MEDICAL EDUCATION RESOURCE

Mouth and Pharynx

Oral Cavity

- The **oral cavity** is the entrance of the digestive and respiratory tracts.
- Used for **ingestion of food and fluids**, **speech**, and **respiration**.
- Posteriorly continues into the **oropharynx**, which communicates with:
    - **Nasal cavity** above (through nasopharynx).
    - **Laryngeal inlet** below.
- The **roof** is formed by **hard and soft palates**.
- The **tongue** forms the floor and occupies most of the cavity.
- Contains **32 teeth in adults**.

Divisions of the Oral Cavity

1. **Vestibule of Mouth**
    - Space between **cheeks/lips (externally)** and **teeth/gums (internally)**.
    - **Communications:**
        - With exterior ? via **oral fissure (mouth opening)**.

        - With oral cavity proper ? behind **last molar teeth** (even when closed).

    - **Openings in Vestibule:**

        - **Parotid duct** opens opposite the **upper second molar**.

        - **Small mucous glands (labial, buccal, and molar glands)** open into vestibule.

    - **Lining:** Mucous membrane forms **frenula of lips** (median folds connecting lips to gums).

Clinical Anatomy:

- **Parotid duct papilla** allows dye injection for locating calculi in the duct or gland.

- **Koplik's spots** — small white pinpoint spots around the parotid duct opening, seen in **measles** (diagnostic sign).

Oral Cavity Proper

- Bounded **anteriorly and laterally** by teeth and gums.

- Roof formed by **palates**; floor mainly by **tongue and mucosa**.

- Lined by **stratified squamous epithelium**, keratinized in areas of friction (gums, hard palate).

- Contains **openings of submandibular and sublingual ducts** under the tongue.

Lips

- Fleshy folds forming the boundary of the oral fissure.
- Each lip composed of:
    - Skin ? superficial fascia ? orbicularis oris ? submucosa (with glands) ? mucous membrane.
- The **frenulum** connects inner lip surface to gum.
- **Philtrum:** Vertical groove on upper lip.
- **Lymph drainage:**
    - Central lower lip ? **submental nodes**.
    - Lateral lip ? **submandibular nodes**.

Cheeks (Buccae)

- Form lateral walls of oral cavity.
- Layers:
    - Skin ? superficial fascia (with facial muscles, parotid duct, glands, vessels, and nerves) ? **buccinator muscle** (pierced by parotid duct) ? mucosa.
- **Buccal fat pad** is well developed in infants, aiding in suckling.
- **Lymph drainage:** Submandibular, preauricular, and buccal nodes.

Nerve Supply of Gums

PART	NERVE SUPPLY
Upper gums (labial)	Posterior, middle, and anterior **superior alveolar nerves** (V2)
Upper gums (lingual)	**Anterior palatine** and **nasopalatine nerves**
Lower gums (labial)	**Buccal branch of mandibular nerve** and **incisive branch of mental nerve** (V3)
Lower gums (lingual)	**Lingual nerve (V3)**

Lymphatic Drainage:

- **Upper gums** ? submandibular nodes.
- **Lower anterior gums** ? submental nodes.
- **Lower posterior gums** ? submandibular nodes.

Clinical Anatomy

- **Ludwig's Angina:**
  - Cellulitis of the **floor of mouth**, causing upward displacement of tongue and swelling below chin.
  - Usually arises from **infection of a carious molar tooth**.
- **Gingivitis:**

    - Inflammation and bleeding of gums, often due to poor oral hygiene or vitamin C deficiency (scurvy).

- **Dental Caries:**
    - Demineralization and decay of enamel and dentine due to bacterial infection.

Teeth

Structure

- Each tooth has three parts: **Crown**, **Neck**, and **Root**.
- **Dentine** forms the main structure, secreted by **odontoblasts** lining the pulp cavity.
- **Enamel** is the hardest body substance, covering the crown.
- **Cementum** covers the root and connects to the **periodontal membrane**, which anchors the tooth in its socket.

Types and Functions

- **Incisors** – cutting teeth.
- **Canines** – tearing teeth.
- **Premolars** – crushing teeth.
- **Molars** – grinding teeth.

Roots

- Upper molars – three roots.
- Lower molars – two roots.

Eruption

- **Deciduous teeth** appear by 6 months and complete by 2 years.
- **Permanent teeth** start erupting around 6 years; third molar (wisdom tooth) appears by 17–25 years.

Blood Supply and Nerves

- Supplied by **maxillary artery branches** and **superior and inferior alveolar nerves**.

Clinical Anatomy

- **Pyorrhoea (periodontitis):** Infection with pus discharge between tooth and gum.
- **Dental caries:** Demineralization of enamel and dentine.
- **Apical abscess:** Infection at the root apex following pulp necrosis.
- **Hutchinson's teeth:** Notched upper incisors seen in congenital syphilis.
- **Impacted wisdom tooth:** Common cause of severe jaw pain.
- **"Eye tooth" infection:** Upper canine root near medial eye angle may cause facial vein thrombosis.
- **Tooth eruption pattern** helps estimate age clinically and forensically.

