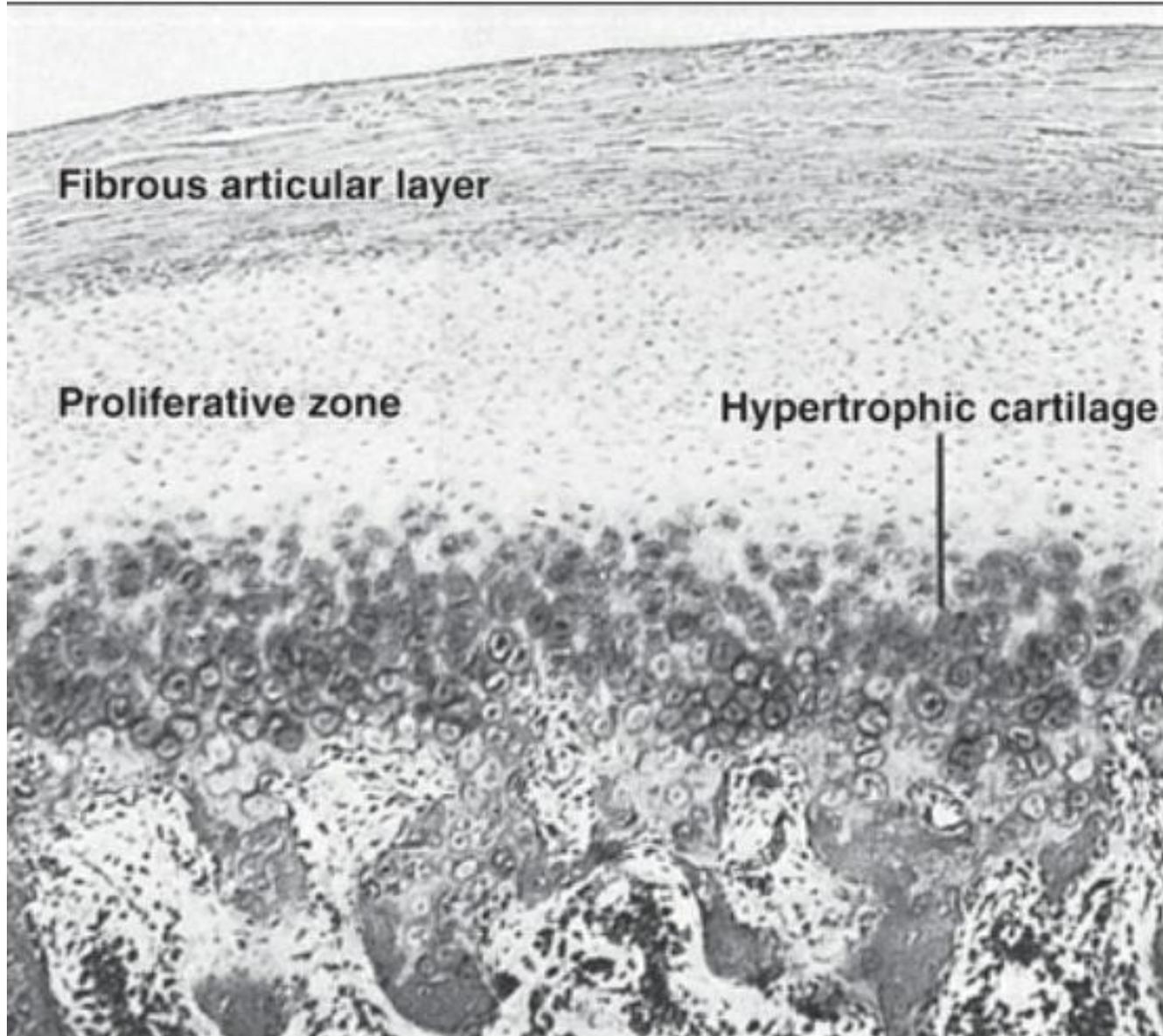
# Histology of mandibular condyle

endochondral ossification بحث  
تستمر في النمو الى 20 سنة

- ① spongy bone (radiating from neck of condyle)
- ② compact bone
- ③ fibrous layer
  - inner layer perpendicular to surface
  - outer layer parallel to surface

- Composed of spongy bone covered by thin layer of compact bone
- The outer surface of condyle is covered by thick layer of fibrous tissue
- Trabeculae of spongy bone is radiating from the neck to reach the cortex at right angle
- ❖ **fibrous layer** covering is composed of two layers:
  - Inner layer: thin collagen fibers arranged perpendicular to condyle bony surface (rich in chondrocytes)
  - Outer layer: strong fibers parallel to condyle bony surface contains fibroblasts and variable number of chondrocytes
  - During growth there is layer of hyaline cartilage under the fibrous layer to serve as growth center till the age of 20 years



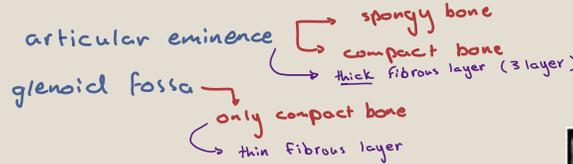


# Condylar cartilage

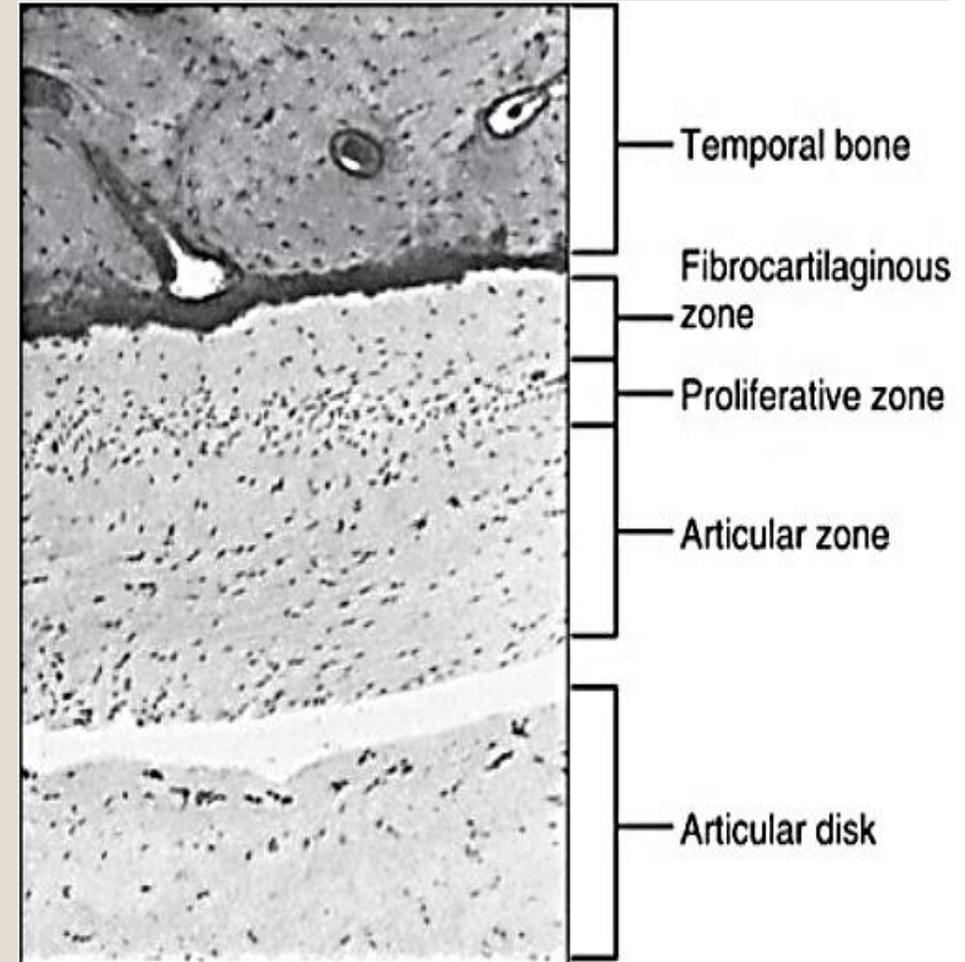
- Is a secondary cartilage
- Multidirectional growth for best anatomic placement of mandible
- Characterized by absence of ordered columns of cartilage cells

