DEFRA EXEMPTION CERTIFICATE

REVISION NOTES

DENTAL PAPER

Anatomy of the Head

Skull

Made up of many bones fused together

By the 8 year the skull is solid and unyielding, prior to that joints joined by cartilage

Skull made up of 2 main portions, the cranium and the face

Cranium lodges the brain, face contains the oral and nasal cavities

The tongue supported by hyoid apparatus which is made up of jointed sections between the mandibles

The Cranium

The roof of the cranium is formed from the occipital, interparietal, parietal and frontal bones

Occipital is the strongest of these and situated at the back of the skull

Other bones of the cranial roof are thinner

Brain protected at the front by the frontal sinuses which provide a double roof of thin bone and large air space between them

The Face

Nasal cavity provides passageway for air flow and contains sensory nerve endings for sense of smell

The olfactory sense is restricted to the nasal mucous membranes covering some bony projections at the back of the nasal chamber

Projecting into the front part on both sides are the turbinate bones (also called conchae) providing increased surface are for large vascular mucous membrane of nose, acting as a heat exchange between warm air exhaled and cold air inhaled, this helps regulate the heat, warming and moistening inhaled air, and also helps with infectious disease resistance

The Sinuses

Large size of skull due to the need to provide large powers of mastication for survival of the animal

Needed strong, continually erupting teeth and large jaws

If only had larger bone structures would have increased weight of head drastically therefore sinus cavities developed increasing surface area of skull with minimal weight increase

Number of sinuses in each half of head, these are, the frontal, superior and inferior maxillary and the sphenopalatine sinuses

The frontal large superior maxillary sinuses are joined

Roots of last three cheek teeth are lodged in the rostral maxillary sinus

Inferior maxillary sinus separated from the superior sinus by thin layer of bone but both access nasal cavity

The sphenopalatine sinus divided into posterior shenoidal and anterior palatine parts, the latter opens into superior maxillary sinus

Infections of the 1 3 sinus can be drained by trephining (removal of circular section of skull)

The spenoidal part of S. sinus has blind end and therefore likely to retain infection as hard to access

The sinuses either fill or change part of their air content during expiration

They are lined by continuation of mucous membrane of the nose and involved in course of nasal infections

The evolution of these sinuses also enabled the horse to have developed greater lateral vision

Dental sinusitis or periapical infection of the 1 occasionally 3 cheek tooth may be indicated by a presence of a uni-lateral nasal discharge persistent, purulent and possibly malodourus.

Guttural Pouch

A large lateral swelling from the pharyngotympaanic tube (eustrachian or auditory tube) This tube connects the tympanic cavity of the middle ear with the nasopharynx (throat)

The guttural pouch extends dorsally ventrally and laterally into the tissues beside the pharynx, under the wing of the atlas and forwards beyond nasopharyngeal opening

Many cranial nerves and blood vessels are related to it

Infection starting in the nose or nasopharynx may enter the pouch, possibly fungal diseases may attack the mucosa and the pouch may fill with pus

Drainage of the pouch is difficult as most of it lies below level of the pharyngeal opening of the pharyngotympathic tube

Muscles

Three types of muscle

a. Voluntary, (striped) which is found in the legs, neck, quarters etc. The horse has complete control over these muscles. Described as striped as muscle fibres lie parallel to each other and, when viewed under the microscope, they show well-marked transverse dark and light bands, hence the name striated or striped muscle.

b. Involuntary, (smooth) which is found in the alimentary canal, the walls of the arteries etc. The horse has no conscious control over these muscles. Described as smooth as bundles of fibres form sheets of muscle.

c. which is found in the heart and contracts rhythmically.

Muscle functions by alternate phases of contraction and relaxation. When fibres contract they become thicker and shorter.

The muscles of the skeleton are arranged in groups some of which are antagonistic to each other. To produce movement at a joint, one muscle or group of muscles contracts while the other antagonists relax. E.g. to bend the knee the muscles on the back of the thigh contract and those on the front relax.

