MEDICAL EDUCATION RESOURCE

Temporal and Infratemporal Regions

Introduction

- The **temporal** and **infratemporal regions** lie on the **lateral aspect of the skull**, housing muscles and neurovascular structures important in **mastication (chewing)**.
- The **temporal region** contains the **temporal fossa**, while the **infratemporal region** lies below the zygomatic arch.
- These two spaces are **continuous** through the **gap deep to the zygomatic arch and behind the infratemporal crest of sphenoid**.

Temporal Fossa

- A **shallow depression** on the side of the skull above the zygomatic arch.
- **Boundaries:**
  - **Superior:** Temporal lines (superior and inferior)
  - **Inferior:** Zygomatic arch
  - **Anterior:** Frontal and zygomatic bones
  - **Floor:** Formed by parts of frontal, parietal, temporal, and sphenoid bones

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- **Roof:** Temporal fascia

- **Contents:**
  - **Temporalis muscle**
  - **Deep temporal arteries and nerves**
  - **Middle temporal artery**
  - **Zygomaticotemporal nerve**
  - **Superficial temporal vessels**
- **Function:** Allows powerful elevation and retraction of mandible through temporalis contraction.

Infratemporal Fossa

- A **deep, irregular space** below the temporal fossa and behind the maxilla.
- **Communicates** with:
  - Temporal fossa (above)
  - Pterygopalatine fossa (medially)
  - Orbit (anterosuperiorly via inferior orbital fissure)
- **Boundaries:**

- **Roof:** Greater wing of sphenoid (with foramen ovale & spinosum)
- **Medial wall:** Lateral pterygoid plate
- **Lateral wall:** Ramus of mandible
- **Anterior wall:** Posterior surface of maxilla
- **Posterior wall:** Tympanic plate and mastoid process

- **Contents:**
  - **Muscles:** Lower part of temporalis, lateral and medial pterygoids
  - **Vessels:** Maxillary artery and pterygoid venous plexus
  - **Nerves:** Mandibular nerve, chorda tympani, otic ganglion

- **Function:**
  - Acts as a *neurovascular hub* for mandibular structures and provides space for jaw movements.

Landmarks on the Lateral Side of the Head

- **Zygomatic arch:** palpable landmark separating temporal and infratemporal regions.
- **Temporal lines:** attachment of temporal fascia and boundary of temporalis.
- **Pterion:** junction of frontal, parietal, sphenoid, and temporal bones — **weakest point of skull**; fracture here may injure **middle meningeal artery** ? extradural hematoma.

Muscles of Mastication

There are **four main muscles** — all supplied by the **mandibular division of the trigeminal nerve (V?)** and acting on the **temporomandibular joint (TMJ)**.

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1. Temporalis

- **Origin:** Temporal fossa and fascia
- **Insertion:** Coronoid process and anterior border of ramus of mandible
- **Nerve supply:** Deep temporal branches (V?)
- **Action:** Elevates and retracts mandible

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2. Masseter

- **Origin:** Zygomatic arch
- **Insertion:** Lateral surface of ramus and angle of mandible
- **Nerve supply:** Masseteric nerve (V?)
- **Action:** Elevates mandible and helps in clenching teeth

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3. Medial Pterygoid

- **Origin:** Medial surface of lateral pterygoid plate and maxillary tuberosity
- **Insertion:** Medial surface of angle of mandible

- **Nerve supply:** Nerve to medial pterygoid (V?)
- **Action:** Elevates mandible; with lateral pterygoid ? side-to-side grinding movements

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4. Lateral Pterygoid

- **Origin:**
  - Upper head ? Infratemporal surface of greater wing of sphenoid
  - Lower head ? Lateral surface of lateral pterygoid plate
- **Insertion:** Neck of mandible, capsule, and articular disc of TMJ
- **Nerve supply:** Nerve to lateral pterygoid (V?)
- **Action:**
  - Both muscles acting together ? protrude mandible
  - One side acting ? produces **contralateral side movement** (grinding action)

