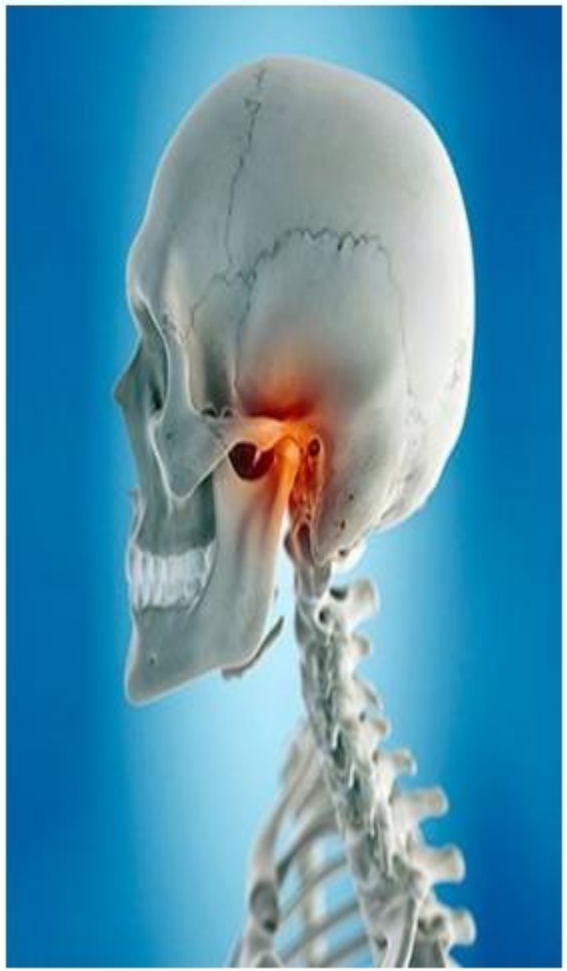


Physical Therapy For TEMPOROMANDIBULAR JOINT

by

Waleed saber

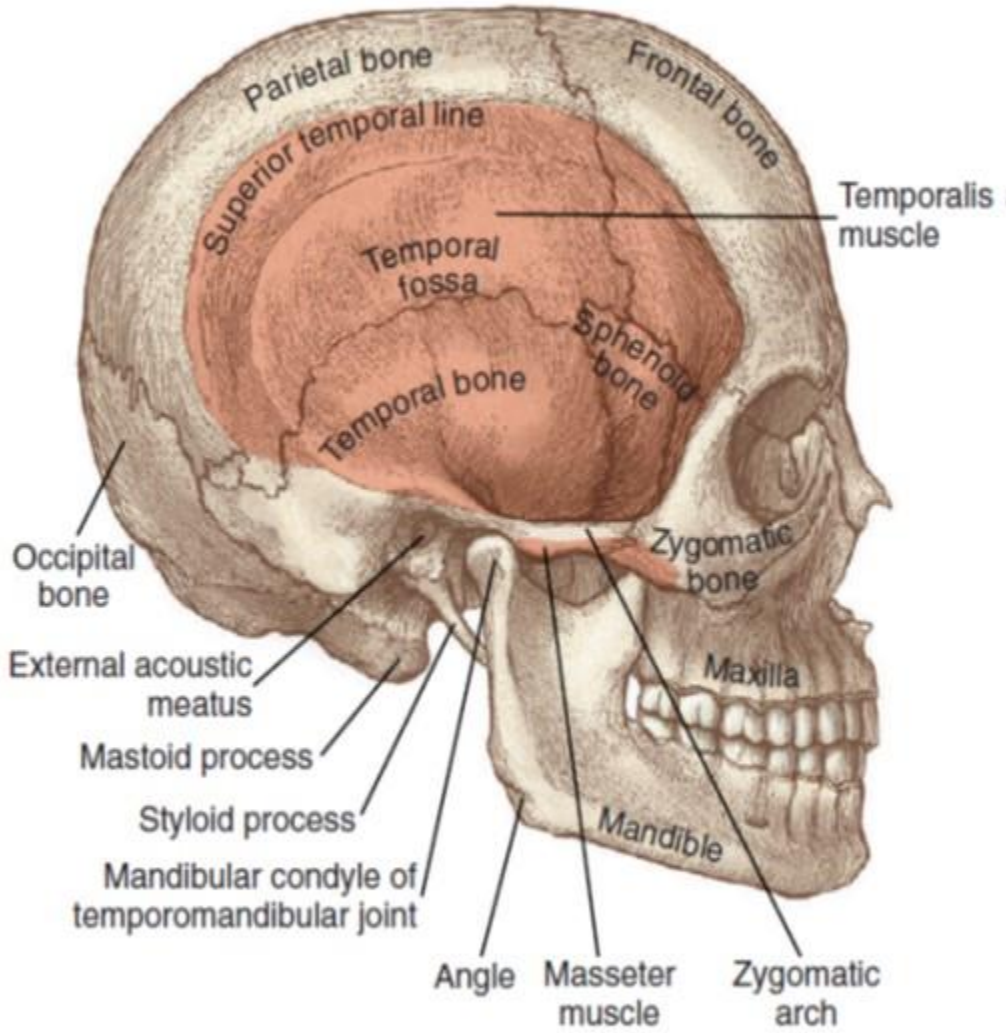
Orthopedic physical therapy lecturer

s.v.u.

Objectives

- Describe the functional anatomy and kinematics of the TMJ
- Describe the functional interrelationships between the TMJ and cervical spine
- Perform a comprehensive examination of the TMJ and related structures
- Perform treatment procedures for the TMJ including soft tissue mobilization, joint mobilization, and exercises

OSTEOLOGY



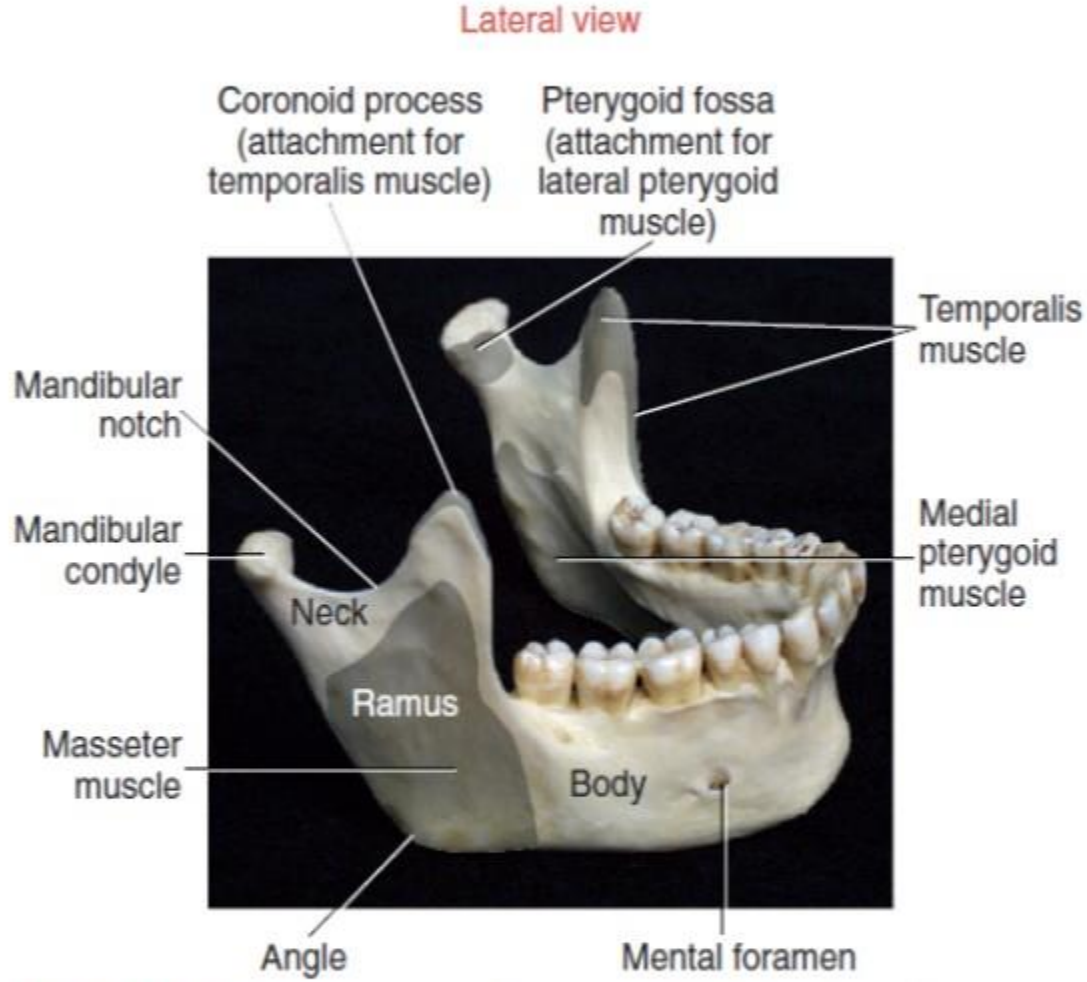


FIGURE 11-2. Lateral view of the mandible. Distal attachments of muscles are shown.

Muscles of mastication

Temporalis Muscle

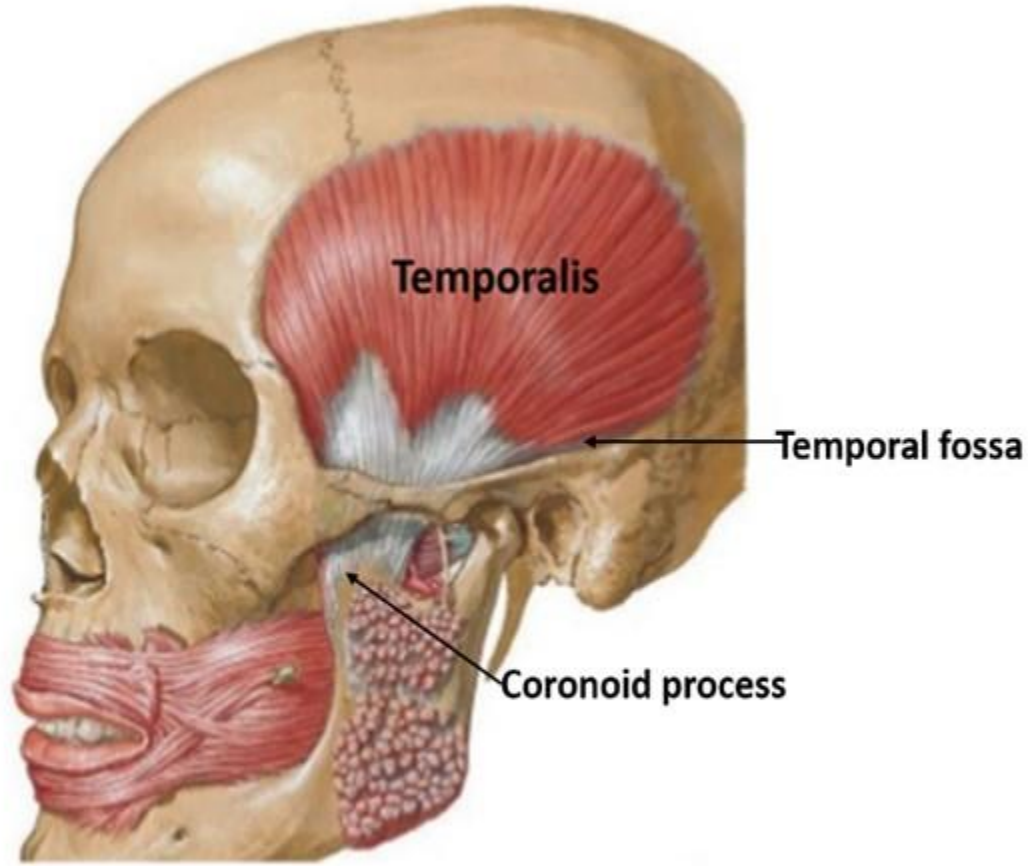
- **Origin:**
  Temporal fossa
- **Insertion:**
  Coronoid process and ramus of mandible
- **Nerve supply:**

Mandibular nerve division of Trigeminal (cranial nerve V)

- **Action:**

bilaterally: elevation, retrusion (posterior fibers)

Unilaterally: ipsilateral lateral deviation



Masseter Muscle

- **Origin:**

Zygomatic arch and zygomatic process of maxilla

- **Insertion:**

Angle of the ramus and coronoid process

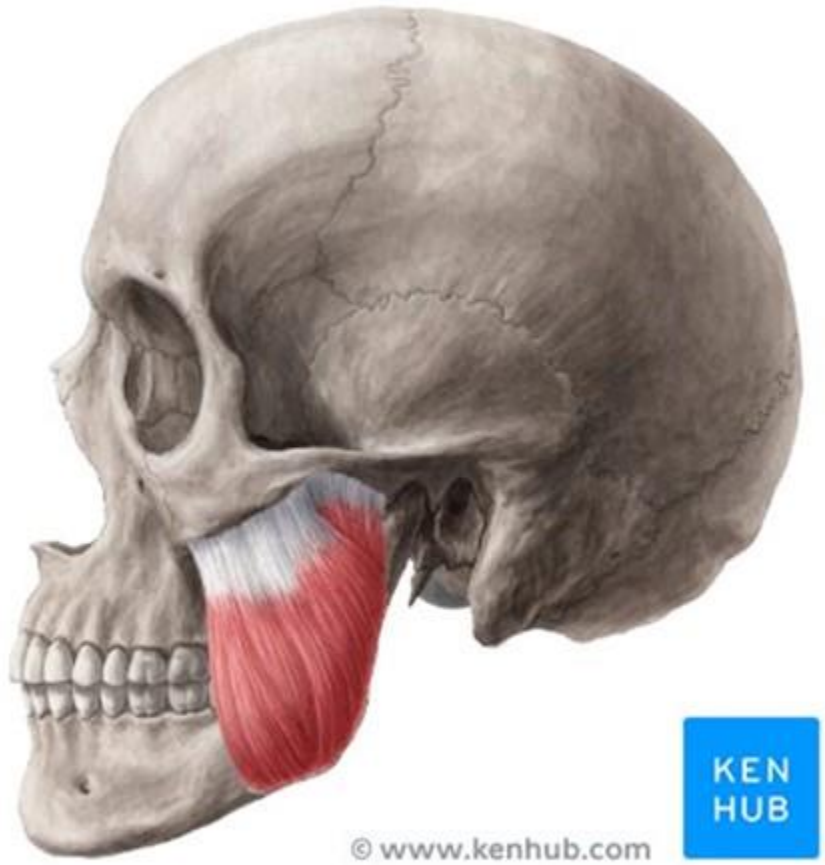
- **Nerve supply:**

Mandibular nerve division of Trigeminal (cranial nerve V)

- **Action:**

Bilaterally: elevation

Unilaterally: ipsilateral lateral deviation



Medial Pterygoid Muscle

- **Origin:**

Deep head: medial surface of Lateral pterygoid plate of the sphenoid bone
superficial head: tuberosity of the maxilla

- **Insertion:**

Ramus and angle of the mandible

- **Nerve supply:**

Mandibular nerve division of Trigeminal (cranial nerve V)

- **Action:**

Bilaterally: elevation, protrusion
Unilaterally: contralateral lateral deviation

Lateral Pterygoid Muscle

- **Origin:**

Inferior head: Lateral pterygoid plate
Superior head: greater wing of the sphenoid

- **Insertion:**

Neck of mandible, articular disk and tmj capsule

- **Nerve supply:**

Mandibular nerve division of Trigeminal (cranial nerve V)

- **Action:**

Bilaterally: depression, protrusion
Unilaterally: contralateral lateral deviation

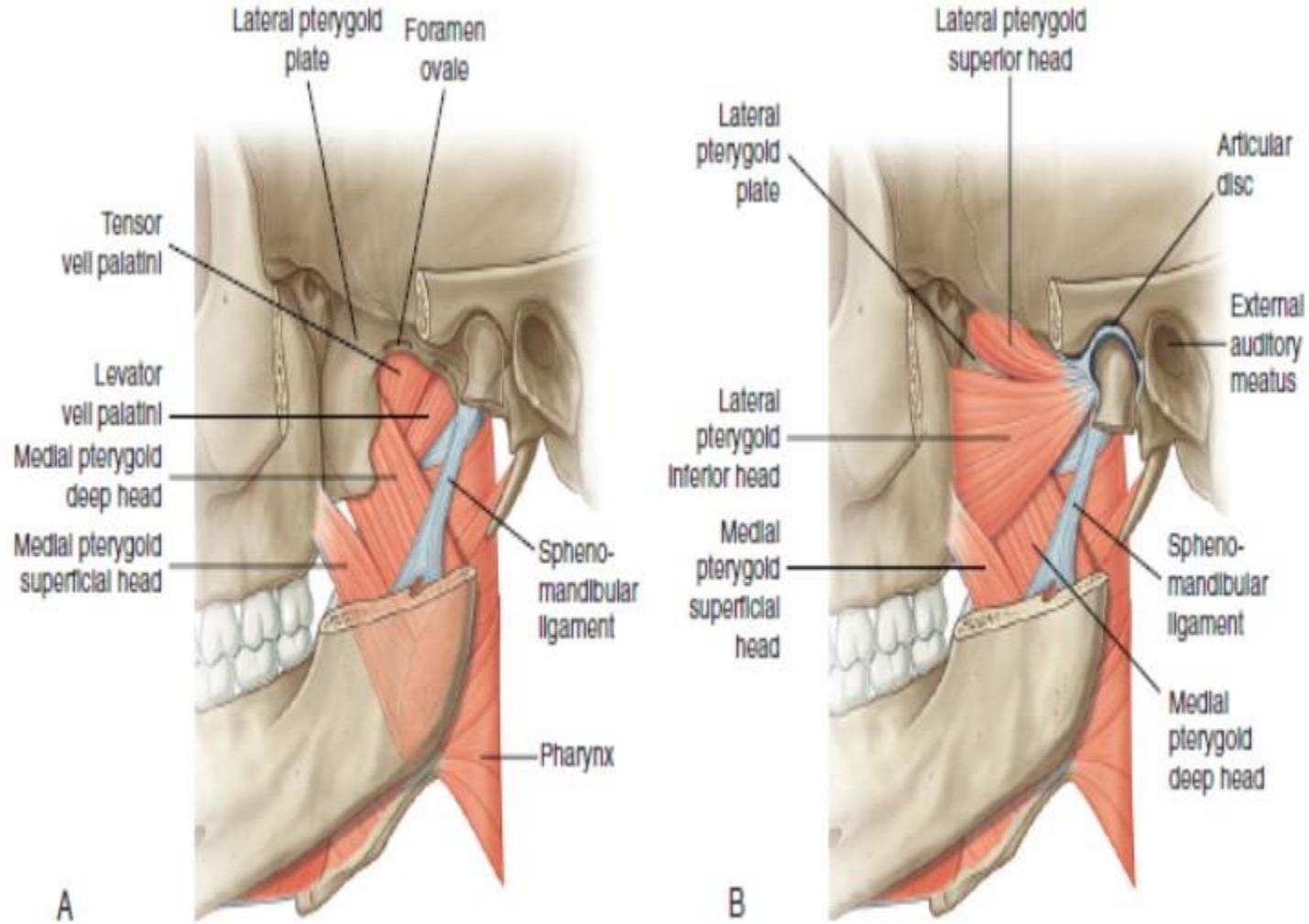


FIGURE 11-19. Illustration highlighting the left medial pterygoid **(A)** and lateral pterygoid **(B)** muscles. The mandible and zygomatic arch have been cut for better exposure of the pterygoid muscles. (From Drake RL, Vogl W, Mitchell AWM: *Gray's anatomy for students*, St Louis, 2005, Churchill Livingstone.)

