2018 Head and Neck Anatomy Midterm Examination
Mean = 28.22 (80.6%); SD=5.00

Grade Distribution

Scores Out of 35

# of Students
Parotid Gland
Facial Nerve
Temporal and Infratemporal Region
Muscles of Mastication and TMJ

Yang Chai, DDS, PhD
July 18, 2018
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
- Identify and relate the mandibular nerve (V₃) branches to their target structures, including components that "hitchhike"
- Learn important branches of maxillary artery
- Clinical considerations
Parotid region
Parotid Gland

Largest of 3 paired salivary glands (submandibular; sublingual)

Ramus of Mandible

Medial pterygoid

Cross section of mandible

Parotid Gland

Masseter

SCM

Mastoid Process

Facial nerve and its branches
Parotid Duct

Parotid Duct

Buccal Branch of the Facial Nerve

Parotid Gland

Masseter

Buccinator

Parotid Duct
Parotid Duct

2nd Molar

Buccinator

Transverse Facial Artery

Parotid Duct

Buccal Branch of the Facial Nerve

Retromandibular v.

Parotid Gland

Masseter
Intraoral opening of the parotid duct (next to the upper second molar)
Innervation of the parotid gland
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

• 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:
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:

- Foramen ovale + Foramen spinosum
- Zygomaticus
- Grtr wing of Sphenoid
- Inferior orbital fissure
- Pterygomaxillary fissure
- Maxilla
- Parietal
- Frontal
- Temporal
- Incisive foramina
- Greater palatine foramen
- Articular tubercle
- Mandibular fossa
- External acoustic pore
- Mastoid process
- Stylo-mastoid foramen
Contents of the infratemporal fossa:

- Three (of four) muscles of mastication
- Mandibular nerve \((V_3)\) + 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

Diagram showing:
- Head
- Coronoid process
- To catch on lingula
Muscles of Mastication:

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

- Medial pterygoid
- Lateral pterygoid
- Articular disk
- Head of mandible
- Medial pterygoid
Temporalis and Masseter muscles
Temporalis 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)
Jaw opening muscles

- Superior longitudinal muscle of tongue
- Lingual aponeurosis
- Lingual mucosa
- Transverse lingual muscle
- Septum of the tongue
- Foramen cecum
- Lingual tonsil; root of tongue
- Cartilage of epiglottis
- Superior aperture of larynx
- Ventricle of larynx
- Hyoid bone
- Thyroid cartilage
- Genioglossus
- Mylohyoid muscle
- Geniohyoid muscle

Lower lip
Vestibule of mouth
Mandible
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**
- Identify and relate the mandibular nerve (V₃) branches to their target structures, including components that “hitchhike”
- Learn important branches of maxillary artery
- Clinical considerations
Temporomandibular Joint: Articulation of condyle of mandible with mandibular fossa plus articular eminence of temporal bone.
TMJ: details of articulation

- **Gliding Action**
  - Upper synovial space

- **Hinge Action**
  - Lower synovial space

- Articular disc
- Lateral pterygoid tendon
- Condyle
- Mandibular fossa
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

- Stylomandibular ligament
- Sphenomandibular ligament
the condylar process of the mandibular rami below.

2) that the articular capsule is a loose sac which is fused anteriorly and laterally with the lateral (temporomandibular) ligament. Note also the stylomandibular ligament extending from the tip of the styloid process to the angle and posterior border of the mandible.

Fig. 613: The Right Temporomandibular Region (Medial View)

NOTE that medial to the temporomandibular joint the pterygospinous ligament extends from the sphenoidal spine to the posterior margin of the lateral pterygoid plate, while the sphenomandibular ligament descends from the sphenoidal spine to the lingula of the mandible.

Fig. 614: The Medial and Lateral Pterygoid Muscles (Lateral View)

NOTE: 1) the left zygomatic arch has been removed. Posteriorly, the bone has been cut through the temporomandibular joint, revealing the articular disc. The location of the medial pterygoid muscle and part of the lateral pterygoid muscle on the inner aspect of the ramus of the mandible is represented as though the bone were transparent.

2) the lateral pterygoid muscle arises by two heads, a superior from the great wing of the sphenoid bone and an inferior from the lateral surface of the lateral pterygoid plate of the sphenoid. The two heads insert posteriorly on the neck of the condyle of the mandible. The lateral pterygoid muscle opens and protracts the mandible and also moves from side to side.

3) the medial pterygoid muscle arises on the medial surface of the lateral pterygoid plate of the sphenoid as well as from the palatine bone, and inserts on the medial surface of the ramus and angle of the mandible. It assists the masseter and temporalis in
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
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

• Identify and relate the mandibular nerve (V₃) branches to their target structures, including components that “hitchhike”

• Learn important branches of maxillary artery

• Clinical considerations
Review: Trigeminal nerve in middle cranial fossa:

V₁, V₂, V₃

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

- **V₃** Somatosensory and somatomotor
- **Mental n**
- **Mylohyoid n** SM to mylohyoid & anterior digastric mm
- **Chorda tympani* n** (VII)
- **Auriculotemporal**
- **Buccal n** To go in and innervate cheek (don't get confused with buccal branch of CNVII)
- **Lingual n**
- **Inferior alveolar n**
- **SS+parast from otic ganglia (IX)**
- **Para pre & Taste**

* Taste & parasympathetic pre-ganglionic
Chorda tympani

Ramus fractured
Chorda tympani

Taste
Para/pre

Submandibular ganglion
Submandibular gland
Sublingual gland
V3: Mandibular Division of the Trigeminal Nerve:

<table>
<thead>
<tr>
<th>Motor branches:</th>
<th>Sensory branches:</th>
<th>“Hitchhikers”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To muscles of mastication:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Masseter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Deep Temporal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Medial Pterygoid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lateral Pterygoid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLUS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mylohyoid nerve to mylohyoid and anterior belly of digastric</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Nerves to tensor tympani and tensor veli palatini</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Buccal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lingual*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Auriculotemporal*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Inferior Alveolar**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Chorda tympani (<em>taste + para pre</em>) from CN 7 joins lingual nerve*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fibers from otic ganglion (<em>para post</em>) (CN 9) join auriculotemporal nerve* → parotid gland?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Maxillary artery
Auriculotemporal nerve

Middle meningeal artery

Maxillary artery

ECA
Maxillary artery entering the pterygopalatine fossa

A

Middle meningeal artery
Deep temporal arteries
Posterior superior alveolar artery
Maxillary artery
External carotid artery
Muscular branches
Inferior alveolar artery

B

Nerve to masseter
Auriculotemporal nerve
Nerves to temporalis
Chorda tympani
Maxillary artery
Buccal nerve
Inferior alveolar nerve
Lingual nerve
Medial pterygoid muscle
Nerve to mylohyoid and digastric
Veins in the facial region
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
• Identify and relate the mandibular nerve (V₃) branches to their target structures, including components that “hitchhike”
• Learn important branches of maxillary artery
• Clinical considerations
Clinical correlation: *Inferior alveolar nerve* block to anesthetize mandibular teeth.
Local Anaesthesia

1. Block injection
   Mandibular nerve block (inferior alveolar nerve)
Mandible
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)