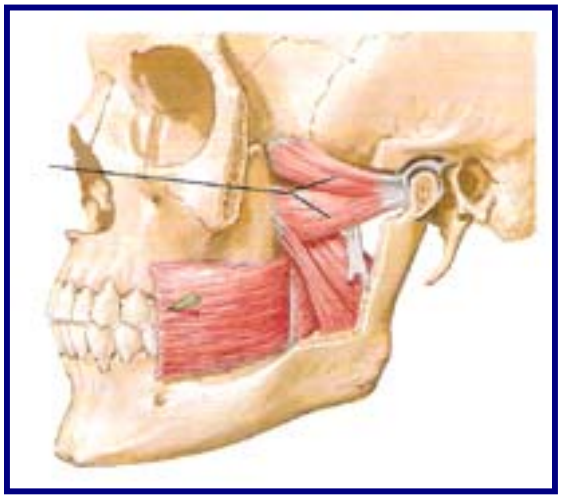
Dissection 10:
Infratemporal & Pterygopalatine Fossae, Nose and Mouth

Objective 1)
Identify the boundaries of the infratemporal fossa, the muscles of mastication, their sources of innervation and their major actions in chewing.

A). Infratemporal fossa boundaries:
- i. Laterally – ramus of the mandible
- ii. Medially – lateral pterygoid plate
- iii. Anteriorly – posterior aspect of the maxilla
- iv. Posteriorly – tympanic plate, mastoid process, and styloid process
- v. Superiorly – inferior (infratemporal) surface of the greater wing of the sphenoid bone
- vi. Inferiorly – attachment of the medial pterygoid muscle to the mandible

B). Muscles of mastication:
- i. Temporalis:
  1. From floor of temporal fossa and deep surface of temporal fascia to tip and medial surface of coronoid process and anterior border of ramus of the mandible
  2. Innervated by deep temporal branches of the mandibular nerve (CN V_3)
  3. Action: elevates mandible, closing jaws and its posterior fibers retrude mandible after protrusion



- ii. Masseter:
  1. From inferior border and medial surface of zygomatic arch to lateral surface of ramus of mandible and its coronoid process
  2. Innervated by mandibular nerve (CN V_3) via masseteric nerve that enters deep to its surface
  3. Action: elevates and protrudes mandible thus closing jaws; deep fibers retrude it
- iii. Lateral pterygoid:
  1. From infratemporal surface and infratemporal crest of greater wing of sphenoid (superior head) and lateral surface of lateral pterygoid plate (inferior head) to neck of mandible, articular disc, and capsule of temporalmandibular joint
  2. Innervated by mandibular nerve (CN V_3) via lateral pterygoid nerve from anterior trunk, which enters deep to its surface

3. Action: Together the heads protrude mandible and depress chin; alone the heads produce side-to-side movements of the mandible

iv. Medial pterygoid:
   1. From medial surface and lateral pterygoid plate and pyramidal process of palatine bone (deep head) and tuberosity of maxilla (superficial head) to medial surface of ramus of mandible, inferior to mandibular foramen
   2. Innervated by mandibular nerve (CN V_3) via medial pterygoid nerve
   3. Action: Together the heads elevate mandible closing the jaws and protrude mandible; alone the heads protrude the side of the jaw; alternately they produce grinding motion

v. Anterior belly of digastric:
   1. Mandibular nerve (CN V_3)
   2. Depresses the mandible and elevates hyoid.

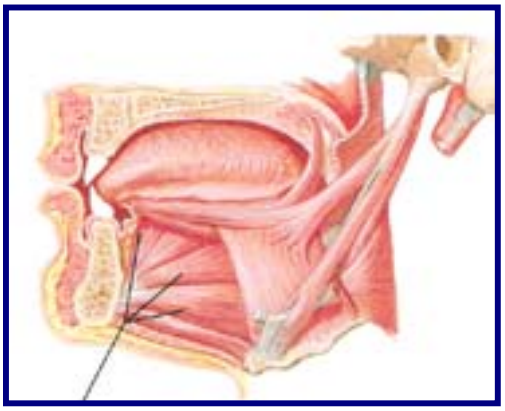
vi. Mylohyoid:
   1. Mandibular nerve (CN V_3)
   2. Elevates hyoid, floor of mouth, and tongue during swallowing and speaking.

vii. Buccinator:
   1. Facial nerve (CN VII)
   2. Presses cheek against molar teeth, thereby aiding chewing, expels air.

