

THE OSTEOLOGY OF THE HEAD AND PARANASAL SINUSES

VBA 501 CLINICAL ANATOMY

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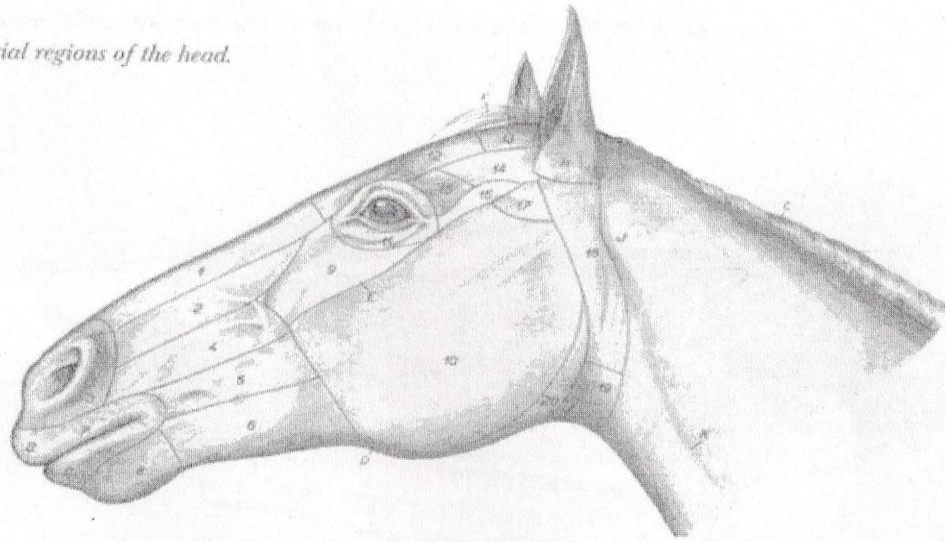
- The head plays a significant role in clinical practice because of the important structures and organs contained therein.
- For example, an impairment of the brain, sensory organs or the cranial nerves can affect not only the head but the entire health status of the animal and may even lead to changes in the behavioural pattern.
- Structures of the digestive and respiratory tracts represent the most important portal of entry for pathogens.

PARANASAL SINUSES

- They are air-filled (pneumatic) diverticula of the nasal cavity that excavate the bones of the head largely post-partum.
- They originate during early fetal life and their pneumatic expansion continues until early adulthood. Because of their origin and growth from the nasal chamber, they share characteristics of this structure, such as its lining membrane and its diseases.
- The orbit, brain, and vital neural and vascular structures, which are adjacent to the paranasal sinuses, may develop serious complications from sinus diseases or from surgery performed on these cavities
- Sinuses retain their communication with the nasal cavity.
- Their openings are narrow, thus relatively slow exchange of air occurs.
- Narrowness and anatomical locations of the openings make them highly susceptible to blockages especially when the mucosa is thickened by inflammation and/or congestion.
- Not all sinuses are of equal clinical significance across species
- The following are the paired paranasal sinuses:
 - Maxillary sinus
 - Frontal sinus
 - Palatine sinus
 - Sphenoidal sinus
 - Lacrimal sinus
 - Dorsal conchal sinus
 - Ventral conchal sinus (pig, ruminant and horse)
- Drugs indicated for the treatment of nasal and paranasal infections are best applied topically because of poor vascularization of their mucosa, unlike that of the respiratory and the olfactory mucosa.
- IV/IM injections are not bioavailable at these sites,

Horse. Superficial regions of the head.

