# CLASSIFICATION AND INTERNAL DERANGEMENT OF TMJ

# CONTENTS

# TEMPOROMANDIBULAR JOINT DISORDERS CLASSIFICATION

- ***Intra-articular origin or intrinsic disorder***
- ***Extra-articular origin or extrinsic disorder***

## *Intrinsic Disorder*

1. ***Trauma***
   - ***Dislocation, subluxation***
   - ***Haemarthrosis***
   - ***Intracapsular fracture, extracapsular fracture***
2. ***Internal disc displacement***
   - ***Anterior disc displacement with reduction***
   - ***Anterior disc displacement without reduction***

3. *Arthritis*
   - *Osteoarthritis*
   - *Rheumatoid arthritis*
   - *Juvenile rheumatoid arthritis*
   - *Infectious arthritis*
4. *Developmental defects*
   - *Condylar agenesis or aplasia—unilateral/bilateral*
   - *Bifid condyle*
   - *Condylar hypoplasia*
   - *Condylar hyperplasia*
5. *Ankylosis*
6. *Neoplasm*
   - *Benign tumours (Osteoma, osteochondroma, chondroma)*
   - *Malignant tumours (Osteosarcoma, chondrosarcoma, fibrosarcoma, synovial sarcoma)*

## *Extrinsic disorder*

1. *Masticatory muscle disorder*
   - *Protective muscle splinting*
   - *Masticatory muscle inflammation*
   - *Masticatory muscle spasm*
2. *Problems that result from extrinsic trauma*
   - *Traumatic arthritis*
   - *Fracture*
   - *Internal disc derangement*
   - *Tendonitis*
   - *Contracture of elevator muscle*

# Physiologic movements of the TMJ

When the mouth is opened, the mandibular heads rotate around a common horizontal axis in combination with a gliding forward and downward movement in contact with the lower surface of the articular discs.

Simultaneously, the discs move both forward and downward on the temporal bones. This results from the attachments of each disc to the lateral and medial poles of the condyles and from the contraction of the lateral pterygoid. The forward gliding of the disc ceases when the posterior attachment to the temporal bone has been stretched to its limits.

Thereafter, further hinging and anterior gliding movement of each condyles continues until they articulate with the most anterior part of the disc and the mouth is open fully (Fig. 40.1)

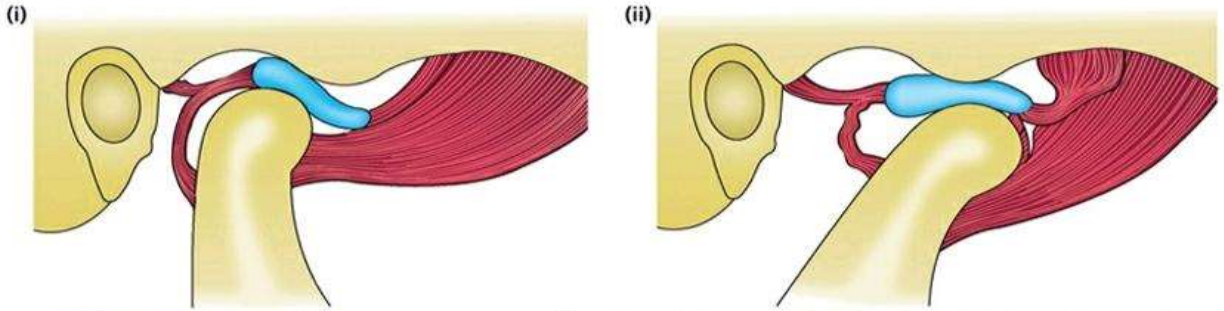



**FIGURE 40.1** Temporomandibular joint articulation **(i)** in closed position, **(ii)** in open position.

While closing the mouth, the movements are reversed. In the first phase, each mandibular head glides backwards and then hinges on its disc, which is held forward by the lateral pterygoid. Finally, this relaxes to allow the disc to glide backwards and upwards on the temporal bone.

# INTERNAL DERANGEMENTS OF TMJ

***Definition :***

*Internal derangement is defined as a disturbance in the normal anatomical relationship between the disc and the condyle that interferes with smooth movement of joint and cause momentary catching, clicking, popping, locking.This condition was first described by Hey and Davies (1814) as a localised mechanical fault interfering with smooth action of a joint.*

# AETIOLOGY

## Trauma

Trauma to the TMJ can be macrotrauma or microtrauma according to magnitude of the traumatic force.

### Macrotrauma

Macrotrauma can be direct or indirect.

#### Direct trauma

- Trauma to mandible in open mouth position
- Can also be iatrogenic
    - Intubation procedures
    - Third molar extractions
    - Long dental appointments
    - Overextension of jaw as yawning

#### Indirect trauma

Cervical flexion-extension injury

### Microtrauma

- Bruxism or clenching
- Malocclusion—traumatic

# ETIOPATHOGENESIS

- *Disc incoordination*
- *Disc displacement with reduction*
- *Disc displacement without reduction*
- *Anchored-disc phenomenon*

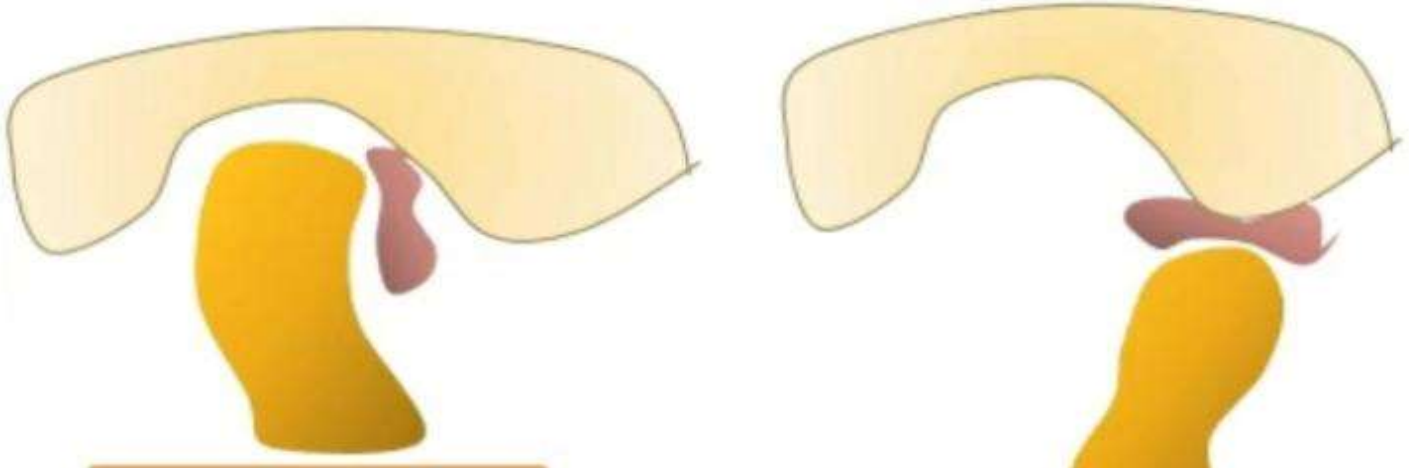
# 1. DISC INCOORDINATION

- Represents earliest indication of an increase in the frictional properties of the joint.
- Patient describe need to perform special maneuver to achieve normal opening of mouth.
- Complain of terminal jolting sensation associated with mandibular closing.
- Usually no pain. But if present, is due to instability of condyle-disc relationship.