Stages of Development of Deciduous Teeth

1. **Dental Lamina Stage (6th week):**
    - Thickening of oral epithelium along alveolar margins forms dental lamina.
2. **Bud Stage:**
    - Ten epithelial buds arise ? form **tooth buds**.
3. **Cap Stage:**
    - Buds invaginated by mesenchyme ? form **enamel organ** and **dental papilla** (tooth germ).
4. **Bell Stage:**
    - **Ameloblasts** form enamel; **odontoblasts** form dentine.
    - Mesenchyme forms **pulp**.
5. **Root Formation:**
    - Odontoblasts ? dentine; cementoblasts ? cementum.
    - Pulp cavity narrows ? root canal.

Germ Layer Origins

- **Ectoderm:** Enamel.
- **Neural crest mesenchyme:** Dentine, pulp, cementum, periodontal ligament.

Molecular Regulation of Tooth Development

- Tooth development depends on **epithelial–mesenchymal interactions**.
- **Patterning** of different teeth controlled by **HOX genes**.
- Key signaling molecules:
  - **BMPs (Bone Morphogenetic Proteins)**
  - **FGFs (Fibroblast Growth Factors)**
  - **WNTs**
  - **SHH (Sonic Hedgehog)**
- **Transcription factors:** MSX1, MSX2, PAX9.
- **Enamel knot:** A transient signaling center that controls cusp shape through secretion of **FGF4, BMP2, BMP4, SHH**.

Hard Palate

Boundaries

- **Anterior 2/3:** Palatine processes of maxillae.
- **Posterior 1/3:** Horizontal plates of palatine bones.
- **Superior surface:** Floor of nasal cavity.
- **Inferior surface:** Roof of oral cavity.

- **Posterior margin:** Continuous with soft palate.

Structures on Inferior Surface

- **Incisive fossa:** Transmits nasopalatine nerves and vessels.
- **Greater palatine foramina:** Transmit greater palatine nerves and vessels.
- **Lesser palatine foramina:** Transmit lesser palatine nerves and vessels.

Nerve and Blood Supply

- **Arteries:** Greater and lesser palatine arteries (from maxillary artery).
- **Nerves:** Greater and nasopalatine nerves (from pterygopalatine ganglion).
- **Lymphatics:** Drain into deep cervical and retropharyngeal nodes.

Dissection of Hard Palate

- Perform **sagittal section** of the head and neck passing through nasal septum, palate, and tongue.
- Strip **mucoperiosteum** to expose palatine processes and foramina.
- Reflect soft palate to identify **palatoglossus**, **palatopharyngeus**, **tensor veli palatini**, and **levator veli palatini** muscles.

Soft Palate

- A **movable muscular fold** hanging from the posterior border of the hard palate.

- **Separates** nasopharynx from oropharynx.
- Has **two surfaces** (anterior, posterior) and **two borders** (superior, inferior).
- **Anterior surface:** concave, faces mouth; marked by median raphe.
- **Posterior surface:** convex, continuous with nasal cavity floor.
- **Superior border:** attached to posterior border of hard palate.
- **Inferior border:** free, forming pharyngeal isthmus with a conical projection called **uvula**.
- From base of uvula arise two folds:
    - **Palatoglossal arch (anterior pillar):** contains palatoglossus muscle.
    - **Palatopharyngeal arch (posterior pillar):** contains palatopharyngeus muscle.
    - Between them lies the **tonsillar fossa** with the **palatine tonsil**.

Structure:
Formed of mucous membrane enclosing:

- **Palatine aponeurosis** (flattened tendon of tensor veli palatini).
- **Muscles, vessels, nerves, mucous glands, and lymphoid tissue.**

Muscles of the Soft Palate

1. Tensor veli palatini

- **Origin:** Scaphoid fossa of sphenoid, lateral side of auditory tube.

- **Insertion:** Forms palatine aponeurosis.
- **Action:** Tenses soft palate; opens auditory tube during swallowing.
- **Nerve supply:** Mandibular nerve.

2. Levator veli palatini

- **Origin:** Inferior aspect of auditory tube, petrous temporal bone.
- **Insertion:** Palatine aponeurosis.
- **Action:** Elevates soft palate during swallowing.
- **Nerve supply:** Pharyngeal plexus.

3. Musculus uvulae

- **Origin:** Posterior nasal spine and palatine aponeurosis.
- **Insertion:** Mucosa of uvula.
- **Action:** Shortens and elevates uvula.
- **Nerve supply:** Pharyngeal plexus.

4. Palatoglossus

- **Origin:** Palatine aponeurosis.
- **Insertion:** Side of tongue.
- **Action:** Elevates tongue and narrows oropharyngeal isthmus.

