Anatomy – Head

Skull

Internal foramina

- **Foramen magnum**
  - Lower medulla
  - Vertebral/spinal arteries
  - Spinal roots accessory N

- **Foramen ovale**

- **Foramen spinosum**
  - Middle meningeal vessels

- **Foramen lacerum**

- **Carotid canal** - Int carotid artery

- **Jugular foramen**
  - Int jugular vein
  - Glossopharyngeal, vagus, accessory nerves

- **Hypoglossal canal** - Hypoglossal nerve

- **Stylomastoid foramen** - Facial nerve

Face

**Motor nerve supply - Facial nerve VII**

1. motor to face
2. parasymp/secretomotor to submandibular/sublingual/lacrimal glands
3. taste to ant 2/3 of tongue

**Course:**
- pons - base skull thru stylomastoid foramen; gives posterior auricular nerve
- superior and inferior divisions
- divides in parotid gland into 5 terminal branches

- **Temporal**
  - From upper border parotid, cross zygomatic arch, supplies Auricularis, Frontal part frontalis; Wrinkling forehead

- **Zygomatic**
  - Crosses zygomatic arch, supplies Orbicularis oculi, zygomaticus major/minor

- **Buccal**
  - Forward close to parotid duct, supplies Buccinator, Muscle of nose/upper lip

- **Mandibular**
  - Along lower border mandible, supplies orbicularis oris, depressor anguli oris

- **Cervical**
  - Downwards from lower border of parotid, supplies Platysma

**Surface Anatomy**

join 2 points: middle ant border mastoid process = stylomastoid foramen; behind neck mandible = division into terminal branches

**Sensory nerve supply - Trigeminal nerve (V)**

**Ophthalmic (V1)**

- **Lacrimal nerve** - skin over lateral part upper lid
- **Supraorbital nerve** - supraorbital foramen, several branch – forehead/scalp to vertex
- **Supratrochlear nerve** - pass up medial supraorbital nerve - mid forehead to hairline
- **Infratrochlear nerve** - med upper lid; pass above med palpebral lig to bridge nose
- **External nasal nerve** - middle of nose down to tip
Maxillary (V2)
Infraorbital nerve
course: into orbit via inferior orbital fissure, traverses infra-orbital groove and canal in orbital floor, emerges through infraorbital foramen
lies between levator labii superioris/levator anguli oris – many branches
supplies: lower lid, cheek, lat nose, upper lip, gum, ant maxillary teeth
Zygomaticofacial nerve - foramen outer surface zygomatic bone → overlying skin
Zygomaticotemporal nerve - emerges temporal fossa thru foramen temporal aspect
zygomatic bone, supplies temporal skin

Mandibular (V3)
Auriculotemporal nerve - around neck mandible, over post root zygomatic arch behind sup temp vessels
auricular branch supplies EAM and TM; temporal branch supplies hairy skin over temple
Buccal nerve - supply area cheek below zygoma between areas supplied infraorb/great auricular nerves
Mental nerve - cutaneous branch inferior alveolar nerve
emerges from mental foramen → numerous branches; supplies skin of lower lip, chin, and gum

Scalp
Extends from supraorbital margins to highest nuchal lines and laterally to ears and zygomatic arches

Layers
Skin → Connective tissue → Aponeurosis (and muscle) → Loose areolar tissue → Pericranium

Muscle
Occipitofrontalis = Occipitalis (from highest nuchal line) and frontalis (from upper part orbicularis oculi) with aponeurosis between

Nerve: Facial, posterior auricular and temporal branches

Artery
ECA and ophthalmic artery branches

Nerve
post – greater occipital/post rami C2/3; temple – auriculotemp/zygomaticotemp; ant – supraorbital/supratrochlear

Blood supply of the face

Arterial supply
1. Facial artery
4th branch external carotid (just above lingual)
Runs on sup constrictor, deep to digastric/stylohyoid and submandibular
Inf border mandible to med canthus eye - between buccinators/dilators lips
Branches to lips, side of nose, med canthus
Branches: tonsillar, asc palatine, sup/inf labial
2. Transverse facial artery - branch of sup temporal – branch of ECA
3. Ophthalmic artery
Supraorbital branch
Anastomoses with superl temporal so communicates ICA with ECA
Supplies skin to vertex, branch to skin at root of nose (dorsal nasal artery)
Supratrochlear branch