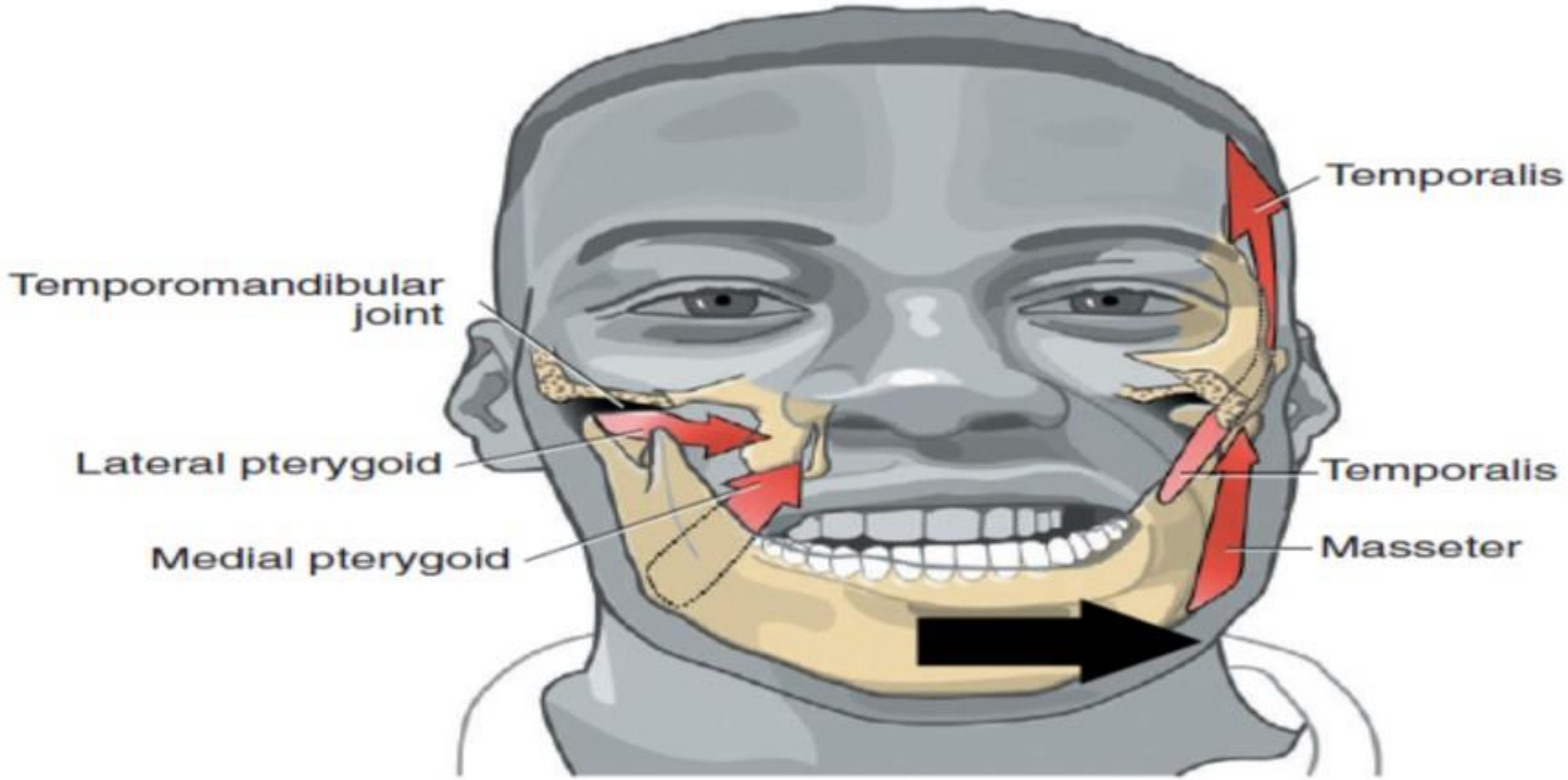


FIGURE 11-18. Frontal plane view shows the muscular interaction during *left lateral excursion* of the mandible. This action may occur during a side-to-side grinding motion while chewing. The muscles producing the movement are indicated in red.

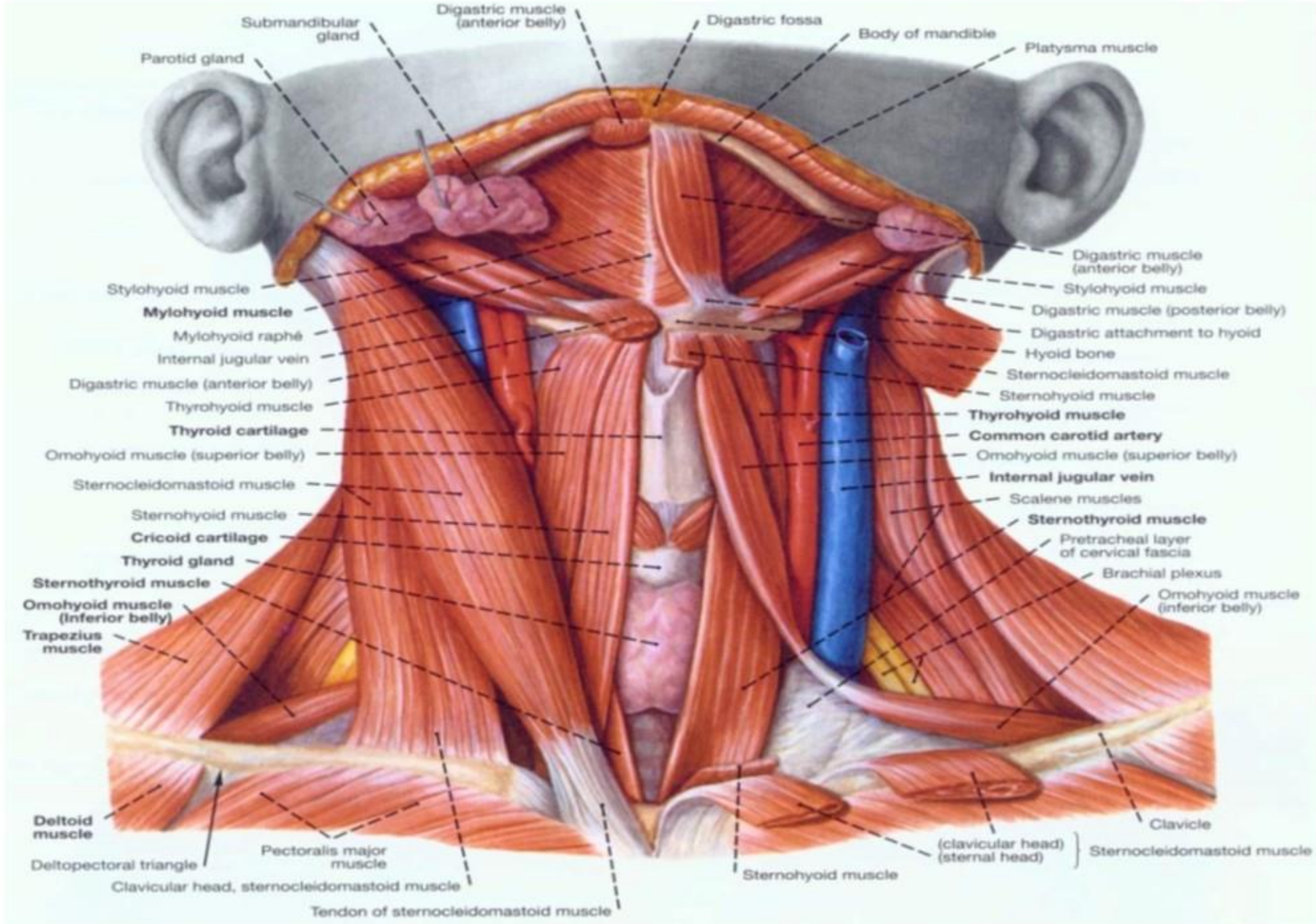
Hyoid Muscles

<u>Supra –hyoid</u>

- Digastric
- Mylohyoid
- Stylohyoid

<u>Infra-Hyoid</u>

- Omohyoid
- thyrohyoid
- Sternohyoid



ARTHROLOGY

- The TMJ is a synovial, condylar and hinge-**type** compound joint
- Articulation between the mandibular condyle and the mandibular fossa of the temporal bone.

CAPSULE

- Loose *fibrous capsule*. The internal surfaces of the capsule are lined with a synovial membrane.
- It is firm medially and laterally, yet loose anteriorly and posteriorly. Because of this arrangement, the joint is more mobile in the anterior-posterior direction, allowing the disk-condyle complex to translate during opening and closing of the mouth. Medial-lateral movement is more stabilized and limited

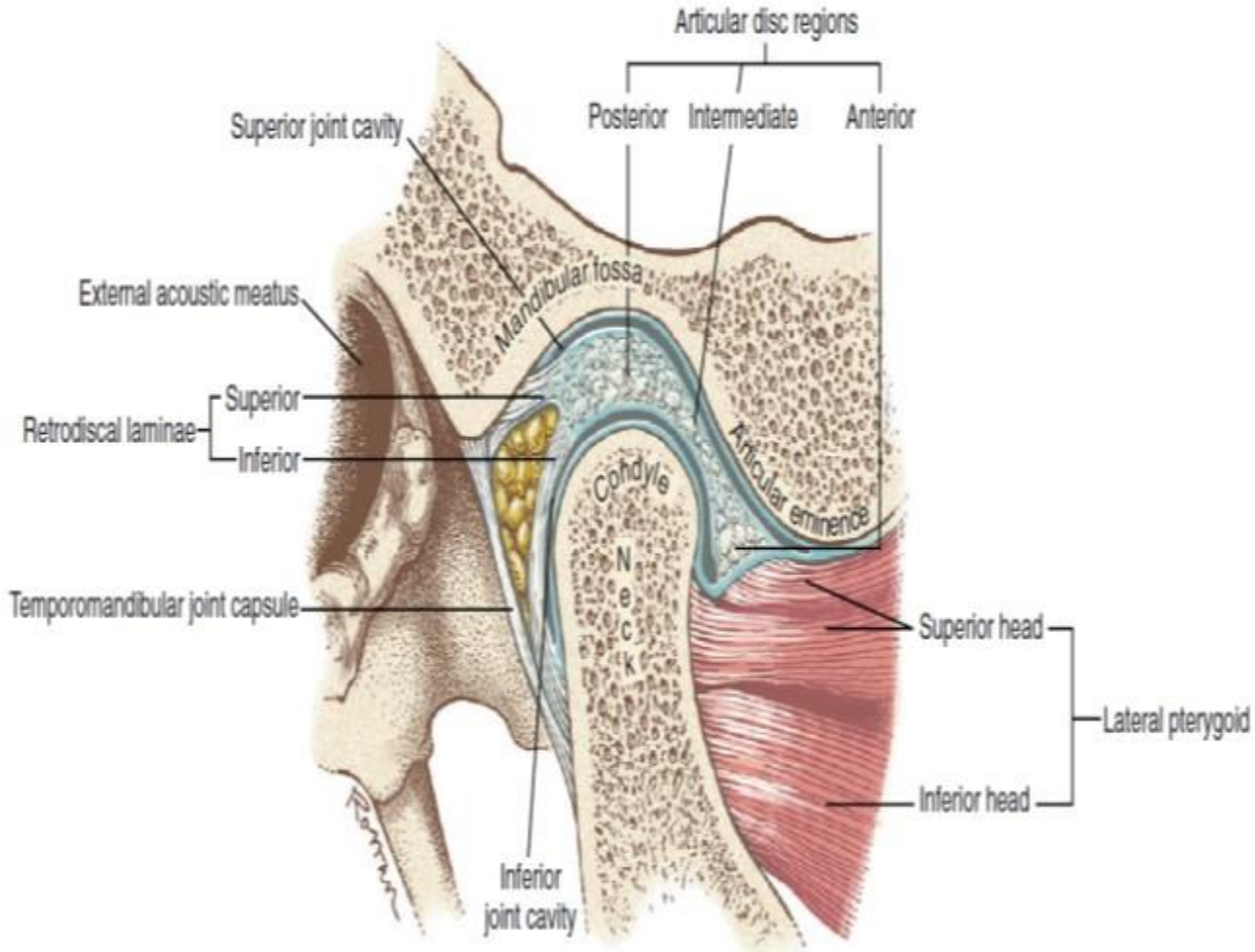


FIGURE 11-10. A lateral view of a sagittal plane cross-section through a normal right temporomandibular joint. The mandible is in a position of maximal intercuspation, with the disc in its ideal position relative to the condyle and the temporal bone.

