Learning Outcomes

• The **Mandible**
  – Surface Anatomy
  – Muscle Attachments
• The **Floor of the Mouth (FOM)**
  – Muscles of the FOM
• The **Tongue**
  – Muscles of the Tongue
• The **Submandibular Region**
  – Submandibular Gland
  – Sublingual Gland
  – Lingual Nerve
• The **Head & Neck Parasympathetics**

Submandibular Region

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Mandible

- Head of Condylar Process
- Condylar Process
- Coronoid (Mandibular) notch
- Neck of Condylar Process
- Mandible
- Mylohyoid Line
- Mylohyoid Groove
- Submandibular Fossa
- Digastric Fossa
- Inferior Mental Spine (Genial Tubercle)
- Alveolar Ridge
- Incisive Fossa
- Symphysis (Median Ridge)
- Mental Protuberance
- Mental Tubercle
- Ramus of Mandible
- Corona (Mandibular) process
- Neck of Condylar Process
- Mandibular Foramen
- Lingual (Genial) Foramen
- Symphysis (Median Ridge)
- Inferior border of body
- Sublingual Fossa
- Superior Mental Spine (Genial Tubercle)
- Posterior border of ramus

Muscle Attachments

The mental tubercle (a raised prominence at the mental symphysis) is a point of muscular attachment. The external surface of the ramus is covered by the attachment of the masseter muscle. On the inner surface of the body of the mandible, there is a horizontal mylohyoid line, which attaches the mylohyoid muscle. Above it, there is a shallow depression for the sublingual salivary gland and below it a deeper depression for the submandibular gland. At the anterior ends of the mylohyoid lines and superior to them, near the symphysis, there is the genial tubercles. Geniohyoid and Genioglossus attach here. The inner surface of the mandibular ramus is where the medial pterygoid muscle attaches. The sphenomandibular ligament attaches to the lingula (and superiorly to the sphenoid spine). The coronoid process is a triangular prominence from the anterosuperior surface of the ramus. The temporalis muscle attaches here, predominantly on the deep surface. The condylar process is one of the important attachments for the lateral pterygoid muscle.
The hyoid bone is situated at the level of the third cervical vertebra and is suspended from the stylohyoid ligaments. The bone is homogenous and consists of a central body spanning the midline, with greater and lesser horns on each side. Muscles attached to the hyoid bone are genioglossus, geniohyoid, hyoglossus, geniohyoid, stylohyoid, thyrohyoid, the levator of the thyroid gland.

Ligaments attached to the hyoid bone are stylohyoid ligaments, thyrohyoid ligaments, and the median thyrohyoid ligament.

The genioglossus muscle originates from the inner oral tubercle, found on the back of the tongue. It develops from the first branchial arch and is supplied by the hypoglossal nerve. It innervates the geniohyoid muscle. The blood supply is derived from the lingual artery. The genioglossus muscle elevates the hyoid bone and is a weak depressor of the mandible.

The mylohyoid muscle arises from the mylohyoid line of the mandible. The anterior fibers of the mylohyoid muscle interdigitate with the corresponding fibers of the opposite side to form a median raphe. This raphe is attached above to the symphysis mentis of the mandible and below to the anterior surface of the hyoid bone. The mylohyoid branch of the mandible division of the trigeminal nerve supplies the muscle. The mylohyoid muscle supplies its arterial supply from the sublingual branch of the lingual artery, the mandible artery, the mylohyoid branch of the superior alveolar artery, and the submental branch of the facial artery. It raises the floor of the mouth during the first stages of swallowing and helps to depress the mandible when the hyoid bone is fixed. Conversely, it aids in elevation of the hyoid bone.

