MEDICAL EDUCATION RESOURCE

Submandibular Region

Submandibular Region

Introduction

- The submandibular region lies **between the mandible and hyoid bone**, below the floor of the mouth.
- It forms part of the **anterior triangle of the neck**, bounded by:
  - **Superiorly** – Base of mandible.
  - **Inferiorly** – Body of hyoid bone.
  - **Laterally** – Skin and superficial fascia.
  - **Medially** – Mylohyoid and hyoglossus muscles.
- Major contents include:
  - **Suprahyoid muscles**
  - **Submandibular gland and duct (Wharton’s duct)**
  - **Sublingual gland**
  - **Submandibular ganglion**
  - **Facial artery and vein**

Suprahyoid Muscles

These muscles lie **above the hyoid bone** and connect it to the mandible or skull base.
Their main function is to **elevate the hyoid and floor of the mouth during swallowing** and **depress the mandible**.

1. Digastric Muscle

- Has **two bellies**:
    - *Anterior belly* – from digastric fossa of mandible.
    - *Posterior belly* – from mastoid notch of temporal bone.
- **Intermediate tendon** connects both bellies, attached to hyoid by a fibrous loop.
- **Nerve supply:**
    - Anterior belly ? Mylohyoid nerve (from inferior alveolar, V?).
    - Posterior belly ? Facial nerve.
- **Action:** Depresses mandible; elevates hyoid during swallowing.

2. Stylohyoid Muscle

- Origin: Styloid process of temporal bone.
- Insertion: Splits around digastric tendon and attaches to hyoid.
- **Nerve:** Facial nerve.
- **Action:** Pulls hyoid upward and backward.

3. Mylohyoid Muscle

- Forms the **muscular floor of the mouth**.
- Origin: Mylohyoid line of mandible.
- Insertion: Median raphe and hyoid bone.
- **Nerve:** Mylohyoid nerve (branch of inferior alveolar nerve, V?).
- **Action:** Elevates floor of mouth and hyoid.

4. Geniohyoid Muscle

- Lies **above mylohyoid**, below genioglossus.
- Origin: Inferior genial tubercle of mandible.
- Insertion: Hyoid bone.
- **Nerve:** C? fibers through hypoglossal nerve.
- **Action:** Pulls hyoid upward and forward.

Dissection Highlights

- Skin incision along the **lower border of mandible** to expose platysma and superficial fascia.
- Identify **facial vein** (superficial) and **facial artery** (deep).
- Reflect platysma to expose:

- **Anterior and posterior bellies of digastric**
- **Stylohyoid and mylohyoid muscles**

- The **submandibular gland** lies **superficial and deep** to the mylohyoid.

Submandibular Duct (Wharton's Duct)

- It is the **excretory duct** of the **submandibular salivary gland**.
- **Length:** Approximately **5 cm** long.
- **Course:**
  - Begins from the **deep part** of the submandibular gland.
  - Runs **forward and upward** between **mylohyoid** (laterally) and **hyoglossus–genioglossus** (medially).
  - Crossed **superficially by the lingual nerve**, which loops under it.
  - Opens into the **floor of the mouth** at the **sublingual papilla**, on either side of the **frenulum linguae**.
- **Relations:**
  - **Medially:** Hyoglossus, genioglossus.
  - **Laterally:** Mylohyoid, sublingual gland, and mucosa of the floor of mouth.

- **Superiorly:** Lingual nerve (first lateral, then inferior, finally medial to duct).
- **Inferiorly:** Hypoglossal nerve and its accompanying veins.

- **Clinical Anatomy:**
  - The **lingual nerve looping** around the duct is a surgical landmark during duct stone removal (sialolithiasis).
  - The duct may become **obstructed by calculi**—the most common site of **salivary stones** due to the duct's long, upward course.

Sublingual Salivary Gland

- **Smallest** of the three paired major salivary glands.
- **Location:** Beneath the mucosa of the **floor of mouth**, above the **mylohyoid** muscle.
- **Shape:** Almond-shaped and flattened.
- **Weight:** Around **2 grams**.

Relations

- **Superiorly:** Oral mucosa.
- **Inferiorly:** Mylohyoid muscle.
- **Medially:** Genioglossus and submandibular duct.
- **Laterally:** Mandible.

Ducts

- Each gland has about **8–20 small ducts**:
    - The **largest duct (duct of Bartholin)** may join the **submandibular duct**.
    - Others open **independently along the sublingual fold** in the floor of the mouth.