کے ترتیب  
مستعد نیا  
میں ہر تیب

# Histology of Articular eminence & glenoid fossa



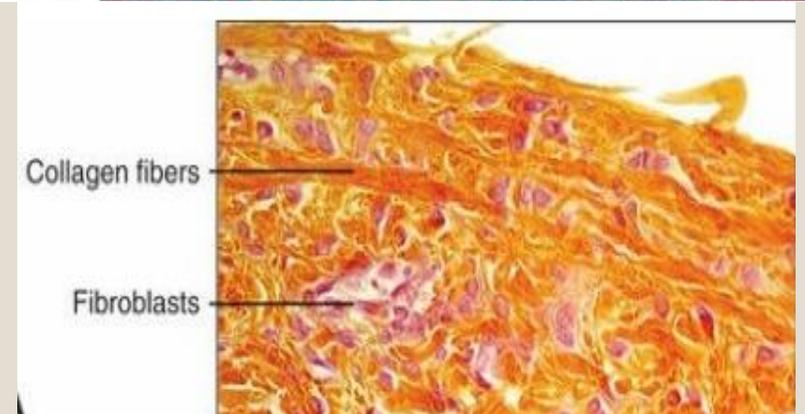
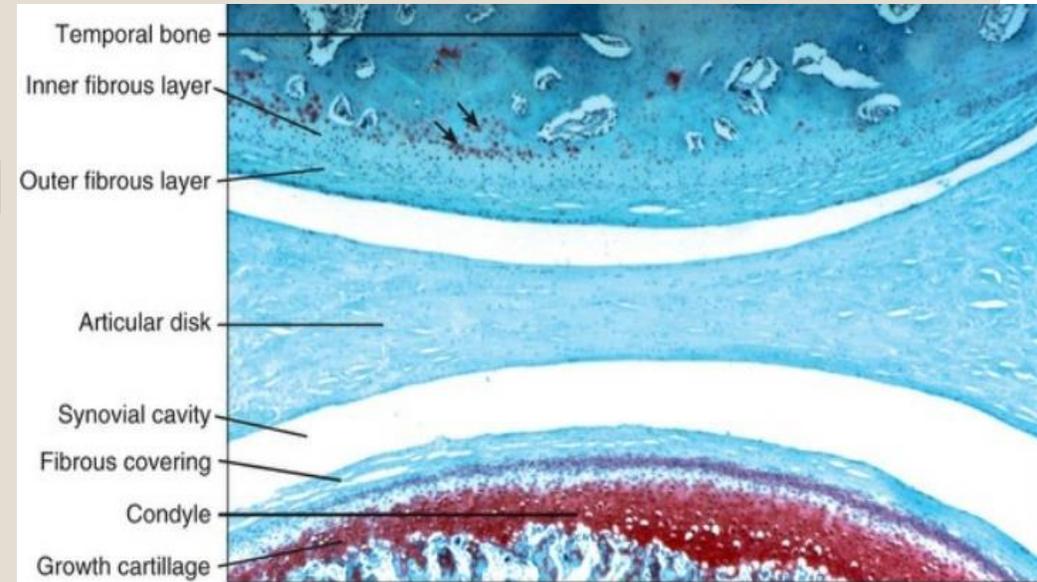
- The eminence is composed of spongy bone covered by thin layer of compact bone
- The fossa is composed of thin layer of compact bone
- **fossa is covered by thin layer of fibrous tissue and eminence is covered by thicker fibrous layer arranged into 3 zones:**
- Inner zone fibers are perpendicular at bone surface
- Outer zone: fibers are parallel to bone surface
- Intermediate zone: fibers are in complex fashion
- Variable number of chondrocytes are present in the fibrous tissue covering
- **No eminence exists at birth.** A layer of secondary cartilage exists for short time that is responsible for its growth



تغذية  
 نمو

# Histology of Articular disc :

- Composed of **dense fibrous** tissue containing straight and tightly packed **collagen fibers** and **few elastic fibers**
- **Fibroblasts** have **elongated processes** that **intertwine with collagen fibers**
- **Chondrocytes** may appear with age



← وجودها دليل على النكر

لا يدل على تقدم ندر على التقدم في العمر

وجودها في علامات النكر في ال (كاديه)

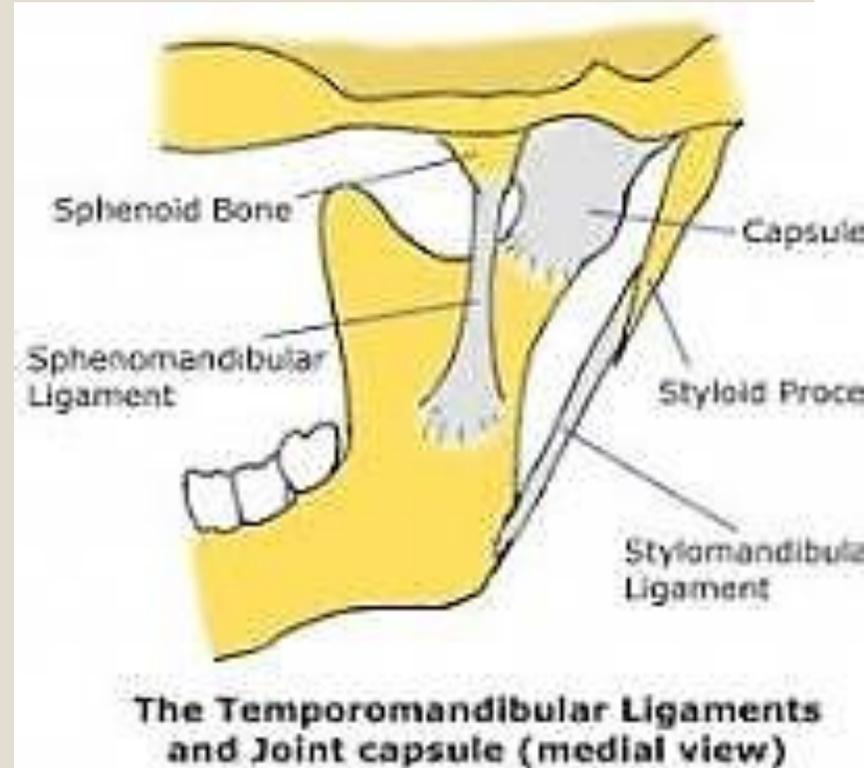
يجب وضع (احاطة) ال Synovial Fluid في شيء و هو ال capsule