Temporal Fascia (p. 124)

- **Definition:**
  A strong fibrous sheet covering the **temporalis muscle**, forming the **roof of the temporal fossa**.
- **Attachments:**

- **Superiorly:** To *superior temporal line*
- **Inferiorly:** Splits into two laminae attached to *lateral and medial margins* of **zygomatic arch**
- **Anteriorly:** Continuous with *pericranium and deep fascia of face*

- **Relations:**
  - **Superficial surface:** Covered by skin, superficial fascia, auriculotemporal nerve, and superficial temporal vessels.
  - **Deep surface:** Gives attachment to **temporalis muscle** and contains **fat pad** between its two laminae.

- **Function:**
  - Protects the temporalis muscle and maintains its contour.
  - Provides origin to **superior fibers** of temporalis.
  - Transmits tension during mastication.

Dissection (p. 124–125)

1. **Reflection of temporal fascia:**
   - Incise and reflect downward from superior temporal line to zygomatic arch.
   - Identify the **superficial temporal vessels** and **auriculotemporal nerve**.

2. **Exposure of temporalis:**
    - Detach fascia and reflect temporalis muscle to observe its deep surface.
3. **Infratemporal region exposure:**
    - Remove the **zygomatic arch** and **mandibular ramus** (by sawing through neck of mandible).
    - Identify:
        - **Lateral and medial pterygoid muscles**
        - **Maxillary artery and branches**
        - **Pterygoid venous plexus**
        - **Mandibular nerve and its branches**
        - **Otic ganglion**
4. **Note:**
    - The **infratemporal crest of sphenoid** separates temporal from infratemporal fossa.
    - All major structures of mastication can be studied here.

Relations of Lateral Pterygoid (p. 126)

- **Shape:** Short, thick, two-headed muscle — upper and lower heads diverge anteriorly.

Attachments

- **Upper head:** Infratemporal surface and crest of greater wing of sphenoid.
- **Lower head:** Lateral surface of lateral pterygoid plate.
- **Insertion:** Neck of mandible and capsule of temporomandibular joint (TMJ).

Relations

Superficial (Upper Head):

- Temporal fascia
- Masseter muscle
- Temporalis insertion

Deep (Lower Head):

- Medial pterygoid (inferomedial)
- Maxillary artery and buccal nerve cross between the two heads

Medial:

- Tensor and levator veli palatini muscles
- Pharyngeal wall

Lateral:

- Ramus of mandible

Superior:

- Foramen ovale (transmitting mandibular nerve)
- Foramen spinosum (middle meningeal artery)

Action

- **Both sides:** Protrude mandible
- **One side:** Moves chin to opposite side (grinding movement)

> **Relations of Medial Pterygoid (p. 127)**

- **Shape:** Quadrangular muscle forming a mirror image of masseter (on the inner side of mandible).

Attachments

- **Superficial head:** Maxillary tuberosity and pyramidal process of palatine bone.
- **Deep head:** Medial surface of lateral pterygoid plate.
- **Insertion:** Medial surface of ramus and angle of mandible.

Relations

Superficial Surface:

- Lateral pterygoid muscle (above)

- Maxillary artery and its branches
- Inferior alveolar and lingual nerves

Deep Surface:

- Tensor veli palatini and superior constrictor of pharynx
- Styloglossus and stylopharyngeus (posteriorly)

Lateral:

- Ramus of mandible (separating it from masseter)

Medial:

- Superior constrictor muscle and pharyngeal wall

Action

- Elevates mandible
- With opposite lateral pterygoid ? **side-to-side (grinding)** movements

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> **Clinical Anatomy (p. 127)**

1. Pterion fracture

- Weakest point on skull (junction of frontal, parietal, sphenoid, temporal bones).

- Fracture may rupture **anterior branch of middle meningeal artery**, causing **epidural hematoma**.
- Rapid intracranial bleeding ? compression of brain ? emergency surgery required.

