Temporal and Infratemporal Region
Muscles of Mastication and TMJ

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Learning Objectives:

• Describe the muscles of mastication, their origins, insertions, innervations and actions
• Describe the TMJ and its clinical considerations
• Identify and relate the mandibular nerve (V₃) branches to their target structures, including components that “hitchhike”
• Learn important branches of maxillary artery
• Clinical considerations
Temporal Fossa

Boundaries

**Anterior:** Zygoma & Zygomatic Process of Frontal Bone

**Superior:** Temporal Line

**Posterior:** Temporal Line

**Inferior:** Zygomatic Arch, Infratemporal Crest of the Greater Wing of the Sphenoid

**Lateral:** Zygomatic Arch

**Medial:** Bone Structure of Skull
Boundaries of the Infratemporal Fossa:

- Temporal
- Parietal
- Frontal
- Greater wing of Sphenoid
- Maxilla
- Zygomatic bone
- Infratemporal fossa
- Lat. pterygoid plate
- Styloid process
- Ext. auditory meatus
- Roof
- Foramina
- Sphenoid sinus
- Meckel's cave
- Stylomastoid foramen
Infratemporal Fossa

Contents: Muscles of mastication and their vascular and nerve supply

Boundaries:

Anterior: Infratemporal Surface of Maxilla and Deep Surface of Zygomatic Bone

Medial: Lateral Surface of Lateral Pterygoid Plate of sphenoid and Pterygomaxillary Fissure

Superior: Infratemporal Crest of Sphenoid and Infratemporal Surface of the Greater Wing of the Sphenoid
Continued:

**Posterior:** Anterior Limits of the Mandibular Fossa (glenoid fossa)

**Inferior:** Open

**Lateral:** Ramus of Mandible
Pterygomaxillary fissure and pterygopalatine fossa
Channels communicating with the infratemporal fossa:

- Temporal
- Parietal
- Frontal
- Greater wing of Sphenoid
- Zygomatic (Zyg)
- Pterygomaxillary fissure
- Inferior orbital fissure
- Foramen ovale
- Foramen spinosum

[Diagram showing the anatomical relationships and locations of these channels]
Contents of the infratemporal fossa:

- Three (of four) muscles of mastication
- Mandibular nerve (V₃) + branches
- Otic ganglion
- Chorda tympani nerve (between facial and lingual nerve)
- Maxillary artery + branches
- Pterygoid plexus of veins
How to gain access into the infratemporal fossa

To catch on lingula
Muscles of Mastication:

- Masseter
- Temporalis
- Masseter fascia
- Parotid duct
Muscles of Mastication:

- Medial pterygoid
- Lateral pterygoid
- Articular disk
- Head of mandible
- Medial pterygoid
Temporalis and Masseter muscles
Temporals muscle and its attachment and actions
Tendon of Temporalis muscle and retromolar pad
Muscle actions
Inferior view of the cranial base
(highlighting the mandibular condyle and lateral pterygoid plate of the sphenoid bone)
Mandibular block
Jaw opening muscles
Anterior belly of digastric muscle
Actions of muscles of mastication
Action of muscles of mastication on the mandible:

- **Depression** (open mouth): anterior belly of digastric, geniohyoid, lateral pterygoids (#3), mylohyoid (minor role)
- **Elevation** (close mouth, occlusion): masseter (#2), temporalis (#1), medial pterygoids (#4)
- **Protrusion** (protraction): mostly medial and lateral pterygoids (#3,4) + masseter (#2)
- **Retrusion** (retraction): temporalis (#1)
- **Lateral** (side to side) motion: lateral and medial pterygoids (#3,4)
Learning Objectives:

- Describe the parotid gland and its relationship with the facial nerve. Learn the innervation of parotid gland.
- Describe the osteology and anatomic boundaries of the temporal and infratemporal fossa.
- Contents of the infratemporal and pterygopalatine fossa.
- Describe the muscles of mastication, their origins, insertions, innervations and actions.
- **Describe the TMJ and its clinical considerations**
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Temporomandibular Joint: Articulation of condyle of mandible with mandibular fossa plus articular eminence of temporal bone
TMJ: details of articulation

- Mandibular fossa
- Gliding Action
- Upper synovial space
- Articular disc
- Lateral pterygoid tendon
- Condyle
- Hinge Action
- Lower synovial space
TMJ movement:

- **Initial** opening of mouth involves rotation of the condyle in the **lower compartment** of the TMJ. This is the **HINGE** motion.