disk → fiber  
condyl → bone  
eminence → bone  
glenoid fossa → bone  
capsule → fiber

# Histology of TMJ capsule

Composed of:

- Outer fibrous connective tissue that is strengthened to form temporomandibular ligament (laterally)
- Inner synovial membrane that lines the entire capsule but **doesn't cover the articulating surfaces** and the disc except its bilaminar posterior region.
- The synovial membrane forms villi protruding into joint cavity.
- Synovial membrane is responsible for production of synovial fluid.
- Synovial membrane is composed of two layers: (Cellular intima & vascular subintima)



مقابلة بطول ال Fluid  
لتي تخرج ل (SF)

elastic fibers + BV فيها يعني  
(تكون supportive)

(بما انه هو الذي يجمع ال SF) فخرج وجود cells تصنع  
cellular intima  
vascular subintima

هو fiber  
تتقابل من ال داخل  
ال (fluid)  
ويتشكل ال  
synovial membrane  
يتكون فيه folding ال villi  
و يعمل على تصنيع ال  
synovial fluid

TMJ capsule → fibrous layer  
يلتصق حول كل ال joint  
إلا ال جزء الذي يحدث  
ال articulation  
فهيكون موجود  
laterally, medially,  
posteriorly, fronta  
لتي lateral يحدث له  
thickening و يتشكل ال  
TMJ ligament

❑ Cellular intima: Composed of one to four discontinuous layers of synovial cells embedded into fiber free intercellular matrix

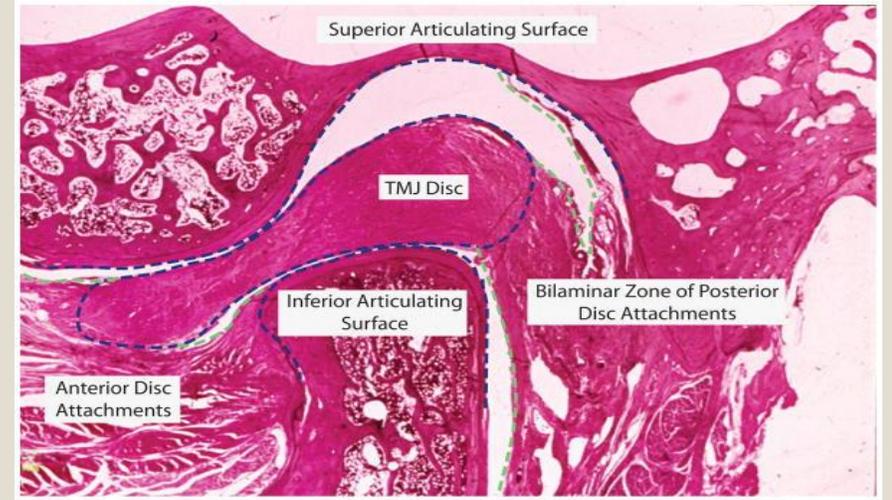
The cells are not connected by junctional complex and don't rest on basement membrane. They are of two types:

1. TYPE A Macrophage like cells (predominant type): has phagocytic function. Cells contain lysosomes and vesicles.

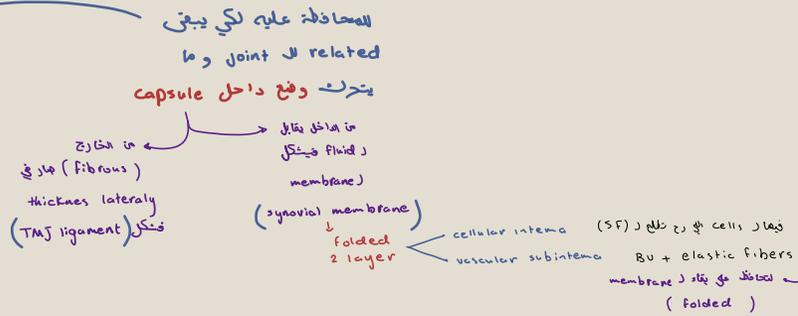
2. TYPE B Fibroblast like cells <sup>B → b (fibroblast)</sup> synthesize hyaluronate added to synovial fluid and so contain RER.   
 ← الخلايا التي رح تصنع

❑ Vascular subintima: Composed of loose vascularized CT containing fibroblasts, macrophages, mast and fat cells and some elastic fibers to prevent overfolding of the membrane

← زي امطاط (نشد وترخي)  
← تشابه على وجود الـ folding  
← زي اشد elastic fibers  
← سيحدث (unfolding)  
← زيها من علامات تقدم العمر في TMJ



# Synovial fluid:

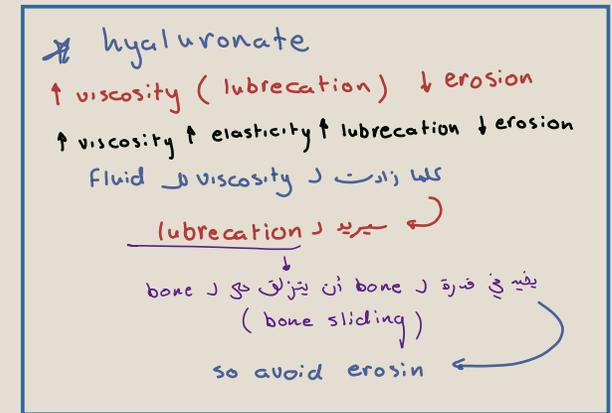


□ plasma with proteins and hyaluronate added by synovial cells. It may contain free synovial cells and inflammatory cells.

