brighton and sussex medical school

BSMS MODULE: 202, NEUROSCIENCE AND BEHAVIOUR
THEME: BRAIN, SPINAL CORD AND NERVE CELLS

DR SESSION: 4. EXAMINATION OF THE MUSCLES OF MASTICATION AND THE TRIGEMINAL NERVE

LEARNING OUTCOMES

By the end of the module students should be able to:

1. Identify the muscles of mastication
2. Discriminate the boundaries of the temporal and infratemporal fossa
3. Identify the major contents of infratemporal fossa
4. Understand the spatial and functional relationship of the structures within the infratemporal fossa

In this practical session you will study the anatomy of the **muscles of mastication** and the contents of the **infratemporal fossa** including relations with the trigeminal nerve. For this session you will be performing much of the dissection and will work on a cadaveric head that has already been bisected for you by the demonstrators. In addition you will be able to examine a number of prosected specimens as well as the anatomical models available within the dissecting room. As with all your other practical sessions in the dissecting room make sure you work through this handout, answer the questions and complete the checklist.

Task 1. Removal of the skin and parotid gland

In order to examine the muscles of mastication and the infratemporal fossa it will be necessary to remove much of the facial skin and also at least part of the **parotid gland**.

Follow the lines of incision shown in the figure below and make sure that in each case the cuts are made **superficially**. Where possible try to avoid damaging major vessels e.g. the **facial artery** (visible at the margin of the mandible) and main nerve branches. As you remove the skin you should reveal the superficial and delicate **muscles of facial expression**, which are innervated by the facial nerve. We will not concentrate on these muscles at this stage, but have a think about why they are referred to as muscles of facial expression. Removal of the skin from the parotid region may prove a little trickier due to the tough nature of the fascial covering of the parotid gland. As you uncover the gland you should be able to make out some of the main branches of the facial nerve – there are five. Next you should remove the parotid gland to allow access to the deeper structures. If possible retain some of the branches of the facial nerve.

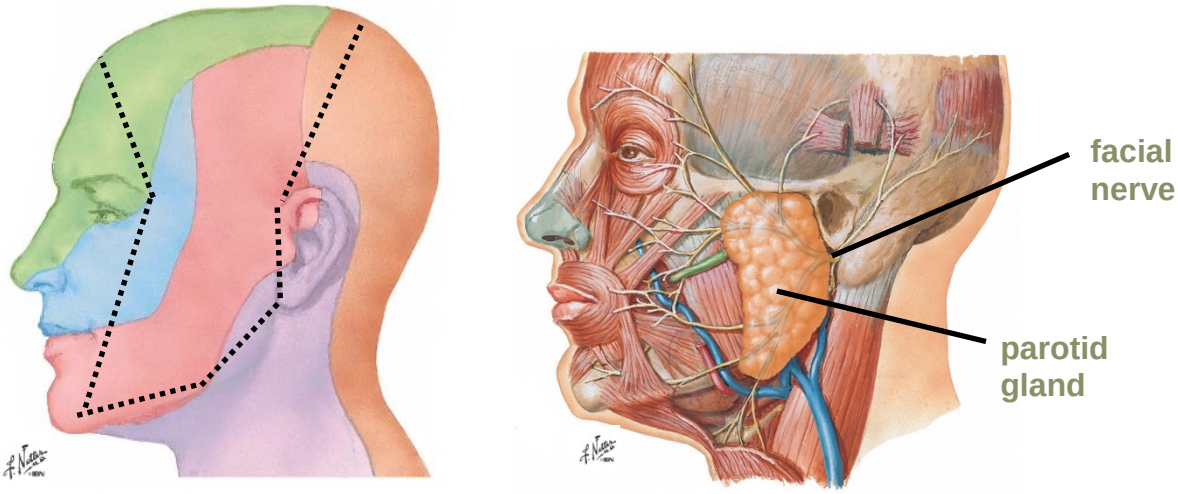
Facial Nerve

The facial nerve has two roots, a large motor root and a smaller nervus intermedius that consists of both sensory and parasympathetic fibres. Both roots arise at the cerebellopontine angle and pass with the vestibulocochlear (CN VIII) nerve and the labyrinthine artery into the internal acoustic meatus. Both roots of the nerve traverse the petrous temporal bone in the facial canal. Within the temporal bone a number of small branches arise from the facial nerve. Some of these pass anteriorly to supply the

pteryopalatine ganglion; postganglionic fibres are distributed to the lacrimal gland (through the lacrimal branch of the ophtalmic nerve) and to the glands and mucous membranes of the nasal cavity and palate. The sensory root is finally distributed as the chorda tympani nerve which supplies taste to the anterior 2/3rds of the tongue and conveys parasympathetic fibres to the submandibular ganglion (see DR Session 5).