TMJ disc

Articular Disc

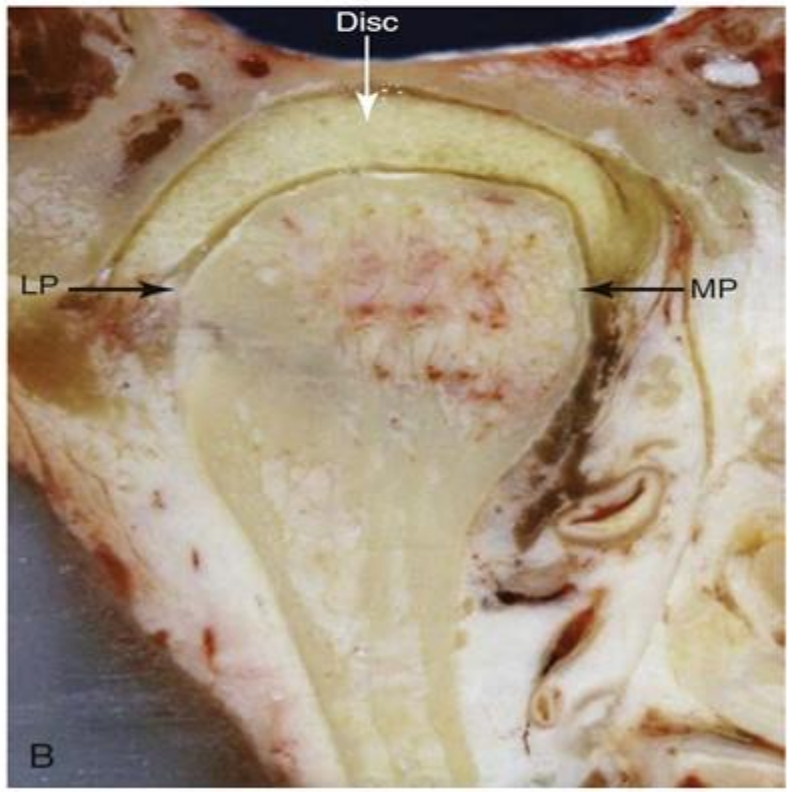
Fibrocartilaginous Disk

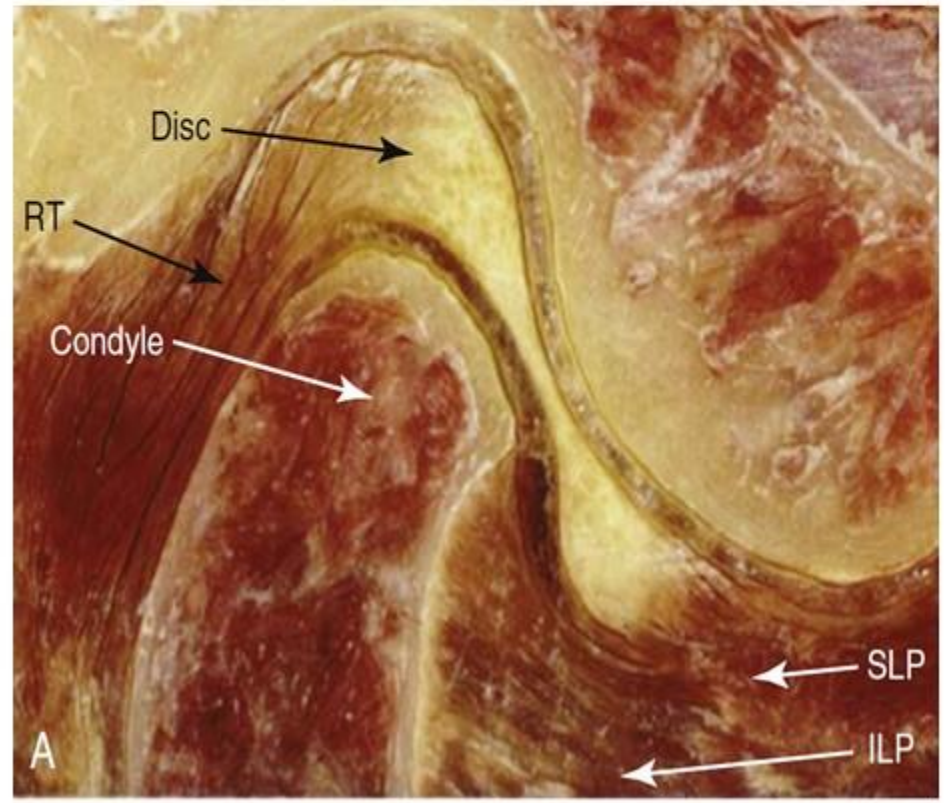
Function of the disc

1. maximizes the congruency within theTMJ
2. Reduce contact pressure.
3. Adds stability to the joint

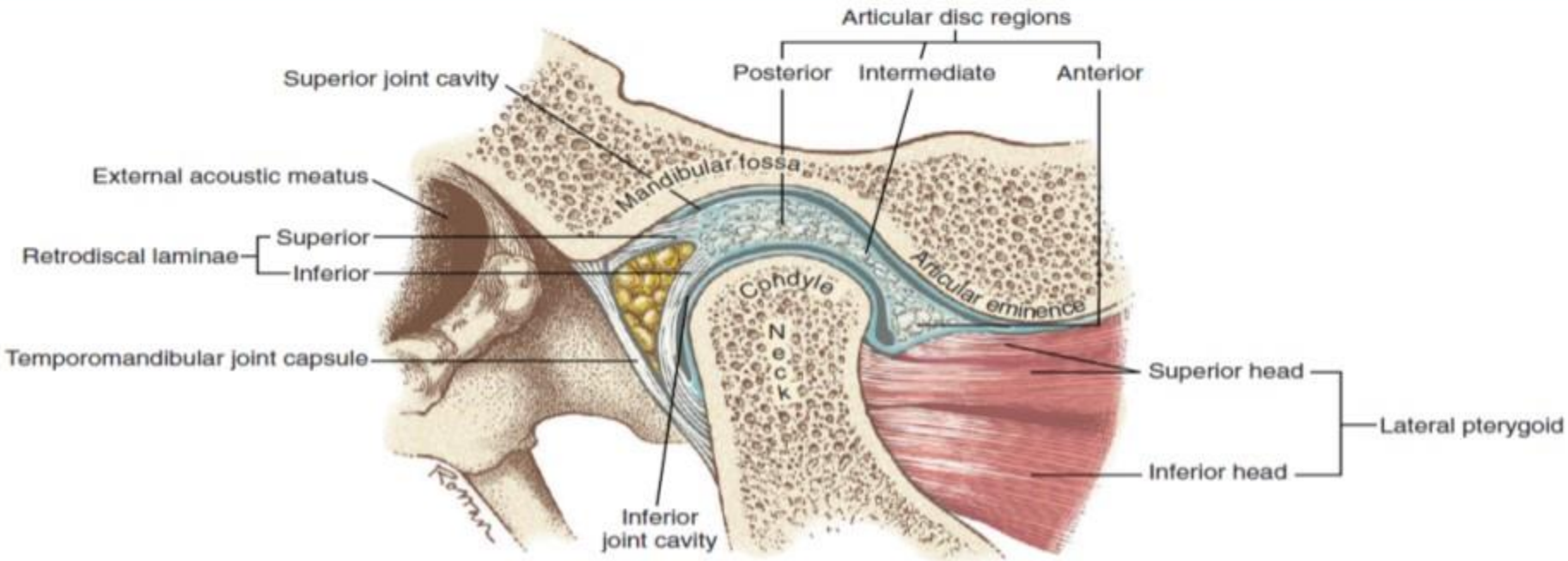
Factors maintaining disc condyle relationship

1. Disc morphology (thicker anterior and posterior borders)
2. the interarticular pressure
3. the medial and lateral discal collateral ligaments, which do not permit sliding movements of the disc on the condyle



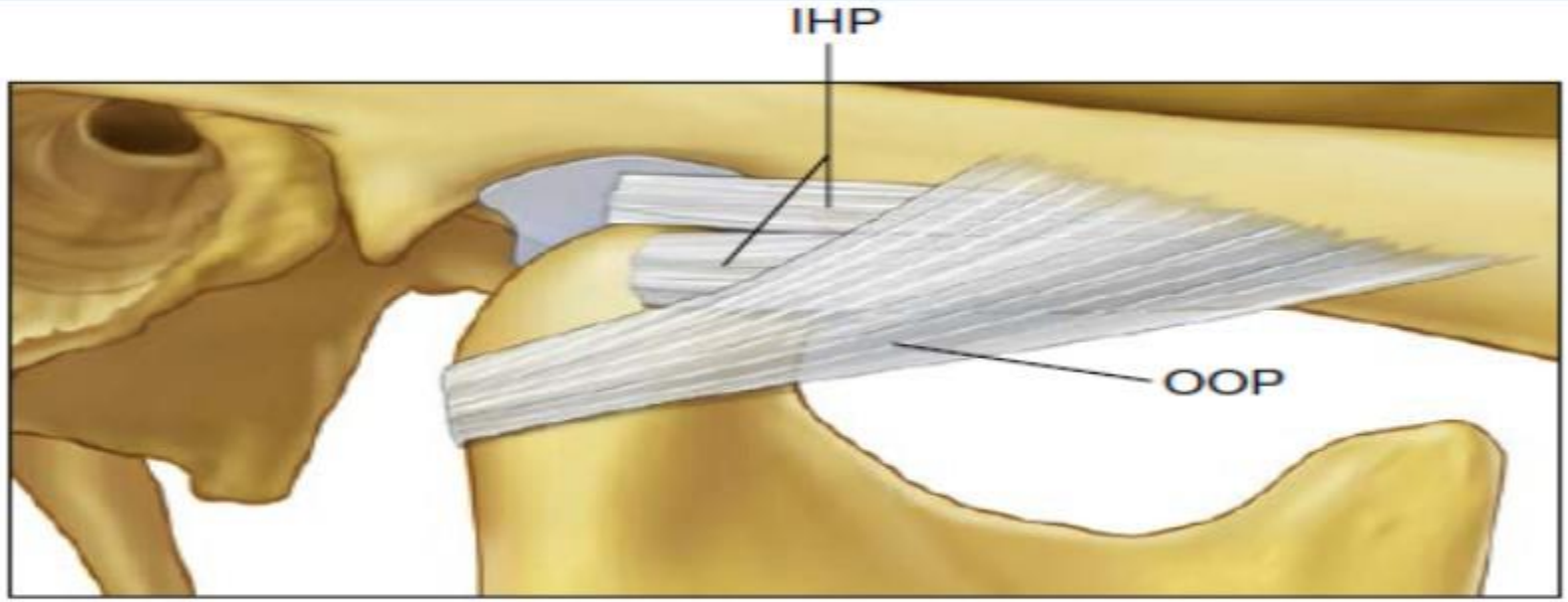


- The disk can be subdivided in 3 portions: anterior, intermediate,and posterior.
- The anterior and posterior portions have neural innervation and vascular supply, in contrast to the intermediate portion, which is avascular and aneural and receives its nutrition from the synovial fluid.
- The densest fibrous tissue of the intermediate portion serves as a pressure-bearing interface between the condylar head and articular eminence during TMJ movements.



Ligaments

1. Temporomandibular Ligament

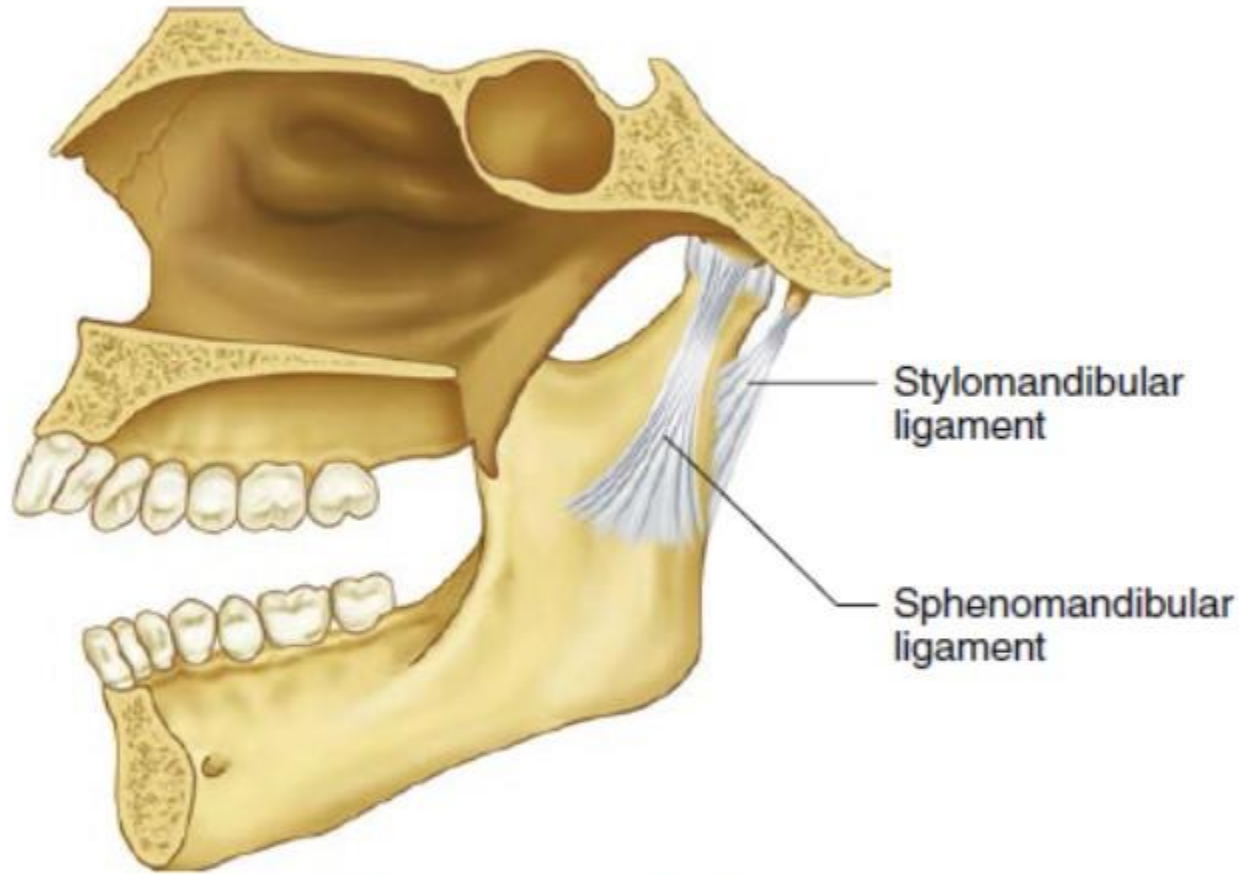


• **Fig. 1.20.** Temporomandibular Ligament (Lateral View). Note that there are two distinct parts: the outer oblique portion *(OOP)* and the inner horizontal portion *(IHP)*. The OOP limits normal rotational opening movement; the IHP limits posterior movement of the condyle and disc. (Modified from Dubrul EL: *Sicher's oral anatomy*, ed 7, St Louis, MO, 1980, The CV Mosby CO, pp 185.)

2. **Stylomandibular ligament.**
   - It serves **to limit excessive protrusion of the jaw**.

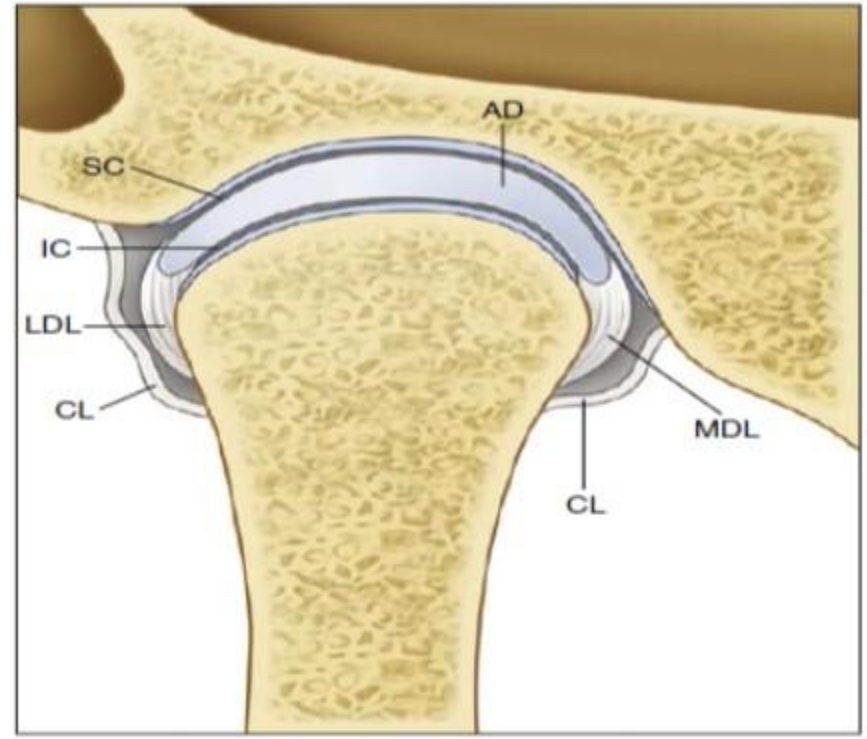
3. **Sphenomandibular Ligament**

- The function of the sphenomandibular ligament is **to limit distension of the mandible in an inferior direction**. It is slack when the temporomandibular joint (TMJ) is in closed position. It is taut as the condyle of the mandible is in front of the temporomandibular ligament.



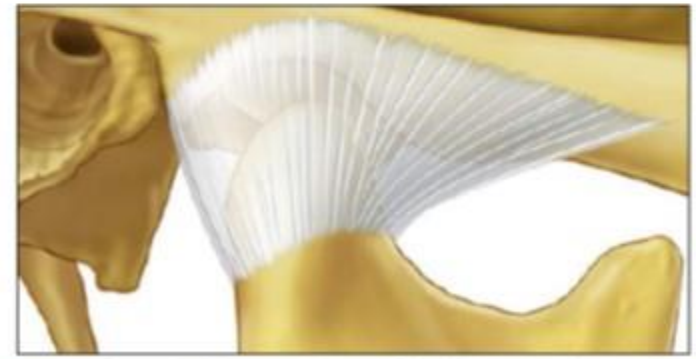
• **Fig. 1.22.** The mandible, temporomandibular joint, and accessory ligaments.

4. Collateral (discal) Ligaments(medial and lateral)



• **Fig. 1.18.** Temporomandibular Joint (Anterior View). The following are identified: *AD*, Articular disc; *CL*, capsular ligament; *IC*, inferior joint cavity; *LDL*, lateral discal ligament; *MDL*, medial discal ligament; *SC*, superior joint cavity.

5. Capsular Ligament



• **Fig. 1.19.** Capsular Ligament (Lateral View). Note that it extends anterior to include the articular eminence and encompass the entire articular surface of the joint.