Figure 104



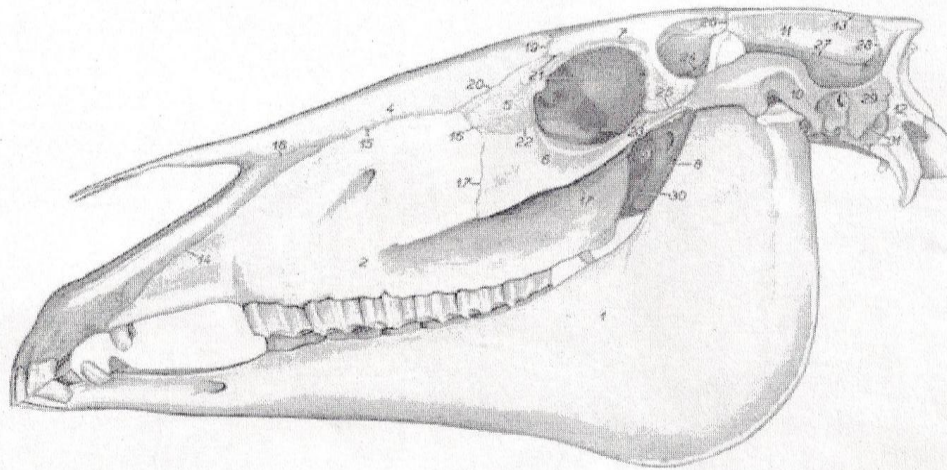
- 1-3. *regio nasalis* — region of nose
1. *regio dorsalis nasi* — dorsal region of nose
2. *regio lateralis nasi* — lateral region of nose
3. *regio nasi* — region of nostril
4. *regio maxillaris* — maxillary region
5. *regio buccalis* — region of cheek
6. *regio mandibularis* — mandibular region
7. *regio oralis (regio labialis maxillaris et labialis mandibularis)* — oral region (region of lips)
8. *regio mentalis* — region of chin
9. *regio infraorbitalis* — infraorbital region
10. *regio masseterica* — masseteric region

11. *regio orbitalis (regio palpebralis superior et palpebralis inferior)* — orbital region (region of eyelids)
12. *regio frontalis* — frontal region
13. *regio parietalis* — parietal region
14. *regio temporalis* — temporal region
15. *fossa supraorbitalis* — supraorbital fossa
16. *regio zygomatica* — zygomatic region
17. *regio articulationis temporomandibularis* — region of temporomandibular articulation
18. *regio parotidea* — parotid region
19. *regio laryngea* — laryngeal region
20. *margo mandibular* — margin of mandible

- A. *nostril* — nostril
- B. *labium maxillare* — upper lip
- C. *labium mandibulare* — lower lip
- D. *incisura (notch) for facial vessels*
- E. *crista facialis* — facial crest
- F. *clivus capitis* — foretop
- G. *juba* — mane
- H. *auricula* — external ear
- J. *processus transversus atlantis* — transverse process of atlas
- K. *sulcus jugularis* — sulcus furrow

Horse. Skull, left lateral view. Bone outlines demarcated by color.

Figure 108



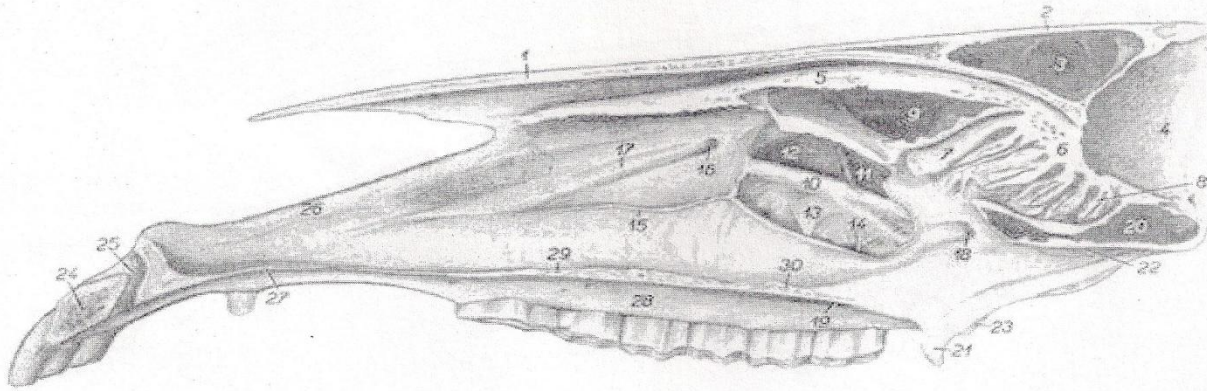
1. *mandibula* — mandible
2. *maxilla* — maxilla
3. *os incisivum* — incisive bone
4. *os nasale* — nasal bone
5. *os lacrimale* — lacrimal bone
6. *os zygomaticum* — zygomatic bone
7. *os frontale* — frontal bone
8. *os presphenoidale* — presphenoid bone
9. *lamina perpendicularis ossis palatini* — perpendicular plate of palatine bone
10. *os temporale* — temporal bone
11. *os parietale* — parietal bone
12. *os occipitale* — occipital bone