The motor root of the facial nerve gives a branch to the stapedius muscle before passing out of the skull via the stylomastoid foramen. It sweeps laterally and forward, gives branches to the posterior belly of digastric and to the stylohyoid muscle before entering the parotid gland. Within the gland the nerve divides into five terminal branches to supply the muscles of the face and scalp. From superior to inferior the branches are, **temporal, zygomatic, buccal, mandibular and cervical**. Locate these on your cadaver.

Because of its long and complex course through the temporal bone, the facial nerve is susceptible to damage by infections and surgical procedures in the middle ear. A facial palsy of unknown origin is usually termed Bell's palsy. Such a palsy can occur in neonates if they are delivered by forceps which compress the nerve. In the newborn the mastoid is undeveloped and the facial nerve is especially superficial and vulnerable.



Skin sensation of the face is supplied entirely by the three divisions of the trigeminal nerve (excepting the angle of the jaw). Using your knowledge of the skull foramina, where would you expect to see the following nerves emerging on to the face: the infra-orbital nerve, the zygomaticofacial nerve and the mental nerve.

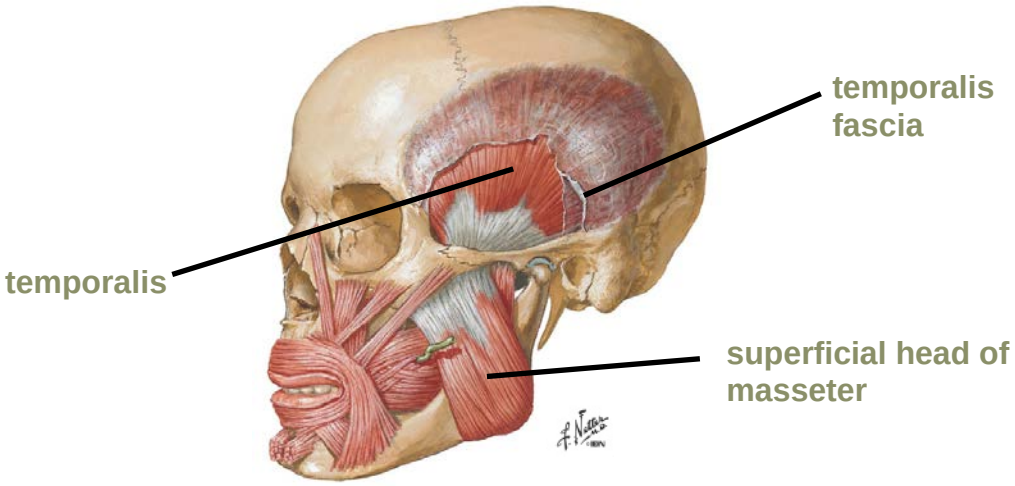
Question 1. From which trigeminal division do these branches arise?

Task 2. Temporalis and masseter muscles

Examine the region containing the **temporalis muscle**. Carefully remove the strong fascia that covers the muscle to expose the full extent of the muscle. In most cases as the calvaria was removed for an earlier dissection some of the muscle will be missing. The temporalis muscle is a fan shaped muscle that fills the **temporal fossa** and contains fibres that run in different orientations accounting for its different actions. Follow the temporalis muscle from its origin on the temporal bone to its insertion on the edge and medial surface of the **coronoid process** of the mandible and along the edge of the **ramus** of the mandible. Note that the insertion is very tendonous. Whilst in this region, observe the course and distribution of the superficial temporal vessels.

The **masseter muscle**, like the temporalis is a muscle of mastication. Note the origin of the masseter on the zygomatic bone (superficial part) and **zygomatic arch** (deep part) and its multiple insertions onto the lateral surface of the ramus. Make a cut along the superior aspect of masseter to reflect it.

Question 2. From which artery is the superficial temporal artery a branch?