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2. Trismus

- Painful restriction of mouth opening due to **spasm of medial pterygoid**.
- Common in **tetanus, peritonsillar abscess**, or **after dental infections**.

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3. Dislocation of Mandible

- Excessive opening of mouth may cause the **head of mandible** to slip **anterior to articular tubercle of temporal bone**.
- The **lateral pterygoid** contributes to this displacement.

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4. Injury to Mandibular Nerve

- May lead to paralysis of muscles of mastication ? **jaw deviates to the affected side** on opening the mouth.

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5. Spread of Infection

- **Infratemporal fossa** communicates freely with **pterygopalatine fossa**, **orbit**, and **cranial cavity**.
- Deep infections here may spread intracranially through venous channels like the **pterygoid plexus**.

Maxillary Artery

Overview

- The **maxillary artery** is the larger terminal branch of the **external carotid artery**.
- It begins **behind the neck of the mandible** inside the parotid gland, then runs forward through the **infratemporal fossa** and enters the **pterygopalatine fossa** via the pterygomaxillary fissure.
- It is divided into **three parts** based on its relation to the **lateral pterygoid muscle**:
    1. **First (mandibular) part** – before the muscle
    2. **Second (pterygoid) part** – superficial or deep to it
    3. **Third (pterygopalatine) part** – beyond it, in the pterygopalatine fossa

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Branches of the Maxillary Artery

1. First (Mandibular) Part

Supplies the **ear, meninges, and lower jaw**.
Mnemonic: *DAM I A Man*

- Deep auricular artery
- Anterior tympanic artery
- Middle meningeal artery

- Inferior alveolar artery
- Accessory meningeal artery

2. Second (Pterygoid) Part

Supplies **muscles of mastication**.

- Deep temporal arteries (anterior and posterior)
- Pterygoid branches
- Masseteric artery
- Buccal artery

3. Third (Pterygopalatine) Part

Supplies **nasal cavity, palate, and pharynx**.
Mnemonic: *P-DISI*

- Posterior superior alveolar artery
- Descending palatine artery
- Infraorbital artery
- Sphenopalatine artery (artery of epistaxis)
- Artery of the pterygoid canal

Clinical Anatomy

- **Fracture at the pterion** may tear the **anterior branch of the middle meningeal artery**, causing an **epidural hemorrhage**.
- **Bleeding from lower teeth** occurs from branches of the **inferior alveolar artery**.
- **Bleeding from upper teeth** arises from **posterior superior alveolar or infraorbital arteries**.
- **Sphenopalatine artery** forms **Kiesselbach's plexus** (Little's area), the most common site of **epistaxis**.

Pterygoid Venous Plexus

- A network of veins around the **lateral pterygoid muscle**.
- **Tributaries** correspond to branches of the **maxillary artery**.
- Drains into the **maxillary vein**, which joins the **superficial temporal vein** to form the **retromandibular vein**.

Communications:

- With **inferior ophthalmic vein** via the inferior orbital fissure
- With **cavernous sinus** via emissary veins
- With **facial vein** via the deep facial vein

Clinical importance:
Infections from the face may spread through these venous connections to the **cavernous sinus**, leading to **cavernous sinus thrombosis** and cranial nerve palsies.

Temporomandibular Joint (TMJ)

Type

- **Synovial joint** of the **condylar variety**.

Articular Surfaces

- **Upper:** Articular tubercle and anterior part of mandibular fossa (temporal bone).
- **Lower:** Head of the mandible.
- Both surfaces are covered by **fibrocartilage** instead of hyaline cartilage.

Articular Disc

- **Biconcave fibrocartilaginous disc** dividing the joint into **upper** (gliding) and **lower** (hinge) cavities.
- Allows both **rotation and translation** movements.