Nerve Supply

- **Secretomotor:** Parasympathetic fibers from **facial nerve** via **chorda tympani** and **submandibular ganglion**.
- **Sympathetic:** From the **superior cervical ganglion**.
- **Sensory:** Lingual nerve.

Clinical Anatomy

- **Ranula** – a cystic swelling due to obstruction of sublingual ducts, resembling a “frog’s belly”.
- **Mucous retention cysts** are common in this gland due to multiple small ducts.

Submandibular Ganglion

- A **small parasympathetic ganglion** associated functionally with the **facial nerve**, though anatomically connected to the **lingual nerve**.
- **Shape:** Oval, about 2–3 mm in size.

- **Location:** Suspended from the **lingual nerve** by **two roots**, on the superficial surface of **hyoglossus**, above the deep part of the submandibular gland.

Connections

- **Parasympathetic root:** From chorda tympani ? joins lingual nerve ? to ganglion.
- **Sympathetic root:** From facial artery plexus (superior cervical ganglion).
- **Sensory root:** From lingual nerve.

Branches

- **To submandibular gland** – postganglionic secretomotor fibers.
- **To sublingual gland** – via lingual nerve branches.

Function

- Relays **secretomotor fibers** to both **submandibular** and **sublingual glands**.

Histology of Submandibular Gland

- **Type:** Predominantly **serous**, with a few mucous alveoli.
- **Acini:**
  - **Serous acini** – pyramidal cells with spherical nuclei; secretory granules in apical cytoplasm.
  - **Mucous acini** – larger, with flattened basal nuclei.

- **Duct System:**
    - Intercalated ? Striated ? Excretory ducts (lined by columnar epithelium).
- **Striated ducts** show **basal striations** due to mitochondria, aiding ion transport.
- **Myepithelial cells** present between acinar cells and basement membrane aid secretion.

Comparison of the Three Major Salivary Glands

FEATURE	PAROTID GLAND	SUBMANDIBULAR GLAND	SUBLINGUAL GLAND
Situation	Below and in front of ear, in parotid fossa	Beneath lower border of mandible	Beneath mucosa of floor of mouth
Type of Secretion	*Purely serous*	*Mixed* (predominantly serous)	*Mixed* (predominantly mucous)
Weight	~25 g	~10–15 g	~2 g
Duct	Stenson’s duct (~5 cm)	Wharton’s duct (~5 cm)	Bartholin’s ducts (8–20 small)
Duct Opening	Opposite upper 2nd molar tooth	Beside frenulum of tongue	Along sublingual fold

FEATURE	PAROTID GLAND	SUBMANDIBULAR GLAND	SUBLINGUAL GLAND
Parasympathetic Source	Glossopharyngeal nerve ? otic ganglion ? auriculotemporal nerve	Facial nerve ? chorda tympani ? submandibular ganglion	Facial nerve ? chorda tympani ? submandibular ganglion (via lingual nerve)
Sympathetic Source	External carotid plexus	Facial artery plexus	Facial artery plexus
Histology	Serous acini only	Mainly serous, some mucous	Mainly mucous, few serous demilunes
Capsule	Dense and unyielding (causes pain in mumps)	Thin and loose	Very thin or absent
Clinical Note	Site of mumps, tumors, and Frey's syndrome	Common site of duct stones (sialolithiasis)	Site of ranula (mucous cyst)

Clinical Anatomy

1. Sialolithiasis (Salivary Calculi)

- Most common in the **submandibular duct** due to:
  - Long upward course against gravity

    - Serous secretion (thicker and more alkaline)
    - Tortuous duct passage
- **Symptoms:** Swelling and pain under jaw, especially during meals (“meal-time syndrome”).
- **Treatment:** Surgical removal of the calculus (ensure lingual nerve is preserved).

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2. Ranula

- Cystic swelling beneath the tongue caused by **obstruction of sublingual duct**.
- Resembles the underbelly of a frog (*rana* = frog).
- **Treatment:** Marsupialization or excision of cyst and sublingual gland.

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3. Sialadenitis

- Inflammation of salivary glands, usually **secondary to infection or duct obstruction**.
- **Parotid gland** ? often affected in *mumps* (paramyxovirus).
- **Submandibular gland** ? bacterial infection from oral cavity due to poor drainage.

