

# Submandibular Region

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## 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**

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## 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.

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### 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.

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## 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.

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### 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**.

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

FEATURE	PAROTID GLAND	SUBMANDIBULAR GLAND	SUBLINGUAL GLAND
<b>Parasympathetic Source</b>	Glossopharyngeal nerve ? otic ganglion ? auriculotemporal nerve	Facial nerve ? chorda tympani ? submandibular ganglion	Facial nerve ? chorda tympani ? submandibular ganglion (via lingual nerve)
<b>Sympathetic Source</b>	External carotid plexus	Facial artery plexus	Facial artery plexus
<b>Histology</b>	Serous acini only	Mainly serous, some mucous	Mainly mucous, few serous demilunes
<b>Capsule</b>	Dense and unyielding (causes pain in mumps)	Thin and loose	Very thin or absent
<b>Clinical Note</b>	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**.

## 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 **suprathyroid 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**.

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## 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**

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#### **Q2. What type of gland is the submandibular salivary gland?**

? It is a **mixed gland**, predominantly **serous** in nature.

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#### **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**.

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#### **Q4. Which nerve supplies secretomotor fibers to the submandibular gland?**

? **Chorda tympani nerve** (a branch of facial nerve), via the **submandibular ganglion**.

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#### **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*.

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#### **Q6. Which muscle divides the submandibular gland into two parts?**

? The **mylohyoid muscle** divides it into **superficial** and **deep** parts.

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#### **Q7. What is the parasympathetic pathway to the submandibular and sublingual glands?**

? Facial nerve ? Chorda tympani ? Lingual nerve ? Submandibular ganglion ? Gland.

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

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

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#### **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.

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#### **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**

**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

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**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 suprathyroid 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.

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**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**.

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**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**.

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**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).

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**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**.

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**Q11. What are the functions of the submandibular gland?**

? Secretes **seromucous saliva** that aids in **digestion**, **lubrication**, and **maintaining oral pH**.

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**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.

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**Q13. What is a ranula?**

? A **cystic swelling** in the floor of the mouth due to **obstruction of sublingual ducts**.

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

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- **Marginal mandibular branch** of facial nerve

- Lingual nerve

- Hypoglossal nerve

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**Q15. Which gland is most commonly affected in mumps?**

? Parotid gland, due to its **enclosed fascial capsule** that causes painful swelling.

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**Q16. What is Frey's syndrome?**

? **Gustatory sweating** following parotidectomy due to misdirected parasympathetic fibers supplying sweat glands.

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**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.

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**Q18. Which nerve supplies the geniohyoid muscle?**

? **C1 fibers** carried by the **hypoglossal nerve**.

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**Q19. Which artery supplies the submandibular gland?**

? Branches of the **facial artery** and **lingual artery**.

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**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**.