# II. DISC DISPLACEMENT WITH REDUCTION

- Articular disc moves into anteromedial position, following shape of condyle and anterior slope of glenoid fossa and influence of lateral pterygoid muscle.
- Posterior, medial and lateral displacement can also occur.
- Reduction refers to the ability of negotiation between the condyle and the disc so that disc assumes a normal position in relation to the condyle and glenoid fossa.
- Patient complains of clicking/popping sound (since the condyle pass over posterior portion of disc and returns to normal position) on mouth opening without pain.

Disc resumes its normal position on top of the condyle on opening



Close mouth position

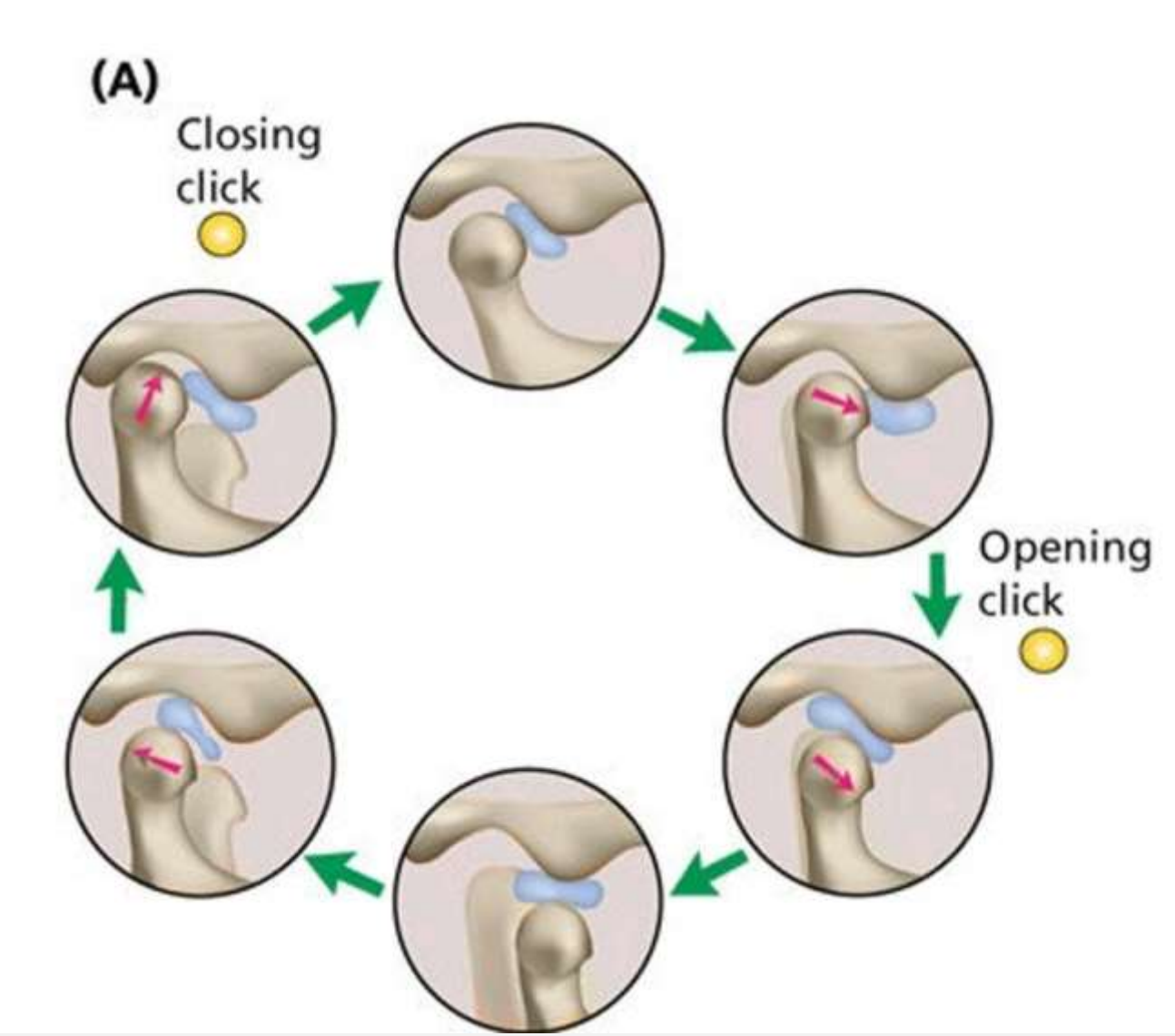
Open mouth position

Forward placement of disc

**First click**

Displaced disc reduces to normal position

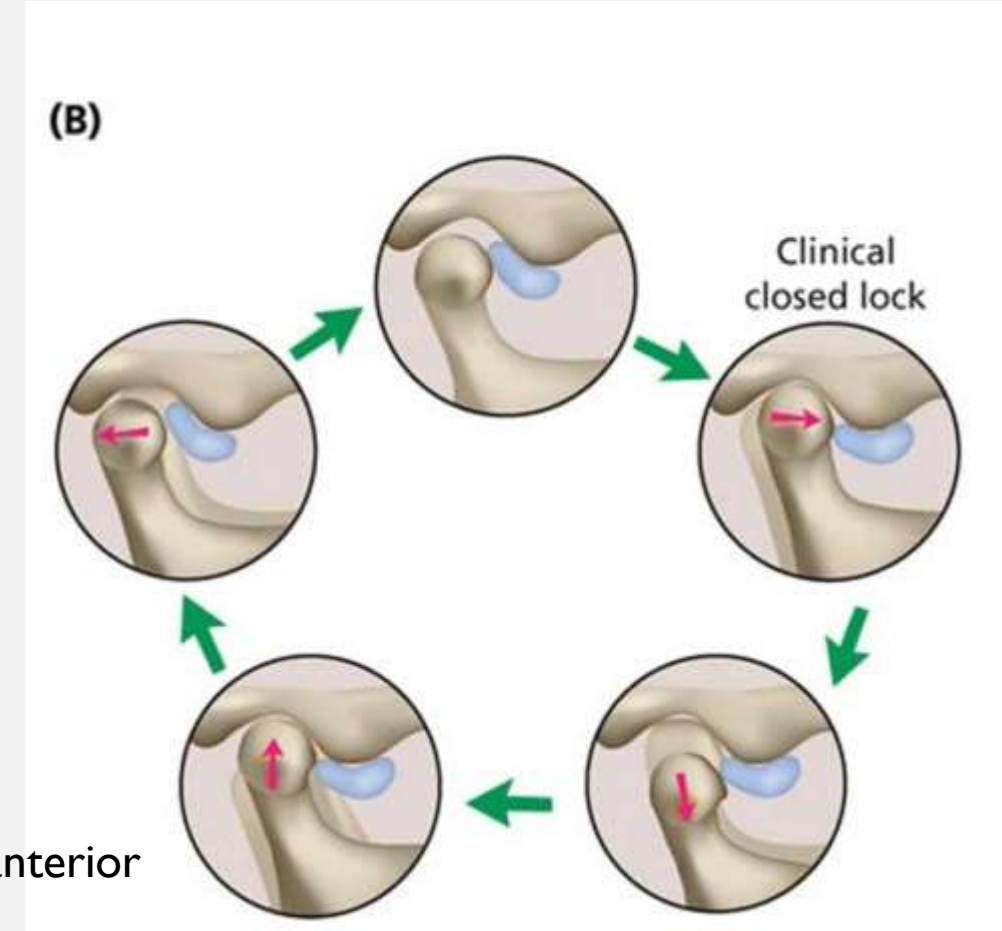
**Second/ Reciprocal click**




Representation of reciprocal clicking, secondary to anterior displacement with reduction.