Venous drainage

Superficial drainage
Supraorbital/supratrochlear veins to med canthus - form angular vein
Becomes facial vein that descends behind facial artery → in IJV
Blood from temple → superficial temporal vein joined by maxillary vein → form retromandibular vein → forms 2 branches – ant and post
Post branch + post auricular vein - forms EJV
Deep venous drainage
Several anastomoses between superficial and deep vessels
Ophthalmic veins
Med angle lid - drain orbit into cavernous sinus if block (danger Δ)
Deep facial vein
Back from facial vein, to cavernous sinus through emissary veins

Lymphatic drainage
Submental nodes Small area skin on chin, tip of tongue
Submandibular nodes Forehead, frontal/maxillary sinuses, ant nose, upper lip, lower face, tongue, floor mouth
Preauricular Lateral forehead, temple, orbital contents, cheek
All drain to deep cervical nodes
**Muscles of facial expression**

**Orbicularis oculi**
- Origin: palpebral part from medial palpebral ligament
  - orbital part from nasal part of frontal bone/anterior lacrimal crest/frontal process maxilla
- Insertion: palpebral part fibres arch across both lids and interdigitate laterally to form lateral palpebral raphe
  - orbital part fibres circumscribe the orbital margin in a series of concentric loops
- Nerve: zygomatic branches of facial nerve
- Action: palpebral – closure of lids; palpebral and orbital – closure of lids and burying of eyelashes

**Orbicularis oris**
- Origin: fibres of self/other dilators; incisive fibres deepest/attached to maxilla and mandible near midline away from alveolar margin
- Insertion: incisive slips curve around the angle of the mouth in a loop on either side
- Nerve: buccal and marginal mandibular branches of facial nerve
- Action: sphincter

**Buccinator**
- Origin: mandible and maxilla, opposite molar teeth (oblique line of mandible, pterygomaxillary ligament, pterygomandibular raphe). Interdigitates with fibres of superior constrictor
- Insertion: fibres converge on modiolus – raphe fibres decussate, maxillary fibres pass into upper lips, mandibular fibres into lower lips. Muscle pierced by parotid duct opposite upper 3rd molar. Overlying buccal fat pad
- Nerve: buccal branches facial nerve
- Action: muscle facial expression/accessory muscle mastication – pass boluses from cheek pouch back to molars

**Levator labii superioris aleque nasi**
- Origin: frontal process maxilla above central incisor
- Insertion: ala of nose, upper lip; overlies exit of infraorbital nerve
- Nerve: buccal branches facial nerve
- Action: elevation ala and upper lip

**Levator anguli oris**
- Origin: canine fossa below orbital margin
- Insertion: fibres converge on modiolus and pass thru it to become superficial; infraorbital nerve sandwiched between it and levator labii superioris
- Nerve: buccal branches facial nerve
- Action: elevation upper lip

**Zygomaticus major/minor/Risorius**
- Nerve: buccal branches of facial nerve
- Action: elevation of upper lip

**Depressor anguli oris**
- Origin: mandible below mental foramen
- Insertion: superficial muscle, inserts into modiolus
- Nerve: marginal mandibular branch facial nerve
- Action: depression of lower lip

**Depressor labii inferioris**
- Origin: mandible below mental foramen
- Insertion: deep muscle, inserts into lower lip
- Nerve: marginal mandibular branch facial nerve
- Action: depression of lower lip

**Mentalis**
- Origin: near midline of mandible
- Insertion: fibres pass downwards
- Nerve: marginal mandibular branch facial nerve
- Action: elevates skin of chin

Also: *Procerus, Nasalis muscle, Corrugator superciliis, Depressor superciliis*

**Muscles of nose**
*All supplied by buccal branches of facial nerve*

**Compressor naris** Maxilla to form aponeurosis over bridge nose with opp muscle

**Dilator naris** Maxilla to lateral part of ala

**Levator labii superioris alaeque nasi** contributes to widening of nostrils

**Depressor septi** From maxilla above central incisor; elevation of ala – contributes to widening of nostril

**Modiolus**
- chiasma of facial muscles held together by fibrous tissue, lateral/superior to angle of mouth
- important in facial expression
- facial nerve, labial branches facial artery
- made up by: orbicularis oris, buccinator, levator anguli oris, depressor anguli oris, zygomaticus major, risorius
Temporal fossa and parotid region