Osteokenimatics

DEPRESSION AND ELEVATION PROTRUSION AND RETRUSION

LATERAL DEVIATION

Arthrokinematics

A. DEPRESSION AND ELEVATION

- The *early phase,*
  - Constituting the first 35% to 50% of the range of motion
  - The mandibular condyle roll relative to the inferior surface of the disc in the lower joint

- The *late phase*
  - 50% to 65% of the total range of motion.
  - The mandibular condyle and disc glide together as a condyle-disc complex along the articular eminence. Translation occurs in the upper joint between the disc and the articular eminence

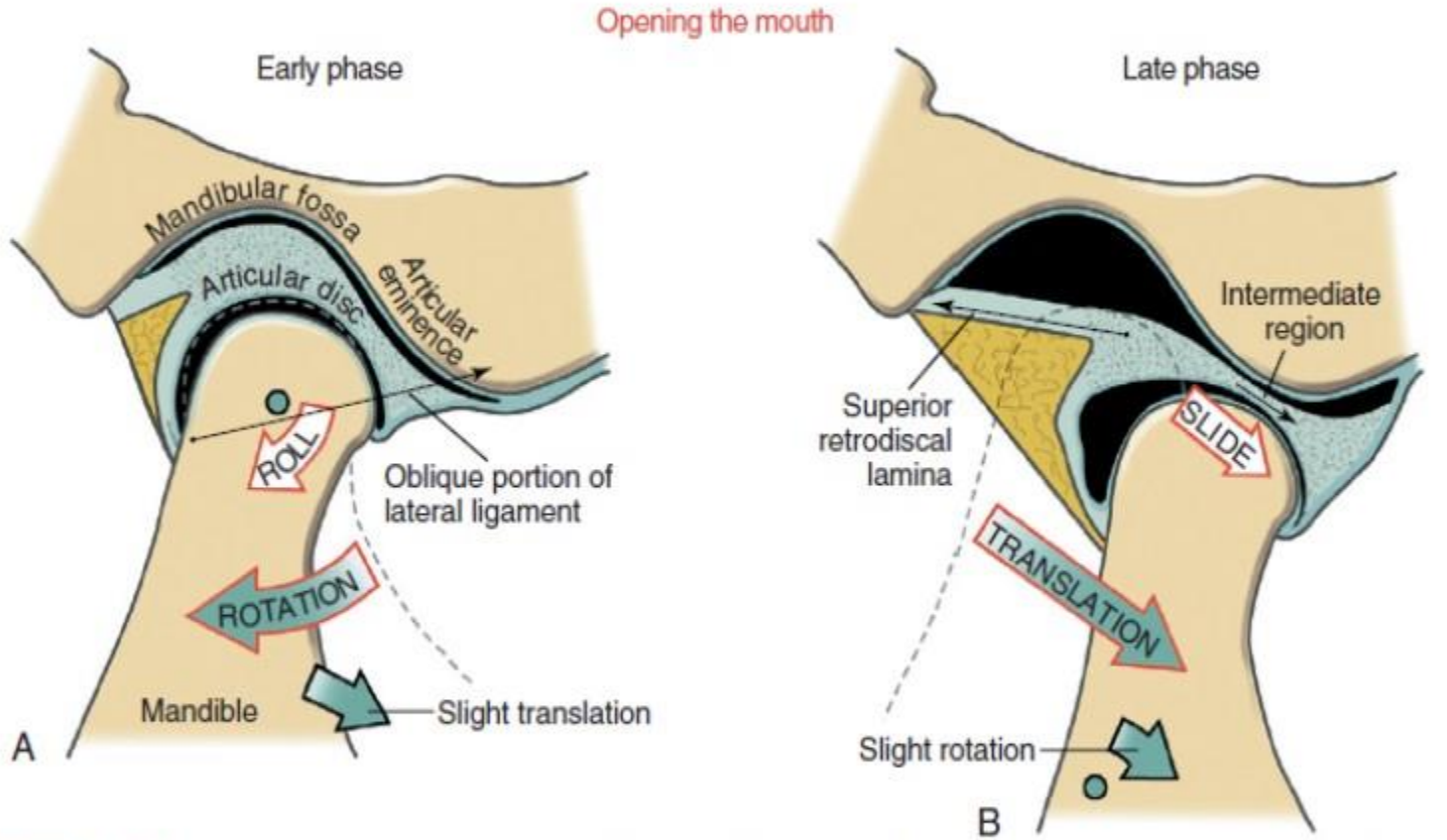
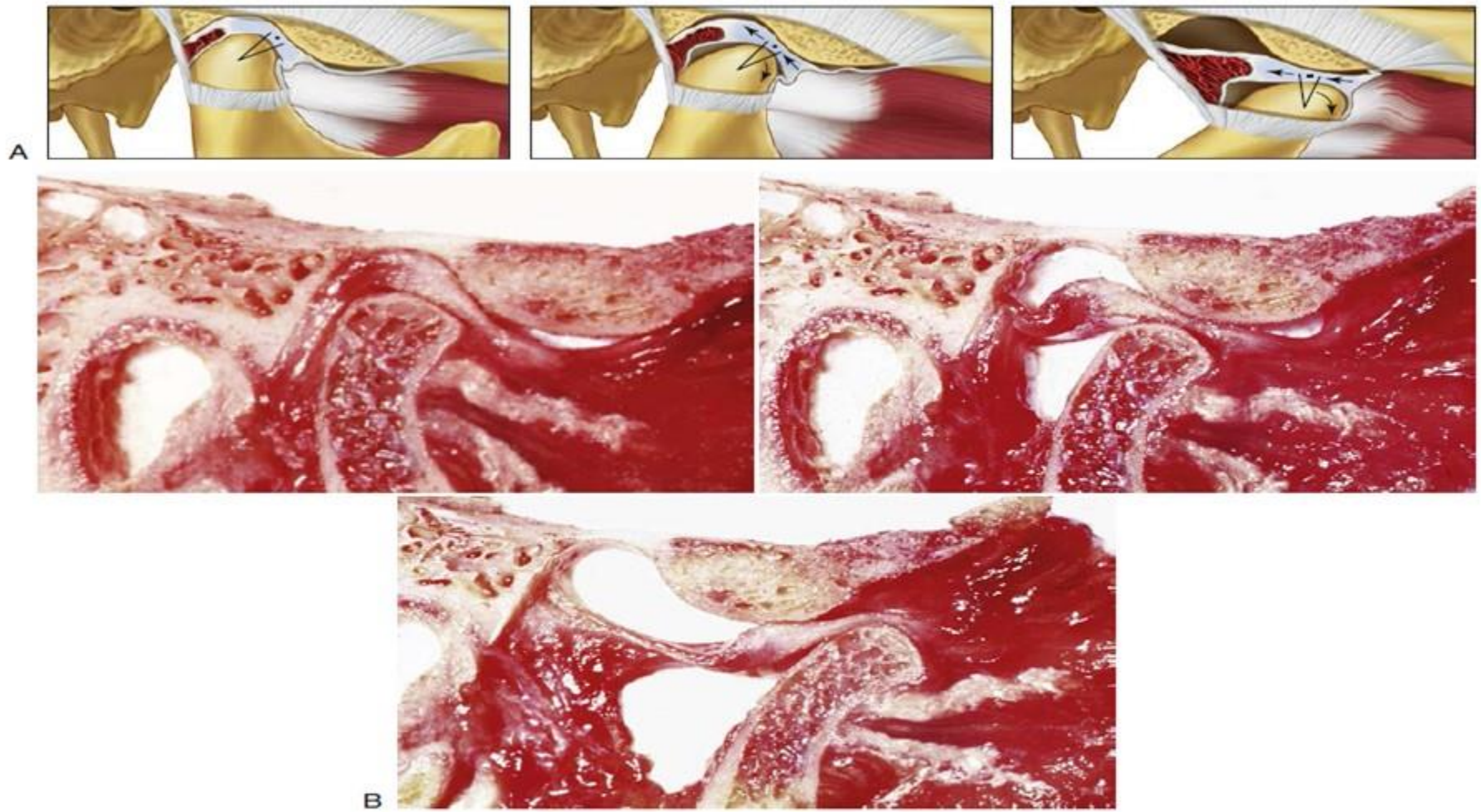
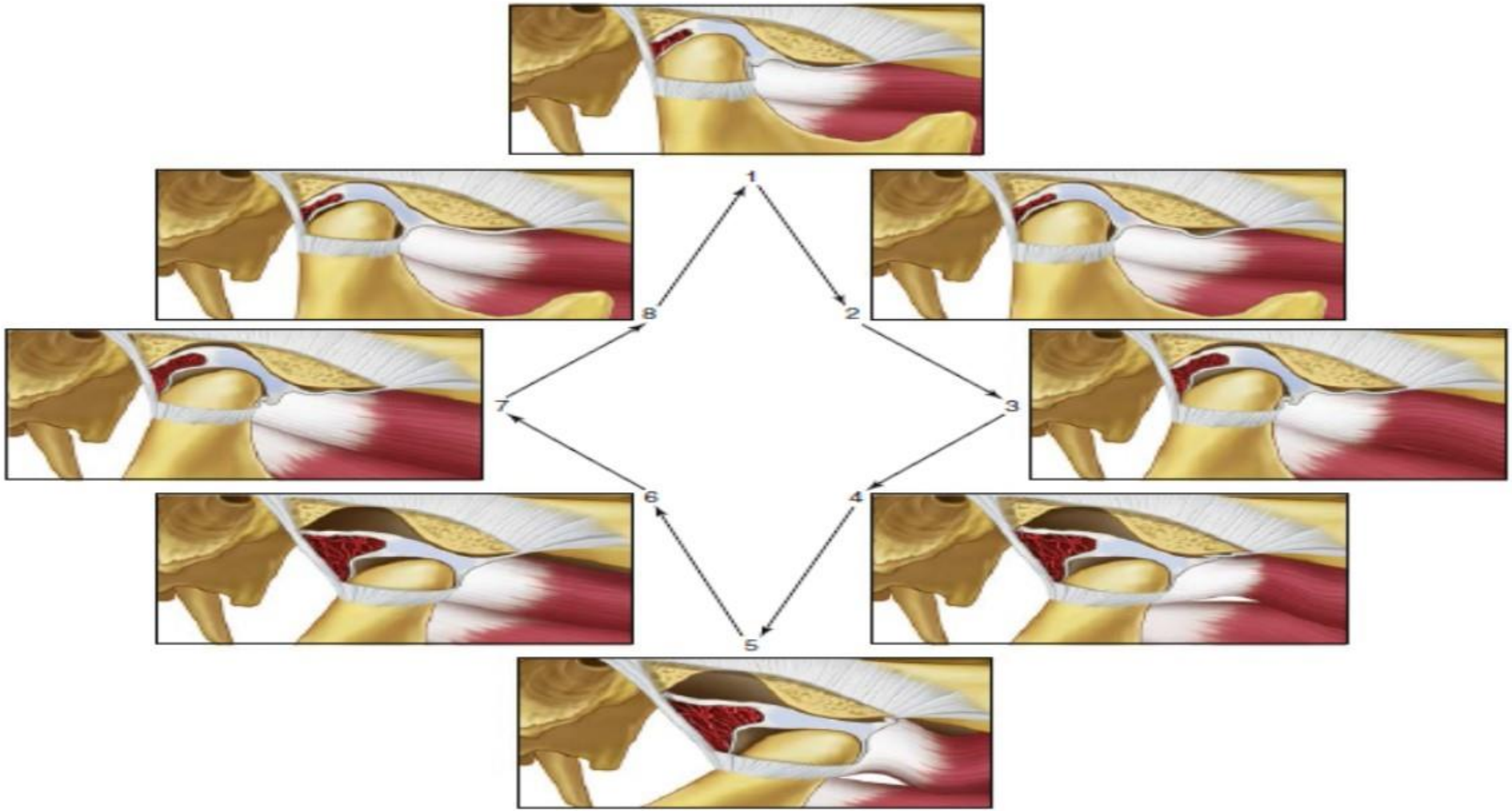


FIGURE 11-16. Arthrokinematics of opening the mouth, illustrated for the right temporomandibular joint only: early phase **(A)** and late phase **(B)**.



• **Fig. 1.30. A.** Normal movement of the condyle and disc during mouth opening. Note that as the condyle moves out of the fossa the disc rotates posteriorly on the condyle. Rotational movement predominately occurs in the lower joint space while translation predominately occurs in the superior joint space. **B.** Note the same movements in the cadaver specimen. (Courtesy Dr. Terry Tanaka, San Diego, CA.)



• **Fig. 1.31.** Normal functional movement of the condyle and disc during the full range of opening and closing. Note that the disc is rotated posteriorly on the condyle as the condyle is translated out of the fossa. The closing movement is the exact opposite of opening. This is pressure *between* the articular surfaces of the joint.

Control of the Disc during Mandibular Elevation and Depression

- The inferior retrodiscal lamina limits forward excursion of the disc During mandibular elevation, the elastic character of the superior retrodiscal lamina applies a posterior distractive force on the disc.

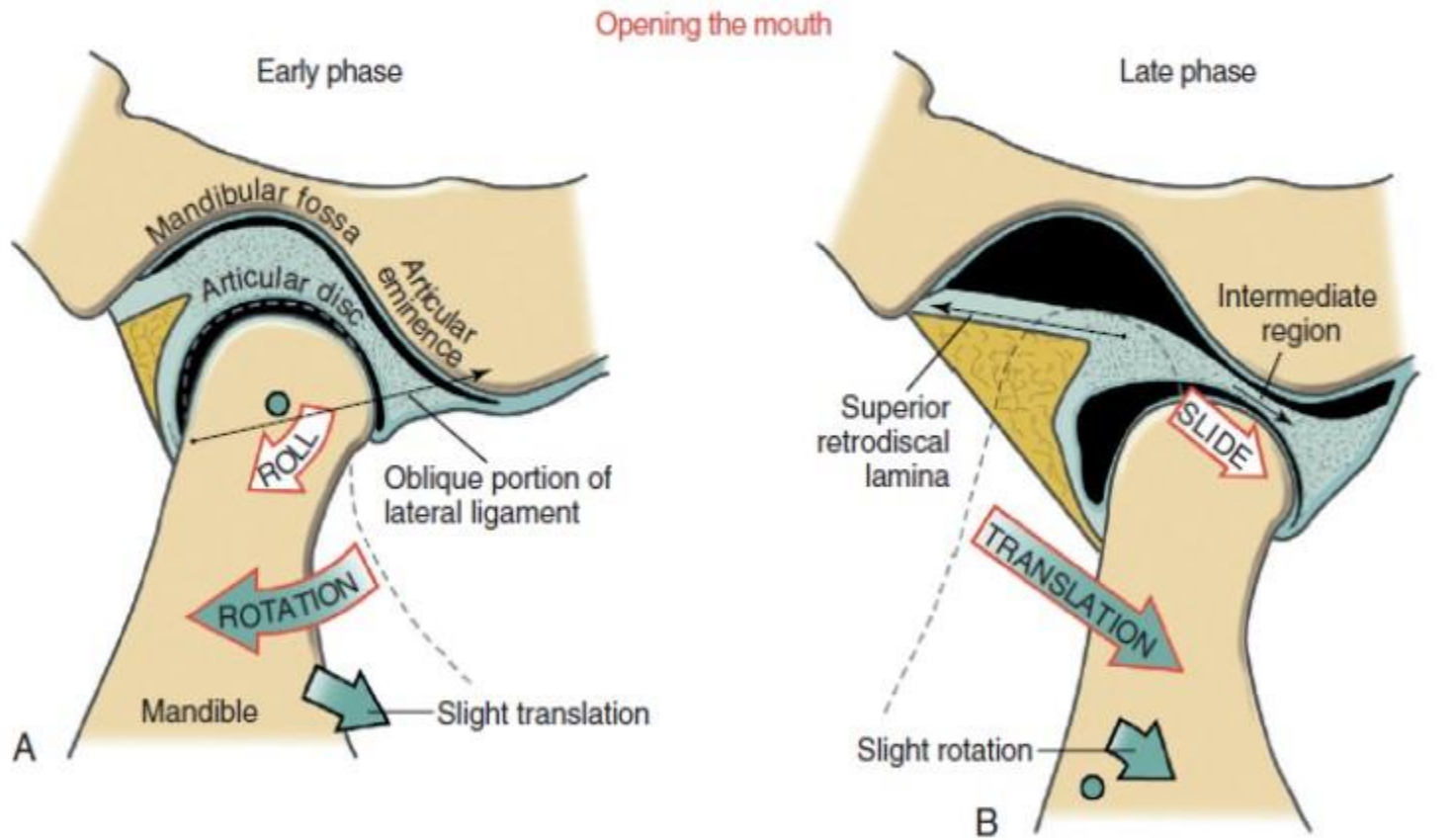
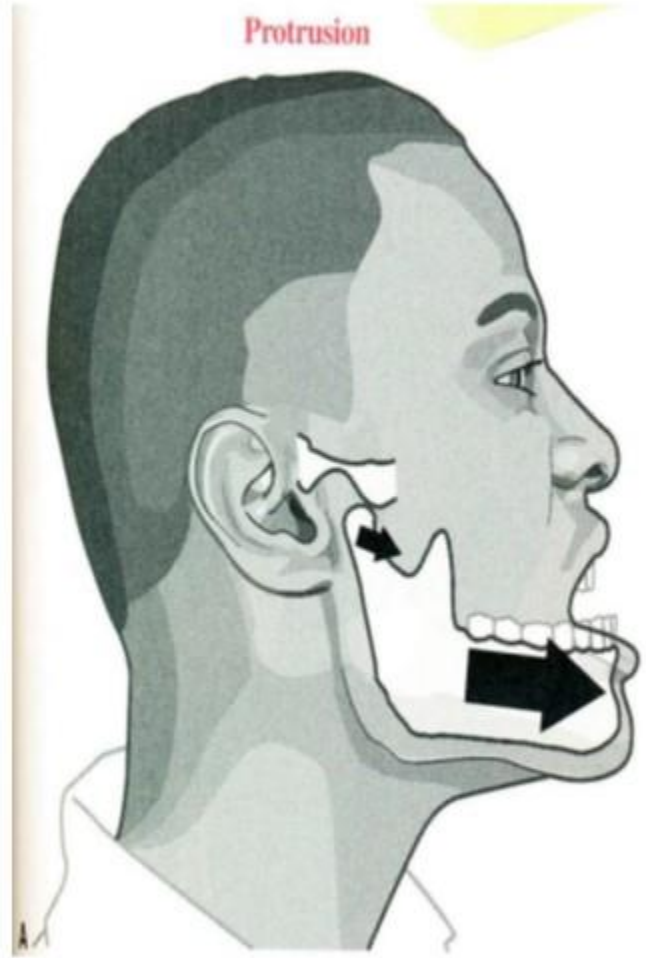
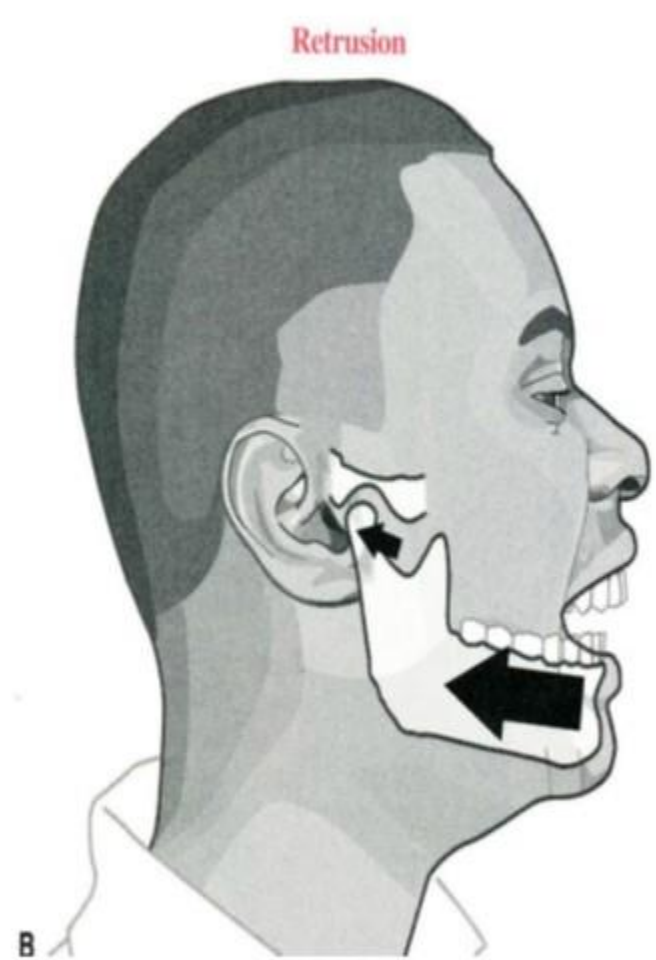