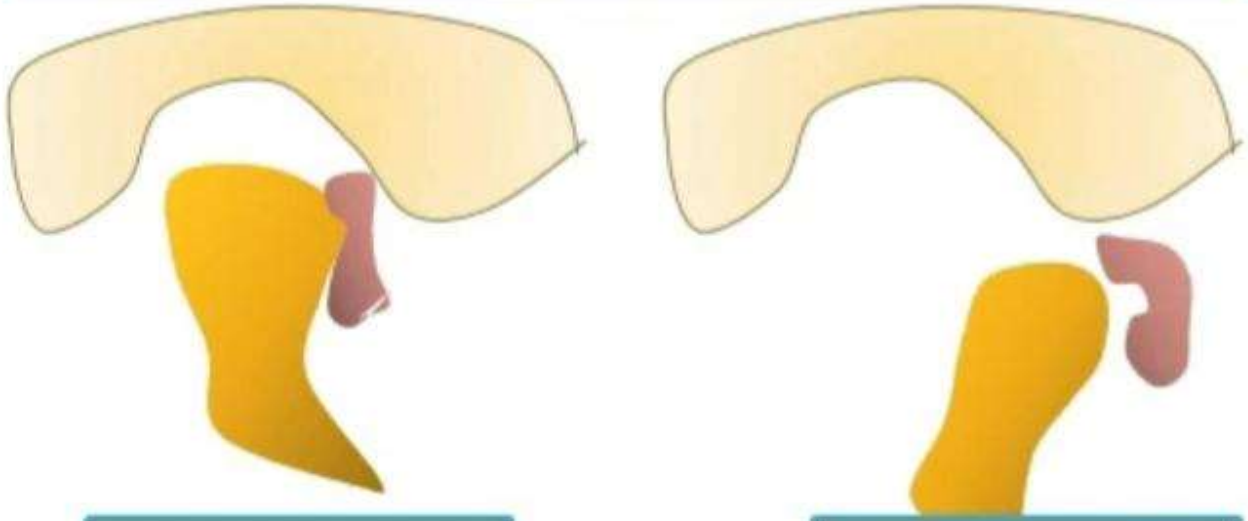
# III. DISC DISPLACEMENT WITHOUT REDUCTION

- (Closed lock), limited mouth opening as the mandible condyle fails to pass over posterior portion of disc.
- Patient feels pain on overloading and stretching.
- Mandible deviates to the affected side in unilateral cases.




The closed-lock position, secondary to anterior displacement without reduction.

Disc remains malpositioned on opening attempts, resulting in restricted mouth opening in acute cases



Close mouth position

Open mouth position

Severe deformation & forward displacement

Disc compressed b/w condyle & eminence

# IV. ANCHORED DISC PHENOMENON

- Also known as Acute Disc displacement without reduction.
- characterized by a sudden, severe and persistent limited mouth opening that is considerably more decreased than disc displacement without reduction (10 - 30mm).

## Wilkes Classification for Internal Derangement of the TMJ

| Stage | Characteristics | Imaging |
|---|---|---|
| I. Early | Painless clicking<br>No restricted motion | Slight forward disc<br>Normal osseous contours |
| II. Early/Intermediate | Occasional painful clicking<br>Intermittent locking<br>Headaches | Slight forward disk<br>Early disk deformity<br>Normal osseous contours |
| III. Intermediate | Frequent pain<br>Joint tenderness<br>Headaches,<br>Locking<br>Restricted motion<br>Painful chewing | Anterior disk displacement<br>Moderate to marked disk thickening<br>Normal osseous contours |
| IV. Intermediate/Late | Chronic pain, headache<br>Restricted motion | Anterior disk displacement<br>Marked disk thickening<br>Abnormal hone contours |
| V. Late | Variable pain, Joint crepitus | Anterior disk displacement with disk perforation and gross deformity<br>Degenerative osseous changes |

# CLINICAL AND DIAGNOSTIC FEATURES OF INTERNAL DERANGEMENT

- History of severe pain on yawning
- History of direct trauma to the joint years earlier
- Clicking sound in the joint during mouth opening and closure. (The clicking sound was earlier considered characteristic of internal derangement with reducing disc, though now not significant)
- Joint tenderness, especially with function
- Deviation to affected side: This characteristically occurs in disc displacement with or without reduction
- Disc displacement with reduction: After the initial 10 mm of mouth opening (rotation or hinge) jaw deviates to affected side

- Disc displacement without reduction: Jaw deviation starts from the initiation of mouth opening and progresses till end of mouth opening
- Trismus: Present only in disc displacement without reduction
- Elimination of pain following local anaesthesia of the affected joint

# CONDYLAR DISLOCATION

- Dislocation of the TMJ occurs when the mandibular condyle is displaced anteriorly beyond the articular eminence and its inability to descend back to its normal position.

- **Subluxation** is defined as a displacement of condyle out of the glenoid fossa and anterosuperior to the articular eminence, which can be reduced by the patient (self-reduced). It may be unilateral or bilateral.
- **True dislocation** is one in which the patient cannot reduce it by himself and requires expert assistance for reduction.
- **Habitual or recurrent dislocation** refers to frequent and repeated episodes of recurrent dislocation that can be manipulated back into position. Also referred as Subluxation or hypermobility.
- Dislocation can be unilateral or bilateral.