Ligaments

- **Capsular ligament** – encloses the joint, loose above, tight below.
- **Lateral temporomandibular ligament** – reinforces the capsule laterally.
- **Sphenomandibular ligament** – runs from spine of sphenoid to lingula of mandible.
- **Stylomandibular ligament** – from styloid process to mandible.

- **Pterygomandibular raphe** – connects buccinator to superior constrictor (functionally related).

Dissection

- Reflect **lateral pterygoid muscle** near its insertion.
- Dislocate the **head of mandible** to reveal the **articular disc** and **joint cavities**.
- Observe the **fibrocartilage** lining and ligaments.

Clinical Anatomy

- **TMJ dislocation:** Mouth opened too wide ? head of mandible moves anterior to the articular tubercle.
- **Subluxation:** Partial dislocation due to loose capsule.
- **Arthritis and clicking jaw:** Degeneration or malalignment of articular disc.
- **Trismus (lockjaw):** Spasm of masticatory muscles, often due to infection or tetanus.
- **Fracture neck of mandible:** May injure the **auriculotemporal nerve**, producing pain and gustatory sweating (Frey's syndrome).

Mandibular Nerve

Overview

- Largest mixed branch of the **trigeminal nerve (V?)**.
- Nerve of the **first branchial arch**, supplying all its derivatives.
- Associated with **otic** and **submandibular ganglia**.

Roots and Course

- Arises from the **trigeminal ganglion** by two roots:
    - **Large sensory root**
    - **Small motor root**
- Both roots pass through the **foramen ovale** and unite just below it.
- Lies in the **infratemporal fossa**, on **tensor veli palatini** and deep to **lateral pterygoid**.
- Quickly divides into:
    - **Small anterior trunk** (mainly motor)
    - **Large posterior trunk** (mainly sensory)

Branches

From Main Trunk

- **Meningeal branch** – passes through foramen spinosum with middle meningeal artery.
- **Nerve to medial pterygoid** – gives branches to:

- Medial pterygoid
- Tensor tympani
- Tensor veli palatini

Anterior Division (Mainly Motor)

- **Masseteric nerve** – to masseter.
- **Deep temporal nerves** – to temporalis.
- **Nerve to lateral pterygoid.**
- **Buccal nerve** – only *sensory* branch here; supplies cheek mucosa and skin.

Posterior Division (Mainly Sensory)

- **Auriculotemporal nerve** – supplies TMJ, auricle, and parotid gland; carries *postganglionic parasympathetic fibres* from otic ganglion.
- **Lingual nerve** – supplies anterior two-thirds of tongue (general sensation); joined by *chorda tympani* for taste and secretomotor fibres to submandibular/sublingual glands.
- **Inferior alveolar nerve** – enters mandibular foramen ? mandibular canal ? supplies lower teeth.
  - *Mylohyoid branch* (motor): to mylohyoid and anterior belly of digastric.
  - *Mental branch:* to skin and mucosa of lower lip and chin.

Dissection

1. Identify **middle meningeal artery** arising from maxillary artery and follow it up to foramen spinosum.
2. Note **auriculotemporal nerve roots** looping around the artery.
3. Trace **lingual and inferior alveolar nerves** anterior to the lower part of lateral pterygoid.
4. Observe **chorda tympani** joining the lingual nerve.
5. Lift the main trunk of the mandibular nerve laterally to identify the **otic ganglion** situated just below the foramen ovale.
6. Trace all ganglionic connections to auriculotemporal, lesser petrosal, and medial pterygoid nerves.

Otic Ganglion

Overview

- A **small (2–3 mm)** parasympathetic ganglion.
- Lies in the **infratemporal fossa**, just **below the foramen ovale**.
- **Medial** to mandibular nerve, **lateral** to tensor veli palatini.
- Functionally part of the **glossopharyngeal nerve**, though topographically attached to V?.