Objective 2)
Identify the extrinsic and intrinsic muscles of the tongue and their actions. Identify the sensory and motor nerve supply to the tongue. Identify the muscles of the soft palate, their innervation and major actions.

C). Extrinsic tongue muscles: alter position of the tongue. Motor innervation supplied by hypoglossal nerve, except palatoglossus

i. Genioglossus:
   1. From superior part of mental spine of mandible to dorsum of tongue and body of hyoid
   2. Innervated by hypoglossal nerve (CN XII)
   3. Action: depresses tongue; its posterior part protrudes it



ii. Hyoglossus:
   1. From body and greater horn of hyoid to side and inferior aspect of tongue
   2. Innervated by hypoglossal nerve (CN XII)
   3. Action: depresses and retracts tongue

iii. Styloglossus:
   1. From styloid process and stylohyoid ligament to side and inferior aspect of tongue
   2. Innervated by hypoglossal nerve (CN XII)

3. Action: retracts tongue and draws it up to create a trough for swallowing

iv. Palatoglossus:
1. From palatine aponeurosis of soft palate to side of tongue
2. Innervated by cranial root of CN XI via pharyngeal branch of CN X and pharyngeal plexus
3. Action: elevates posterior part of tongue

D). Intrinsic muscles: alter tongue shape. Motor innervation supplied by hypoglossal nerve.

i. Superior longitudinal:
1. From submucous fibrous layer and median fibrous septum to margins of tongue and mucous membrane
2. Innervated by hypoglossal nerve (CN XII)
3. Action: curls tip and sides of tongue superiorly and shortens tongue

ii. Inferior longitudinal:
1. From root of tongue and body of hyoid to apex of tongue
2. Innervated by hypoglossal nerve (CN XII)
3. Action: curls tip inferiorly and shortens tongue

iii. Transverse:
1. From median fibrous septum to fibrous tissue at margins of tongue
2. Innervated by hypoglossal nerve (CN XII)
3. Action: narrows and elongates tongue

iv. Vertical:
1. From superior surface of borders of tongue to inferior surface of borders of tongue
2. Innervated by hypoglossal nerve (CN XII)
3. Action: flattens tongue and broadens it

v. **Transverse and Vertical act simultaneously to protrude the tongue.

E). Nerve supply to the tongue:

i. All motor function to tongue form hypoglossal nerve (CN XII), except palatoglossus, which is innervated by cranial root of CN XI via pharyngeal branch of CN X and pharyngeal plexus.

ii. Sensory:
1. For general sensation (touch and temperature), the mucosa of the anterior 2/3 of the tongue is supplied by the lingual nerve (branch of CN V_3).
2. For taste in anterior 2/3, except for vallate papillae, the chordae tympani (branch of CN VII) is the nerve supply.
a. Chordae tympani and lingual nerve join and run anteriorly in its sheath
3. The mucous membrane of the posterior 1/3 of the tongue and vallate papillae are supplied for general sensation and taste by the lingual branch of the glossopharyngeal nerve (CN IX).
4. Twigs of the internal laryngeal nerve (branch of CN X) supplies mostly general but some taste to small area of tongue just anterior to the epiglottis.

F). Muscles of the soft palate:

i. Tensor veli palatini:

1. From scaphoid fossa of medial pterygoid pate, spine of sphenoid bone, and cartilage of pharyngotympanic tube to palatine aponeurosis
2. Innervated by medial pterygoid nerve [branch of mandibular nerve (CN V_3)] via otic ganglion
3. Action: tenses soft palate and opens mouth of pharyngotympanic tube during swallowing and yawning

2. Levator veli palatini:
   - A). From cartilage of pharyngotympanic tube and petrous part of temporal bone to palatine aponeurosis
   - B). Innervated by cranial root of CN XI via pharyngeal branch of CN X and pharyngeal plexus
   - C). Action: elevates soft palate during swallowing and yawning
3. Palatoglossus:
   - A). From palatine aponeurosis to side of tongue
   - B). Innervated by cranial root of CN XI via pharyngeal branch of CN X and pharyngeal plexus
     1. Action: elevates posterior part of tongue and draws soft palate onto tongue

ii. Palatopharyngeus:

1. From hard palate and palatine aponeurosis to lateral wall of pharynx
2. Innervated by cranial root of CN XI via pharyngeal branch of CN X and pharyngeal plexus
3. Action: tenses soft palate and pulls walls of pharynx superiorly, anteriorly, and medially during swallowing

iii. Uvular:

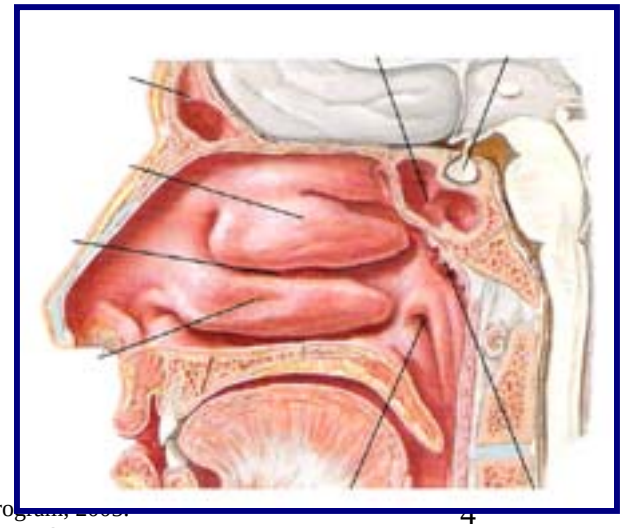
1. From posterior nasal spine and palatine aponeurosis to mucosa of uvula
2. Innervated by cranial root of CN XI via pharyngeal branch of CN X and pharyngeal plexus
3. Action: shortens uvula and pulls it superiorly

Objective 3)
Trace the flow of air into each of the paranasal sinuses, note the communication with the nasal cavity the relationships of each sinus to the oral, orbital and cranial cavities.

C). The nose

i. 3 conchae that partition four meatuses:

1. Sphenoethmoidal meatus – lies superoposterior to the superior concha and receives the opening of the sphenoid sinus
2. Superior concha – divides sphenoethmoidal meatus and superior meatus
3. Superior nasal meatus – narrow passage b/ superior and middle nasal concha



(parts of ethmoid bone) into which the posterior ethmoidal sinuses open by one or more orifices.

4. Middle concha – divides superior and middle meatus
5. Middle nasal meatus – wide and anterosuperior part of this passage communicates with the frontal sinus.
    a. Hiatus semilunaris: frontal, maxillary, anterior ethmoidal sinuses drain into this sinus
6. Inferior concha – divides middle and inferior meatus
7. Inferior nasal meatus – horizontal passage inferolateral to the inferior nasal concha
    a. Nasolacrimal duct: drains tears that accumulate in conjunctiva

D). Paranasal sinuses: lighten weight of head and give additional resonance to voice. Helps deal with upper respiratory infections (nose)

i. Frontal sinuses: Located b/ outer and inner tables of the frontal bone. Air flows into the nasal cavity to the semilunar hiatus in middle meatus and through the frontonasal duct, opening in the infundibulum, into the frontal sinuses.
    1. The frontal sinuses are located superior to the nasal cavity, superomedial to the orbit, and anterior and inferior to the anterior cranial fossa.

ii. Ethmoidal sinuses: These are composed of several ethmoidal cells that are located b/ the nasal cavities (lateral to them) and the orbits (medial to them). Air flows through the infundibulum to the middle meatus (opening b/ inferior and middle concha) and into the anterior ethmoidal cells. Air moves directly through the middle meatus into the middle ethmoidal cells, and posterior ethmoidal cell, which form the ethmoidal bulla, get air from the superior meatus (opening b/ the middle and superior nasal concha).
    1. Superior border: frontal sinus and anterior cranial fossa; inferior border: meatuses of nose; medial border: nasal cavity; lateral border: orbit; anterior border: maxilla; posterior border: sphenoid sinuses