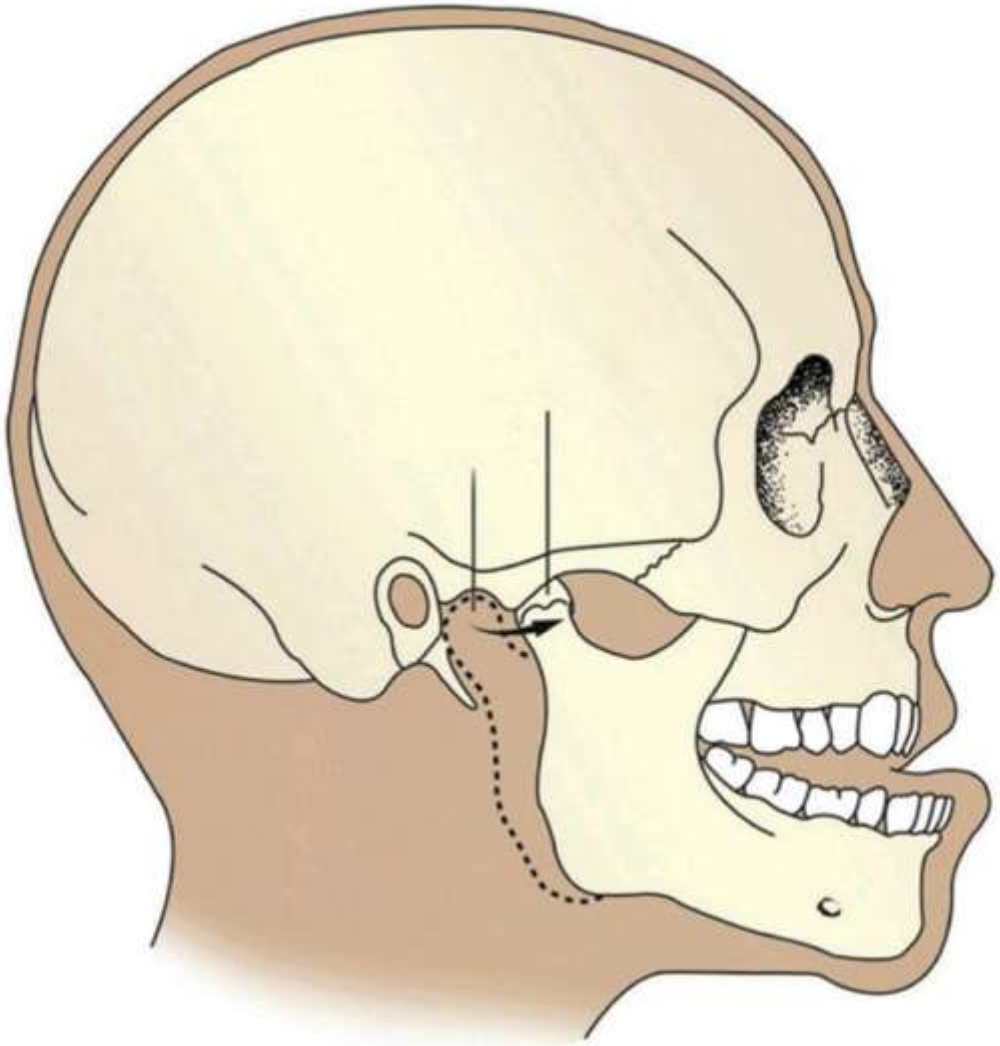


FIGURE 40.3 Dislocation of the mandible.

**Subluxation**—incomplete dislocation
**Luxation**—dislocation
**Recurrent dislocation**—repeated dislocation with no strong psychological components

# CAUSES

## ***Intrinsic causes:***

- Wide jaw opening due to- yawning, vomiting, singing/laughing loudly, blowing wind instruments, and seizure disorder.
- It is associated with spasm of lateral pterygoid and other muscles of mastication resulting in locking of condylar head into abnormal anterior position in the infratemporal fossa causing inability to close the mouth.

## Extrinsic causes

Extrinsic trauma may also result in dislocation with injury to capsule and ligaments.

### Trauma

- Injudicious use of gag during intubation for general anaesthesia (GA)
- Dental extraction
- Flexion-extension injury to the mandible
- Endoscopy

### Occlusal factors

- Excessive tooth abrasion
- Severe malocclusion
- Loss of dentition (leading to overclosure and loss of vertical dimension)

### Connective tissue disorders

- Hypermobility syndrome
- Ehlers-Danlos syndrome
- Marfan syndrome

### Psychogenic

- Habitual dislocation

### Drugs

- Antipsychiatric drugs
- Phenothiazines—may produce extrapyramidal effects resulting in spasm

### Miscellaneous causes

- Internal derangement
- Dyssynchronous muscle function
- Contralateral intra-articular obstruction
- Loss of vertical dimensions

# CLINICAL FEATURES

- Inability to close the mouth
- Preauricular depression evident on the skin
- Excessive salivation
- Tense, spasmatic muscles of mastication
- Severe pain of the TMJ
- Condyle palpable anterior to articular eminence

# UNILATERAL DISLOCATION

- Mouth is open and the mandible deviated to the opposite side.
- Deviation produces lateral cross and open bite.
- Teeth cannot be closed into occlusion.
- Difficulty in mastication and swallowing.
- Affected condyle is impalpable.
- Drooling of saliva with speech difficulty.

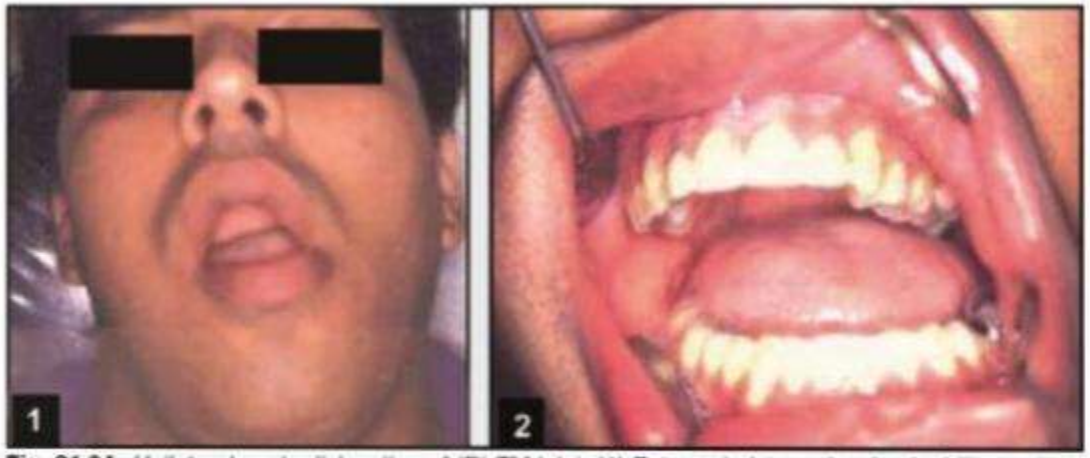
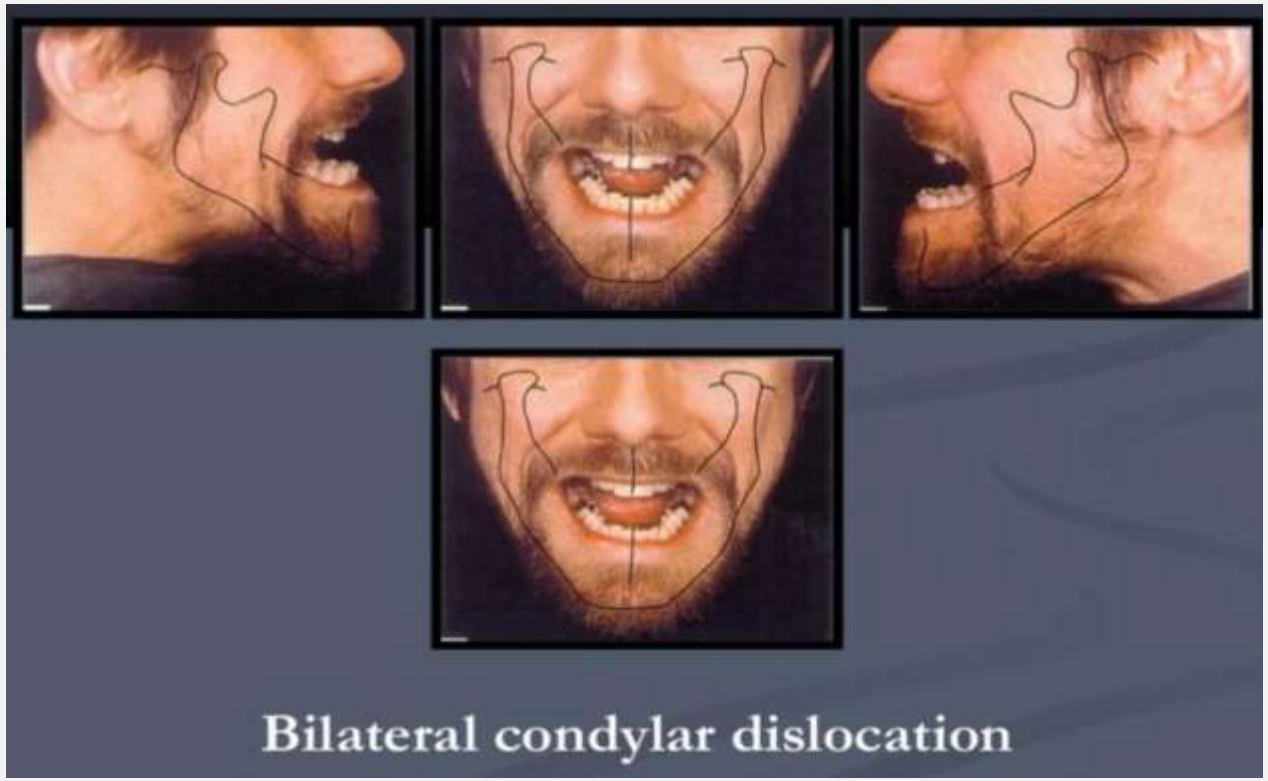