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4. Frey’s Syndrome (Auriculotemporal Syndrome)

- Complication after **parotidectomy**.
- Misguided regeneration of **parasympathetic fibers** (that normally stimulate saliva) ? stimulate **sweat glands** on cheek during eating ? *gustatory sweating*.

5. Tumors of Salivary Glands

- **Pleomorphic adenoma:** Most common benign tumor (usually parotid).
- **Mucoepidermoid carcinoma / adenoid cystic carcinoma:** Common malignant forms.
- **Clinical Significance:** In parotid tumors, surgical removal risks **facial nerve injury**.

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6. Nerve Relations in Surgeries

- **Lingual nerve** loops under **Wharton's duct** — easily injured in submandibular duct surgery.
- **Hypoglossal nerve** passes deep to the gland and may be at risk during deep gland excision.

> **Facts to Remember — Submandibular Region**

- **Chorda tympani nerve** carries **secretomotor fibers** to the **submandibular ganglion**. It also conveys **taste sensations** from most of the **anterior two-thirds of the tongue**.
- **Submandibular lymph nodes** are located **both within and outside** the submandibular gland.
    - In **cancer of the tongue**, this gland is often **excised** to remove lymph nodes containing **secondary deposits**.
- The **facial artery** is **tortuous**, allowing it to adapt to **movements of the pharynx**.

    - It is also the **chief arterial supply** to the **palatine tonsil**.

- The **suprahyoid muscles** are arranged in **four layers**:

    1. **First layer:** Digastric and Stylohyoid
    2. **Second layer:** Mylohyoid
    3. **Third layer:** Geniohyoid and Hyoglossus
    4. **Fourth layer:** Genioglossus

- The **submandibular gland** can be **palpated** by placing one finger inside the mouth and one outside the mandible.

- During **surgical excision** of the gland, the **incision** must be made **4 cm below the angle of the jaw** to avoid injuring the **marginal mandibular branch of the facial nerve**.

> **Clinicoanatomical Problem — Submandibular Region**

Clinical Case

A patient is diagnosed with **carcinoma of the tongue**, with the lesion located on the **dorsum near its lateral border**.

Questions

1. Into which lymph nodes will the **cancerous lesion** drain?
2. Which additional structures need to be removed during surgery?

Explanation

- The **lymph from the dorsum of the tongue**, especially near its **lateral border**, drains mainly into the **submandibular group of lymph nodes**.
- Some lymphatic vessels **cross the midline** and drain into the **opposite submandibular lymph nodes**, explaining **bilateral spread** in tongue cancer.
- Since **submandibular lymph nodes** lie **within and around** the **submandibular salivary gland**, this gland must be **removed along with affected lymph nodes** during **neck dissection**.

Surgical Precaution

- The **incision** for gland or lymph node removal is made about **4 cm below the angle of the mandible** to protect the **marginal mandibular branch of the facial nerve**, which runs **posteroinferior** to the angle before curving upward across the jaw.
- **Injury to this nerve** causes **paralysis of the muscles of the lower lip**, leading to facial asymmetry.

Additional Clinicoanatomical Problems — Submandibular Region

1. Submandibular Sialolithiasis (Stone in Wharton's Duct)

Clinical Case:
A 45-year-old patient presents with painful swelling beneath the mandible that worsens during meals.

Explanation:

- The **submandibular duct** has a long, upward, tortuous course and its secretion is **viscous**, predisposing it to **stone formation**.

- When saliva is secreted during eating, the stone **obstructs the duct**, causing **painful distension** of the gland (“meal-time syndrome”).

- **Radiographs** or **sialography** confirm the diagnosis, as the calculus is often **radio-opaque**.

Treatment Note:

- The duct can be incised **intraorally** to remove the stone.

- Care must be taken to **preserve the lingual nerve**, which loops beneath the duct before ascending medially.

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2. Surgical Removal of Submandibular Gland

Clinical Case:
A patient requires excision of the **submandibular gland** due to chronic infection or tumor.

Explanation:

- The **marginal mandibular branch of the facial nerve** runs **posteroinferior to the angle of the mandible** before curving upward.

- During surgery, an incision must be placed **more than 4 cm below the angle of the jaw** to avoid injury.

- Damage to this branch leads to **paralysis of lower lip muscles**, resulting in **facial asymmetry** during smiling.

Precaution:
The nerve also crosses the **submandibular lymph nodes**, so special care is needed during

biopsy or lymph node excision.