The digastric muscle consists of an anterior belly and a posterior belly, connected by an interdigastric tendon. The anterior belly is attached to the digastric fossa on the inferior border of the mandible. It runs downwards and backwards and is inserted onto the anterior surface of the mandible. It develops from the first branchial arch and is supplied by the hypoglossal nerve. It innervates the digastric muscle. The blood supply is derived from the lingual artery. It retracts the tongue and is supplied by the mandible artery. It helps to extend the mandible.
Nerve Supply to the Tongue

**TONGUE - SENSATION & TASTE**

1. **ANTERIOR 1/3**: Lingual nerve (V3)
2. **POSTERIOR 1/3**: Lingual nerve (IX)
3. **MEDIAL**: Lingual nerve (XII)

**TONGUE - MUSCLES**

1. **SUPERIOR TRANVERSE & VERTICAL Lingual Muscles (CNXII)**
2. **SUPERIOR LONGITUDINAL Lingual Muscles (CNXII)**
3. **GENIOGLOSSUS (CNXII)**
4. **SYMPHYSIS MENTI (Median Ridge)**
5. **STYLOGLOSSUS (CNXII)**
6. **HYOGLOSSUS (CNXII)**
7. **INFERIOR TRANVERSE & VERTICAL Lingual Muscles (CNXII)**
8. **HYOID BONE**

**Hyoglossus**

The hypoglossus is a thin, quadrilateral muscle, which provides an important landmark in the floor of the mouth. It originates from the superior border of the greater horn of the hyoid bone and has been called 'chondroglossus'. At its origin, the hypoglossus muscle is separated from the attachment of the middle constrictor muscle of the pharynx by the lingual artery. It passes vertically upwards to insert into the side of the tongue. The hypoglossal nerve supplies the hypoglossus muscle. The sublingual branch of the lingual artery and the submental branch of the facial artery supply hypoglossus. Hypoglossus depresses the tongue. The submandibular duct and lingual nerve cross hypoglossus as it forms the floor of the submandibular fossa. It is a key landmark in submandibular gland surgery.

**Hypoglossal Nerve (CNXII) and Muscles of the Tongue**

- **Genioglossus (CNXII)**
- **Hyoglossus (CNXII)**
- **Hyoid bone**

**Lingual Artery**

The lingual artery is the main blood supply of the tongue, arising from the external carotid artery and coursing to the posterior region. When resecting the tongue haemorrhage is more marked in the posterior region. Hence laser surgery or diathermy techniques are preferred. Venous drainage is by the lingual vein (superficial to hyoglossus), draining to the internal jugular vein. The lingual veins may be seen easily on the underside of the tongue, running just beneath the mucosa. These veins tend to become more prominent with age.

**Brainstem: Pons**

- **Hyoglossal nerve root**
- **Cervical ventral nerve root**
- **Spinal accessory nerve**

**Brainstem: Medulla Oblongata**

- **Cerebellum**
- **Hypoglossal nerve root**
- **Hypoglossal nerve (CNXII)**

**Hypoglossal Nerve (CNXII)**

- **Branches from hypoglossal nerve (CNXII)**

**The Tongue**

- **Brainstem: Pons**
- **Brainstem: Medulla Oblongata**
- **Cerebellum**
- **Hypoglossal nerve root**
- **Cervical ventral nerve root**
- **Spinal accessory nerve**
- **Hypoglossal nerve (CNXII) and Muscles of the Tongue**
- **Hyoid bone**
- **Genioglossus (CNXII)**
- **Hyoglossus (CNXII)**
- **Hyoid bone**

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Muscles of the Tongue

<table>
<thead>
<tr>
<th>All Muscles of</th>
<th>Are supplied by:</th>
<th>Except:</th>
<th>Which is/are supplied instead by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharynx</td>
<td>Pharyngeal plexus (IX, X, sym)</td>
<td>Stylopharyngeus</td>
<td>Glossopharyngeal (IX)</td>
</tr>
<tr>
<td>Palate</td>
<td>Pharyngeal plexus</td>
<td>Tensor palatini</td>
<td>Off n to med pterygoid (Vc)</td>
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<tr>
<td>Tongue</td>
<td>Hypoglossal (XII)</td>
<td>Palatoglossus</td>
<td>Pharyngeal plexus</td>
</tr>
<tr>
<td>Mastication</td>
<td>Mandibular (Vc)</td>
<td>Buccinator</td>
<td>Facial (VII)</td>
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<tr>
<td>Larynx</td>
<td>Recurrent laryngeal (X)</td>
<td>Cricothyroid</td>
<td>Ext br of superior laryngeal (X)</td>
</tr>
<tr>
<td>Facial expression &amp; buccinator</td>
<td>Facial (VII)</td>
<td>Levator palpebrae superioris</td>
<td>Oculomotor (III) &amp; sympathetic</td>
</tr>
<tr>
<td>Eye</td>
<td>Oculomotor (III)</td>
<td>Superior oblique</td>
<td>Trochlear (IV)</td>
</tr>
<tr>
<td>Strap group</td>
<td>Ana cervicalis</td>
<td>Thyrohyoid</td>
<td>C1 fibres on hypoglossal</td>
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</tbody>
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Sublingual Gland

When saliva is retained or is extravasated into the adjacent tissues, mucocoeles (salivary cysts) appear. In the floor of the mouth they are called a ranula because they look like the belly of a frog.