13. *os interparietale* — interparietal bone
14. *sutura maxilloincisiva* — maxilloincisive suture
15. *sutura nasomaxillaris* — nasomaxillary suture
16. *sutura lacrimomaxillaris* — lacrimomaxillary suture
17. *sutura zygomaticomaxillaris* — zygomaticomaxillary suture
18. *sutura nasoincisiva* — nasoincisive suture
19. *sutura frontomaxilla* — frontomaxillary suture
20. *sutura nasolacrimalis* — nasolacrimal suture
21. *sutura frontolacrimalis* — frontolacrimal suture
22. *sutura lacrimozygomatica* — lacrimozygomatic suture

23. *sutura tempozygomatica* — tempozygomatic suture
24. *sutura squamosofrontalis* — squamosofrontal suture
25. *sutura temporofrontalis* — temporo-frontal suture
26. *sutura coronalis* — coronal suture
27. *sutura squamosa* — squamous suture
28. *sutura lambdoidea* — lambdoid suture
29. *sutura occipitomastoides* — occipitomastoid suture
30. *sutura sphenopalatina* — sphenopalatine suture
31. *sutura squamosomastoides* — squamosomastoid suture

Horse. Midsagittal section through skull after removal of the conchae. Right view.

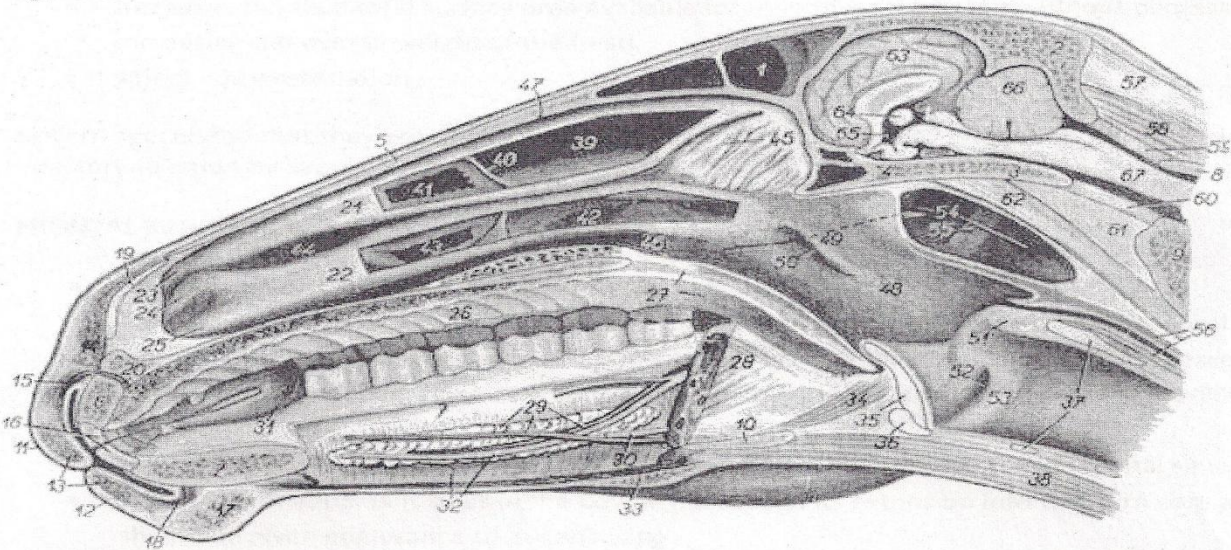
Figure 129



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|---|--|---|
| <p>1. os nasale — nasal bone
 2. os frontale — frontal bone
 3. sinus frontalis — frontal sinus
 4. cavitas cranii — cranial cavity
 5. concha nasalis dorsalis — dorsal nasal concha
 6. crista galli — crista galli
 7. concha nasalis media — middle nasal concha
 8. embolus turbinatus VI — sixth endoturbiniate
 9. sinus conchofrontalis — conchofrontal sinus
 10. canalis infraorbitalis — infraorbital canal
 11. sinus maxillaris caudalis — caudal maxillary sinus
 12. sinus maxillaris rostralis — rostral maxillary sinus
 13. sinus conchae nasalis ventralis — sinus of ventral nasal concha</p> | <p>14. sinus maxillaris caudalis (apertura sinus sphenoidalis) — caudal maxillary sinus (opening of sphenoid sinus)
 15. crista conchalis (maxillaris) — conchal crest (of maxilla)
 16. canalis lacrimalis — lacrimal canal
 17. sulcus lacrimalis — lacrimal sulcus
 18. foramen sphenopalatinum — sphenopalatine foramen
 19. foramen palatinum majus — greater palatine foramen
 20. sinus sphenopalatinum — sphenopalatine sinus
 21. hamulus pterygoideus — pterygoid hamulus
 22. vomer — vomer</p> | <p>23. tuber maxillare — maxillary tuber
 24. corpus ossis incisivi — body of incisive bone
 25. canalis interincisivus — interincisive canal
 26. processus nasalis ossis incisivi — nasal process of incisive bone
 27. processus palatinus ossis incisivi — palatine process of incisive bone
 28. processus alveolaris maxillae — alveolar process of maxilla
 29. processus palatinus maxillae — palatine process of maxilla
 30. lamina horizontalis ossis palatini — horizontal plate of palatine bone</p> |
|---|--|---|