Connections and Roots

1. **Parasympathetic (secretomotor) root:**
    - From **lesser petrosal nerve** (branch of glossopharyngeal).
    - Synapses in the otic ganglion ? postganglionic fibres travel via **auriculotemporal nerve** to the **parotid gland**.
2. **Sympathetic root:**
    - From **plexus on middle meningeal artery** (superior cervical ganglion).
    - Passes through without synapse ? **vasomotor** to parotid.
3. **Sensory root:**
    - From **auriculotemporal nerve** ? sensory to the parotid gland.
4. **Motor root:**
    - From **nerve to medial pterygoid** ? passes through ganglion to supply:
        - *Tensor tympani*
        - *Tensor veli palatini*
5. **Other communications:**
    - With **chorda tympani** and **nerve of pterygoid canal**, allowing an alternative taste pathway from the anterior two-thirds of the tongue.

Clinical Anatomy

- **Testing of mandibular nerve (motor part):**
  - Ask patient to **clench teeth** ? palpate temporalis and masseter.
  - Paralysis ? *jaw deviates to the affected side* on opening due to unopposed action of opposite lateral pterygoid.
  - Test pterygoid activity by asking patient to move chin side to side.
- **Referred pain:**
  - In **carcinoma of tongue**, pain radiates to ear and temple along the **auriculotemporal nerve** (branch of V?).
  - Since **lingual** and **auriculotemporal** nerves are both branches of V?, irritation of one may cause referred sensation in the other.
- **Surgical significance:**
  - The **lingual nerve** may be cut (neurectomy) below and behind the last molar to relieve **intractable tongue pain**.
  - Great care is needed to preserve **auriculotemporal and facial nerves** during operations near TMJ.

Mnemonics

Function of Pterygoid Muscles

- **“La”** ? *Lateral pterygoid opens mouth* (jaw open).
- **“Me”** ? *Medial pterygoid closes mouth* (jaw closed).

Sensory Branches of Mandibular Nerve (V?)

- **Mnemonic:** *“Buccaneers Are Inferior Linguists”*
  - **B** – Buccal nerve
  - **A** – Auriculotemporal nerve
  - **I** – Inferior alveolar nerve
  - **L** – Lingual nerve

Branches of Maxillary Artery

- **Mnemonic:** *“DAM I AM Piss Drunk But Stupid Drunk”*
  - **D** – Deep auricular
  - **A** – Anterior tympanic
  - **M** – Middle meningeal
  - **I** – Inferior alveolar
  - **A** – Accessory meningeal

Facts to Remember

- The **mandibular nerve** is the **only mixed branch** of the trigeminal nerve.
- It is associated with **two parasympathetic ganglia** — the **otic** and **submandibular** ganglia.
- The **maxillary artery** gives off many branches; some accompany branches of the **maxillary nerve**, others follow branches of the **mandibular nerve**, since there is *no separate mandibular artery*.
- The **lateral pterygoid** is the *only* muscle of mastication that **depresses (opens)** the temporomandibular joint.
- The **spine of sphenoid** is related to the **chorda tympani** and **auriculotemporal nerves** — injury here affects secretion from **three salivary glands** (parotid, submandibular, sublingual).
- The **auriculotemporal nerve** and **branches of the facial nerve** are closely related to the **temporomandibular joint**.

Clinicoanatomical Problem

Clinical Case

A patient with **carcinoma involving the anterior two-thirds of the tongue** complains of **pain in the lower teeth, temporal region, and temporomandibular joint**.

Questions

1. Why is the **pain of the tongue** referred to the **lower teeth**?

2. Which are the **other areas of referred pain**?

Explanation

- Sensations from the **anterior two-thirds of the tongue** are carried by the **lingual nerve**, a branch of the **mandibular nerve (V?)**.
- In carcinoma, **excessive pain impulses** travel through the lingual nerve and may get diverted into other **branches of the same mandibular nerve**, causing **referred pain**.
- The **lower teeth** are supplied by the **inferior alveolar nerve**, another branch of V?, so pain from the tongue is often perceived there.
- The **mandibular nerve** also carries sensory fibers from the **temporomandibular joint** and **temporal region**, hence the pain is also referred to these regions.