**Fig. 21.9A:** Unilateral acute dislocation of (R) TM joint. (1) Extraoral picture showing inability to close the mouth and deviation of the mandible on the unaffected side. (2) Intraoral picture showing the deviation of the mandible

# BILATERAL DISLOCATION

- Pain
- Difficulty in speech and excessive salivation.
- Drooling of saliva due to difficulty in swallowing.
- Mouth opens in protruded position.
- Restricted range of mandibular movements.
- Bilateral preauricular hollow.
- Gagging of occlusion (molar teeth)
- Anterior open bite



# DIAGNOSIS

- Clinical history and examination
- Radiological examination
    - OPG
    - TMJ views
    - Plain and contrast CT
    - 3D CT
    - MRI

# MANAGEMENT

Management can be nonsurgical and surgical.

Conservative management should be done before employing aggressive therapies, It is necessary to reduce tension, anxiety or muscle spasm by reassuring the patient and prescription of sedatives or tranquilizers.

# NONSURGICAL MANAGEMENT

## *Acute dislocation*

Acute dislocation requires immediate treatment. Manual reduction can be done with or without the use of local anaesthesia immediately or within 72 h. Beyond that duration reduction may be done under sedation/LA or general anaesthesia.

- **Dingman and Natwig**: recommended use of local anaesthesia based on the theory that dislocation is maintained by muscle spasm secondary to painful stimuli arising from the capsule. On injection of ligno-caine into the glenoid fossa or the muscles of mastication, sensory reflex mechanism of the joint is blocked and the muscle spasm is overcome respectively.

- ***Reduction-Nilaton technique:*** (Fig. 40.4) The patient is made to sit upright in a chair with the clinician standing in front, sometimes behind based on convenience. The thumbs of the clinician are covered with gauze or a protective covering and positioned over the lower molar teeth bilaterally. The index fingers are placed under the inferior border of the mandible. The posterior aspect of the mandible is depressed inferiorly to depress the condyle, while the chin is elevated anteriorly and the entire mandible is pushed backwards with the palm. The mandible is moved downward backwards and then upwards, thus manipulating the condyle back into position (Fig. 40.5). After reduction, the mandible should be immobilised using Barton's bandage for several days to allow for capsular repair, muscle rest, and prevention of recurrence.


FIGURE 40.4 **(A)** Nilaton's technique of reduction padding of the operator's finger (thumb) before reduction (using gauze). **(B)** Anterior bilateral dislocated condyle with inability to occlude. **(C)** Padded thumbs placed over the occlusal surface of the mandibular molars (Step 1). **(D)** Padded thumb placed over the external oblique ridge buccal to the mandibular molars to avoid injury. **(E&F)** Other fingers of the hand grasp the mandible supporting the lower border, the palm of the hand placed against the chin. Reduction including downward, backwards and upwards motion of the dislocated mandible. **(G)** Barton's bandage.