- **Nerve supply:** Pharyngeal plexus.

5. Palatopharyngeus

- **Origin:** Hard palate and aponeurosis.
- **Insertion:** Pharyngeal wall.
- **Action:** Elevates pharynx and larynx during swallowing.
- **Nerve supply:** Pharyngeal plexus.

Note: All muscles supplied by **pharyngeal plexus (via vagus)** except **tensor veli palatini** (mandibular nerve).

Passavant's Ridge:
Formed by circular fibers of palatopharyngeus; aids in closing nasopharynx during swallowing.

Clinical Anatomy of Soft Palate

- **Cleft palate:** Failure of fusion of palatal processes ? communication between oral and nasal cavities.
- **Paralysis (vagus lesion):** Causes nasal regurgitation, nasal twang in voice, uvula deviates to normal side.
- **Heimlich manoeuvre:** Emergency technique for foreign-body obstruction — abdominal thrusts expel airway block.

Development of Palate

- **Anterior (primary) palate:** From fusion of medial nasal folds ? premaxilla with four incisor teeth.

- **Posterior (secondary) palate:** From fusion of maxillary shelves and palatine processes.
- **Soft palate:** Formed from unossified posterior part of these shelves.
- **Cleft palate:** Due to non-fusion of these processes; may be partial (soft palate only) or complete (with harelip).

Pharynx

- A **fibromuscular tube** (~12 cm long) behind nose, mouth, and larynx.
- Functions as a **common pathway** for food and air.

Extent and Boundaries

- **Superior:** Base of skull (posterior sphenoid and occipital).
- **Inferior:** Continuous with oesophagus at level of C6.
- **Anterior:** Opens into nasal cavity, oral cavity, and larynx.
- **Posterior:** Related to prevertebral fascia.
- **Lateral:** Related to styloid apparatus, carotid arteries, and cranial nerves IX–XII.

Dimensions:

- Widest at upper part (3.5 cm); narrowest at lower end (just above oesophagus).

Parts of the Pharynx

1. **Nasopharynx:**

- Above soft palate.
- Contains **pharyngeal tonsil** and **opening of auditory tube**.

2. **Oropharynx:**
   - Behind oral cavity.
   - Contains **palatine tonsils** between palatoglossal and palatopharyngeal arches.
3. **Laryngopharynx (Hypopharynx):**
   - Extends from upper border of epiglottis to lower border of cricoid cartilage.
   - Leads into oesophagus.

Waldeyer’s Lymphatic Ring

- Circular arrangement of lymphoid tissue guarding entrances of pharynx:
  - **Pharyngeal tonsil (nasopharynx)**
  - **Tubal tonsils (around auditory tubes)**
  - **Palatine tonsils (oropharynx)**
  - **Lingual tonsil (base of tongue)**
- Acts as a **defensive ring** against infections entering via air or food.

Clinical Anatomy of Pharynx

- **Pharyngitis:** Inflammation due to infection.
- **Adenoids:** Enlarged pharyngeal tonsil causing nasal obstruction and deafness in children.
- **Peritonsillar abscess (quinsy):** Infection spreading around tonsil.
- **Nasopharyngeal carcinoma:** Commonly arises near pharyngeal recess (fossa of Rosenmüller).

Palatine Tonsil (The Tonsil)

Location and Features

- The **palatine tonsil** occupies the **tonsillar fossa** between the **palatoglossal** and **palatopharyngeal arches**.
- It is **almond-shaped**, about **2 cm long**.
- Has **two surfaces (medial and lateral)**, **two borders (anterior and posterior)**, and **two poles (upper and lower)**.
- **Medial surface:** Faces oropharynx, covered with **stratified squamous epithelium**; contains **12–15 crypts** (largest is **intratonsillar cleft**).
- **Lateral surface:** Covered by **fibrous capsule** (from pharyngobasilar fascia); separates tonsil from **superior constrictor muscle**.
- **Bed of the tonsil:** From within outwards — pharyngobasilar fascia, superior constrictor, and buccopharyngeal fascia.

Relations

- **Anterior border:** Palatoglossal arch.
- **Posterior border:** Palatopharyngeal arch.
- **Upper pole:** Related to soft palate.
- **Lower pole:** Related to tongue.

Vessels and Nerves

- **Arterial supply:**
    - Tonsillar branch of **facial artery (main)**.
    - Ascending palatine (facial artery).
    - Dorsal lingual (lingual artery).
    - Ascending pharyngeal (external carotid).
    - Greater palatine (maxillary artery).
- **Venous drainage:** To **paratonsillar vein** and **pharyngeal/facial veins**.
- **Lymphatic drainage:** To **jugulodigastric node** (deep cervical).
- **Nerve supply: Glossopharyngeal** and **lesser palatine nerves**.