iii. Sphenoidal sinuses: These sinuses are unevenly divided and separated by a bony septum, and they occupy the body of the sphenoid bone posterior to the nasal cavity. They make the body of the sphenoid fragile and move into the wings of the elderly. The sphenoidal sinuses lie anterior to the optic chiasm and anterior to the middle cranial fossa and hypophysial fossa. Air flows from the nasal cavity to the sphenoethmoidal recess (lying superoposterior to the superior nasal concha) through the opening of the sphenoidal sinus and into the sinuses themselves.
    1. Superior border: brain; inferior border: nasal cavity and pharynx; medial border: each other; lateral border: optic nerve and cavernous sinus; anterior border: nasal cavity and ethmoid sinuses; posterior border: sphenoid bone

iv. Maxillary sinuses: The largest of the paranasal sinuses and take up the whole body of the maxilla. The roof of the sinus is the orbit; the base is the inferior part of the lateral wall of the nasal cavity, and the floor is the alveolar part of the maxilla. Air flows to the sinus through semilunar hiatus of the nasal cavity into the middle meatus, and through the maxillary ostium (opening in maxillary sinuses).

1. Apex: zygomatic; base: forms inferior part of lateral wall of nasal cavity; roof: floor of orbit; floor: alveolar part of maxilla

Objective 4)
Follow the course of the cranial nerves supplying structures in or passing through the infratemporal fossa, the nasal and oral cavities. Indicate the source of and region supplied by and the functional components carried by each nerve.

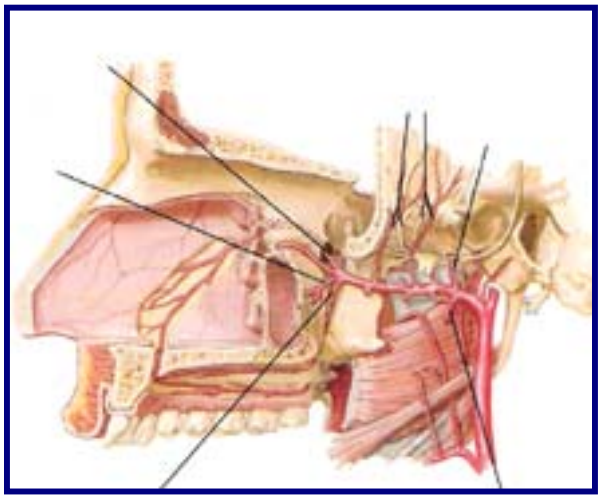
E). Infratemporal fossa
- i. Mandibular nerve
  1. Passes through foramen ovale & separates into anterior and posterior trunks
     - a. Anterior trunk:
       - i. Buccal nerve: innervates skin and mucosa of cheek and buccal gingiva adjacent to the 2nd and 3rd molars
       - ii. Branches to 4 muscles of mastication: masseteric, lateral pterygoid, medial pterygoid, and temporal branches
     - b. Posterior trunk:
       - i. Auriculotemporal nerve (largest branch supplies sensation superior to ear; fibers to TMJ; parasympathetic secretomotor fibers to parotid)
       - ii. Inferior alveolar nerve: forms inferior dental plexus; supplies all teeth on that side; a branch is the mental nerve (through mental foramen & supplies mucous membrane and skin of chin & of lower lip)
       - iii. Lingual nerve: sensory for anterior 2/3 of tongue
- ii. Otic ganglion
  1. Preganglionic parasympathetic fibers from CN IX via the lesser petrosal nerve synapse here
  2. Postganglionic parasympathetic fibers travel to parotid (secretory) through auriculotemporal nerve
- iii. Chorda tympani (branch of CN VII)
  1. Carries taste fiber form anterior 2/3 of tongue and preganglionic parasympathetic secretomotor fibers for the submandibular and sublingual salivary glands. It joins the lingual nerve in the IT fossa

F). Nasal cavity
- i. Olfactory nerve (CN I): innervates olfactory epithelium, which is superior to and around the superior nasal concha
- ii. Anterior ethmoidal nerve (CN V_1): innervates upper and anterior parts of lateral wall, medial wall, and septum via external, lateral, and medial branches
- iii. CN V_2 innervates lower and posterior parts of the nose as the:
  1. Infraorbital nerve: innervates the inside of the cartilaginous nose anterior to the nasal concha
  2. Greater palatine nerve: axons go through the pterygopalatine ganglion and innervate the posterior lateral walls of the nasal cavity via the posterior superior and inferior lateral nasal nerves
  3. Nasopalatine nerve: axons go through the pterygopalatine ganglion and innervate the posterior medial wall of the nasal cavity