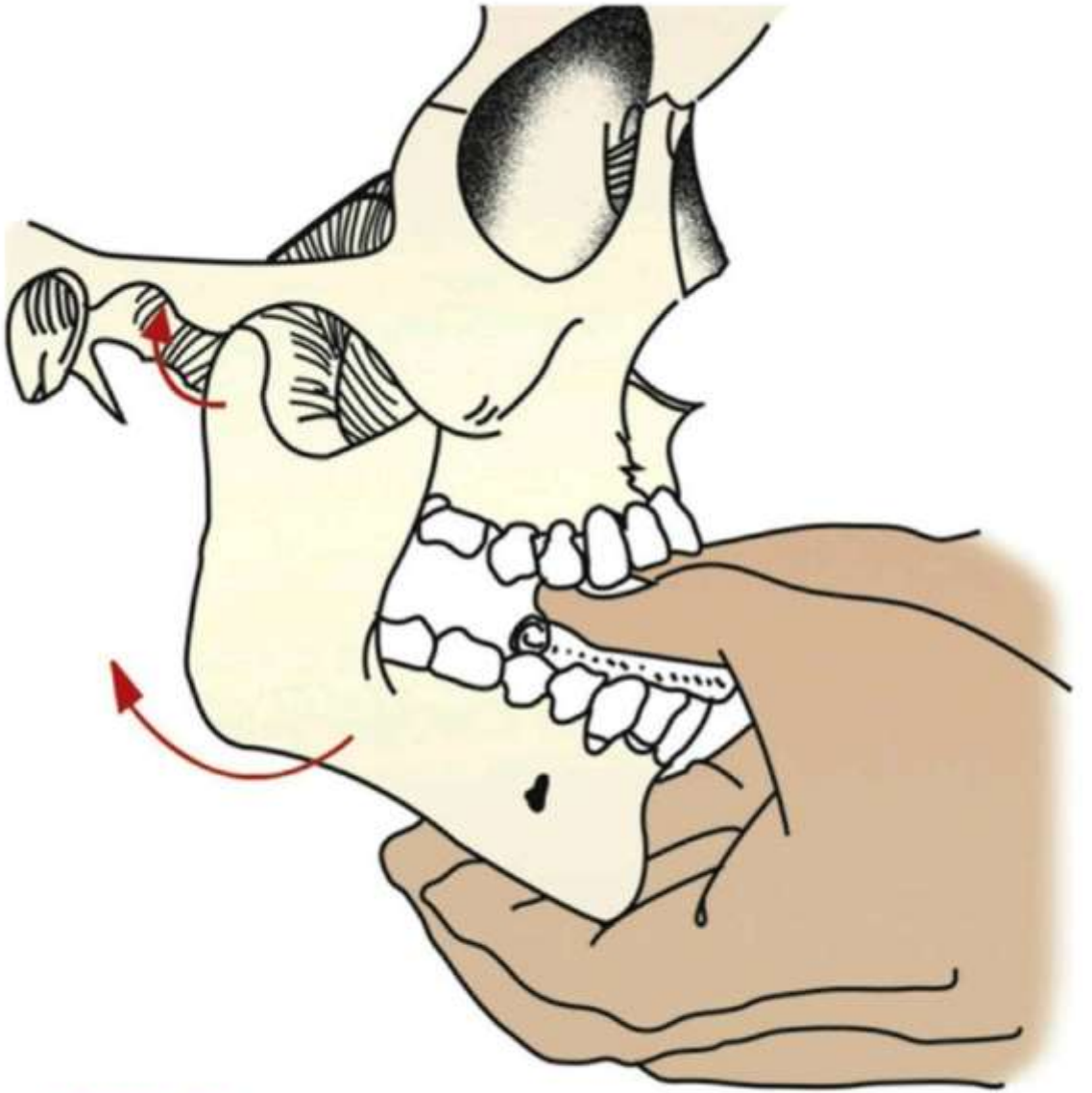


**FIGURE 40.5** Hippocratic method or the Bimanual mandibular manipulation in a downward-posterior direction to disengage the condyle from its open locked position posterior to the articular eminence.

- Other methods of reduction include wrist pivot reduction or by use of interdental bite blocks.
- In cases of bilateral dislocation, the reduction can occur simultaneously or one at a time.
- Can also be done under GA with the help of muscle relaxants.
- Use of sedatives and tranquillisers prior to manipulation also helps in facilitating reduction.
- IMF for 10–14 days after reduction is recommended to allow inflammation and oedema to subside and prevent redislocation.

## ***Chronic dislocation :***

Long standing Dislocation.

Encountered mainly in elderly persons. Long standing/chronic dislocation over time develops fibrous adhesions between the disc, condyle and articular eminence.

Jaw muscles and ligaments also undergo fibrous change, preventing nonsurgical reduction.

- Manual reduction assisted by use of GA and a muscle relaxant is helpful.
- If this fails, then an open reduction should be considered.
- Bilateral ramus osteotomy can be done to restore the occlusion, leaving the condyles in dislocated position.

- ***Chronic recurrent dislocation***

- IMF for a prolonged period of 4–6 weeks, but relapse occurs.

- The laxity of the capsule and the ligaments can be corrected by chemical capsulorrhaphy by using 0.5% sodium tetradecyl sulphate. This causes pericapsular fibrosis, limiting excursion of condylar head.

- Surgical correction is the ideal treatment for these cases.

# SURGICAL MANAGEMENT

- ***Surgical procedures can be divided into 5 categories by MILLER & MURPHY 1976:***

***I. <u>CAPSULE TIGHTENING PROCEDURE:</u>***

***a. Capsulorrhaphy: Shortening capsule***

***b. Vertical incision and overlapping of capsule***

***c. Turning downward & suturing a strip of temporal fascia***

***II. <u>CREATION OF NEW MUSCLE BALANCE:</u>***

***a. Shortening & scaring of muscles***

***III. <u>DIRECT RESTRAIN OF CONDYLE</u>:***

***a. Temporalis fascia sutured to capsule***

***b. Sling of fascia lata threaded through hole in zygomatic arch and hole in condyle and tightened***

***IV. <u>REMOVAL OF MECHANICAL OBSTRUCTION:</u>***

***a. Meniscectomy***

***b. Condylectomy***

***c. Eminectomy by Myrhang (1951)***

***V. <u>CREATING MECHANICAL OBSTRUCTION</u>***

***a. LINDERMAN: Osteotomy turning down the articular eminence***

***b. MAYER: Placement of graft from zygoma to emnence***

***c. DAUTRY: Osteotomy of zygomatic arch and down fracture***

***d. FINDLEY: Inserting a L-shaped pin in zygoma process:***

# I. CAPSULE TIGHTENING PROCEDURE

1. Use of sclerosing agent: Injection of sclerosing agent into the capsular space of the TMJ. The aim is to cause fibrosis with resultant tightening of the capsule, which could prevent or limit exaggerated condylar movement.

    - Alcohol, tincture of iodine, 5% sodium psylliate, sodium morrhuate, 3% sodium tetradecyl sulphate and autologous blood have been used.
    - Associated with side effects like pain, muscle tenderness, temporary nerve paresis and excessive salivation.
    - IMF may be used as an adjuvant treatment to aid in the development of mature fibrosis within the joint.

2. Strengthening of the ligaments by surgically exposing the temporalis fascia and suturing a flap of fascia onto the capsular ligament.

3. Capsular plication: This involves exposure of the capsule, followed by an incision vertically through the body of the ligaments. The incision margins are then overlapped and sutured. This technique violates the joint cavity. To overcome this, several sutures are placed along the inferior aspect of the capsule, to tighten the capsular ligaments (Fig. 40.6).

4. Ligamentorrhaphy: This technique involves anchoring the lateral ligaments of the capsule to the periosteum of the zygomatic arch, followed by IMF for a week.

5. Capsulorrhaphy: Surgical shortening of capsule.

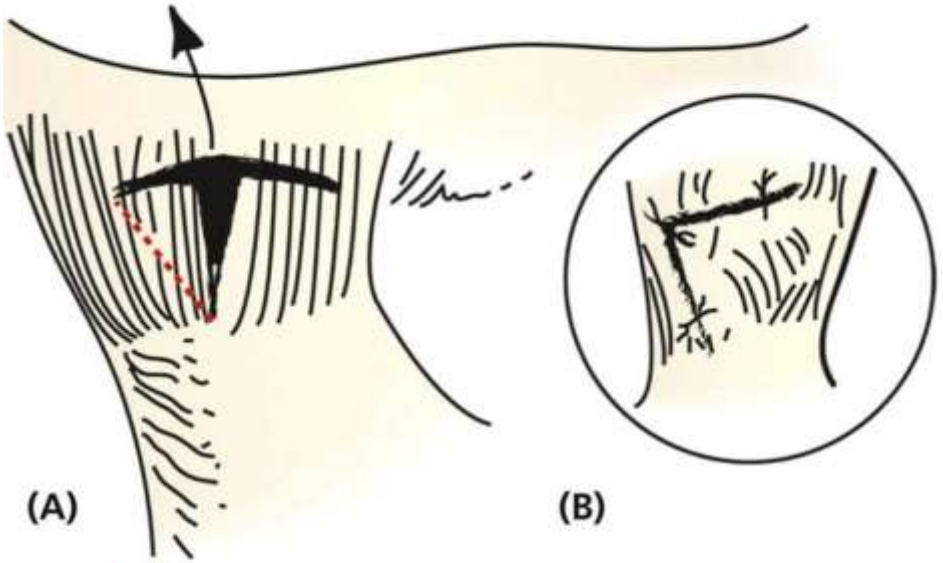



**FIGURE 40.6** Capsular plication. The exposed lateral capsule is incised. **(A)** T shaped incision on the capsule. **(B)** Inverted L shaped incion.