□ Functions of synovial fluid:

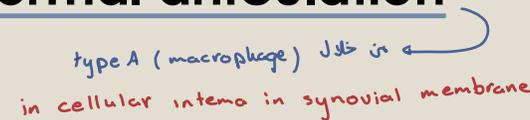
1. Hyaluronate: → from fibroblast (type B cell) in cellular intema in synovial membrane

- increase viscosity of synovial fluid
- increase elasticity of cartilage cells
- lubricate articular surfaces to reduce erosion



Fluid ← 2. Nutrition of avascular tissues covering the articular surfaces and avascular parts of the disc

3. Clear the joint cavity from debris result from normal articulation



# TMJ DYNAMICS

## TMJ MOVEMENTS:

- **MANDIBULAR MOVEMENT OCCURS as a complex of rotational and translational movements**

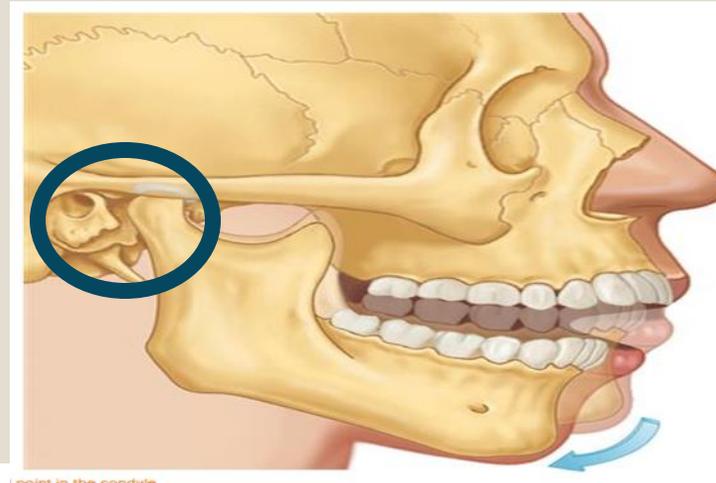
- Rotation movement is the process of turning around a fixed axis, movement of a body about its axis.

just in  
small opening

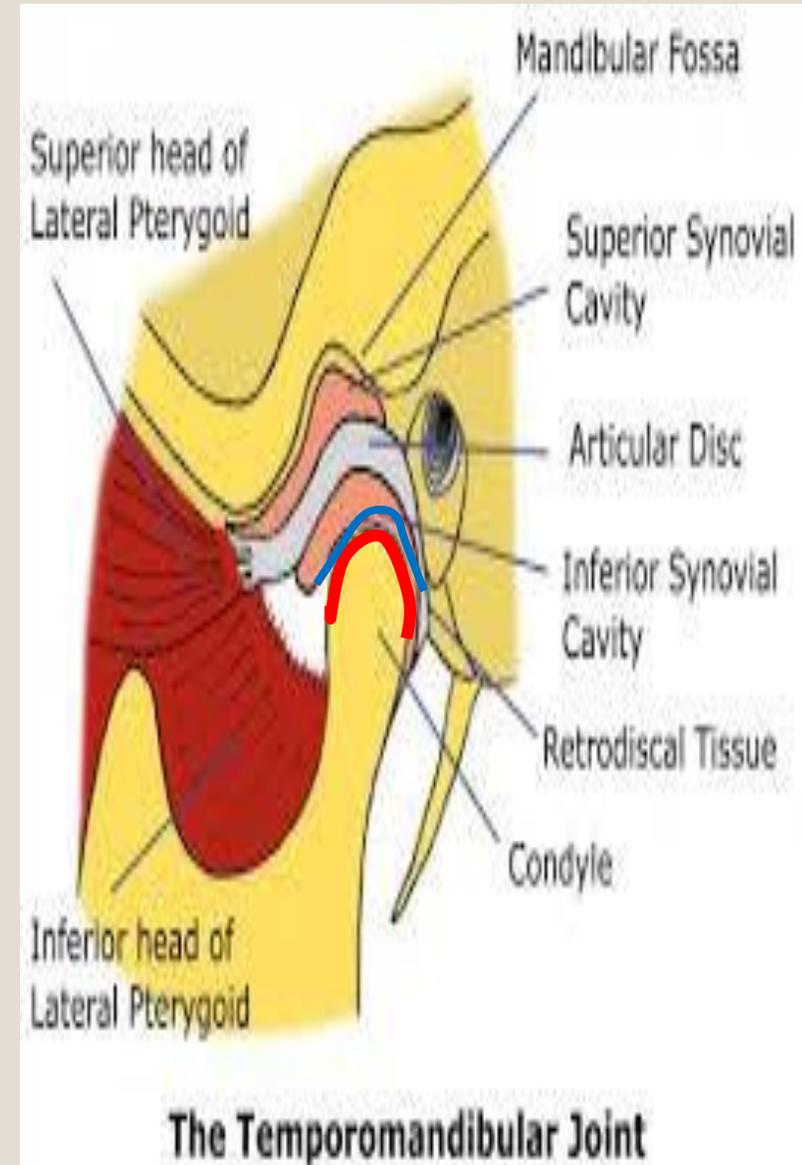
disk divide the joint to upper and lower compartment

\* lower compartment → make rotation movement (hinge movement)  
Fixed axis حول المحور الثابت

small opening (2cm)

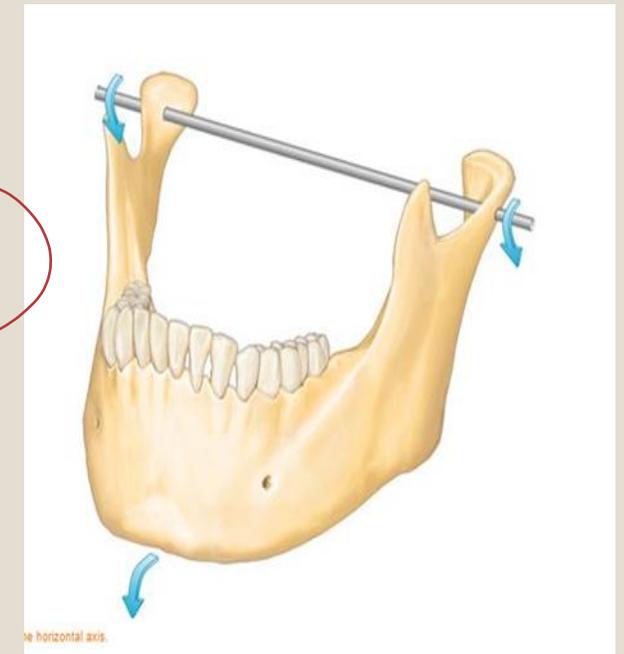


- In the masticatory system, **rotation** occurs when the mouth **opens and closes** around a **fixed point or axis within the condyles**.
- In the TMJ, rotation occurs as movement within the **inferior cavity of the joint**
- movement **between the superior surface of the condyle and the inferior surface of the articular disc.**



## Horizontal axis of rotation:

- Mandibular movement around the horizontal axis is an opening and closing motion (for short distance nearly 2 cm)
- It is referred to as a hinge movement.
- The hinge movement is probably the only example of mandibular activity in which a "pure" rotational movement occurs.
- In all other movements rotation around the axis is accompanied by translation of the axis.
- When the condyles are in their most superior position in the articular fossae and the mouth is purely rotated open, the axis around which movement occurs is called the terminal hinge axis



# Translational Movement

*in upper compartment*

○ **Translation** can be defined as a movement in which every point of the moving object simultaneously has the same direction and velocity.