Temporal fossa ‘area bounded by temporal lines above/zygomatic arch below’

Contents - Temporalis muscle

Parotid region ‘in front of ear and below zygomatic arch’

Parotid duct 5cm long, opens opposite upper 2nd molar

Muscles of mastication

1 Temporalis
   Origin: temporal fossa
   Insertion: medial aspect coronoid process and anterior ramus mandible
   Anterior fibres vertical, posterior fibres horizontal
   Nerve: temporal branches of mandibular nerve
   Action: elevation and retraction of mandible

2 Masseter
   Origin: maxillary process/lower border zygomatic arch
   Insertion: lateral surface ramus of mandible
   Nerve: masseteric branch of mandibular nerve
   Action: elevation and retraction of mandible

3 Lateral pterygoid
   Origin: greater wing sphenoid and lateral surface lateral pterygoid plate
   Insertion: joint capsule, disc and pterygoid fossa on neck of mandible
   Nerve: nerve to lateral pterygoid (branch mandibular)
   Action: bilat protracts mandible, depress chin; unilat swings jaw other side

4 Medial pterygoid
   Origin: medial surface lateral pterygoid plate and tuberosity of maxilla
   Insertion: medial ramus below foramen
   Nerve: nerve to medial pterygoid (branch mandibular)
   Action: acts with masseter to elevate mandible, protrusion; unilat swings cf lateral pterygoid

Nose

External nose - root, dorsum (bridge and ala), nares
Nerve: External nasal, Infratrochlear

Sphenoethmoidal recess above and post to sup concha - Ostium of sphenoidal air sinus
Superior concha overlies sup meatus (drains post ethmoidal air cells)
Middle concha overhangs middle meatus (drains ant/middle ethmoidal air cells, maxillary and frontal sinuses) - Sphenopalatine foramen behind post end transmits sphenopalatine A

Inferior concha nasolacrimal duct

Blood supply

1. Sphenopalatine artery from maxillary artery anastomoses with septal branch sup labial artery, asc branch greater palatine artery - forms Keiselbach’s plexus in Little’s area on lower ant part septum

2. Ant/post ethmoidal branches ophthalmic A supply roof/upper part lat wall/septum

Nasal cavity

Superior Post nasal apertures (choanae) between post borders med pterygoid plates of sphenoid/vomer
Inferior Nares
Lateral wall Maxilla, Nasal bone, Lateral mass of ethmoid bone
Medial wall Nasal septum, Nasal cartilage, Perpendicular plate of ethmoid
Floor Hard palate (palatal process of the maxilla and horizontal plate of ethmoid)
Roof Cribriform plate of ethmoid

Paranasal sinuses Four pairs of sinuses

Maxillary sinus
Pyramidal space within body of maxilla
Small at birth, rapid increase in size during puberty

Relations
Sup - Floor orbit
Inf - Alveolar part maxilla
Ant - Cheek
Post – Infratemporal/pterygopalatine fossae
Ostium High up, post on nasal wall, Opens in middle meatus

Ethmoidal sinus
Between orbit/nose, divide by bony septa into air cells (18) – ant/mid/post

Relations
Lat wall - Medial wall of orbit – lamina papyracea
Med wall - Forms superior and middle concha
Roof - Orbital part of frontal bone
Sphenoidal sinus
 Occupy body of sphenoid, In front of pituitary fossa, medial to cavernous sinus/internal carotid

Frontal sinus

Tongue
 Components
 Dorsum
 Oral part Ant 2/3
 Surface roughened by papillae
 Fillifor - Small velvety protrusions
 Fungiform - Pinhead size, sides
 Vallate - 12, V in front of sulcus terminalis, surrounded by taste buds/serous glands

Pharyngeal part
 Post 1/3 from sulcus terminalis to epiglottis
 Between tongue and epiglottis is median glossoepiglottic fold with vallecula on each side
 then lateral glossoepiglottic fold extending to side wall of pharynx

Tip, root
 Inferior surface Midline frenulum, Deep lingual artery lateral to frenulum

Muscles
 Intrinsic Sup/inf longitudinal, Transverse, Vertical
 Extrinsic Genioglossus, Hyoglossus, Styloglossus, Palato