Horse. Sagittal section through the head, medial surface. Nasal septum, partition between the air sinuses, part of the nasal turbinates, and the tongue are all removed. Left view.

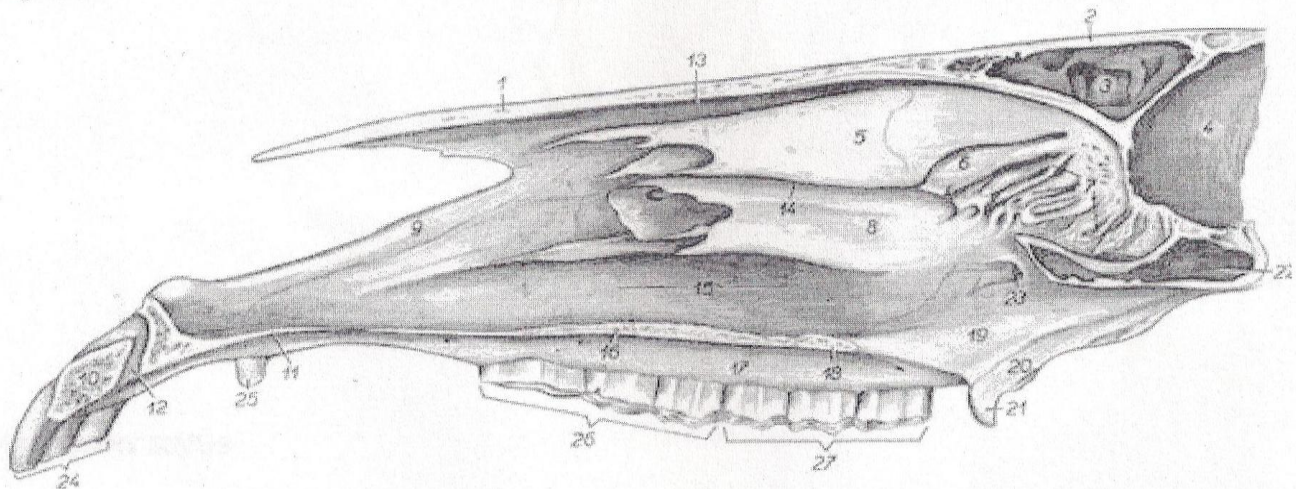
Figure 124



- 21-Dorsal nasal concha; 22-Ventral nasal concha; 39-Conchofrontal sinus; 41-Bulla of dorsal nasal concha; 42-Sinus of ventral nasal concha; 43-Bulla of ventral nasal concha; 44-Middle nasal meatus; 46-Ventral nasal meatus; 47-Dorsal nasal meatus

Horse. Midsagittal section through skull. Right view.

Figure 128



- | | | |
|--|--|---|
| <p>1. <i>os nasale</i> – nasal bone
 2. <i>os frontale</i> – frontal bone
 3. <i>sinus frontalis</i> – frontal sinus
 4. <i>caerum cranium</i> – cranial cavity
 5. <i>concha nasalis dorsalis</i> – dorsal nasal concha
 6. <i>concha nasalis media</i> – middle nasal concha
 7. <i>labrynthus ethmoidalis</i> – ethmoidal labyrinth
 8. <i>os conchae nasalis ventralis</i> – ventral nasal conchal bone
 9. <i>processus nasalis ossis incisivi</i> – nasal process of incisive bone
 10. <i>corpus ossis incisivi</i> – body of incisive bone</p> | <p>11. <i>processus palatinus ossis incisivi</i> – palatine process of incisive bone
 12. <i>canalis interincisivus</i> – interincisive canal
 13. <i>meatus nasi dorsalis</i> – dorsal nasal meatus
 14. <i>meatus nasi medialis</i> – middle nasal meatus
 15. <i>meatus nasi ventralis</i> – ventral nasal meatus
 16. <i>processus palatinus maxillae</i> – palatine process of maxilla
 17. <i>processus alveolaris maxillae</i> – alveolar process of maxilla
 18. <i>lamina horizontalis ossis palatini</i> – horizontal plate of palatine bone</p> | <p>19. <i>lamina perpendicularis ossis palatini</i> – perpendicular plate of palatine bone
 20. <i>os pterygoideum</i> – pterygoid bone
 21. <i>hamulus pterygoideus</i> – pterygoid hamulus
 22. <i>sinus sphenopalatinus</i> – sphenopalatine sinus
 23. <i>foramen sphenopalatinum</i> – sphenopalatine foramen
 24. <i>dentes incisivi</i> – incisors
 25. <i>dens caninus</i> – canine tooth
 26. <i>dentes premolares</i> – premolar teeth
 27. <i>dentes molares</i> – molar teeth</p> |
|--|--|---|