Clinical Relevance

Referred pain through branches of the mandibular nerve explains why **tongue cancers** can cause discomfort not only in the tongue but also in **jaw, teeth, and temple**, misleading early diagnosis unless nerve pathways are understood.

Frequently Asked Questions — Mandibular Nerve

Q1. What is the functional component of the mandibular nerve?
? It is a **mixed nerve**, carrying both **motor and sensory fibers**.

Q2. Which muscles are supplied by the mandibular nerve?
? All **muscles of mastication**, plus:

- Mylohyoid

- Anterior belly of digastric
- Tensor tympani
- Tensor veli palatini

Q3. What is the only sensory branch in the anterior division of the mandibular nerve?
? The **buccal nerve**.

Q4. Which branch of the mandibular nerve carries parasympathetic fibers to the parotid gland?
? The **auriculotemporal nerve** (via the otic ganglion).

Q5. What is the nerve supply of the anterior two-thirds of the tongue?
? **Lingual nerve** – for general sensation.
? **Chorda tympani (via lingual nerve)** – for taste sensation.

Q6. What is the applied importance of the mandibular nerve in tongue carcinoma?
? Pain from the tongue is referred to **lower teeth, temple, and ear** due to common sensory pathways through **V? branches**.

Q7. What are the effects of mandibular nerve paralysis?
? Paralysis of **masticatory muscles**, causing:

- Deviation of jaw **toward the affected side** on opening.
- Weakness in chewing and clenching.

Q8. Which muscle of mastication opens the mouth?
? **Lateral pterygoid**.

Q9. What is the location of the otic ganglion?
? In the **infratemporal fossa**, just **below the foramen ovale**, medial to V? and lateral to tensor veli palatini.

Q10. Which nerve gives motor supply to the tensor tympani?
? **Nerve to medial pterygoid**, through the otic ganglion.

Multiple Choice Questions

1. The mandibular nerve is:

A. Purely sensory

B. Purely motor

C. Mixed

D. None of the above

? **Answer:** C. Mixed

2. The only sensory branch of the anterior division of the mandibular nerve is:

A. Buccal nerve

B. Lingual nerve

C. Auriculotemporal nerve

D. Inferior alveolar nerve

? **Answer:** A. Buccal nerve

3. The otic ganglion is functionally associated with:

A. Facial nerve

B. Glossopharyngeal nerve

C. Mandibular nerve

D. Vagus nerve

? **Answer:** B. Glossopharyngeal nerve

4. The nerve that carries secretomotor fibers to the parotid gland is:

A. Auriculotemporal nerve

B. Buccal nerve

C. Lingual nerve

D. Inferior alveolar nerve

? **Answer:** A. Auriculotemporal nerve

5. The muscle responsible for opening the mouth is:

A. Masseter

B. Medial pterygoid

C. Lateral pterygoid

D. Temporalis

? **Answer:** C. Lateral pterygoid

Viva Voce

Q1. What is the only mixed division of the trigeminal nerve?

? Mandibular nerve (V?).

Q2. Name the parasympathetic ganglia related to the mandibular nerve.

? Otic ganglion and submandibular ganglion.

Q3. Name the nerve supplying the anterior two-thirds of the tongue.

? Lingual nerve (for general sensation); chorda tympani via lingual nerve (for taste).

Q4. What happens if the lingual nerve is injured during molar extraction?

? Loss of all sensations (touch, temperature, taste) from the anterior two-thirds of the tongue.

Q5. What is the jaw-jerk reflex and which nerve mediates it?

? Stretch reflex of the masseter and pterygoids; both afferent and efferent limbs through the **mandibular nerve**.

Q6. What happens if there is a lesion at the foramen ovale?

? Paraesthesia along the mandible, tongue, temporal region, and paralysis of muscles of mastication with loss of jaw-jerk reflex.