*all movement except (small opening)*

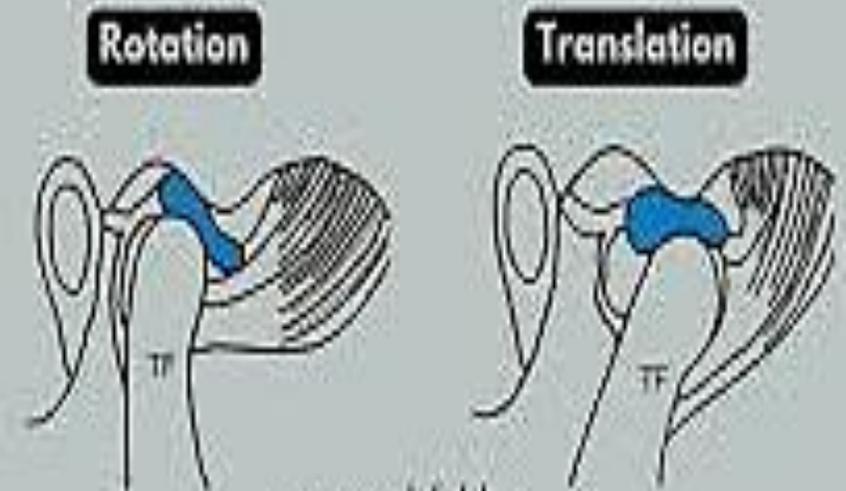
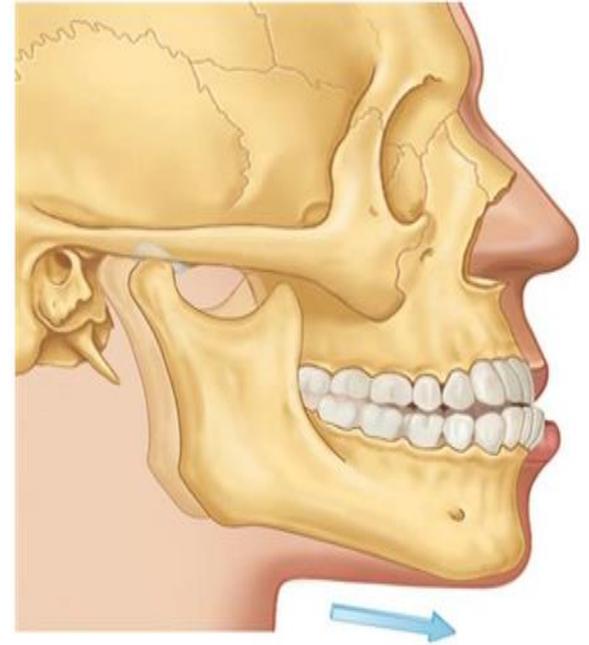
*when all object move at the same direction of the same time*

○ In the masticatory system, it may occur in protrusion the mandible moves downward forward

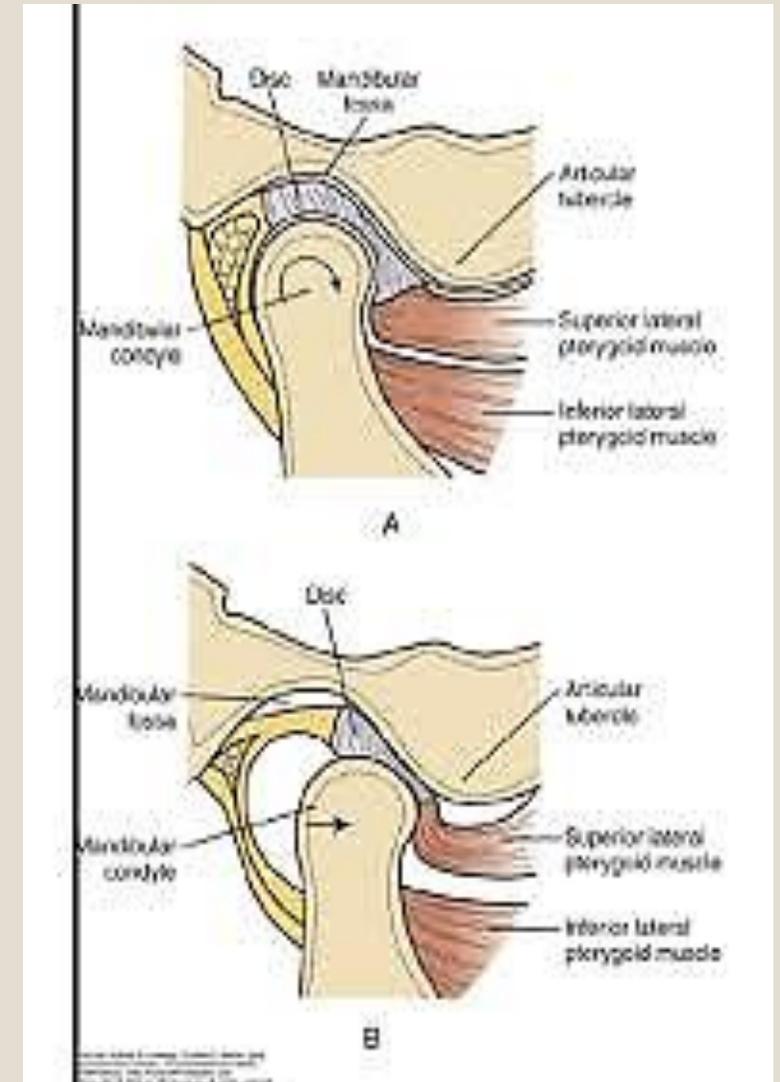
*all object (movement of condyle) with disk at same time and direction*

○ The teeth, condyles, and rami all move in the same direction and to the same degree

*translation movement in protrusion and side to side movement*



- **Translation** occurs within **the superior cavity of the joint between the superior surface of the articular disc and the inferior surface of the articular fossa**
- During most normal movements of the mandible, both **rotation and translation occur simultaneously.**
- That is, while the mandible is rotating around one or more of the axes, each of the axes is translating (changing its orientation in space).