Blood supply Lingual artery and lingual vein
 Nerve All except palatoglossus (pharyngeal plexus) hypoglossal
 Sens - Lingual nerve ant 2/3, Chorda tympani – taste ant 2/3

External ear
 Blood supply
 Auricle and external meatus - Post auricular/sup temporal arteries
 Deep part ext aud meatus - Deep auricular from maxillary artery

Nerve supply
 Cranial surface auricle and lower half - Greater auricular nerve (C2)
 Upper half, ext and meatus and TM - Auriculotemporal (mandibular)
 Post wall and floor meatus - Auricular branch vagus nerve
 Other nerves - Lesser occipital, vagus, glosopharyngeal, facial

Orbit
 ‘4-sided pyramid lying on its side with apex posteriorly’
 Relations
 Superior - Anterior cranial fossa
 Inferior - Maxillary sinus
 Medial - Nasal cavity, ethmoidal/sphenoid sinus
 Postlat - Infratemporal fossa, Mid cranial fossa

Walls
 Orbital rim = frontal + zygomatic + maxilla
 Roof - Frontal bone
 Medial wall Ant lacrimal crest on front process max
 Orbital plate of ethmoid, Body of sphenoid
 Lateral wall Zygomatic bone, Greater wing sphenoid
 Floor - Maxilla
 Posterior - Sphenoid

Muscles
 Oculomotor nerve III
 - Levator palpebrae superioris
 - SR (up and in), IR (down and in)
 - MR, IO (up and out)
 → Posis (levator), down/ out (unopposed LR/SO), dilate pupil, can’t accomm

Abducent nerve V1
 - LR → Diplopia looking down and in

Trochlear nerve IV
 - SO (down and out) → Can’t look out
**Eyeball**

**Nerve** Short + long ciliary nerve from nasociliary nerve

**Blood** Ophthalmic artery (Branch of cerebral part ICA)

**Venous** Into cavernous sinus

**Movements**

*Aqueous humour*

Produced by ciliary processes, enter post chamber, thru pupil to ant chamber, thru iridocorneal angle to Canal of Schlemm, into ant scleral veins

**Important structures of eyeball**

- Cornea, anterior chamber, lens, iris, ciliary body, limbus, vitreous body, choroid, sclera, retina, optic nerve/disc

**Wall of eyeball**

- Fibrous – cornea, conjunctivae, sclera
- Uveal tract (vascular) – choroid, ciliary body, iris
- Nervous – retina, optic disc, macula

**Pupillary light reflex**

Light – retina – optic nerve – pretectal nucleus in midbrain - Edinger-Westphal nuclei – parasymp, oculomotor nerve to ciliary ganglion, short ciliary nerve – sphincter pupil

**Passing through superior orbital fissure**

Ophthalmic n. (V1), III, IV, VI, sympathetic fibres, ophthalmic veins

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**Lacrimal apparatus**

Lacrimal gland/its ducts, lacrimal canaliculi, lacrimal sac, nasolacrimal duct

**Lacrimal Gland**

in fossa on anterolat angle of roof of orbit
rests on lat rectus & levator palpebrae sup
consists of 2 parts: orbital part, palpebral part
continuous with each other around lat border aponeurosis of lev palpebrae sup
drain by -12 lacrimal ducts - open into sup fornix conjunctiva

**Lacrimal Canaliculi**

1 each eyelid, ~1 cm long, begins as lacrimal punctum, pass medially, open into lat wall of lacrimal sac

**Lacrimal Sac**

~ 1 to 1 ½ cm long, located in a fossa at med margin of orbit, btw ant & post lacrimal crests

**Nasolacrimal Duct**

~ 2 cm long, extends from lower end of lacrimal sac to inf meatus of nose

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**Pterygopalatine Fossa**

Small pyramidal space behind & below orbital cavity

**Boundaries**

- **Anterior** – post surface maxilla
- **Posterior** – greater wing sphenoid/root pterygoid process
- **Medial** – upper part perpendicular plate with orbital and sphenoidal processes with palatine bone
- **Lateral** – open (pterygomaxillary fissure)
- **Superior** – body sphenoid
- **Inferior** – pyramidal process and palatine bone

**Contents**

- Maxillary art – 3rd part & branch
- Maxillary nerve & 2 branches (zygomatic, post alveolar)
- Pterygopalatine ganglion & branches