G). Oral cavity

i. Infraorbital nerve from CN V_2, innervates upper lip
ii. Mental nerve from CN V_3, innervates lower lip
iii. Buccal nerve from CN V_3, innervates mandibular molar gums.
iv. Lingual nerve, from CN V_3, innervates gums for mandibular non-molar gums.
v. Greater palatine nerve, from CN V_2, innervates gums of maxillary pre-molar and molar gums for those teeth.
vi. Nasopalatine nerve, from CN V_2, innervates incisor gums.
vii. Superior alveolar nerve innervates labial and buccal aspects of the maxillary gums.
    1. Anterior branch
    2. Middle branch
    3. Posterior branch

Objective 5)
Trace the flow of blood through the maxillary artery and its major branches. Note the regions supplied and the interconnections between branches. Trace the flow of blood into the nasal and oral cavities. Indicate the major sources of blood supply to these regions and any known vascular interconnections.



H). Maxillary artery: Larger of the two terminal branches of the external carotid artery. It arises posterior to the neck of the mandible and courses anteriorly deep to the neck of the mandibular condyle passing deep or superficial to the lateral pterygoid. It is divided into three parts based on its position to the lateral pterygoid muscle.

i. 1st part or retromandibular part and it branches:
    1. Deep auricular artery to the external acoustic meatus
    2. Anterior tympanic artery to the tympanic membrane
    3. Middle meningeal artery to the dura of the calvaria
    4. Accessory meningeal artery to the cranial cavity.
    5. Inferior alveolar artery to the mandible, gingivae, teeth, and floor of the mouth
ii. 2nd part or pterygoid part and its branches:
    1. Deep temporal arteries, anterior and posterior, which ascend to supply the temporal muscle
    2. Pterygoid arteries, which supply the pterygoid muscles
    3. Masseteric artery, which passes laterally through the mandibular notch to supply the masseter muscle
    4. Buccal artery, which supplies the buccinator muscle and mucosa of the cheek
iii. 3rd part or pterygopalatine part and its branches:

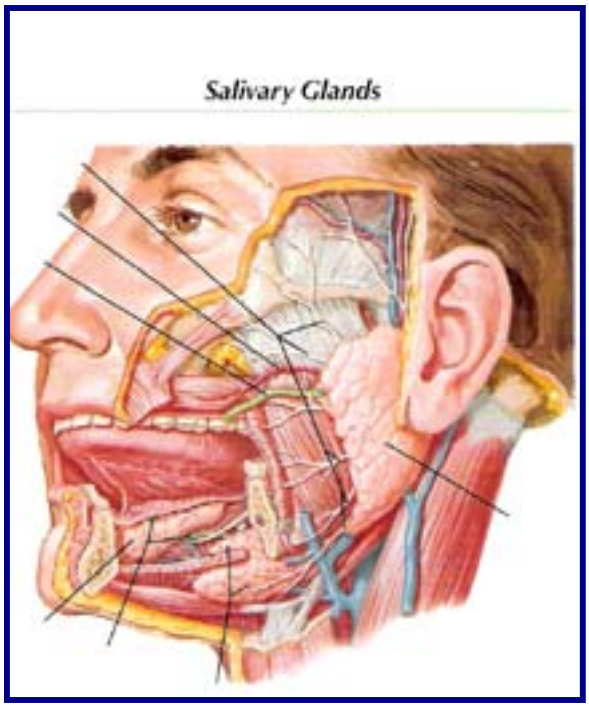
1. Posterior superior alveolar artery, which supplies the maxillary molar and premolar teeth, the buccal gingiva, and the lining of the maxillary sinus
2. Infraorbital artery, which supplies the inferior eyelid, lacrimal sac, infraorbital region of the face, side of the nose, and the upper lip
3. Descending palatine artery, which supplies the mucous membrane and glands of the palate (roof of the mouth) and palatine gingiva
4. Artery of the pterygoid canal, which supplies the superior part of the pharynx, the pharyngotympanic (auditory) tube, and the tympanic cavity
5. Pharyngeal artery, which supplies the roof of the pharynx, the sphenoidal sinus, and the inferior part of the pharyngotympanic tube
6. Sphenopalatine artery, the termination of the maxillary artery, which supplies the lateral nasal wall, the nasal septum, and the adjacent paranasal sinuses