FIGURE 11-16. Arthrokinematics of opening the mouth, illustrated for the right temporomandibular joint only: early phase **(A)** and late phase **(B)**.

B. Protrusion and retrusion

- Mandibular protrusion and retrusion occur in the upper TM joint.
- The condyle-disc complex translates in an anterior inferior direction,
- Rotation is not present during protrusion and retrusion.





C. Lateral deviation

- Occurs in the horizontal plane.
- It involves one condyle spin in the articular fossa while the other condyle glides forward.

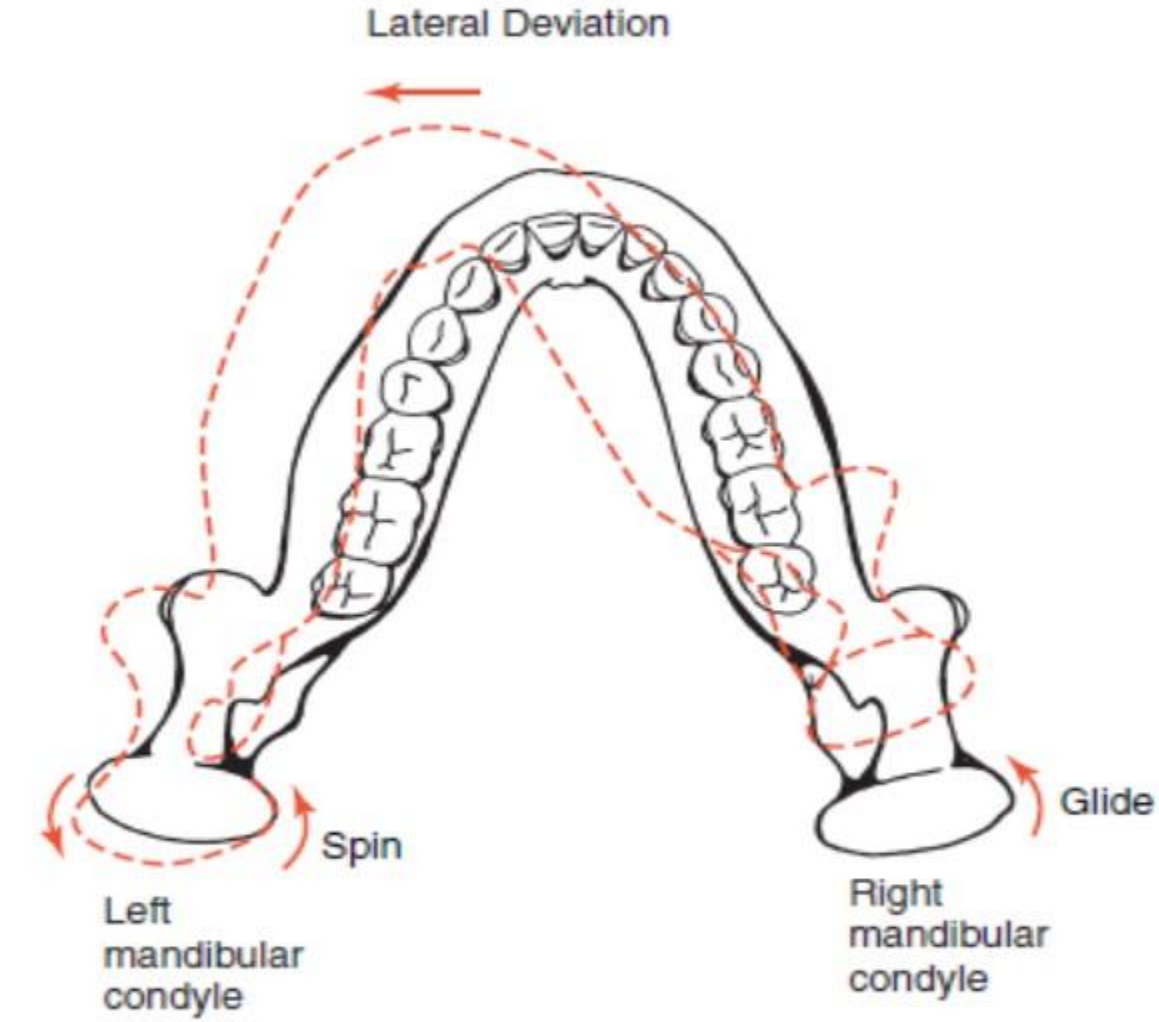


Figure 14-14. Mandibular motion during lateral deviation to the left side (superior view).

functional Interactions between the Masseter and Medial Pterygoid Muscles

- The medial pterygoid and masseter muscles form a *functional sling* around the angle of the mandible Simultaneous contractions of these muscles can exert a powerful biting force and effective shear force between the upper and lower molars.

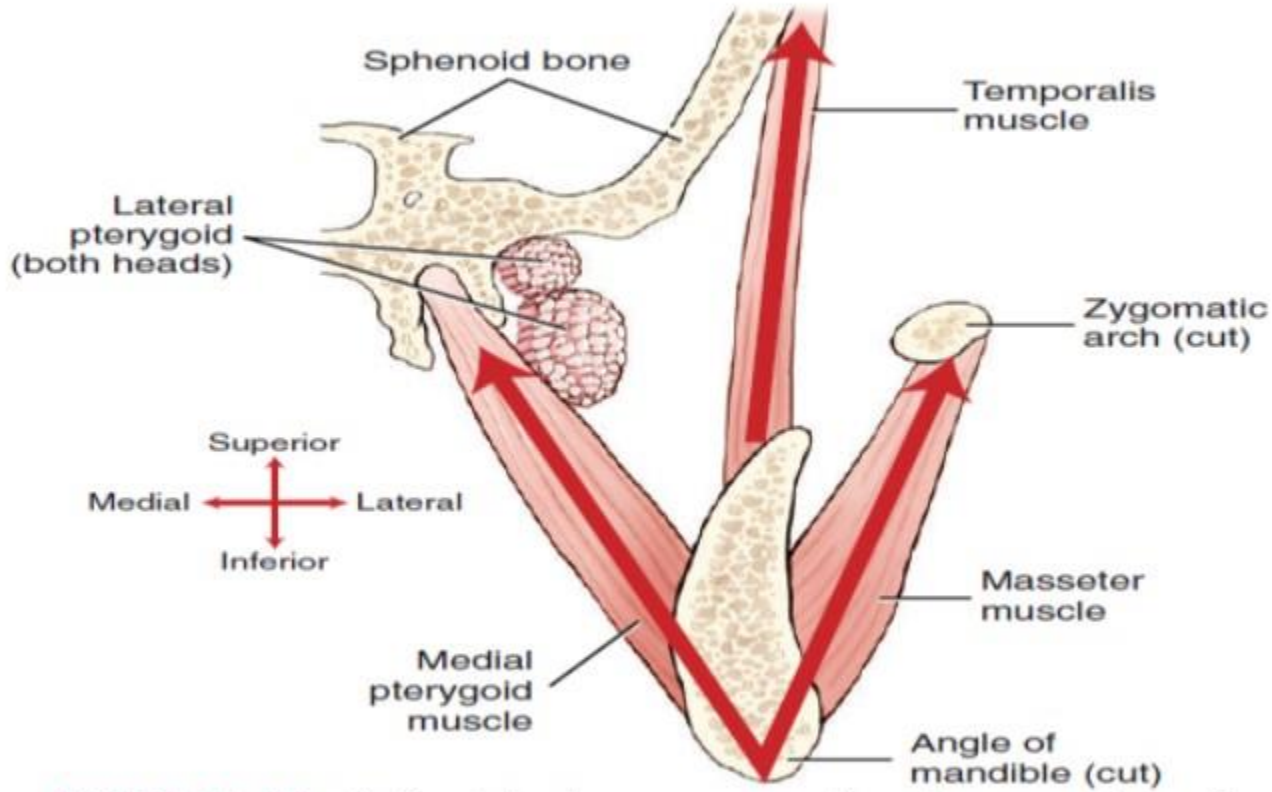


FIGURE 11-20. A frontal plane, cross-sectional perspective of the cranium is shown through the mid region of the zygomatic arch. This cross-sectional perspective includes the primary muscles of mastication (left side only). The lines of force are indicated for the primary muscles that close the mouth: masseter, temporalis, and medial pterygoid. Note the functional sling formed around the angle of the mandible by the masseter and medial pterygoid muscles.

MUSCULAR CONTROL OF OPENING AND CLOSING OF THE MOUTH

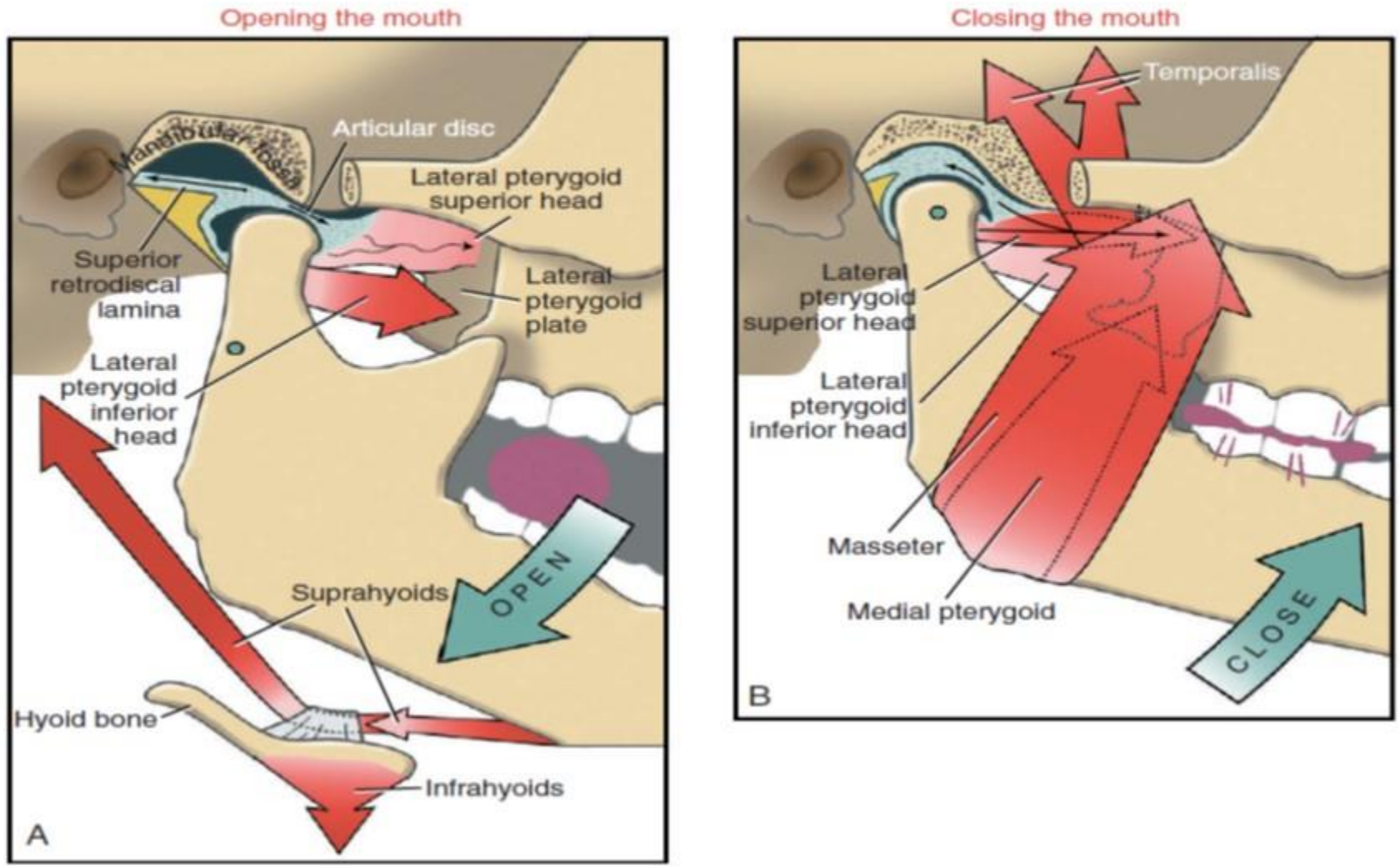


FIGURE 11-22. The muscle and joint interaction during opening **(A)** and closing **(B)** of the mouth. The relative degree of muscle activation is indicated by the different intensities of red. In **B,** the superior head of the lateral pterygoid muscle is shown eccentrically active. The locations of the axes of rotation (shown as small green circles in **A** and **B**) are estimates only.

Clinical examination of the temporomandibular joint

Currently, clinical examination is the gold standard for diagnosing TMDs.

History

➢ **Restricted jaw function**

- Limited mouth opening, Sudden catches or locks

➢ **Joint noises**

- (clicking) of the TMJ may or may not be significant, as they occur frequently in healthy populations.
- TMJ sounds should be related to symptoms, as joint noise in of itself, is of little clinical importance in the absence of pain
- Some joint sounds are not audible to the clinician, so a stethoscope may be required.
- The type and temporal sequence of joint clicking
- Reciprocal clicking is defined as clicking that occurs during opening and again during closing.

a) Early clicking usually indicates a small anterior displacement.
b) Late clicking usually indicates that the disk has been further displaced.

- Clicking that occurs at the end of opening often results from articular hypermobility and is accompanied by a deviation of the jaw toward the contralateral side.
- Crepitation is most commonly associated with osteoarthritic changes of the articular surfaces of the joint

➢ **Orofacial pain.**

- Onset, nature, intensity, site, aggravating factors and relieving factors

Observation

- local swelling, deformation, deviation of the chin
- head and neck posture
- facial asymmetry
- Three types of facial profile are recognized:

-Orthognathic: A straight facial profile in which the upper and lower lips are in line with the tip of the chin.

- Retrognathic: Describes a facial profile in which the tip of the chin is posterior to the upper and lower lips.
- Prognathic: Describes a facial profile in which the tip of the chin is anterior to the upper and lower lips.