- Further opening (beyond 20 mm.) requires translation of the condyle+articular disc on the articular eminence, which occurs in the **upper compartment**. This is the **GLIDING** motion.
Movements possible at the TMJ: rotation and translation

Functionally, the lower compartment acts as a hinge joint (rotational movement); the upper compartment acts as a gliding joint (translational movement).
Ligaments of the temporomandibular joint
Capsular ligament of the TMJ (enclosing the TMJ)
Extracapsular ligaments (three) of the TMJ

Lateral, sphenomandibular and stylomandibular ligaments
Two other extracapsular ligaments of the TMJ
Innervation of the TMJ
Articular eminence

Articular disc

Postglenoid tubercle

Capsular ligament
Normal articular disc in TMJ
Damaged articular disc in TMJ
Clinical Correlation: Mandibular Dislocation

- Condyles are displaced anteriorly beyond articular tubercles
- Usually bilateral
- Muscle spasm
- Treatment: judicious (minimal) force needed to reduce dislocation of mandible, by guiding it inferiorly and posteriorly
Clinical correlation: TMJ Disorder

Primary Symptoms include:

• pronounced joint noises associated with movement (clicking, popping).
• pain and deviation with jaw opening.
• limited range of opening.
Clinical correlation: TMJ Ankylosis

- Young patient presents with restricted mouth opening
- Hx of fall on chin approximately 1 year prior to visit
- Physical exam, images obtained

Coronal CT (above)
- Normal mandibular condyle on patient’s right, articulating with mandibular fossa
- Abnormal condyle on patient’s left, fusion of mandibular ramus with temporal bone
Clinical correlation: TMJ Ankylosis

- The TMJ is approached from a pre-auricular incision
- The joint space is opened and the condyle is recontoured
- Mobility of the mandible is checked in the operating room

Post operative view: normal mandibular opening, no deviation from midline
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Review: Trigeminal nerve in middle cranial fossa:

V1, V2, V3 exits through foramen ovale to enter infratemporal fossa.
MANDIBULAR NERVE (V₃)

**Somatosensory and somatomotor**

- **Mental n**
- **Mylohyoid n**
- **Chorda tympani**

**SS**
- **Inferior alveolar n**
- **SS, taste, para pre**

**SS+parapost from otic ganglia (IX)**

**Buccal n**
- To go in and innervate cheek (don’t get confused with buccal branch of CNVII)

**Lingual n**
- SS, taste, para pre

**Auriculotemporal**

*Taste & parasympathetic pre-ganglionic*
Anterior

Posterior

Chorda tympani

Ramus fractured

B

L

I

M
Chorda tympani

Ramus fractured
Chorda tympani
Taste
Para/pre
Submandibular ganglion
Submandibular gland
Sublingual gland
SS
Para pre & taste
SS
Para pre & taste
V3: Mandibular Division of the Trigeminal Nerve:

**Motor branches:**
- To muscles of mastication:
  - Masseter
  - Deep Temporal
  - Medial Pterygoid
  - Lateral Pterygoid

  PLUS
  - Mylohyoid nerve to mylohyoid and anterior belly of digastric
  - Nerves to tensor tympani and tensor veli palatini

**Sensory branches:**
- Buccal
- Lingual*
- Auriculotemporal*
- Inferior Alveolar**

**“Hitchhikers”**
- Chorda tympani (taste + para pre) from CN 7 joins lingual nerve*
- Fibers from otic ganglion (para post) (CN 9) join auriculotemporal nerve* → parotid gland?
Maxillary artery
Middle meningeal artery

Auriculotemporal nerve

Maxillary artery

ECA

V₃
Maxillary artery entering the pterygopalatine fossa
Veins in the facial region
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Clinical correlation: *Inferior alveolar nerve* block to anesthetize mandibular teeth:
Local Anaesthesia

1. Block injection

Mandibular nerve block (inferior alveolar nerve)
2. Local infiltration

Maxillary injections

**Posterior Superior Alveolar Nerve Block (PSA)**
Clinical correlation: trigeminal neuralgia

- Characterized by severe pain, paroxysmal, stabbing or burning, along the distribution of the trigeminal nerve

- Can be in the distribution of one or more divisions of the trigeminal nerve (V1, V2 and/or V3), usually unilateral

- Anatomic basis of neuralgia is abnormal activation of CNV

- Treatment options: neuroactive medications, injections, ablation, microvascular surgery and gamma knife (radiation)
Clinical correlation: Mandible fracture

• Commonly fractured facial bone because of prominence
• MUST assess patients with facial trauma for airway issues and head injury
• Mechanisms of injury include assaults, motor vehicle accidents, falls, penetrating trauma, sports
• Treatment involves reducing the fracture and fixating it so it can heal
Patient presents to the emergency department complaining of jaw pain after motor vehicle accident (unbelted driver)
Force applied to mandible + mandibular anatomy = type of fracture
Radiographs and physical exam to assess the injury:

*Note fracture at angle of mandible as well as at the symphysis/body area
Treatment: open reduction (surgically approximate the bone fragments) and internal fixation (bone plates)

Risks: bleeding, swelling, nerve injury (inferior alveolar, lingual, mental)