Clinical Anatomy

- **Tonsillitis:** Inflammation with sore throat, fever, and difficulty swallowing.

- **Peritonsillar abscess (quinsy):** Pus between capsule and pharyngeal wall, starting from **intratonsillar cleft**.
- **Referred ear pain:** Via glossopharyngeal nerve (shared sensory supply).
- **Tonsillectomy:**
  - Done in chronic tonsillitis.
  - Risk of hemorrhage from **external palatine vein** or **tonsillar branch of facial artery**.
  - **Glossopharyngeal nerve** may be injured, causing taste loss in posterior 1/3 of tongue.
- **Adenoids:** Hypertrophied nasopharyngeal tonsils may obstruct air passage, especially in children.

Histology

- Covered by **non-keratinized stratified squamous epithelium** forming **deep crypts**.
- **Lymphoid tissue** organized into nodules around crypts; no cortex or medulla differentiation.
- **Crypts** lined by reticulated epithelium that traps microorganisms and stimulates lymphocytes.

Development

- Develops from **endoderm of second pharyngeal pouch**.

- The **intratonsillar cleft** represents the remnant of the pouch opening.
- **Lymphocytes** are derived from **mesoderm** (mesenchyme).

Laryngeal Part of Pharynx (Laryngopharynx)

- Extends from **upper border of epiglottis** to **lower border of cricoid cartilage**.
- **Anterior wall:**
    - Inlet of larynx, posterior surfaces of arytenoid and cricoid cartilages.
- **Posterior wall:** Supported by **C4–C6 vertebrae**; formed by pharyngeal constrictors.
- **Lateral wall:**
    - Contains **piriform fossa** (one on each side of laryngeal inlet).
    - Bounded medially by **aryepiglottic fold** and laterally by **thyroid cartilage and thyrohyoid membrane**.
    - The **internal laryngeal nerve** lies under mucosa here — vulnerable during removal of foreign bodies.
- **Lining epithelium:** Stratified squamous non-keratinized.
- **Function:** Passage for food; directs bolus into esophagus.

Structure of the Pharynx

From **inside outward**, five layers are recognized:

1. **Mucous membrane** – epithelium varies by region.
2. **Submucosa** – contains lymphoid tissue and glands.
3. **Pharyngobasilar fascia** – fibrous layer forming internal framework; thickest above superior constrictor.
4. **Muscular coat** – outer circular (constrictors) and inner longitudinal (elevators).
5. **Buccopharyngeal fascia** – outermost layer continuous with fascia of neck.

Muscles of the Pharynx

A. Circular (Constrictor) Muscles

1. **Superior constrictor** – from medial pterygoid plate, pterygomandibular raphe; forms pharyngeal wall.
2. **Middle constrictor** – from hyoid bone; overlaps inferior constrictor.
3. **Inferior constrictor** – from thyroid and cricoid cartilages; continuous with esophagus.

B. Longitudinal Muscles

1. **Stylopharyngeus** – from styloid process; enters pharynx between superior and middle constrictors.
2. **Palatopharyngeus** – from soft palate to pharyngeal wall.
3. **Salpingopharyngeus** – from auditory tube to pharynx.

Nerve Supply

- All muscles by **pharyngeal plexus (via vagus)**, except **stylopharyngeus** (glossopharyngeal nerve).

Actions

- **Constrictors:** Propel bolus into esophagus (peristaltic action).
- **Longitudinals:** Elevate pharynx and larynx during swallowing.

Structures in Between Pharyngeal Muscles

1. Between Base of Skull and Superior Constrictor (Sinus of Morgagni)

- This is a **semilunar gap** closed by the **pharyngobasilar fascia**.
- Structures passing through it:
    - Auditory (Eustachian) tube.
    - Levator veli palatini muscle.
    - Ascending palatine artery.
    - Palatine branch of ascending pharyngeal artery.

2. Between Superior and Middle Constrictors

- Structures passing through:
    - **Stylopharyngeus muscle.**
    - **Glossopharyngeal nerve.**

3. Between Middle and Inferior Constrictors

- Structures passing through:
    - **Internal laryngeal nerve.**
    - **Superior laryngeal vessels.**

4. Below Inferior Constrictor (Between it and Esophagus)

- Structures passing through:
    - **Recurrent laryngeal nerve.**
    - **Inferior laryngeal vessels.**

Dissection Steps

- Expose the **attachments of middle and inferior constrictors**.
- Identify **structures passing through gaps** between the constrictors.
- Note **tensor veli palatini** and its relation to the auditory tube.
- Observe **pharyngeal plexus** on the middle constrictor.
- Identify the **superior laryngeal and recurrent laryngeal nerves** below the constrictor levels.