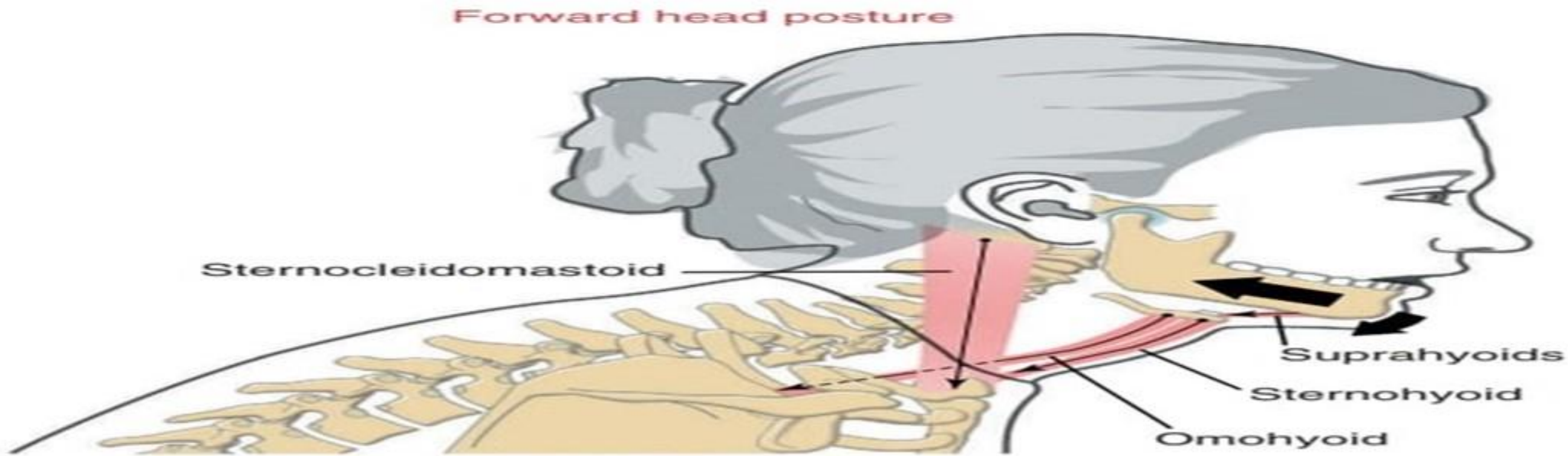
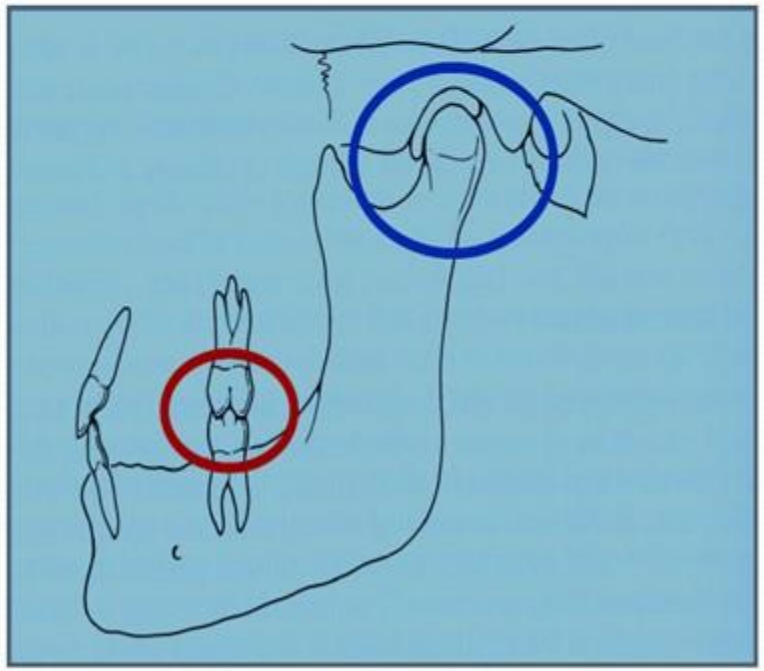


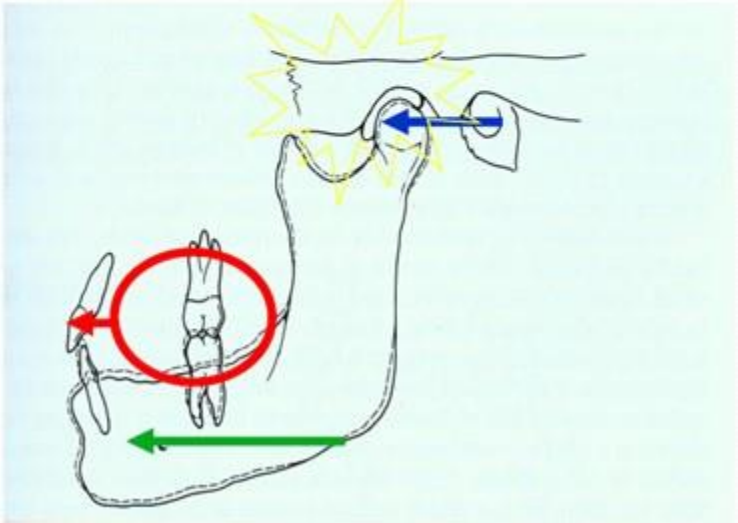
FIGURE 11-32. A forward head posture shows one mechanism by which passive tension in selected suprahyoid and infrahyoid muscles alters the resting posture of the mandible. The mandible is pulled inferiorly and posteriorly, changing the position of the condyle within the temporomandibular joint.

- ***Resting Position of the Teeth***
  - The normal resting position of the teeth is slight opening with the tongue placed near the roof of the mouth (The clinician should also note whether the teeth are normally aligned or whether there is any crossbite, underbite, or overbite



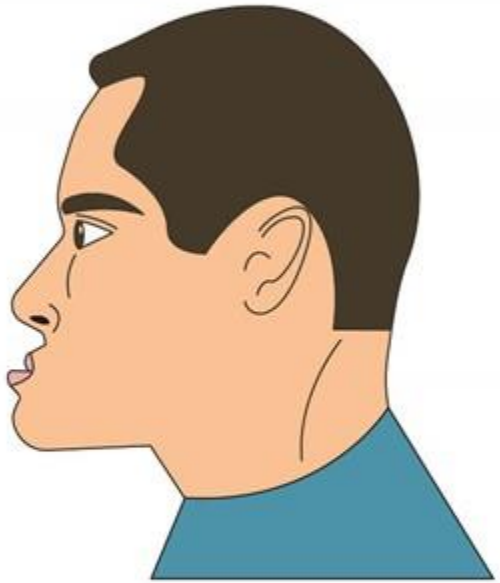
- Normal Intermolar relationship (red).
- Allows Normal seating of Mandible-disc-condyle relationship (blue).

Pathological



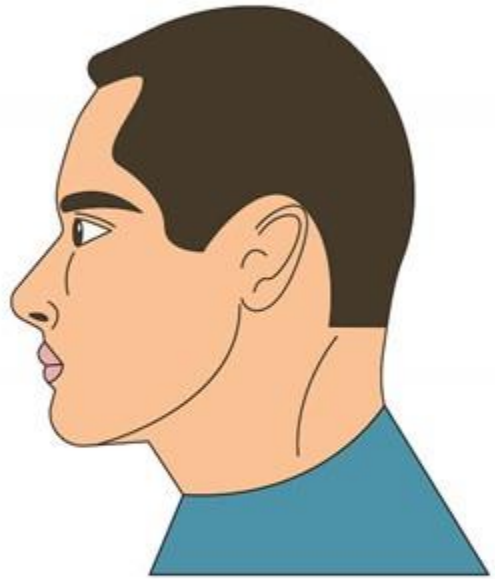
- Poor occlusion between molars (red).
- Pulls mandible forward (green).
- Places anterior stress on the disc of the TMJ.
- Jaw and facial pain.

Underbite



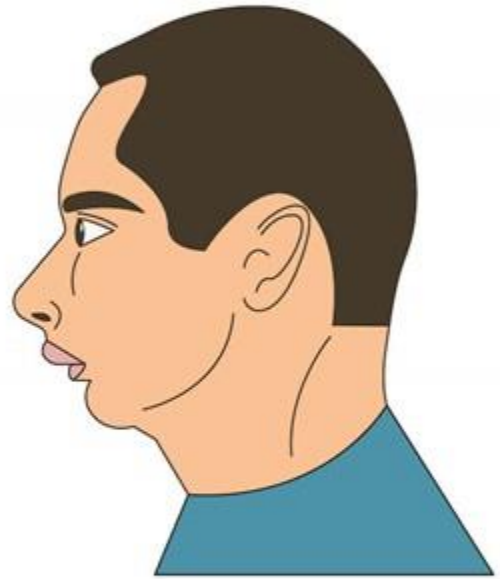
Lower jaw positioned further forward in the face than the top jaw.

Normal



Lower jaw and top jaw are in alignment. This is the optimal bite.

Overbite



Top jaw positioned further forward in the face than the lower jaw.

Open Bite

Crossbite

- **Active Physiological Movements**

• **Fig. 9.24.** Alterations in the Opening Pathway. **A.** Deviation. The opening pathway is altered but returns to a normal midline relationship at maximum opening (see arrow). **B.** Deflection. The opening pathway is shifted to one side and becomes greater with opening (see arrow). At maximum opening, the midline is deflected to its greatest distance.

TMJ Passive Accessory Mobility Testing

Palpation

Bony and soft tissue palpation

TMJ palpation

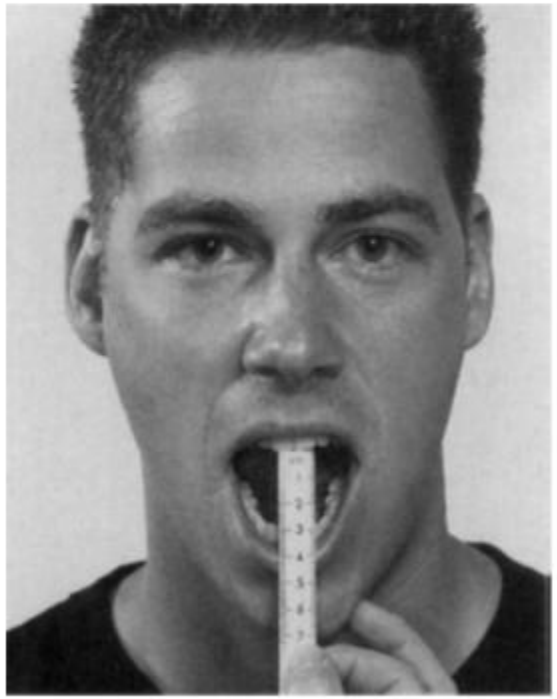
(a) (b)

Fig 9 • Palpation of the temporomandibular joint: (a) anterior to the tragus; (b) in the external auditory meatus.

Range of motion

Mandibular depression (40-50 mm)

- Functional range of motion 2 to 3 knuckles of non-dominant hand



PROTRUSION OF THE MANDIBLE (7-15 mm)

Lateral Deviation (7-15 mm)

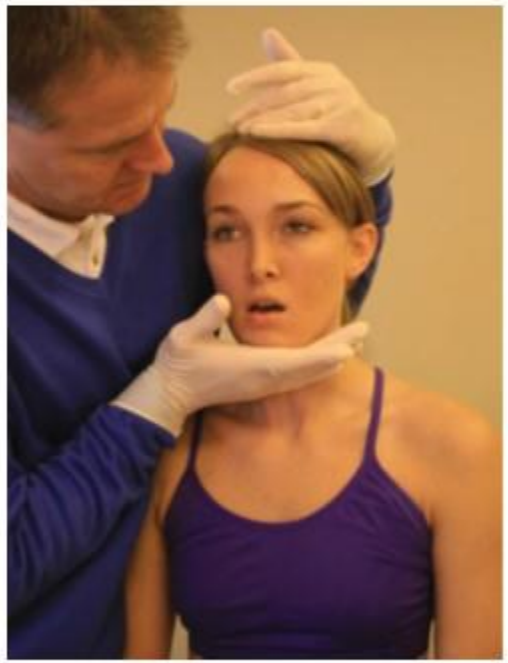
End feel

A *soft end feel* suggests muscle-induced restriction. If no increase in opening can be achieved, this is considered a *hard end feel*. Hard end feels are more likely associated with intracapsular sources (e.g., a disc displacement without reduction).

• **FIg. 9.22.** Checking the "End Feel." Gentle but steady pressure is placed on the lower incisors for approximately 5 to 10 seconds. Increased mandibular opening indicates a soft end feel (usually associated with a masticatory muscle disorder).

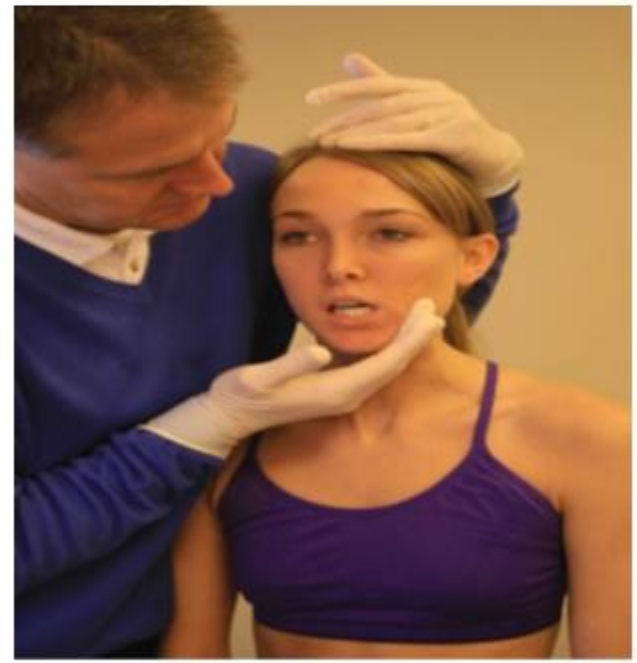
Manual muscle testing

Resisted mouth opening



Resisted mouth closing

Resisted lateral deviation



Cranial Nerve Examination

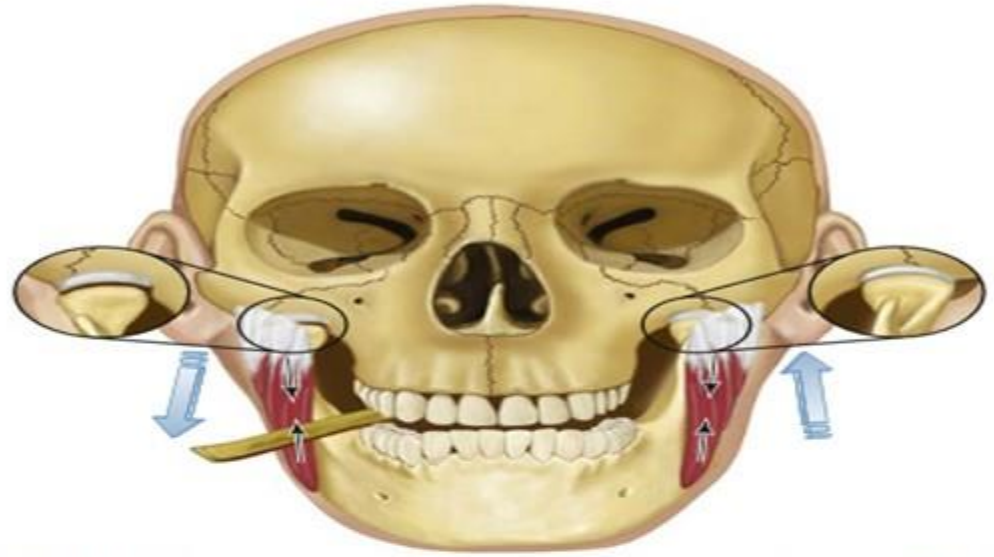
Trigeminal Nerve (V). The fifth cranial nerve is both sensory (from the face, scalp, nose, and mouth) and motor (to the muscles of mastication).