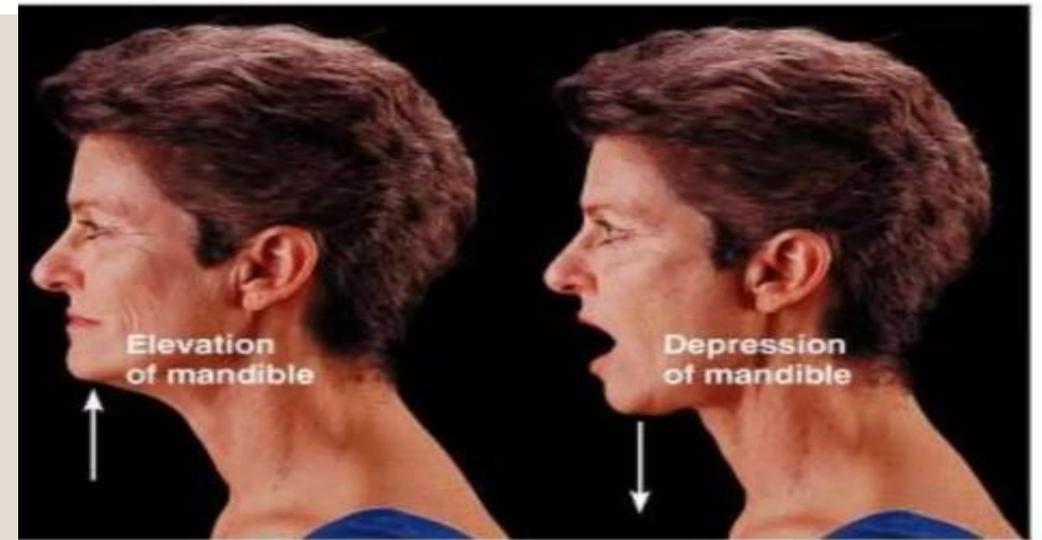


# Mandibular movement

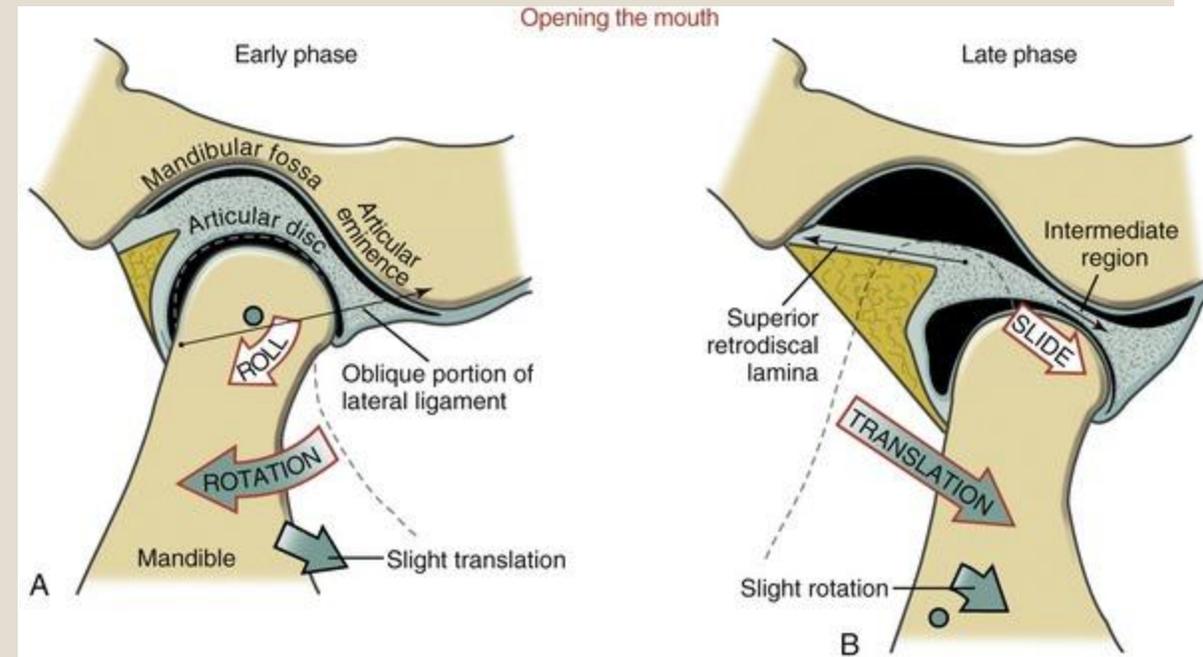
1. opening and closing
2. Protrusion and retrusion
3. Lateral movement 

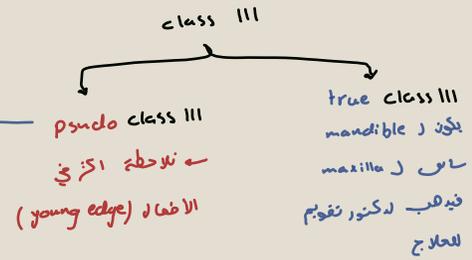
# opening and closing

*elevate (closing)* →  All muscles of mastication are elevator except lateral pterygoid # lateral pterygoid is responsible for opening *(depression)*



**Elevation and depression**





- normal occlusion class I (1)
- protruded mandible class III (3)
- protruded maxilla class II (2)

← مشكلة في تصحيحه اذا كان هذا true و pseudo  
 تصحيحه خطة العلاج التي بالتالي اضرب الولد بالفم على وجهه درجة  
 (sudden shock) فلورمع حكة كرد محل سيكن pseudo لو لم يج  
 سيكن true

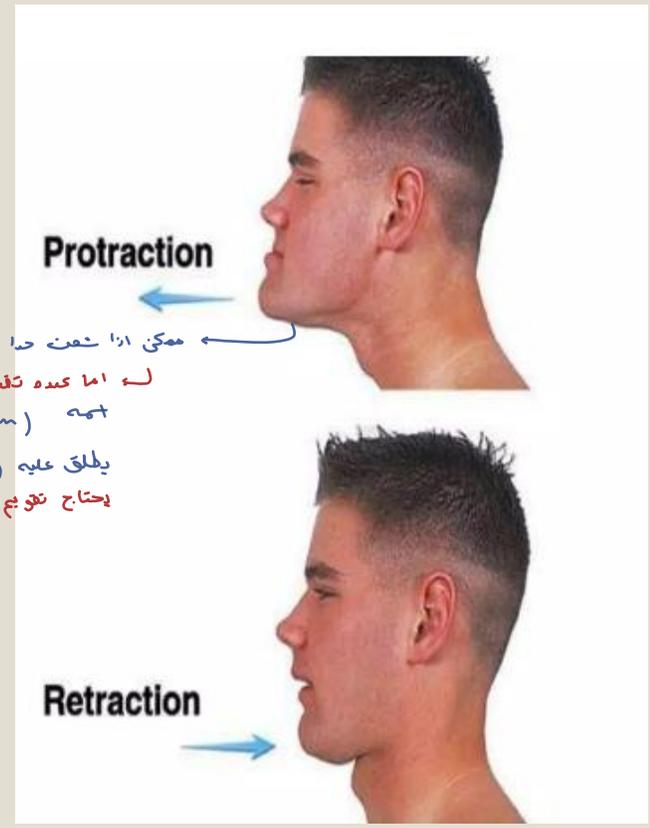
← ممكن الطفل يعيش مع اجارده فقله طريقه اكلهم  
 فتعود ان يأكل والد mandible سابق ل maxilla  
 تعود في ذلك فاستعمل الأمر ← هذا الطفل يحتاج  
 psychologist للمعالج المشكله لأنه مشكله ليست  
 في ل bone ولا في الأسنان

## PROTRUSION

:the lower teeth are positioned in front of the upper teeth.