Killian’s Dehiscence

- A **potential weak area** between the **thyropharyngeus** and **cricopharyngeus** parts of the **inferior constrictor**.
- The two parts have **different nerve supplies**:
    - Thyropharyngeus ? **pharyngeal plexus (vagus)**.
    - Cricopharyngeus ? **recurrent laryngeal nerve**.
- During swallowing, lack of coordination may cause failure of cricopharyngeus to relax ? **formation of a pharyngeal diverticulum** (Killian's diverticulum).
- Seen clinically as **pouching of mucosa**, leading to **regurgitation of food** and **dysphagia**.

Clinical Anatomy

- **Dysphagia:** Difficulty in swallowing due to muscle incoordination or mechanical obstruction.
- **Pharyngeal diverticulum:** Herniation of mucosa through Killian's dehiscence; may enlarge with time and retain food.
- **Foreign bodies:** May lodge in piriform fossa; injury here endangers the internal laryngeal nerve, causing loss of sensation above vocal cords.

Nerve Supply of Pharynx

- **Pharyngeal plexus** lies mainly on the middle constrictor.
- Components:

- **Pharyngeal branch of vagus** (carrying cranial accessory fibers).
- **Pharyngeal branches of glossopharyngeal nerve.**
- **Sympathetic branches** from superior cervical ganglion.

Functional Components

- **Motor fibers:** To all pharyngeal muscles (via vagus), except **stylopharyngeus** (via glossopharyngeal nerve).
- **Sensory fibers:**
  - Oropharynx ? glossopharyngeal nerve.
  - Nasopharynx ? maxillary nerve (via pterygopalatine ganglion).
  - Soft palate and tonsil ? lesser palatine and glossopharyngeal nerves.
- **Taste fibers:** From vallecula and epiglottis via **internal laryngeal nerve (vagus)**.
- **Parasympathetic fibers:** From **lesser palatine branches** of pterygopalatine ganglion.

Blood Supply of Pharynx

Arterial Supply

- Ascending pharyngeal artery (external carotid).
- Ascending palatine and tonsillar branches (facial artery).
- Dorsal lingual branches (lingual artery).

- Greater palatine, pharyngeal, and pterygoid branches (maxillary artery).

Venous Drainage

- **Pharyngeal venous plexus** on posterolateral pharyngeal wall.
- Drains into **internal jugular** and **facial veins**.

Lymphatic Drainage of Pharynx

- **Nasopharynx:** Retropharyngeal and upper deep cervical nodes.
- **Oropharynx:** Deep cervical nodes (mainly jugulodigastric).
- **Laryngopharynx:** Deep cervical and paratracheal nodes.

Deglutition (Swallowing)

Definition:
The process of **swallowing food** involves coordinated muscular actions in three stages.

First Stage – Voluntary Phase

- The **anterior part of the tongue** presses against the **hard palate**, pushing food backward.
- **Superior longitudinal and transverse muscles of the tongue** form the bolus and propel it posteriorly.
- **Soft palate** lowers onto the tongue to help shape the bolus.

- **Hyoid bone** moves upward and forward by **suprahyoid muscles**.
- **Palatoglossal arches** approximate to close the oropharyngeal isthmus.
  ? Bolus enters the **oropharynx**, beginning the next stage.

Second Stage – Involuntary (Pharyngeal Phase)

- **Soft palate** elevates by **levator and tensor veli palatini**, closing the **nasopharynx**.
- **Passavant's ridge** of palatopharyngeus helps seal the posterior wall.
- **Laryngeal inlet** closes by the **aryepiglottic folds** to prevent food entering the airway.
- **Larynx and pharynx** elevate behind the hyoid by longitudinal muscles.
- **Superior and middle constrictors** contract, pushing the bolus downward over the **epiglottis** into the laryngopharynx.

Third Stage – Involuntary (Esophageal Phase)

- **Inferior constrictors** contract sequentially to push food from the **lower pharynx into the esophagus**.
- Passage aided by gravity and peristaltic action.

Development of the Pharynx

- The **primitive gut** extends from **buccopharyngeal membrane** (cranially) to **cloacal membrane** (caudally).
- Divided into: **pharynx**, **foregut**, **midgut**, and **hindgut**.

- The **pharynx** extends from the **buccopharyngeal membrane** to the **tracheobronchial diverticulum**, and is subdivided into:
    - **Nasopharynx** (upper part)
    - **Oropharynx** (middle part)
    - **Laryngopharynx** (lower part)
- Derivatives from **pharyngeal arches and pouches** form its walls, muscles, and glands.

Pharyngotympanic Tube (Auditory / Eustachian Tube)

Definition:
A **trumpet-shaped channel** connecting the **middle ear cavity** to the **nasopharynx**, maintaining equal air pressure on both sides of the tympanic membrane.

Length and Direction:

- About **4 cm long**, directed **downward, forward, and medially**.
- Makes an angle of **45° with the sagittal** and **30° with the horizontal plane**.