Excessive salivation (sialorrhea) may appear in patients who have little lip control such as stroke patients or by parasympathetic stimulation. Conversely, sympathetic stimulation such as in the fight or flight response or by sympathomimetic drugs such as hyosine (used in motion sickness) causes a dry mouth.

Sublingual Gland

The paired sublingual glands are about twice the size of an almond. They are mainly mucous and have over a dozen ducts, half of which open into the submandibular gland and half of which open into the sublingual papilla directly. It lies in front of the anterior border of hyoglossus, between mylohyoid and genioglossus and makes a superficial depression in the mandible.
Submandibular Gland

The submandibular gland is subject to all the diseases of the salivary glands including stones that form by precipitation on epithelial debris. They are not always calcified and so do not always appear on radiographs. However, sialography, when a dye is introduced into the gland, will reveal any blockage.

The incision for removal of the gland must also be at least one finger's breadth inferior to the lower border of the mandible to avoid damage to the mandibular branch of the facial nerve. Having incised platysma, the facial veins are the next obstacle. They are usually ligated and cut. Occasionally the facial artery requires ligation. It is important to tie off both ends securely as the artery can bleed from both points due to multiple anastomoses along its length. Finally care must be taken to identify the duct correctly and avoid damage to the lingual nerve. It is extremely important to identify the duct correctly before cutting it, because severing the lingual nerve will cause paresthesia of the anterior two thirds of the tongue which may not fully recover.

Submandibular Gland

The submandibular gland is irregularly shaped and about 2 x 3 x 3 cm in size. The gland consists of a larger superficial part and a smaller deep part. The two are continuous as they wrap around the posterior free edge of the mylohyoid muscle. The submandibular gland extends anteriorly as far as the anterior belly of the digastric and posteriorly as far as the stylohyoid ligament. Laterally, it lies within the submandibular fossa on the medial surface of the mandible. The submandibular (Wharton’s) duct is 4 to 5 cm long. It leaves the deep part of the gland, runs anteriorly on the surface of hyoglossus (and deep to the mylohyoid), and terminates at the sublingual papilla in the floor of the mouth. The submandibular duct is accompanied by the lingual nerve the external surface of hyoglossus. The lingual nerve is crossed by the duct superiorly on its way into the hyoglossus, hence the rhyme:

The lingual nerve takes a swerve,
Around the hyoglossus
Says Wharton’s duct to the nerve, “I think I’m going to cross it!”

The Parasympathetic Ganglia in the Head
**PATTERN OF PARASYMPATHETICS IN HEAD**

All the parasympathetic nuclei for the head are in the brain stem and are associated with cranial nerves 3, 7, & 9. The nuclei are:
- Edinger Westphal (III)
- Superior salivary (VII)
- Inferior salivary (IX)

**Edinger Westphal nucleus (III)**
From this nucleus parasympathetic fibres travel with III, into its branch to the inferior oblique muscle to reach the ciliary ganglion

**PATTERN OF PARASYMPATHETICS IN HEAD**

Unlike somatic nerves, all parasympathetic nerves have two neurones: pre- and post-ganglionic with a synapse between the two. The vast majority of the synapses in the head are in one of 4 ganglia:
- Ciliary
- Pterygopalatine
- Submandibular
- Otic

**PATTERN OF PARASYMPATHETICS IN HEAD**

**Inferior salivary nucleus (IX)**
From this nucleus parasympathetic fibres travel with lesser petrosal nerve to reach the otic ganglion

**PATTERN OF PARASYMPATHETICS IN HEAD**

**Superior salivary nucleus (VII)**
From this nucleus parasympathetic fibres travel with greater petrosal nerve and chorda tympani to reach the pterygopalatine and submandibular ganglia respectively