Jaw reflex

Joint Loading Tests (Provocation testing)

Dynamic Loading

• **Fig. 10.17.** Biting on a tongue blade is being used to differentiate if the patient's pain has its origin in the joint structures or the muscles. Biting on the tongue on the right side will reduce right intracapsular pain, while biting on the tongue blade on the left side will increase the right joint pain



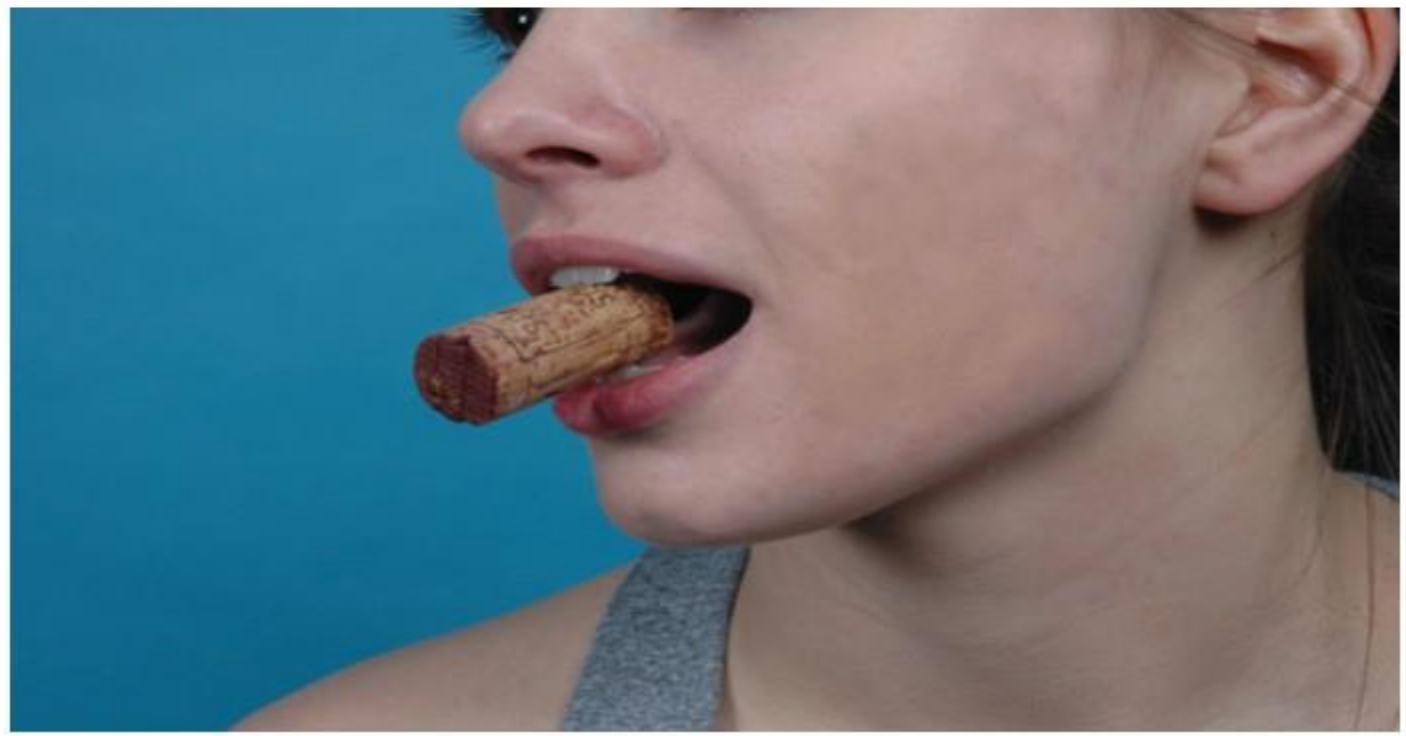
• **Fig. 10.16.** This illustration shows that when biting on a tongue blade the tongue blade becomes a fulcrum with muscles on both sides. Therefore biting hard on the right side will reduce the pressure in the ipsilateral joint. If the tongue blade is moved to the left side and the patient is asked to bite, the pressure in the right joint will increase.

Joint Compression

Therapeutic techniques

PRICEMEM
(protection, rest, ice, compression, elevation, manual therapy, early motion, and medications)

the cork exercise



Controlled opening. The patient positions the tongue in the rest position and practices chewing and opening the mouth to the point where the tongue begins to leave the roof of the mouth

- **Postural training**

Upper cervical flexion training

Shoulder retraction

Myofascial release

Passive muscle stretching

• **Fig. 11.15.** Stretching exercises can often be used to regain normal opening movement. The patient is instructed to apply stretching force gently and intermittently to the elevator muscle with the fingers. Pain should not be elicited. If it is, then the force should be decreased or the exercises stopped completely.

Oral Habits Modification

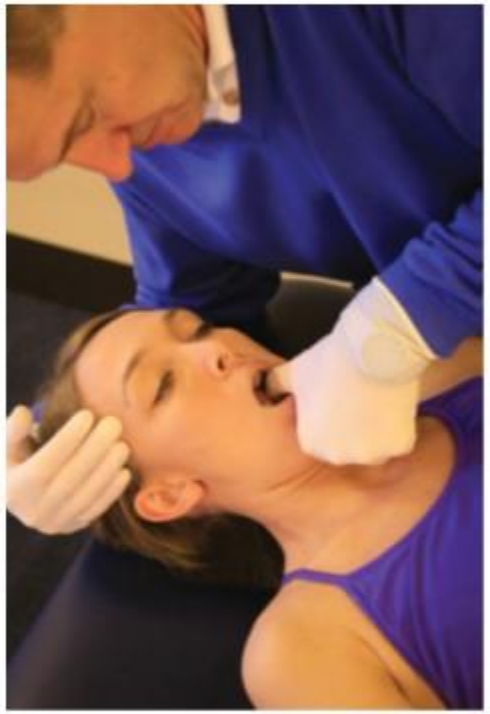
- Proper tongue resting position is necessary for a relaxed jaw.
- The patient is instructed to gently keep the tip of the tongue on the palate, resting slightly posterior to the maxillary central incisors
- keep the back molars apart
- lips together, while breathing normally
- maintain the jaw and surrounding muscles in a relaxed manner at all times.

- **Rhythmic stabilization.** The patient positions the tongue in the rest position and grasps the chin with one or both hands. The patient then applies a resistance sideways to right deviation and then left deviation. The patient then applies a resistance against mouth opening and closing. Throughout all of these exercises, the patient must maintain the resting jaw position.

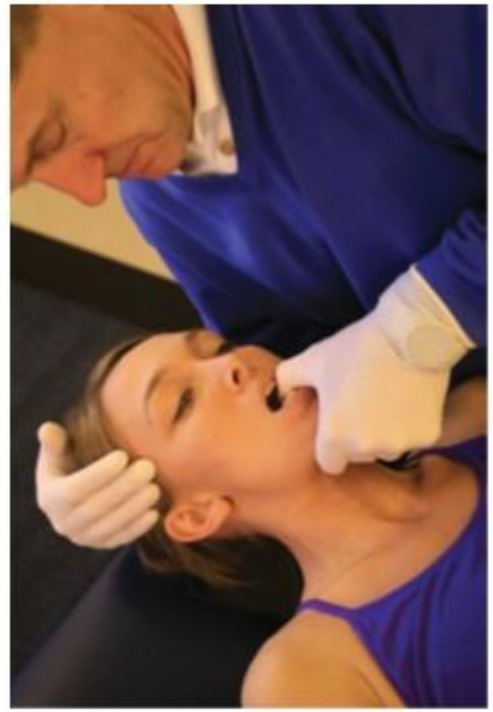
Trigger point release

Splinting (night Gard)

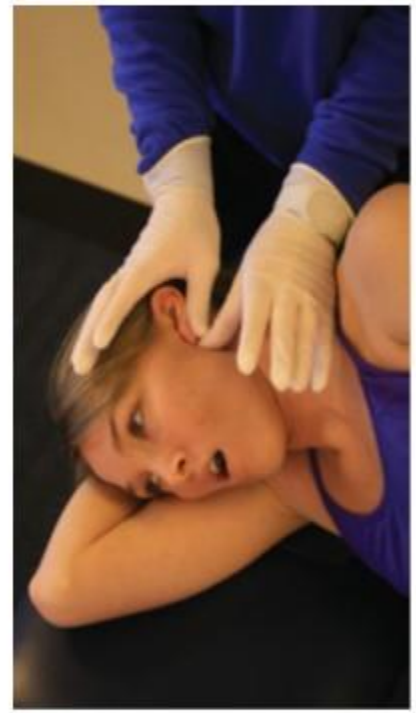
Joint Mobilizations



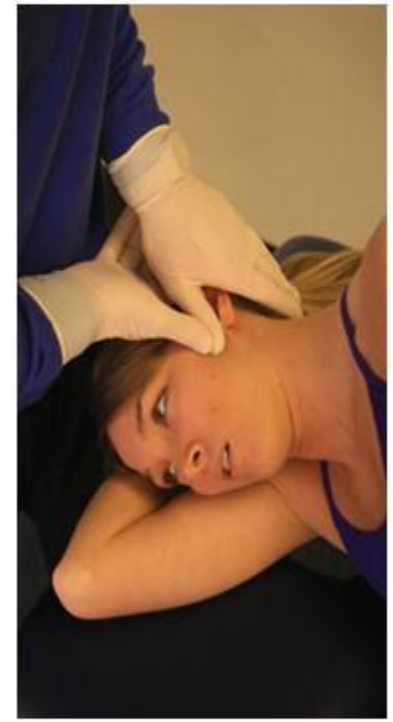
distraction



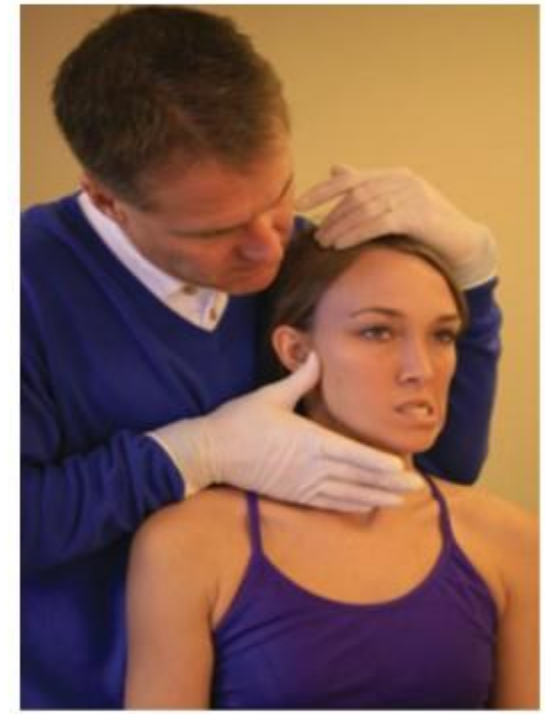
Qaudal anterior glide



Posterior–Anterior glide



Anterior–Posterior glide



Mobilization with Movement

Life (Basel). 2023 Feb; 13(2): 292.
Published online 2023 Jan 20. doi: 10.3390/life13020292
PMCID: PMC99671
PMID: 3683664

The Efficacy of Manual Therapy Approaches on Pain, Maximum Mouth Opening and Disability in Temporomandibular Disorders: A Systematic Review of Randomised Controlled Trials

Leonardo Sette Vieira,[1] Priscylla Ruany Mendes Pestana,[1] Júlio Pascoal Miranda,[1] Luana Aparecida Soares,[1] Fabiana Silva,[2,*] Marcus Alessandro Alcantara,[1] and Vinicius Cunha Oliveira[1,3]

Evidence supports manual therapy as effective for TMD.

BMC Oral Health. 2022; 22: 217.
Published online 2022 May 31. doi: 10.1186/s12903-022-02220-3
PMCID: PMC9158275
PMID: 35641993

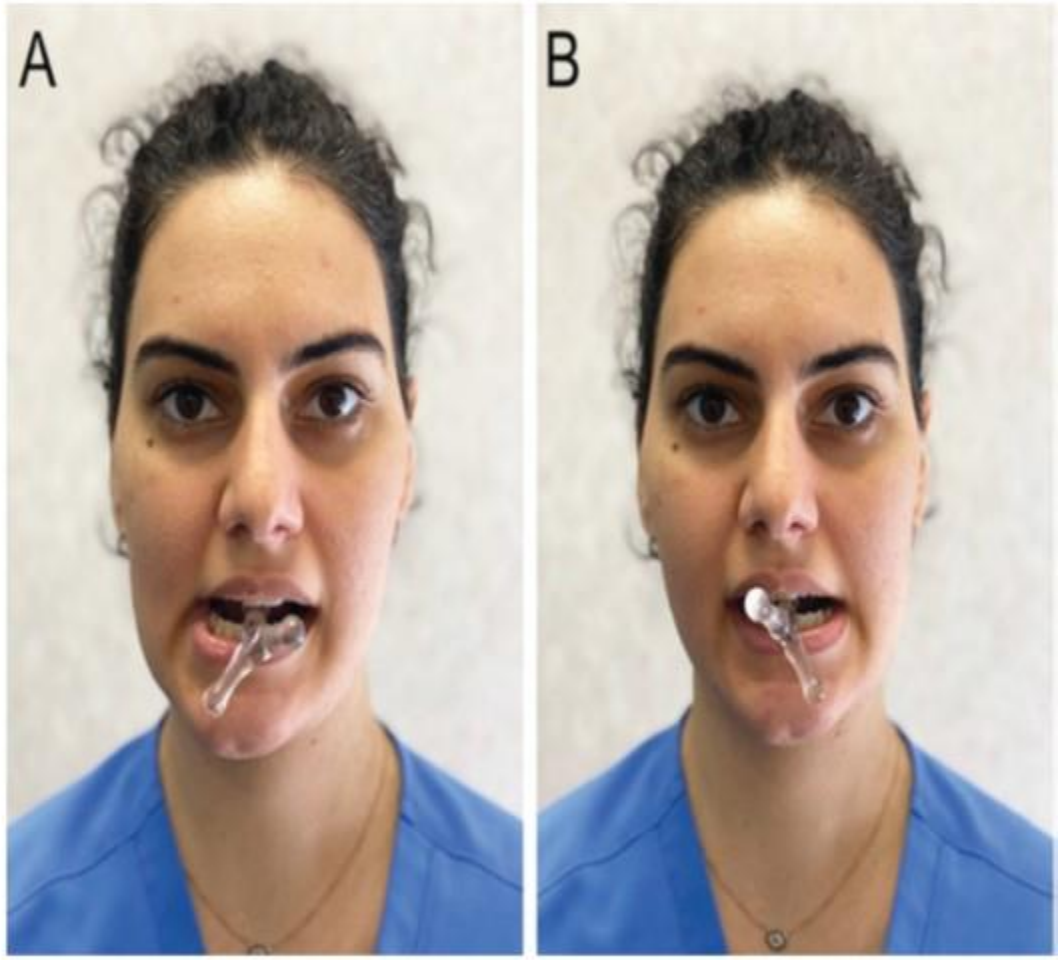
The effects of botulinum toxin A injection on the lateral pterygoid muscle in patients with a painful temporomandibular joint click: a randomized clinical trial study

results showed that click and pain severity decreased, but the difference was not statistically significant. Therefore, further studies with a higher dosage of BTX and more participants are recommended

Condylar remodeling exercise program

This exercise program was designed by Rocabado for neuromuscular re-education of the TMJ.

- With a 1 cm (0.5 inch) piece of surgical tubing resting between the maxillary and mandibular central incisors
- the patient is asked to move the jaw laterally to the contralateral side of the symptomatic joint. (If both joints are involved, then use the more symptomatic side as the ipsilateral joint).
- If the movement is pain-free, then “gentle biting” is incorporated at the end of the movement.
- The patient is then instructed to release the contraction before returning to the midline.
- The next phase is to perform the same routine, but to maintain the bite as the jaw is moved back to midline.
- If no symptom is reported, then the patient is instructed to perform the same procedure but with protrusion instead of lateral excursion.
- After this phase, isometric contractions with tubing in place can be introduced via mandibular stabilization or tubing distraction



- Theoretically, this exercise can recruit the muscles of mastication to stabilize the disk via the compression force, and result in improved condyle-disk-eminence congruency.
- Furto et al used this exercise program in conjunction with other physical therapy techniques, such as mobilization, iontophoresis, and exercises, and found favorable improvement in disability and overall perceived change.

- **Ultrasound Therapy.**
- **Transcutaneous electrical nerve stimulation (TENS)**
- **Postural Training.**
- **Relaxation Therapy (biofeedback)**
- **psychotherapy**

Low-level laser (LLL) light therapy has gained attention in recent years for its analgesic and anti-inflammatory effects.