Parts

1. **Bony Part**
    - Posterior one-third (12 mm), within the **petrous temporal bone**.
    - Opens on the **anterior wall of the middle ear cavity**.
    - Narrow medial end forms **isthmus** attaching to cartilaginous part.

2. **Cartilaginous Part**
    - Anterior two-thirds (25 mm), lies between **greater wing of sphenoid** and **petrous apex**.
    - Formed by a **triangular cartilage plate** curled to make superior and medial walls; floor is fibrous.
    - Medial end opens into the **nasopharynx** forming the **tubal elevation**.

Relations

- **Superior:** Canal for **tensor tympani** muscle.
- **Medial: Carotid canal**.
- **Lateral: Chorda tympani**, **spine of sphenoid**, **auriculotemporal nerve**, and **TMJ**.

Lining Epithelium:
Ciliated columnar epithelium with goblet cells (respiratory type).

Muscles Associated:

- **Tensor veli palatini** and **levator veli palatini** help open the tube during swallowing and yawning.

Clinical Anatomy

- **Function:** Equalizes air pressure between middle ear and atmosphere.
- **Infection:** Nasal infections can spread to the middle ear through this tube, causing **otitis media**.

- **Blockage:** Common in children due to horizontal orientation and shorter tube ? **earache, hearing loss, or effusion**.
- **Patulous tube:** Abnormally open tube causing echoing or autophony (hearing one's own voice loudly).
- **In infants:** Tube more horizontal and wide, predisposing to middle ear infections.

Mnemonics

Tonsils — "PPLT (People) have tonsils"

- **P** ? Pharyngeal tonsil
- **P** ? Palatine tonsil
- **L** ? Lingual tonsil
- **T** ? Tubal tonsil

Muscles Supplied by Vagoaccessory Complex
All muscles of the pharynx and soft palate are supplied by the vagoaccessory complex, ***except two:***

- **Stylopharyngeus** ? supplied by **Glossopharyngeal nerve (IX)**
- **Tensor veli palatini** ? supplied by **Mandibular nerve (V3)**

Openings in the Pharynx (Top to Bottom)
"**Two Nostrils, One Mouth, One Larynx, One Esophagus**"
? Openings into the **nasopharynx**, **oropharynx**, and **laryngopharynx** respectively.

Facts to Remember

- Both **maxillary and mandibular teeth** are supplied by **branches of the maxillary artery** .
- **Upper teeth** ? branches of **maxillary nerve**.
- **Lower teeth** ? branches of **mandibular nerve**.
- **Waldeyer’s ring** is formed by:
    - Lingual tonsil
    - Palatine tonsils
    - Tubal tonsils
    - Nasopharyngeal (pharyngeal) tonsil
- All **three constrictors** and **two longitudinal muscles** of the pharynx are supplied by the **vagoaccessory complex**, except **stylopharyngeus**, which is supplied by **glossopharyngeal nerve**.
- The **pharyngotympanic tube** connects the **middle ear cavity** with the **nasopharynx**, maintaining air pressure balance.
- **Killian’s dehiscence** is the weak area between **thyropharyngeus** and **cricopharyngeus**, a site prone to **pharyngeal diverticulum**.
- **Jugulodigastric node** is the main lymph node draining the **tonsil** and **pharynx**.
- **Passavant’s ridge**, a mucosal elevation formed by **palatopharyngeus**, aids in closing the **nasopharyngeal isthmus** during swallowing.

Clinicoanatomical Problem

Case:
A 12-year-old boy presents with **sore throat**, **earache**, **fever (102°F)**, and **difficulty in swallowing**. He is also a **mouth breather**.

Questions and Explanations

1. What is Waldeyer's lymphatic ring?

- A circular collection of **lymphoid tissue** guarding the entrance of the pharynx.
- Formed by:
  - **Pharyngeal tonsil** (posteriorly)
  - **Tubal tonsils** (posterolaterally)
  - **Palatine tonsils** (laterally)
  - **Lingual tonsil** (anteriorly)
- Functions as the **first line of immune defense** for the upper respiratory and digestive tracts.

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2. Explain the basis of the boy's earache.

- **Infection of the throat** (pharyngitis or tonsillitis) spreads to the **middle ear** through the **pharyngotympanic (Eustachian) tube**.
- The tube connects the **nasopharynx** to the **middle ear cavity**, allowing passage of pathogens.

- Additionally, the **glossopharyngeal nerve (IX)** supplies both **pharynx and middle ear**, causing **referred pain** from the throat to the ear.

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3. Which lymph node is likely to be swollen and tender?

- The **jugulodigastric lymph node** (upper deep cervical group) is enlarged.
- It receives lymph from the **palatine tonsil** and adjacent pharyngeal walls.
- The swelling causes **pain and tenderness** during swallowing or head movement.