Task 3. Infratemporal fossa and the pterygoid muscles

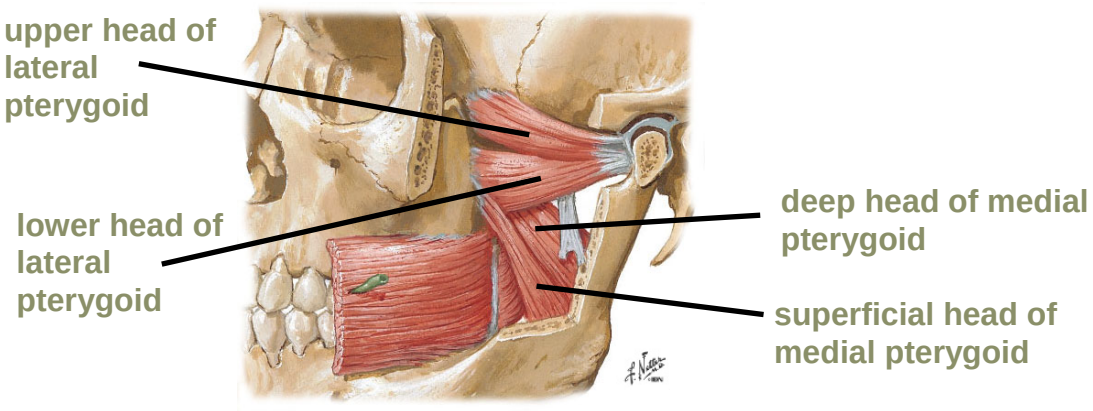
In order to continue the examination of the muscles of mastication it is necessary to expose the **infratemporal fossa**. This is a difficult and time consuming dissection. Hence the next section requires detailed examination of the instructor body and the prosections.

The infratemporal fossa is a wedge-shaped cavity that lies inferior to the temporal fossa and between the ramus of the mandible and the wall of the pharynx. The fossa contains many structures and features and it is impossible to cover these all in part of one session, therefore this handout directs you to some of the most important aspects. The infratemporal fossa contains three muscles of mastication - the lower part of temporalis, and the lateral and medial pterygoid muscles, the maxillary artery and its branches, the pterygoid venous plexus, the mandibular and chorda tympani nerves and the otic ganglion. To demonstrate the infratemporal fossa a section through the zygomatic arch

has been removed. A section of the mandible has also been removed. Begin by examining where the zygomatic arch was and where the remaining parts of the mandible are.

The **medial** and **lateral pterygoid** muscles are the other muscles of mastication. The medial pterygoid has two heads with the deep head taking origin at the medial surface of the **lateral pterygoid plate** of the sphenoid bone and the superficial head arising from the maxilla. Both heads insert at the angle of the mandible (try using a skull as an aid to understanding these attachments) and enable elevation and side-to-side movement of the mandible. The lateral pterygoid also has two heads. The upper head is not easy to see and arises on in the roof of the fossa, whilst the lower head is more visible and you should find it originating from the lateral surface of the lateral pterygoid plate. Both heads insert into the neck of the mandible and the capsule of the **temporomandibular joint**.

Question 3. What makes the lateral pterygoid muscle different from the other muscles of mastication?



Task 4. Mandibular branch of trigeminal and maxillary artery

The mandibular (branch of trigeminal) nerve has a large sensory and a small motor root. It supplies the skin in the temporal region, part of the auricle (including the external auditory meatus and the tympanic membrane), the lower lip, the lower part of the face, the lower teeth and gums, the mucosa of the anterior two thirds of the tongue and the mucosa of the floor of the mouth. One of the sensory branches (auriculotemporal nerve) conveys postganglionic parasympathetic fibres from the otic ganglion to the parotid gland. The motor root of the mandibular nerve passes with the sensory root out of the posterior cranial fossa via the foramen ovale. The motor root supplies the muscles of the first pharyngeal arch, extensively concerned with mastication. The mandibular nerve and its branches are intimately related to the structures found within the infratemporal fossa.

As the mandibular nerve enters the infratemporal fossa through the foramen ovale, it is attached to the **otic ganglion**. The nerve supplies the medial and lateral pterygoids,

tensor palatini, temporalis and masseter. It has a sensory branch the buccal nerve which supplies the cheek not the buccanator muscle.