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**Mandible**

**Body**

Horizontal U shaped body continuous at its post ends with pair vertical rami

**Mental foramen**

*Depressor anguli oris* attached below mental foramen.
Depressor labii inferioris attached anterior to mental foramen (and deep to depressor anguli oris)

Mentalis attached near midline

Mylohyoid line
Inner surface of body characterised by mylohyoid line which forms attachment of mylohyoid muscle

Sublingual fossa
Above ant end mylohyoid line - contains sublingual gland

Submandibular fossa
Below ant end mylohyoid line - contains submandibular gland

Mental spines
Four projections low down in midline
Genioglossus from upper pair, geniohyoid from lower

Digastric fossae
Oval depressions either side midline lateral to mental spines
Give attachment to anterior bellies digastric

Rami
Vertical continuation of body

Oblique line
Extends down from anterior border of ramus
Buccinator attached here opposite molar teeth
Masseter attached to whole lateral surface ramus

Neck
Expands to a head (condyle)
Neck of mandible hollowed anteriorly by pterygoid fovea that gives attachment to lateral pterygoid.
TMJ capsule attached to margins
Lateral TM ligament attached below this to lateral neck

Coronoid process
Anterior border ramus extends up to pointed coronoid process.
Temporalis attached to medial surface of coronoid process

Lingula and mandibular foramen
Medial surface of the ramus characterised by the lingula
Located at anterior margin of the mandibular foramen.
Inferior alveolar nerve and vessels pass through foramen
The mylohyoid groove carries mylohyoid vessels
Sphenomandibular ligament attached to lingula
Medial pterygoid attach mylohyoid groove/angle mandible

Temporomandibular joint
Atypical synovial joint
Bony surfaces covered by fibrocartilage
Fibrocartilagenous disc

Articulation
head mandible/mandibular fossa of squamous part temporal bone
Capsule attached high on neck mandible ant/low down post + to margins mandibular fossa + to disc

Ligaments
Lateral temporomandibular ligament (strong)
Sphenomandibular ligament, Stylogomandibular ligament
Weak accessory ligament between spine of sphenoid and lingula of mandible

Nerve branches of mandibular
Artery superficial temporal and maxillary (ECA)

Movement
Depression Digastrics, Mylohyoid, Geniohyoid (infrahyoid muscles stabilise hyoid)
Elevation Masseter, Medial pterygoid, Temporalis
Lateral ‘grinding’ Medial and lateral pterygoids acting alternately on either side
Protrusion All four pterygoids together
Retraction Passive recoil, Posterior fibres of temporalis, Deep fibres of masseter

Stability
Most stable when teeth occluded, Less stable in open position, Prone to forward dislocation

Bony factors Shape – postglenoid tubercle prevents posterior dislocation
Articular eminence, Occlusion of teeth
**Ligaments**

Stylomandibular and sphenomandibular ligaments (weak)
Temperomandibular (lateral) ligament prevents posterior dislocation

**Muscles of mastication**

Masseter, Temporalis, Medial pterygoid, Lateral pterygoid

**Capsule**

**Radiology of face**

Supraorbital margin, Infraorbital margin
Nasal bones and nasal septum
Maxilla, Zygomatic arch, Body of mandible
Frontal sinus, Ethmoidal sinus, Maxillary sinus
Greater wing of sphenoid, Lesser wing of sphenoid

1. Frontal sinus
2. Crista galli
3. Cribriform plate
4. Lesser wing of sphenoid
5. Superior orbital fissure
6. Superior border petrous part temporal bone
7. Dense shadow petrous part temporal bone
8. Perpendicular plate of the ethmoid
9. Vomer
10. Maxillary sinus
11. Inferior concha
12. Ramus of mandible
13. Body of mandible

1. Frontal sinus
2. Ethmoidal sinus
3. Sphenoidal sinus
4. Maxillary sinus
5. Anterior clinoid processes
6. Hypophyseal fossa
7. Posterior clinoid processes
8. Clivus
9. Great density of the petrous part of the temporal bone
10. External acoustic meatus
11. Mastoid cells
12. Nasopharynx
13. Angle of mandible
14. Anterior arch of the atlas
15. Dens of axis
16. Posterior arch of the atlas
17. Internal occipital protuberance

A. Coronal suture
B. Lambdoid suture
C. Grooves for branches of middle meningeal vessels