I). Blood flow to the nasal cavity:
   i. The arterial supply of the medial and lateral walls of the nasal cavity is from branches of the sphenopalatine artery, anterior and posterior ethmoidal arteries, greater palatine artery, superior labial artery, and the lateral nasal branches of the facial artery.
   ii. The anterior part of the nasal septum is an area rich in capillaries (Kiesslebach area) where all five arteries supplying the septum anastomose.

J). Blood flow to the oral cavity:
   i. Oral vestibule: The superior labial branches of the facial and infraorbital arteries supply the upper lip. The inferior labial branches of the facial and mental arteries supply the lower lip.
   ii. Teeth: The superior and inferior alveolar arteries, branches of the maxillary artery, supply both the maxillary (upper) and mandibular (lower) teeth, respectively.
   iii. Palate: The greater palatine artery and lesser palatine artery richly supply the palate.
   iv. Tongue: Arteries of the tongue derive from the lingual artery, which comes off the external carotid artery. The branches of the lingual artery once it passes under the hyoglossus muscle are:
      1. Dorsal lingual artery, supply the posterior part of the tongue and send a tonsillar branch to the palatine artery
      2. Deep lingual artery, which supplies the anterior part of the tongue; the dorsal and deep arteries communicate with each other near the apex of the tongue
      3. Sublingual artery, which supplies the sublingual gland and the floor of the mouth.
   v. Salivary glands:
      1. Parotid gland: branches of external carotid and superficial temporal arteries.
      2. Submandibular gland: submental artery
      3. Sublingual glands: sublingual and submental arteries

Objective 6)
Identify the parotid, submandibular and sublingual salivary glands. Trace the course of their innervation and follow the flow of saliva from each gland to the mouth.

K). Parotid glands:



i. Largest of the salivary glands and occupies the area b/ the ramus of the mandible and the styloid and mastoid processes of the temporal bone.

ii. The greater auricular nerve innervates the parotid sheath and skin overlying the gland for some of the sensory function. The auriculotemporal nerve, form CN V_3, is closely associated with it and passes through it to provide some sensory function. Preganglionic parasympathetic component comes from the glossopharyngeal nerve (CN IX) via tympanic nerve to the otic ganglion and postganglionic parasympathetic axons on the auriculotemporal nerve causes saliva production. Sympathetic innervation comes from the cervical ganglia via the external carotid nerve plexus (maxillary and superficial temporal arteries).

iii. Saliva from the gland comes through the parotid duct, which comes off the anterior border of the gland, passes anteriorly and horizontally towards the anterior border of the masseter to turn medially, pierce the buccinator, and enter the oral cavity opposite the second maxillary molar tooth.

L). Submandibular glands:

i. Lies along the body of the mandible, partly superior and partly inferior to the posterior half of the mandible and partly superficial and partly deep to the mylohyoid muscle.

ii. It is innervated parasympathetically via preganglionic secretomotor fibers from the facial nerve via the chordae tympani to the lingual nerve. These fibers synapse at the submandibular ganglion and fibers accompanying the arteries supplying it, innervate it. Postganglionic sympathetic fibers come from the superior cervical sympathetic ganglion and travel up the external carotid plexus (lingual and facial arteries) to the gland.
iii. Saliva exits it via the submandibular duct and arises from the intra-oral part of the gland that lays b/ the mylohyoid and the hyoglossus and comes up under the tongue.

M). Sublingual glands:

i. Smallest and most deeply situated of the salivary glands. Each almond-shaped gland lays in the floor of the mouth b/ the mandible and the genioglossus muscle. The glands from each unite to form a horseshoe-shaped glandular mass around the lingual frenulum.
ii. Its innervation is the same as the submandibular glands.
iii. Saliva passes from the sublingual glands to the floor of the mouth through many numerous sublingual ducts.