This is achieved by, the downward and forward translation of the condyles

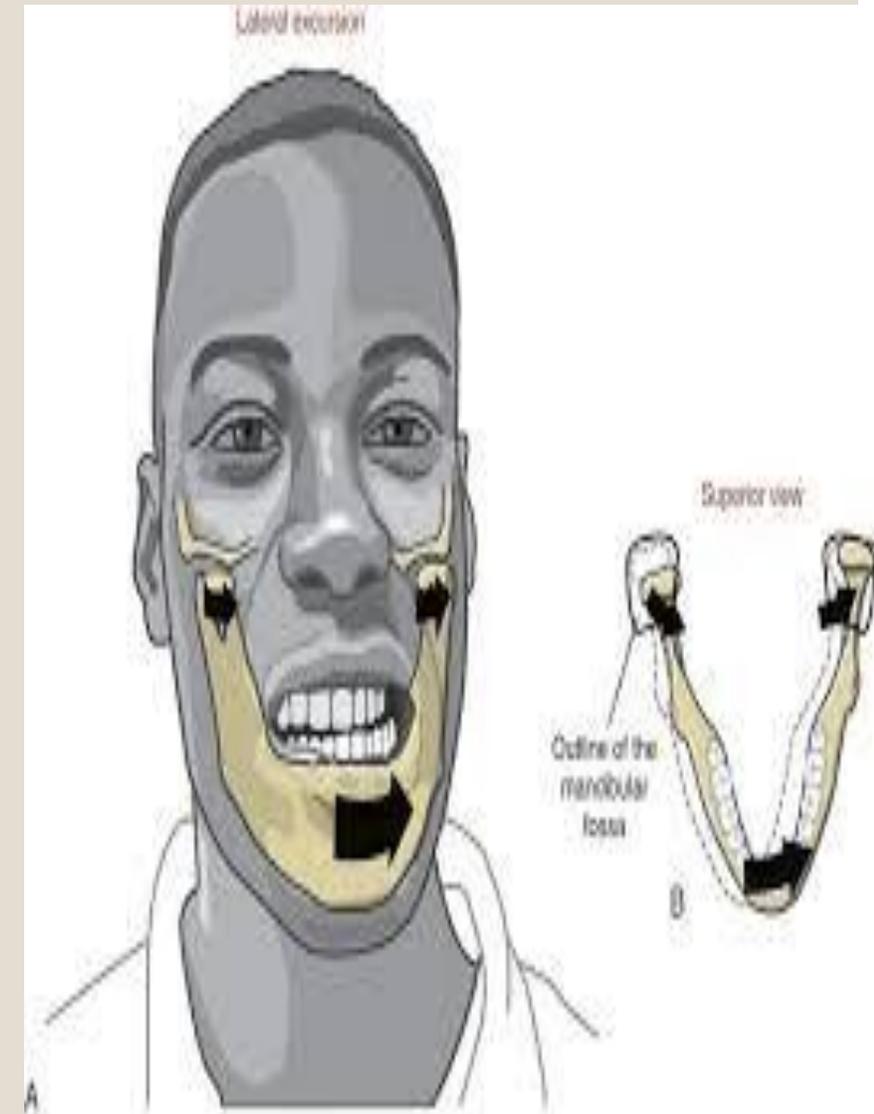
**RETRUSION:** is the opposite of protrusion. It refers to the movement of a structure in a posterior, or backward upward direction



← ممكن اذا شفت حد كامل هيلك  
 له اما عنده تقدم في ال mandible  
 (prognathism) فيه  
 يطلق عليه class (III)  
 يحتاج تقويم سنن للعلاج

# LATERAL MOVEMENT

- **Side-to-Side Movements:** The mandible moves from one side to another.
- allowing grinding actions during mastication.
- These movements are controlled by the medial and lateral pterygoid muscles



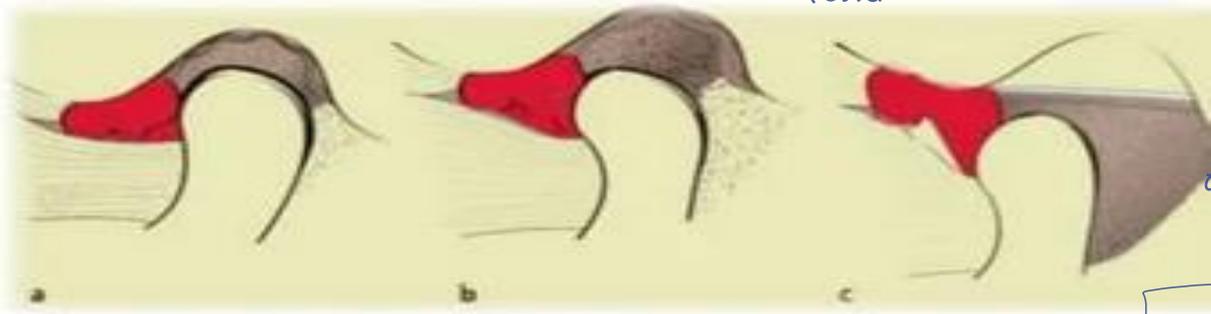
# Clinical consideration of TMJ

- **TMJ symptoms can appear at any age**
- **the peak incidence occurs in adults aged 20 to 40**
- **Women are much more likely to be affected than men**
- **up to 60 to 70% of the population shows signs of TMJ disorders, only 5% to 12% of people report symptoms and require treatment**

# Common Disorders Affecting Jaw Movements

- Temporomandibular Joint Disorders
- Bruxism (Teeth Grinding and Clenching)  
بعضی عی ثنانه
- Malocclusion (Improper Bite Alignment)
- Trismus (Lockjaw)
- Impacted tooth

\* TMJ composed of -  
 - condyle - disk  
 - fossa - eminence



# 1 Temporomandibular Joint Disorders

**TMJ disc displacement** occurs when disc dislocated from its place leading to pain, restricted movement, and clicking sounds during jaw movement

## Ankylosis of the TMJ

is a serious condition characterized by fusion of the jawbone to the joint, leading to restricted movement and significant functional impairment.