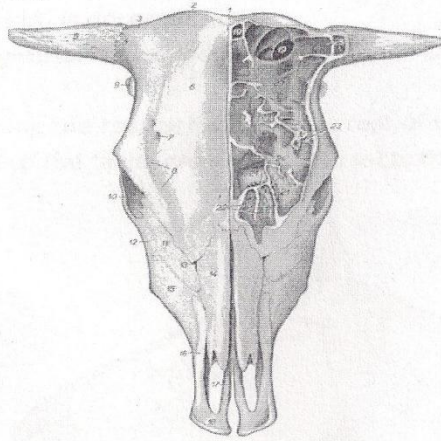
FUNCTIONS

- Thermal and mechanical protection to the orbit, and nasal and cranial cavities
- Increases the skull total surface area available for muscular attachment without necessarily increasing the overall weight of the head.
- Affect voice resonance

Skillern speculated that they are of olfactory use in animals and that they give some assistance in olfactory function by evenly distributing the inspired air in the olfactory region.

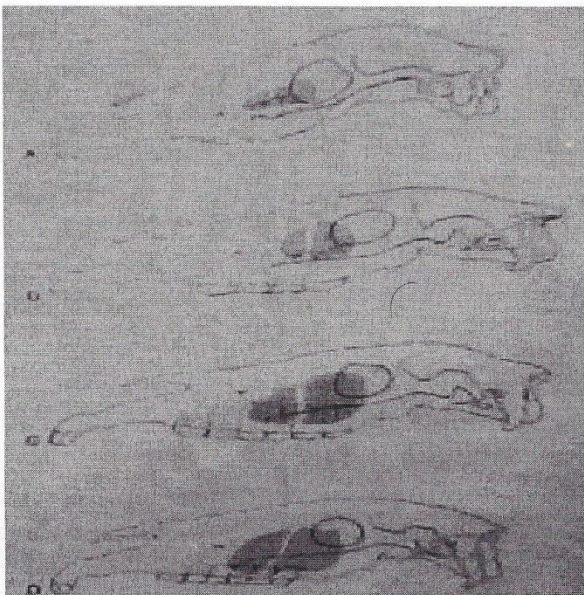
FRONTAL SINUS

- Occupies the dorsal part of the skull medial to the orbit
- Consist of one or more spaces within the frontal bones at the border between the nasal and cranial cavities whose compartments open separately into the ethmoidal meatuses except in the horse where it communicates with the nasal cavity indirectly with the caudal maxillary sinus
- It is connected to the dorsal conchal sinus, in the horse, forming the conchofrontal sinus
- It is the most important sinus in the bovine because of its extension into the horn core and should be given cognisance to in dehorning



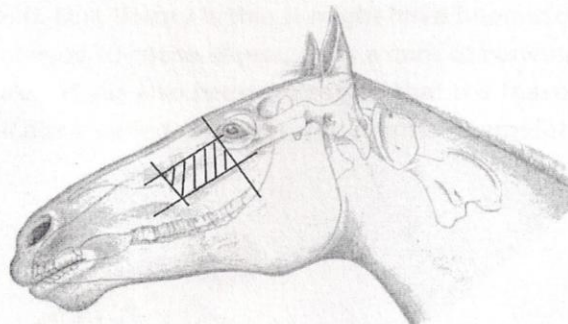
MAXILLARY SINUS

- Separated into 2 compartments by a bony septum
- Occupies the caudolateral parts of the upper jaw above the caudal cheek teeth
- Divided into caudal and rostral parts, in the horse and both connected to the middle nasal meatus by a common slit-like nasomaxillary opening.
- In addition, each of these is subdivided into a medial (inside) and lateral (outside) component, by an incomplete bony wall that carries the infraorbital canal containing nerves and blood vessels. The close proximity to the tooth roots mean that as the teeth erupt with age, the maxillary sinuses become larger.
- Difficult to state the exact extent and projections of the maxillary sinuses, which enlarges considerably after birth as the teeth erupt.
- Their relationship with the teeth is also affected by the forward migration of the teeth as they develop and wear.
 - Last premolar and 1st molar in newborn foal
 - Last four premolar later in life
 - Molars (3) in the adult life