# II. CREATION OF NEW MUSCLE BALANCE

1. Active physiotherapy to strengthen the suprahyoid muscles thereby counterbalancing the action of the lateral pterygoid muscle.

2. Injection of 500 mouse units of type A Botulinum toxin 1 cm anterior to the condyle in a slightly open mouth position, so as to inject into the lateral pterygoid (around 100 mouse units every 2–4 months to achieve long-term effects). The aim is to weaken the lateral pterygoid muscle sufficiently to prevent dislocation. Contraindicated in patients with impaired neuromuscular function.

3. Lateral pterygoid myotomy: First described by Boman. In this technique, the attachment of the muscle to condylar neck and anterior aspect of disc is exposed and divided, followed by IMF for 7–10 days. The disadvantage is loss of translator movement in the joint (Fig. 40.7).

4. Closed condylotomy: (Tansen and Lamber) to affect the lateral pterygoid muscle indirectly. A Gigli saw is used intraorally to bisect the condylar neck thus eliminating the effect of spasticity of lateral pterygoid. However, there is a potential for bleeding from the internal maxillary artery.

5. Shortening of all muscles by severing & scar formation.

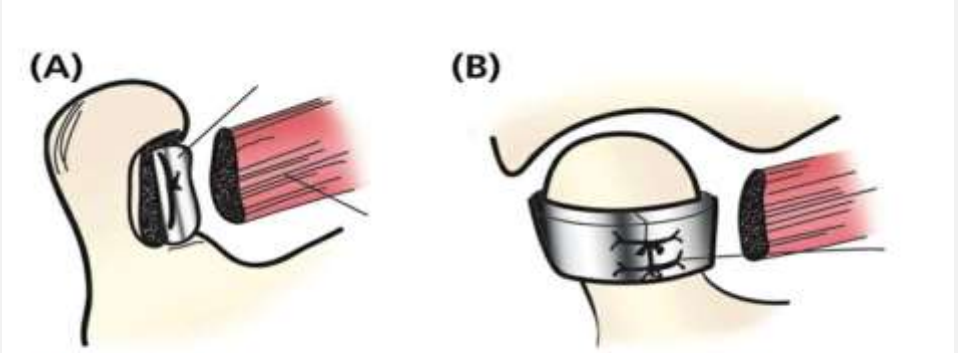



FIGURE 40.7 **(A)** Lateral pterygoid myotomy. **(B)** Silastic band is applied to prevent reattachment.

# III. DIRECT RESTRAIN OF CONDYLE

1. Georgiade advocated ligation of the coronoid process to the zygomatic arch anterior to the articular tubercle.

- Two holes are drilled; one into the condylar neck and the other into the zygomatic arch.
- A Dacron mesh suture is passed through the 2 holes and tightened, thereby restraining the condyle.

2. Scarification of the temporalis tendon at its area of insertion: An intraoral incision is made in the posterior regions along the external oblique ridge. The tendinous fibres are dissected off from the ascending ramus and sutured to the reflected periosteum and oral mucosa. The incision is then sutured. This creates a horizontal scar which may tighten the tendon and limit the range of motion.

This procedure is technique sensitive and associated with the risk of buccal nerve hypoaesthesia.

# IV. REMOVAL OF BONY OBSTRUCTION

- Condylectomy: Reidel in 1883 performed the first condylectomy for treatment of dislocation. Later Henny and Baldridge (1957) advocated this procedure. It is an intracapsular procedure and involves removal of the entire articular surface of the condyle, above the attachment of the lateral pterygoid. The resulting pseudoarthrosis may limit the range of mandibular motion. Use of chewing gum in early postoperative period is recommended. Modification of this involves condylectomy along with lateral pterygoid myotomy (Fig. 40.8). Occlusion will return to normal after 4 weeks of surgery; if not, selective grinding is done to eliminate premature contact.

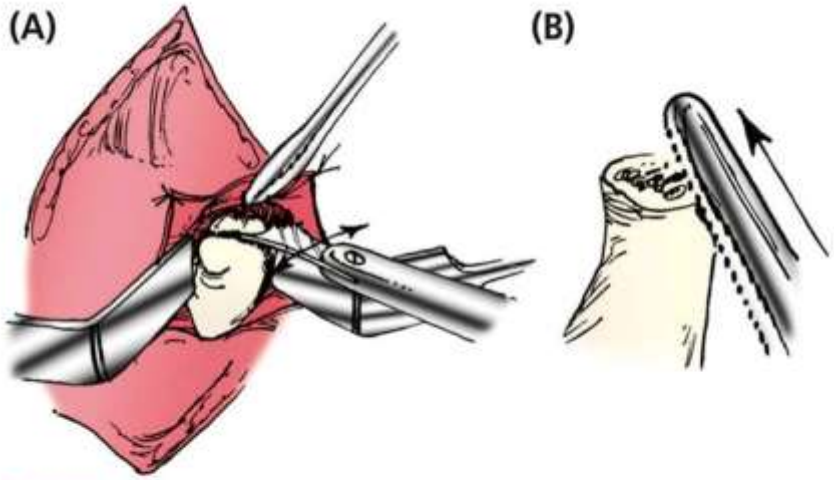


FIGURE 40.8 High condylar shave with; **(A)** Sagittal saw. **(B)** Bone file.

- Eminectomy: First introduced by Myrhaug (1951).

This involves reduction of height of eminence to allow free forward and backwards movements of the condyle. It is important to remove the most medial part of the eminence. It does not interfere with internal structure of the joint. Success rate is 100% (Fig. 40.9).

Complications:

- Pneumatisation of eminence and dural tear during its removal
- Recurrent subluxation
- Formation of postoperative osteophytes
- Crepitus and pain

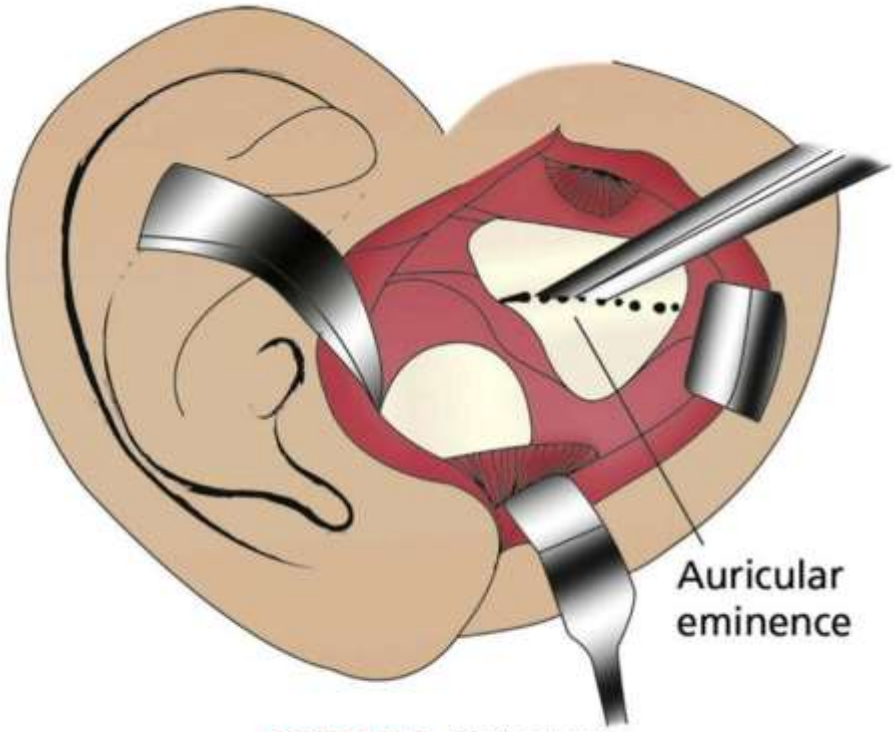



FIGURE 40.9 Eminectomy.