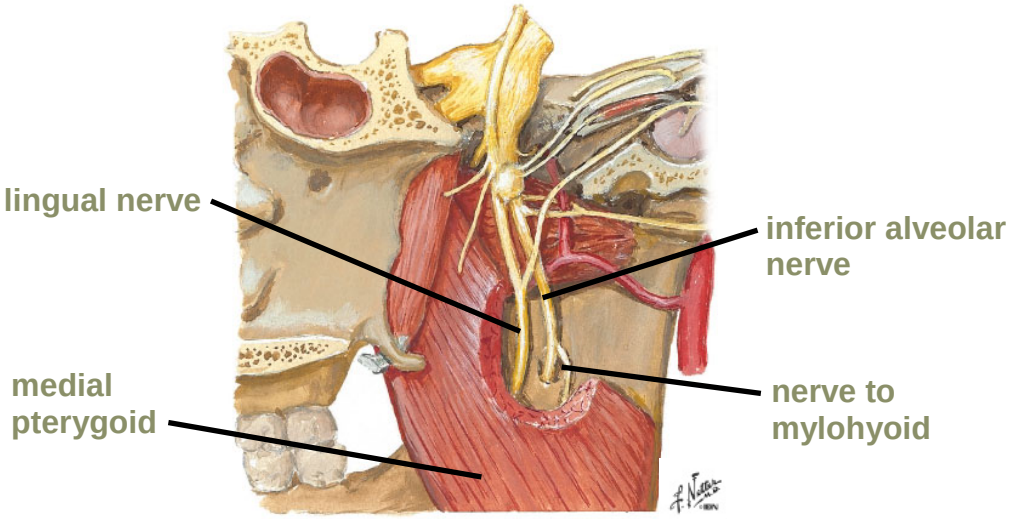
From the **mandibular nerve** the **auriculotemporal** branch passes around the middle meningeal artery to supply the external acoustic meatus, tympanic membrane and skin over the temple; it also carries parasympathetic fibres. The remainder of the posterior division of the mandibular nerve divides into the **lingual and inferior alveolar nerves**.

The **lingual nerve** is joined by the **chorda tympani** (branch of facial nerve) as it crosses the medial pterygoid and passes into the floor of the mouth. The **inferior alveolar nerve** gives off a small motor branch to the mylohyoid muscle and continues as a sensory nerve. It enters the mandibular foramen on the medial aspect of the mandible and runs in the mandibular canal to supply the lower teeth. The terminal portion emerges at the mental foramen to supply the lower lip and chin.

Examine some of the main branches of the the **mandibular nerve** (CNV_3) as it descends from the location of the foramen ovale.

Use the pot CX21 and/or the QR code with the IPAD to trace out the branches of V_1, V_2 and V_3.

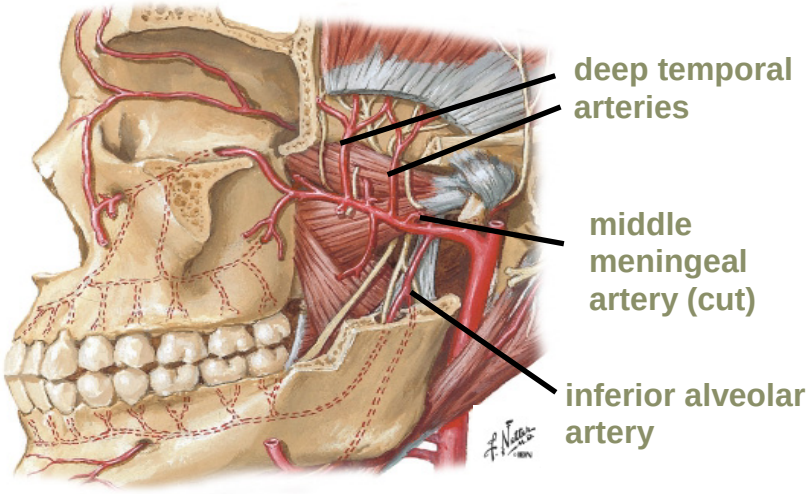
Question 4. Why does the inferior alveolar nerve enter the mandibular foramen?



The **maxillary artery** is the largest branch of the **external carotid artery** and should be clearly evident within the infratemporal fossa. The maxillary artery originates in the substance of the parotid gland (which you have largely dissected away) and passes deep to the neck of the mandible and gives off a number of branches in the fossa. One

of the most important branches of the maxillary artery clinically is the **middle meningeal artery**. This passes deep to the lateral pterygoid, between the roots of the auriculotemporal nerve to enter the skull via the foramen spinosum. Identify the middle meningeal artery. In the specimens see if you can also identify the **inferior alveolar artery**, which runs inferiorly along with its nerve to the mandibular canal. Like the nerve the inferior alveolar artery also gives off a small mylohyoid branch.

The venous drainage of this area is through a dense pterygoid plexus around the pterygoid muscles. Veins corresponding to the branches of the maxillary artery open into this plexus which is drained by a maxillary vein. The pterygoid plexus communicates with the cavernous sinus and with the facial vein. The communications between intra and extra cranial veins can allow infections to spread into the cranial cavity.



Checklist

Review all the structures you have examined today and ensure that your demonstrator is satisfied that you have completed the check list below before you leave the dissecting room:

- **Identified the muscles of mastication**
- **Discriminated the boundaries of the infratemporal fossa**
- **Identified the major contents of the infratemporal fossa**
- **Understood the spatial and functional relationship of structures within the infratemporal fossa**