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3. Referred Pain from Tongue Carcinoma

Clinical Case:
In **carcinoma of the tongue**, the patient experiences pain in the **mandible or ear**.

Explanation:

- The **lingual nerve**, carrying sensations from the anterior two-thirds of the tongue, joins the **mandibular nerve (V?)**.
- Pain impulses are referred via its branches to **lower teeth, mandible, or external ear**, leading to **misdiagnosed dental or ear pain**.

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4. Lymph Node Metastasis in Tongue Cancer

Clinical Case:
A carcinoma near the **lateral border of the tongue** shows bilateral lymph node enlargement.

Explanation:

- Lymph from this area drains mainly into **submandibular lymph nodes**, but a few vessels **cross the midline**.
- Hence, **bilateral spread** is common, and the **entire submandibular gland with lymph nodes** must be removed during neck dissection.

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5. Spread of Infection from Oral Cavity

Clinical Case:
Dental abscess or infected lower molar leads to swelling under the jaw.

Explanation:

- Infection from the oral cavity can spread to the **submandibular space** via the **mylohyoid gap**.

- This space communicates with the **sublingual and parapharyngeal spaces**, allowing infection to spread rapidly to **deep neck regions** (Ludwig's angina).

Complication:
Untreated infection may cause **airway obstruction** due to elevation of the tongue and floor of the mouth.

Frequently Asked Questions — Submandibular Region

Q1. What are the main salivary glands?
? The three pairs of large salivary glands are:

1. **Parotid gland**
2. **Submandibular gland**
3. **Sublingual gland**

Q2. What type of gland is the submandibular salivary gland?
? It is a **mixed gland**, predominantly **serous** in nature.

Q3. Name the duct of the submandibular gland and its opening site.
? The **submandibular (Wharton's) duct** opens on the **sublingual papilla**, beside the **frenulum of the tongue**.

Q4. Which nerve supplies secretomotor fibers to the submandibular gland?
? **Chorda tympani nerve** (a branch of facial nerve), via the **submandibular ganglion**.

Q5. What is the relation between the lingual nerve and Wharton's duct?
? The **lingual nerve** first lies **lateral**, then **below**, and finally **medial** to the duct — it *loops around it like a hook*.

Q6. Which muscle divides the submandibular gland into two parts?
? The **mylohyoid muscle** divides it into **superficial** and **deep parts**.

Q7. What is the parasympathetic pathway to the submandibular and sublingual glands?
? Facial nerve ? **Chorda tympani** ? **Lingual nerve** ? **Submandibular ganglion** ? Gland.

Q8. What are the common diseases of the submandibular gland?
?

- **Sialolithiasis (salivary calculi)** – stone formation in Wharton's duct.
- **Sialadenitis** – inflammation due to infection or obstruction.
- **Ranula** – cystic swelling due to blocked sublingual ducts.

Q9. What is Frey's syndrome?
? A condition of **gustatory sweating** following **parotid gland surgery**, due to misdirected regeneration of **parasympathetic fibers** that stimulate **sweat glands** instead of salivary glands.

Q10. What is the significance of the marginal mandibular branch of the facial nerve in surgery?
? During submandibular gland excision, incision should be placed **more than 4 cm below the angle of the mandible** to avoid injuring this nerve, which supplies **muscles of the lower lip**.

Multiple Choice Questions — Submandibular Region

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1. Which of the following salivary glands is mixed but predominantly serous?

A. Parotid gland

B. Submandibular gland

C. Sublingual gland

D. Buccal glands

? **Answer:** B. Submandibular gland

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2. The submandibular duct (Wharton’s duct) opens into the oral cavity —

A. Opposite the upper second molar tooth

B. At the tip of the tongue

C. Beside the frenulum of the tongue

D. In the vestibule of the mouth

? **Answer:** C. Beside the frenulum of the tongue

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3. Which muscle divides the submandibular gland into superficial and deep parts?

A. Digastric

B. Stylohyoid

C. Mylohyoid

D. Hyoglossus

? **Answer:** C. Mylohyoid

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4. The submandibular ganglion is functionally related to which cranial nerve?