- Surface projections of the maxillary sinuses is considerably larger than the *safe surgical field* (because of the vulnerable nasolacrimal duct of the lacrimal gland and the infraorbital nerve)

- This field (safe surgical field) is determined by:
 - Vertical line tangential to the rostral limit (medial canthus) of the orbit
 - Facial crest
 - Oblique line joining the rostral limit of the crest of the infraorbital foramen and;
 - The line parallel to the facial crest that intersects the infraorbital foramen.



The shaded portion is the "safe surgical field"

- Premolars and molars of the horse can't be extracted from within the oral cavity, except when they are quite loose. They must be tapped out from the roots (repulsion), which can only be reached through the maxillary sinus.
- In the dog, it is called the maxillary recess because of its free communication with the nasal cavity
- Root abscess may break into the maxillary recess in the dogs and ultimately affecting the surface of the skull
- Surgical drainage recommended
- Access through the paranasal sinuses is achieved through TREPANATION/TREPHINATION

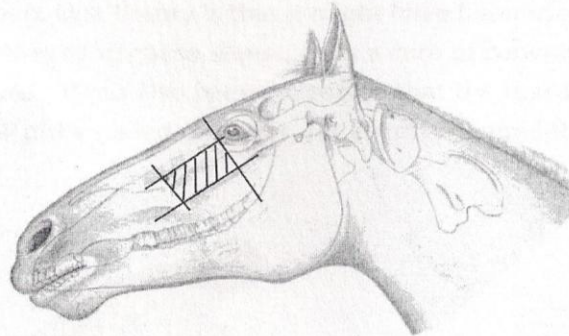
SPHENOPALATINE SINUSES - Small pouches medial to the caudal maxillary sinus

INDICATIONS

Primary sinusitis occurs subsequent to an upper respiratory tract infection that has involved the paranasal sinuses. It usually involves all sinus cavities but can be confined to the ventral conchal sinus. This cavity is difficult to detect radiographically and access is surgically by sinusotomy. Treatment of primary sinusitis involves lavage of the sinus cavity and systemic antimicrobial therapy based on culture and sensitivity results. Physiologic saline is a suitable lavage solution. If povidine iodine is used in the lavage fluid it needs to be very diluted (0.01% or a weak tea colour) because higher concentrations can irritate the sinus mucosa. Sterile lavage fluids are generally not required and addition of antibiotics to the lavage solution is usually unnecessary. An isotonic saline solution can be made simply by adding 30mLs (measured by volume) of sodium chloride to 4L of tap water. Most horses will tolerate lavage unседated.

Secondary sinusitis can result from tooth root infection, fracture, or sinus cyst. Tooth root abscesses typically produce a fetid nasal discharge. The first molar, fourth premolar, and third premolar (in decreasing frequency) are the most likely to develop tooth root abscesses. Clinical signs of secondary sinusitis closely resemble those of primary sinusitis including unilateral mucopurulent nasal discharge and facial deformity. Secondary sinusitis requires removal of affected cheek teeth or cystic material via sinusotomy

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 - Vertical line tangential to the rostral limit (medial canthus) of the orbit
 - Facial crest
 - Oblique line joining the rostral limit of the crest of the infraorbital foramen and;
 - The line parallel to the facial crest that intersects the infraorbital foramen.



The shaded portion is the "safe surgical field"

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TREPHINATION

- Trephination, or making a hole in the skull of a living person/animal, seems to have been the first surgical practice. **But why would people cut holes in the skull?** There are many theories about the practice, which first appeared during the Neolithic period. It was most often performed on adult males – although examples have been found in the skulls of children and women. One theory is that it might have been used for the exit or entrance of spirits believed to cause illness, or as a cure of convulsions, headaches, infections and fractures. It has also been suggested that the reason for trephination was the collection of skull discs, called *rondelles*, for charms or amulets.