## Anterior condylar dislocations

The condyle displaced and become anterior to the eminence. In normal anterior translation of the condyle in the glenoid fossa

It resulted from acute and forceful opening of the mouth e.g. trauma, long dental procedures (endotreatment, surgery), intubation, it may be chronic condition

sliding  
 تحريك اجزاء  
 بمحاكية للحلاج

many causes...  
 - congenital  
 - trauma  
 - disease  
 like auto-immune disease

fusion between  
 bone and bone  
 tooth and bone

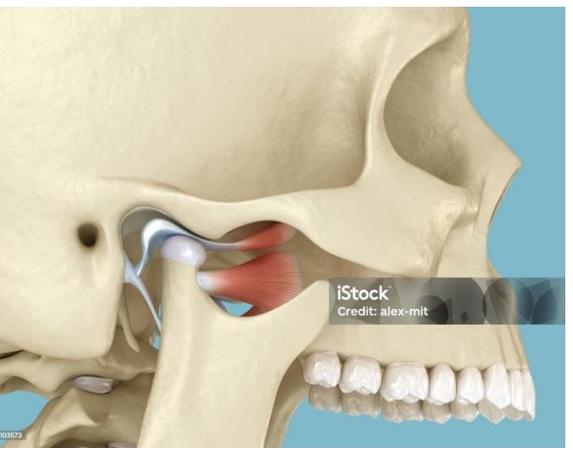
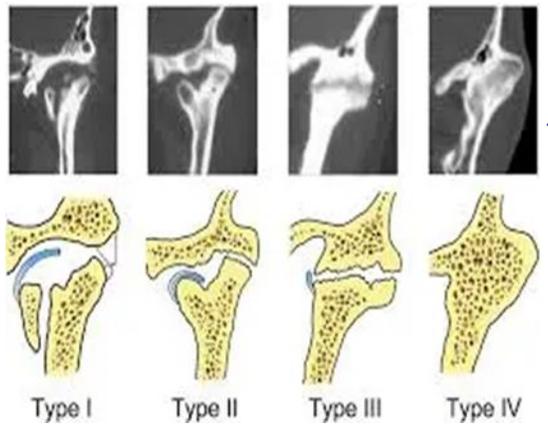
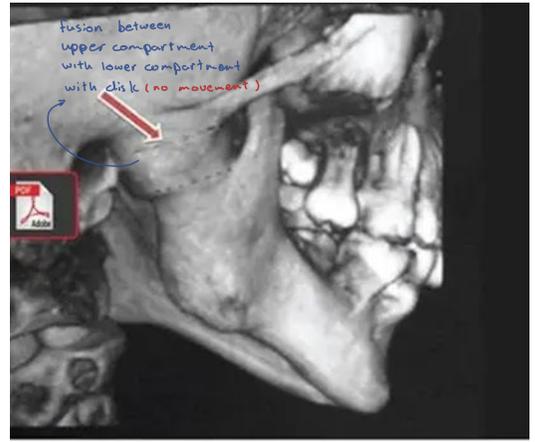
Ankylosis grade  
 تغير ال function  
 تماماً حيث  
 fusion of bone  
 من راح يكون في  
 حصة العمل

يجب ان تشخيص العودت ليكرها  
 يجب اعادتها عند الدكتور

like impacted lower (8)  
 يمكن ياخذ من

10م الى 3-2 h  
 في حالة ر 3h ممكن  
 نسبة للمريض (ACD)

عنه دخول العناية المكثفة  
 ووضع ر tube لانيام





## ② **Bruxism** (Teeth Grinding and Clenching)

حل المشكلة هو اعداد  
night guard  
(التقويم اللي اشفاه)

○ **Bruxism** is a condition characterized by **involuntary grinding** or **clenching** of the teeth, often **during sleep**.

This **excessive force** can lead to:

اح يتعب ل TMJ

د بحال يتعب  
العصبان

○ **Jaw pain and tightness**

○ **(Worn-down) enamel and tooth sensitivity**

تآكل  
enamel, dentin  
pulp exposed - تآكل بهل  
د pulp في بعض الحالات

○ **Headaches and facial soreness**

○ **TMJ dysfunction over time**

vertical dimention  
ثني ثامت يقويه للمريض

كل مرة بأتي العيادة يكون يقول  
كان 12 يومها 10 بجها 8

يجد تآكل في الأسنان

كند مريض

Bruxism ل

يقول (UD)

③ **Malocclusion** An improper bite can lead to:

- Uneven stress on the jaw
- Chronic jaw pain and discomfort
- Difficulty in chewing and speaking
- Long-term TMJ complications

دانه کاسه د فیسور  
مش طایقتین می بصر



#### ④ Trismus (Lockjaw)

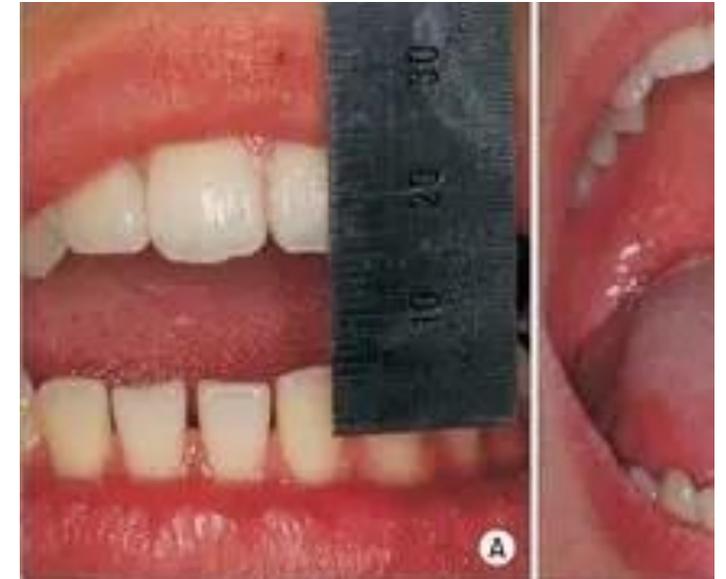
- Trismus is a condition where the jaw becomes restricted in movement, making it difficult to open the mouth fully.
- It is a painful condition causing jaw muscle spasms

ممکن یسبب

wisdom tooth  
اد امشكلة في ال  
muscles

لعلاج منال wisdom  
ادا كان هو السبب  
يجب ان اعطي المريض  
مخبرتي للعلاجات وبعده

دهجة اناهم يعود للمراجعة  
عندما يستطيع ان يفتح  
فمه فاستطاع المصارف  
تاجرات العلاج (رؤية  
وعلاج wisdom)



## ⑤ The Connection between Impacted Teeth and TMJ Disorders

- 1- impacted tooth may cause misalignment in the jaw. This misalignment can lead to tension in the muscles surrounding the jaw joint, resulting in TMJ pain and discomfort.
- 2- Impacted tooth can also affect jaw function. When a tooth is impacted, it can put pressure on the surrounding teeth, causing them to shift out of alignment and may cause resorption in bone and adjacent teeth
  - Patient with impacted 8 may suffering from: headache, pain and tenderness in tmj, ear pain, trismus, clicking, difficulty in chewing and speaking.



*Thank You*