A. Facial nerve

B. Glossopharyngeal nerve

C. Trigeminal nerve

D. Vagus nerve

? **Answer:** A. Facial nerve

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5. The lingual nerve crosses the submandibular duct —

A. Laterally only

B. Medially only

C. From lateral to medial side

D. From medial to lateral side

? **Answer:** C. From lateral to medial side

6. Which gland is most commonly affected by salivary calculi (sialolithiasis)?

A. Parotid

B. Submandibular

C. Sublingual

D. Buccal

? **Answer:** B. Submandibular

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7. The parasympathetic secretomotor fibers to the submandibular gland reach it through —

A. Auriculotemporal nerve

B. Lingual nerve and submandibular ganglion

C. Glossopharyngeal nerve

D. Great auricular nerve

? **Answer:** B. Lingual nerve and submandibular ganglion

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8. The largest salivary gland is —

A. Parotid

B. Submandibular

C. Sublingual

D. Palatine

? **Answer:** A. Parotid

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9. The ranula is caused by obstruction of —

A. Parotid duct

B. Wharton’s duct

C. Sublingual duct

D. Duct of Bartholin

? **Answer:** C. Sublingual duct

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10. In carcinoma of the tongue, lymph from the anterior two-thirds mainly drains into —

A. Parotid nodes

B. Submandibular nodes

C. Retropharyngeal nodes

D. Deep cervical nodes directly

? **Answer:** B. Submandibular nodes

Viva Voce — Submandibular Region

Q1. What are the boundaries of the submandibular triangle?

? Superiorly by the lower border of the mandible,

? Anteriorly by the anterior belly of digastric,

? Posteriorly by the posterior belly of digastric and stylohyoid.

Q2. What are the main contents of the submandibular triangle?

? Submandibular gland, facial artery and vein, submandibular lymph nodes, and the mylohyoid nerve.

Q3. Which muscle forms the floor of the submandibular triangle?

? The **mylohyoid** forms the main part, with **hyoglossus** and **middle constrictor** deeper to it.

Q4. Which nerve supplies the mylohyoid muscle?

? The **nerve to mylohyoid**, a branch of the **inferior alveolar nerve** (from mandibular division of trigeminal).

Q5. Name the suprahyoid muscles and their nerve supply.

?

- **Digastric:** Anterior belly – mylohyoid nerve; posterior belly – facial nerve.
- **Stylohyoid:** Facial nerve.
- **Mylohyoid:** Mylohyoid nerve.
- **Geniohyoid:** C1 via hypoglossal nerve.

Q6. What type of gland is the submandibular gland?
? It is a **mixed gland**, mainly **serous** in nature.

Q7. Through which nerve does the submandibular gland receive parasympathetic fibers?
? Through the **chorda tympani** branch of the **facial nerve**, relayed in the **submandibular ganglion**.

Q8. What is the course of Wharton's duct?
? It runs forward on the **hyoglossus**, between **mylohyoid and genioglossus**, crossed by the **lingual nerve**, and opens beside the **frenulum of the tongue**.

Q9. What is the relation between Wharton's duct and lingual nerve?
? The **lingual nerve** passes **lateral ? inferior ? medial** to the duct (loops around it).

Q10. What is the embryological origin of the submandibular gland?
? It develops from the **endoderm of the floor of the mouth** around the **6th week of intrauterine life**.

Q11. What are the functions of the submandibular gland?
? Secretes **seromucous saliva** that aids in **digestion, lubrication**, and **maintaining oral pH**.

Q12. Why is submandibular gland prone to calculus formation?
? Because the duct is **long, narrow, and runs upward**; its secretion is **viscous** and **alkaline**, favoring stone deposition.

Q13. What is a ranula?
? A **cystic swelling** in the floor of the mouth due to **obstruction of sublingual ducts**.

Q14. What structures are at risk during submandibular gland excision?
?

- **Marginal mandibular branch** of facial nerve

- **Lingual nerve**
- **Hypoglossal nerve**

Q15. Which gland is most commonly affected in mumps?
? **Parotid gland**, due to its **enclosed fascial capsule** that causes painful swelling.

Q16. What is Frey's syndrome?
? **Gustatory sweating** following parotidectomy due to misdirected parasympathetic fibers supplying sweat glands.

Q17. How can the submandibular gland be palpated?
? One finger is placed **in the floor of the mouth** and another **beneath the mandible** — the gland lies between them.

Q18. Which nerve supplies the geniohyoid muscle?
? **C1 fibers** carried by the **hypoglossal nerve**.

Q19. Which artery supplies the submandibular gland?
? Branches of the **facial artery** and **lingual artery**.

Q20. What is the importance of the submandibular lymph nodes clinically?
? They drain the **face, tongue, and floor of mouth** — often enlarged in **tongue carcinoma** or **oral infections**.