# V. CREATING MECHANICAL OBSTRUCTION

- a. Glenotemporal osteotomy: Glenotemporal osteotomy of the TMJ (Norman) with interpositional bone grafts is to augment the height of the articular eminence for TMJ subluxation.
- b. Dautry (1967): This involves down fracture of zygomatic arch just anterior to the eminence (Fig. 40.10).

**Procedure**: A preauricular approach is used to access the zygomatic arch. Subperiosteal dissection is done over the arch. An oblique cut is made through arch, running in a downward and forward direction, to divide the lower border just anterior to eminence. Using controlled pressure, the arch is first sprung laterally and then downwards to fit into a groove on under surface of eminence. A greenstick fracture should occur at the zygomatic temporal suture, thus giving the segment some rebound elasticity to provide stability in its altered position. It is preferred in younger individuals (<40) to reduce the likelihood of sutural fracture because of increasing brittleness with age.

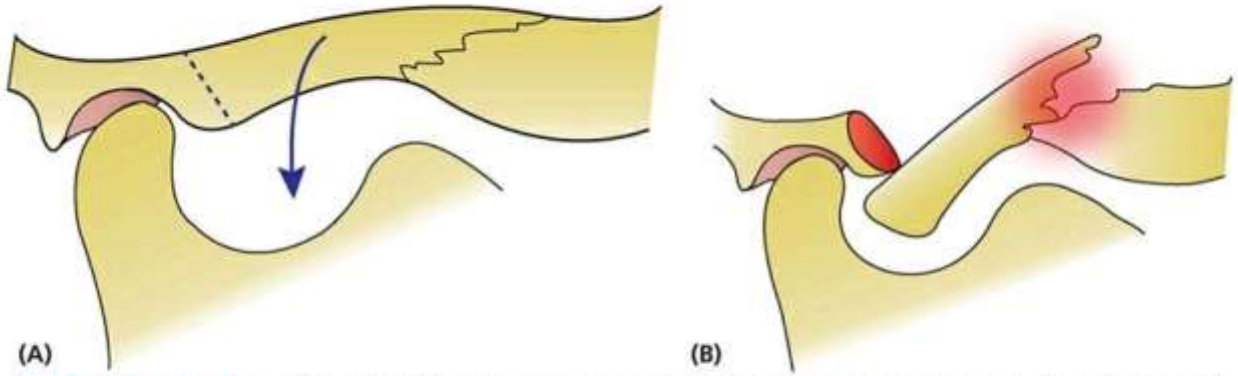



FIGURE 40.10 **(A, B)** Dautry's procedure involving down-fracture of the zygomatic arch.

Advantages: • Does not violate joint space • Allows immediate normal anterior movement with little limitation in maximal opening

Disadvantages: • Risk of fracture of distal segment • Resorption of distal segment

- c. Mayer (1933) inserted bone grafts over eminence to increase the height, thus blocking the movement of the condyle. A large piece of zygomatic process is laid anterior to eminence and maintained by a groove in the underlying temporal bone.
- d. Iliac or calvarial bone grafts may be used to augment the eminence. The capsule can be displaced posteriorly to create a space for graft placement. Bone resorption is higher with iliac grafts.
- e. Alloplastic graft: Use of vitallium mesh implants, miniplates and silastic blocks to increase the height of the eminence.
- f. Findlay advocated the use of 'L'-shaped pins anchored to the zygomatic process of temporal bone anterior to the condyle

- g. Distraction osteogenesis Currently eminence augmentation using distraction osteogenesis is under study.

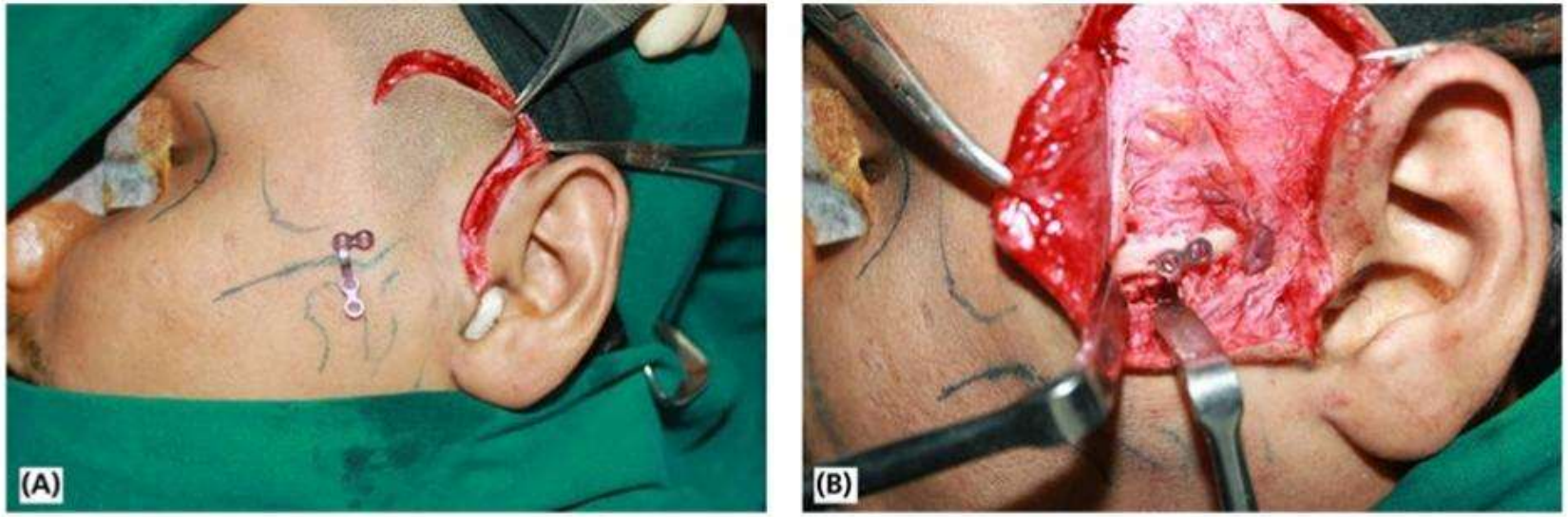



**FIGURE 40.11** The use of a L- shaped plate on the zygomatic arch that acts as a mechanical hindrance to the condyle while opening the mouth.

# *Thankyou*