• **Fig. 11.4. Biofeedback Training.** The patient is encouraged to assume a relaxed position in a comfortable quiet setting. The EMG sensors are attached to the masseter muscle. A finger sensor may also be used to monitor temperature and/or galvanic skin response. The patient is instructed to relax the muscles as much as possible. The computer monitor provides immediate feedback regarding the success in reducing the muscle activity. After several training sessions the patient becomes aware of effective relaxation and is encouraged to accomplish this without the biofeedback unit. Effective relaxation of muscle reduces muscle symptoms.

internal derangement of the temporomandibular joint

an abnormal relationship between the articular disc and the mandibular condyle that interferes with the normal biomechanics of the TMJ

Types of Disc Displacement

- Anterior disc displacement (80–90%), being most common
- Medial/Lateral displacement (5%)
- Posterior displacement (1%), least common
- Stuck disc (4%) (anchored disc phenomenon)

Etiology :

- Direct trauma to the joint
- Chronic low grade microtrauma-bruxism, clenching.
- Generalized laxity of the joint
- Indirect trauma- from cervical flexion extension injuries or mal-occlussion

Clinical features :

- Abnormal joint sounds- clicking, popping, crepitus
- Limitation and deviation of mandibular motion.
- Pain/tenderness in the pre-auricular or TMJ region

Red flags

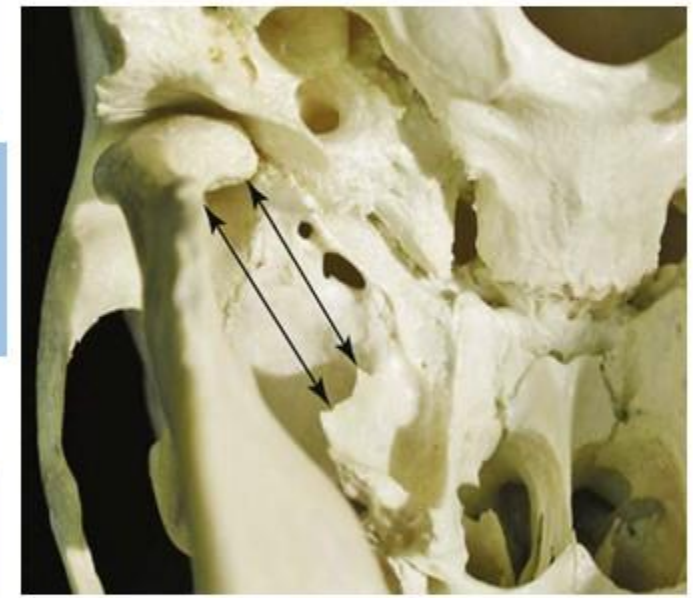
1. Neurological signs
2. Nose bleeding
3. Dysphagia or dysarthria
4. Unexplained weight loss
5. Auditory complaints
6. Constant pain unrelated to jaw movement

pathogenesis

morphology of the disc is altered (thinning of the posterior border)

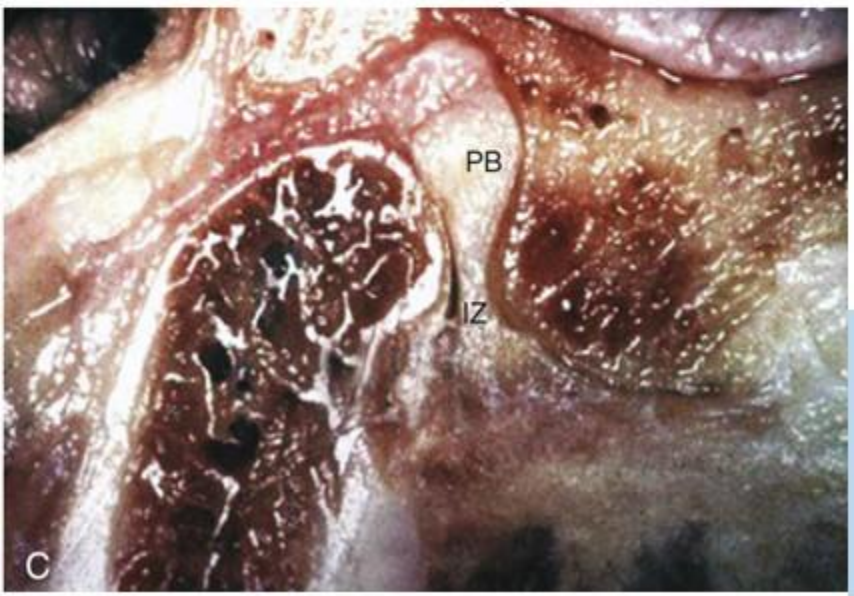
the discal ligaments become elongated

the disc is then permitted to slide (translate) across the articular surface of the condyle



superior retro-discal lamina provides little resistance in the closed joint position

the attachment of the superior lateral pterygoid pulls the disc not only forward but also medially on the condyle



Due to Prolonged muscle pull the posterior border of the disc become more thinned

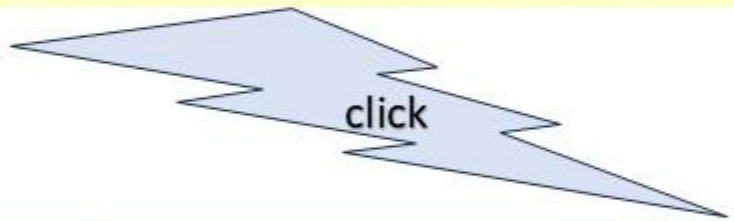
the condyle becomes positioned on the posterior border of the disc. This condition is known as a

disc displacement

Disc displacement with reduction

Disc displacement with reduction (with a Single Click)

As the mouth opens and the condyle moves forward, a short distance of translatory movement can occur between the condyle and the disc until the condyle once again assumes its normal position on the thinnest area of the disc (intermediate zone).



Once the joint has clicked, the normal relationship of the disc and condyle is re-established and this relationship is maintained during the rest of the opening movement.

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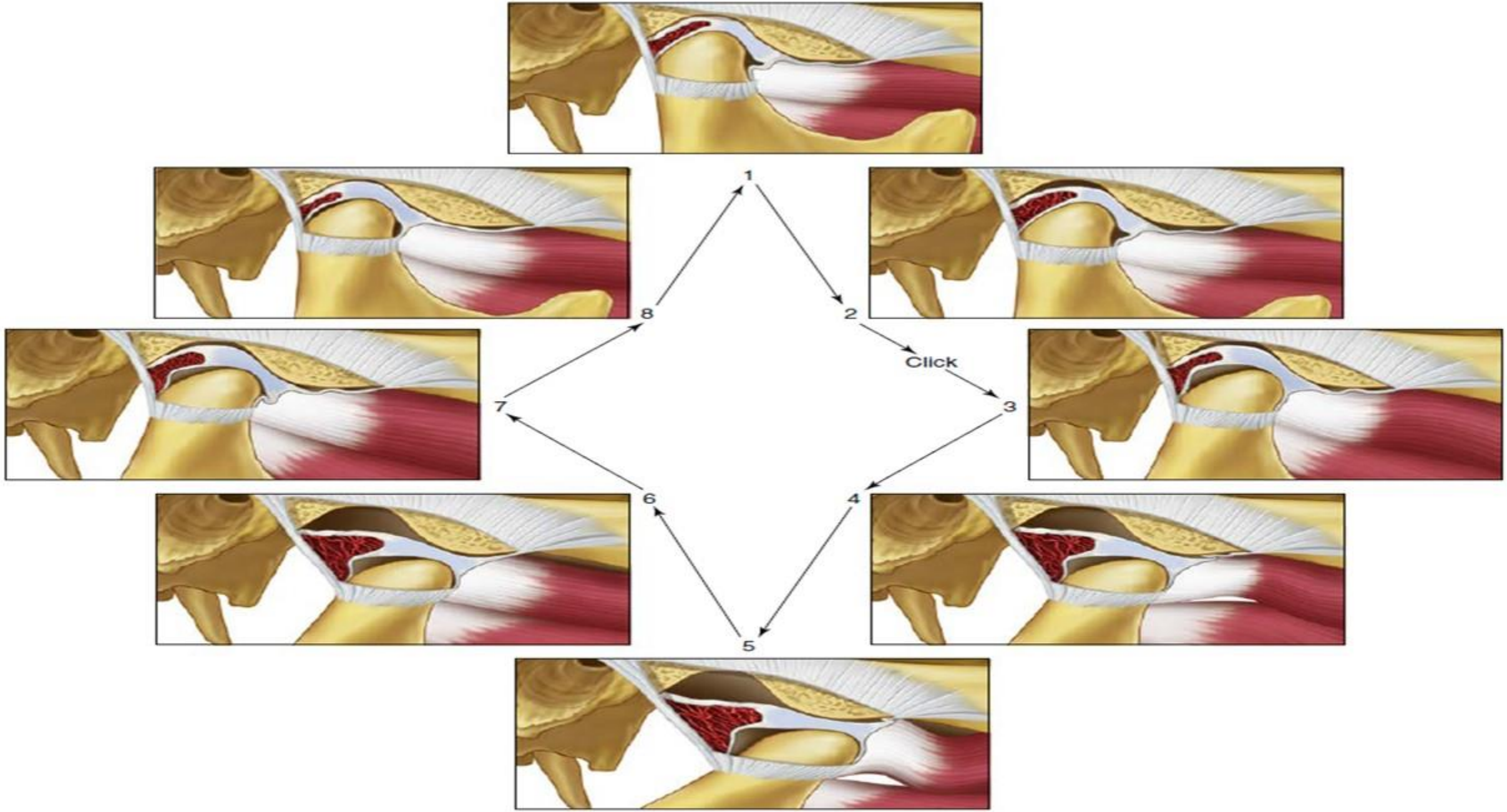
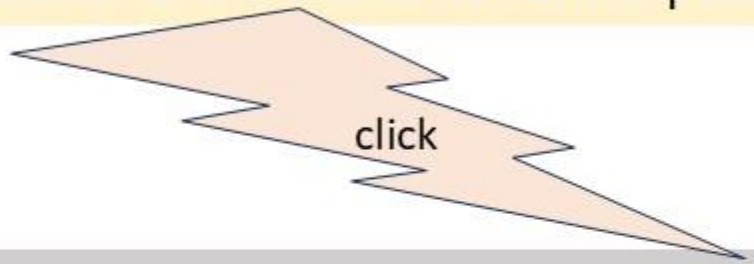
However, once the mouth is closed and the interarticular pressure is lower, the disc can once again be displaced forward by tonicity of the superior lateral pterygoid muscle.



• **Fig. 8.8. Disc Displacement with a Single Click.** Between positions 2 and 3 a click is felt as the condyle moves across the posterior border into the intermediate zone of the disc. Normal condyle-disc function occurs during the remaining opening and closing movement. In the closed joint position (1) the disc is again displaced forward (and medially) by activity of the superior lateral pterygoid.

Disc displacement with reduction (Reciprocal clicking)

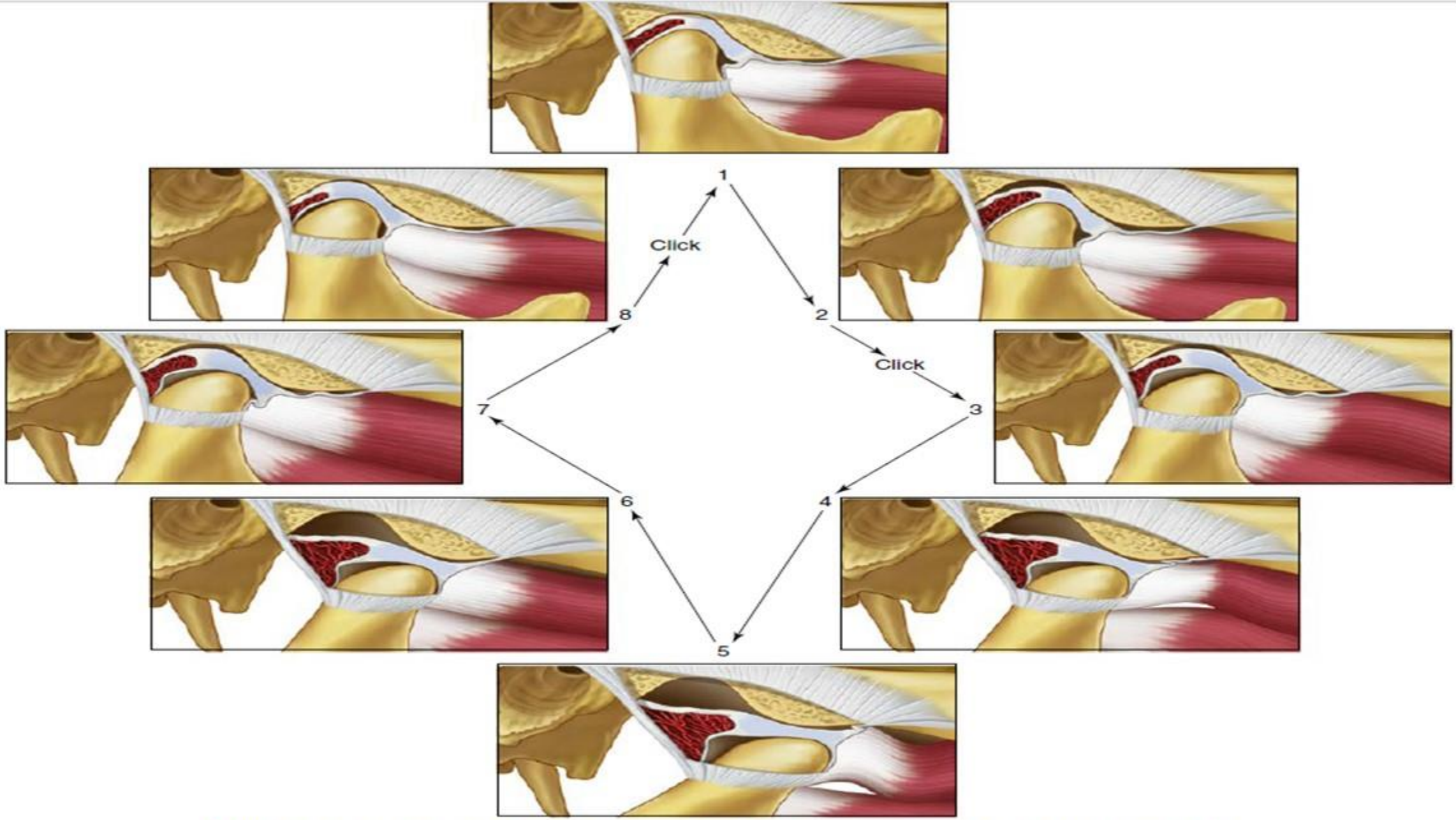
During mandibular opening a sound is heard that represents the condyle moving across the posterior border of the disc to its normal position on the intermediate zone.



The normal disc-condyle relationship is maintained through the remaining opening movement

During closing, the normal disc position is maintained until the condyle returns to very near the closed joint position.

As the closed joint position is approached, the posterior pull of the superior retro-discal lamina is decreased. The combination of disc morphology and the pull of the superior lateral pterygoid muscle allows the disc to slip back into the more anterior displaced position, where movement began. This final movement of the condyle across the posterior border of the disc creates



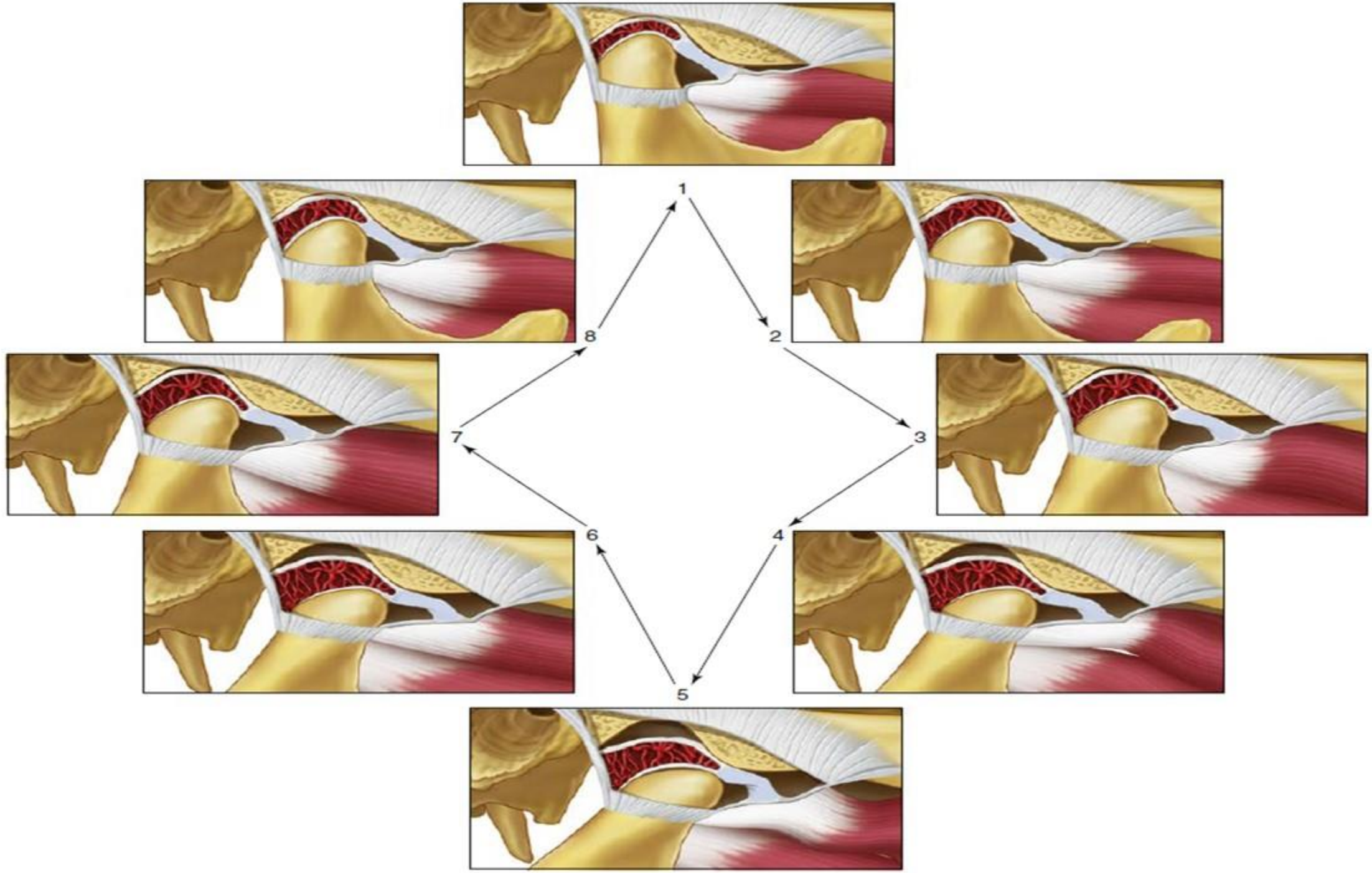
• **Fig. 8.9. Disc Displacement With a Reciprocal Clicking.** Between positions 2 and 3 a click is felt as the condyle moves across the posterior border of the disc. Normal condyle-disc function occurs during the remaining opening and closing movement until the closed joint position is approached. Then a second click is heard as the condyle once again moves from the intermediate zone to the posterior border of the disc (between 8 and 1).

disc displacement with intermittent locking

Some persons with a total displacement of the disc are able to move the mandible in various lateral or protrusive directions to accommodate the movement of the condyle over the posterior border of the disc, and the locked condition is resolved

Disc displacement without reduction

condyle never assumes a normal relationship on the disc, but instead causes the disc to be maintained in front of the condyle. This condition limits the distance it can translate forward.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Thank you!