Summary

- **Diagnosis:** Acute tonsillitis with referred otalgia.
- **Complication:** Middle ear infection due to spread through Eustachian tube.
- **Anatomical correlation:** Shared innervation by glossopharyngeal nerve and lymphatic drainage via jugulodigastric node

Frequently Asked Questions

1. Describe the nerve supply and actions of the muscles of the soft palate. Add a note on its development and congenital anomalies.

- **Muscles:** Tensor veli palatini, levator veli palatini, palatoglossus, palatopharyngeus, musculus uvulae.
- **Nerve supply:**
    - Tensor veli palatini ? Mandibular nerve (V?).

- Remaining muscles ? Pharyngeal plexus (via vagus).

- **Actions:**
  - Tensor & levator veli palatini elevate the palate during swallowing.
  - Palatoglossus closes the oropharyngeal isthmus.
  - Palatopharyngeus elevates the pharynx.
  - Musculus uvulae shortens and raises the uvula.

- **Development:** From the **4th pharyngeal arch**.

- **Anomaly:** Failure of fusion ? **Cleft palate**.

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2. Enumerate the components of Waldeyer's ring. Describe the palatine tonsil in detail. Add its clinical importance.

- **Components:** Pharyngeal, tubal, palatine, and lingual tonsils.

- **Palatine tonsil:** Lies in **tonsillar fossa** between palatoglossal and palatopharyngeal arches; covered by stratified squamous epithelium; drained by paratonsillar vein.

- **Clinical importance:**
  - Infection ? Tonsillitis.
  - Referred ear pain ? via glossopharyngeal nerve.
  - Enlarged jugulodigastric node in tonsillar inflammation.

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3. Describe the pharyngotympanic (Eustachian) tube and its clinical relevance.

- Connects **middle ear cavity** to **nasopharynx**.
- Equalizes pressure across tympanic membrane.
- Opened by **tensor and levator veli palatini** during swallowing.
- **Clinical relevance:** Infections may spread from nasopharynx ? **Otitis media**; tube blockage ? earache or deafness.

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4. What are the stages of deglutition (swallowing)?

- **Stage 1 (Voluntary):** Tongue pushes bolus backward into oropharynx.
- **Stage 2 (Involuntary):** Soft palate elevates; laryngeal inlet closes; pharyngeal constrictors propel bolus downward.
- **Stage 3 (Involuntary):** Bolus enters esophagus; peristalsis completes swallowing.

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5. Enumerate the muscles of the pharynx with their nerve supply.

- **Constrictors:** Superior, middle, and inferior (via vagus through pharyngeal plexus).
- **Longitudinal muscles:** Stylopharyngeus (glossopharyngeal), palatopharyngeus (vagus), salpingopharyngeus (vagus).

---

6. Mention the blood supply and lymphatic drainage of the pharynx.

- **Arteries:** Ascending pharyngeal, ascending palatine, tonsillar, and dorsal lingual branches.
- **Veins:** Pharyngeal venous plexus ? internal jugular vein.

- **Lymphatics:** Retropharyngeal and deep cervical lymph nodes.

Multiple Choice Questions

1. Which muscle of the soft palate is supplied by the mandibular nerve?
A. Palatopharyngeus
B. Palatoglossus
C. Tensor veli palatini
D. Levator veli palatini
? Answer: C. Tensor veli palatini

---

2. Killian's dehiscence is a weak area between:
A. Superior and middle constrictors
B. Middle and inferior constrictors
C. Thyropharyngeus and cricopharyngeus
D. Stylopharyngeus and palatopharyngeus
? Answer: C. Thyropharyngeus and cricopharyngeus

---

3. The intratonsillar cleft represents the remnant of:
A. First pharyngeal pouch
B. Second pharyngeal pouch
C. Third pharyngeal pouch
D. Fourth pharyngeal pouch
? Answer: B. Second pharyngeal pouch

---

4. The lymph from the palatine tonsil primarily drains into which node?
A. Submandibular
B. Parotid
C. Retropharyngeal
D. Jugulodigastric
? Answer: D. Jugulodigastric

---

5. Which of the following opens into the nasopharynx?

A. Auditory tube

B. Esophagus

C. Larynx

D. Mouth

? Answer: A. Auditory tube

---

6. Waldeyer’s ring includes all except:

A. Palatine tonsil

B. Pharyngeal tonsil

C. Tubal tonsil

D. Submandibular gland

? Answer: D. Submandibular gland

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7. The motor nerve of the pharynx is:

A. Vagus

B. Glossopharyngeal

C. Accessory

D. Mandibular

? Answer: A. Vagus

---

8. Stylopharyngeus muscle is supplied by:

A. Vagus nerve

B. Glossopharyngeal nerve

C. Mandibular nerve

D. Facial nerve

? Answer: B. Glossopharyngeal nerve

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9. The auditory tube is opened during swallowing by:

A. Palatoglossus

B. Levator veli palatini

C. Tensor veli palatini

D. Musculus uvulae

? Answer: C. Tensor veli palatini

10. The cleft palate results from failure of fusion between:

A. Lateral nasal and maxillary processes

B. Medial nasal and maxillary processes

C. Palatine shelves of maxillae

D. Mandibular processes

? Answer: C. Palatine shelves of maxillae

Additional MCQs

1. Communication between the vestibule and oral cavity proper lies:

A. Behind the first molar

B. Behind the second molar

C. Behind the third molar

D. No communication

? **Answer:** B. Behind the second molar

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2. The joint between tooth and gum is:

A. Syndesmosis

B. Gomphosis

C. Suture

D. Primary cartilaginous joint

? **Answer:** B. Gomphosis

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3. The first permanent tooth to erupt is:

A. First molar

B. First premolar

C. Second molar

D. Canine

? **Answer:** A. First molar

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4. Most muscles of the soft palate are supplied by:

A. Glossopharyngeal nerve

B. Mandibular nerve

C. Vagoaccessory complex

D. Facial nerve

? **Answer:** C. Vagoaccessory complex

---

5. Which of the following is not a component of Waldeyer’s ring?

A. Tubal tonsil

B. Pharyngeal tonsil

C. Palatine tonsil

D. Submental lymph node

? **Answer:** D. Submental lymph node

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6. The muscle not forming the bed of the tonsil is:

A. Superior constrictor

B. Pharyngobasilar fascia

C. Buccinator

D. Buccopharyngeal fascia

? **Answer:** C. Buccinator

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7. Muscle of pharynx not supplied by vagoaccessory complex:

A. Superior constrictor

B. Stylopharyngeus

C. Palatopharyngeus

D. Salpingopharyngeus

? **Answer:** B. Stylopharyngeus

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Extra Practice MCQs

8. The main artery supplying the tonsil is:
A. Ascending pharyngeal artery
B. Tonsillar branch of facial artery
C. Lingual artery
D. Ascending palatine artery
? **Answer:** B. Tonsillar branch of facial artery

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9. Tonsils have:
A. Only afferent lymph vessels
B. Both afferent and efferent lymph vessels
C. Only efferent lymph vessels
D. Neither
? **Answer:** C. Only efferent lymph vessels

---

10. The Eustachian tube is opened by:
A. Tensor veli palatini
B. Levator veli palatini
C. Both A and B
D. Salpingopharyngeus
? **Answer:** C. Both A and B

Viva Voce

1. What is Waldeyer's lymphatic ring?
A circular ring of lymphoid tissue at the junction of the digestive and respiratory tracts. It includes:

- Pharyngeal tonsil
- Tubal tonsils

- Palatine tonsils
- Lingual tonsil

---

2. Which nerve supplies the stylopharyngeus muscle?

- **Glossopharyngeal nerve (cranial nerve IX)**.

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3. Which muscle opens the auditory (Eustachian) tube during swallowing?

- **Tensor veli palatini** assisted by **levator veli palatini**.

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4. What is the main artery supplying the palatine tonsil?

- **Tonsillar branch of the facial artery.**

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5. To which lymph node does the palatine tonsil primarily drain?

- **Jugulodigastric lymph node** (upper deep cervical group).

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6. What is Killian's dehiscence?

A **potential weak area** between the **thyropharyngeus** and **cricopharyngeus** parts of the inferior constrictor, prone to formation of **pharyngeal diverticulum**.

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7. What are the three stages of swallowing (deglutition)?

- **Stage 1:** Voluntary — bolus pushed into oropharynx.
- **Stage 2:** Involuntary — passage through pharynx, closure of nasopharynx and larynx.

- **Stage 3:** Involuntary — food enters esophagus via peristalsis.

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8. Which muscle of the soft palate is supplied by the mandibular nerve?

- **Tensor veli palatini.**

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9. Which part of the pharynx communicates with the middle ear cavity?

- **Nasopharynx**, through the **pharyngotympanic (Eustachian) tube.**

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10. What is the function of Passavant's ridge?

It helps **close the nasopharyngeal isthmus** during swallowing by the contraction of **palatopharyngeus muscle.**

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11. What is the epithelial lining of the pharynx?

- **Nasopharynx:** Ciliated columnar epithelium (respiratory type).
- **Oropharynx and laryngopharynx:** Stratified squamous non-keratinized epithelium.

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12. What causes referred pain to the ear during tonsillitis?

- Shared sensory supply of **pharynx and middle ear** by the **glossopharyngeal nerve.**

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13. What is the nerve supply of the soft palate?

- **Pharyngeal plexus (via vagus)** for most muscles.
- **Tensor veli palatini** by **mandibular nerve (V?)**.

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14. What is the function of the pharyngotympanic tube?

- To **equalize air pressure** between the **middle ear** and the **atmosphere.**

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15. Which tonsil is commonly called the “adenoid”?

- The **pharyngeal tonsil**, when hypertrophied.