Soft tissue anatomy of the head

Temporal muscle located in the temporal fossa

- closes the jaw elevates mandible and presses it against the maxilla

Masseter muscle is the basis of the cheek

- One of the major jaw closing muscles elevates mandible and presses it against the maxilla

Buccinator muscle located at border of upper jaw and coronoid process of the mandible

- forms muscular basis of the cheek; returns food to the central cavity of the mouth

Orbicularis oris forms a closed circle around the mouth

- closes the mouth opening

Diagastricus

-opens mouth, elevates hyoid apparatus

Mylohyoideus located lingual surface of the mandible

- elevates floor of the mouth; presses tongue against the hard palate

Pterygoideus

Medialis/lateralis

- Synergist to masseters in unilateral contraction: moves lower jaw laterally

In front of the masseter muscle the body of the mandible is crossed by the facial artery and vein and the duct of the salivary gland

This means the lower end of the jaw is a good place to feel the pulse where the facial artery crosses it. (Normal pulse is about 35bpm in resting horse with a variation of 28-

40)

Across the surface of the masseter muscle runs a branch of the facial nerve

- these are often visible as raised areas in many thin skinned breeds

- this nerve supplies the facial muscles and passes around the lower jaw

- if the mandibular nerve is damaged, atrophy of the masticatory muscles may occur

Any facial paralysis will be indicated by a facial squint, drooping lips, mastication problems

Behind the jaw bone lies the largest of the salivary glands, the parotid, lying almost directly beneath the skin

- this gland fills the space between the wing of the atlas and the lower jaw and is bordered below by the external maxillary branch of the jugular vein.

- - this gland produces approximately 15 litres of saliva daily

Saliva is a bicarbonate-rich fluid produced by exocrine cells in the various salivary glands.

Saliva is important for predigestion of food by adding moisture and amylase, an enzyme needed for carbohydrate breakdown. The bicarbonate in saliva is also important for preserving systemic acid-base balance.

Foramen

Mental foramen from which emerges the mental nerve supplying the lips with feeling and nourishment

Infraorbital foramen nerve supplies nourishment and feeling land marked by the facial crest. Maxillary sinus disease arising secondarily to dental disease may have a profound effect on the infraorbital nerve. The pathogenesis of this is uncertain but direct inflammation or physical distortion may be involved. May result in head shaking, bit resentment. (Gordon Baker & Jack Easley, Equine Dentistry Chapter lO.p.l28 Headshaking and Facial Pain.)

Supraorbital foramen

The Jaws

Upper jaw consists of maxilla and premaxilla

-upper cheek teeth housed in maxilla

-premaxilla supports upper incisors

-both form the hard palate

Lower jaw or mandible is very large and houses lower incisors and molars

The articulation between upper and lower jaws is called the temporomandibular joint and is seated behind the orbit.

Outer surface of the skull shows a number of small apertures where muscles are attached and through which blood vessels and nerves pass.

Implantation of teeth

The horse has high-crowned teeth

-the crown is the part covered with enamel

-as the teeth erupt the part of the crown embedded in the jaw becomes smaller and a distinct root begins to form.

At 5 yo the last three or four teeth practically fill the area of the maxillary sinus reaching up to the infraorbital canal above the facial crest.

At 10 yo the teeth now occupy less of the jaws, especially the cavity of the maxillary sinus

At 18 yo the teeth have very little crown left embedded in the jaws and very little of maxillary sinus is occupied by the cheek teeth the upper level of the roots being below the facial crest

The temporomandibular joint and muscles of mastication

In contrast to carnivores that have vertical power stroke when chewing, horses have a transverse power stroke in a lingual and or medial direction

This means their masseter and pterygoid muscles are their most developed chewing muscles in the horse

In horses the TMJ is about 15cm above level of occlusal surfaces

The TMJ allows limited opening of the jaws, but gives a wide range of lateral movements allowing effective mastication

Chewing is based on a repetition of a cyclic movement that results from controlled rhythmic contractions of all the muscle groups associated with the opening and closing of the jaws

However, there is no standard pattern, what happens to the food and the way it is broken down is dependant on the cheek teeth

The three phases of mastication in the horse are

The opening stroke

The closing stroke

The power stroke

It is not strictly accurate to say that horses are either right sided or left sided chewers.

Major pressure is applied to one arcade then the other on the power stroke, but contact between both arcades does occur during this stroke

When eating the horse uses it's upper and lower lips to select test and pull food into the mouth between the incisor teeth

Short sliding strokes of the incisors cut or grasp the food material

This process continues until the rostral part of the mouth is filled with food material and then the cheek tooth grinding of food starts

The loph basins of the cheek teeth (the food channels across the occlusal surfaces) direct the food as it is crushed in the mouth

The 18 pairs of palatine ridges are curved from lateral to the midline and are incomplete and offset at the midline

The food material is squashed in the IDOC (interdental oral cavity) and pressed against the palatine ridges by the tongue

The rotary action of mastication and tongue and cheek compression moves the food caudally in a spiral fashion

The bolus of food collects and is swallowed

Horses without teeth can survive on special diets such as crushed and soaked feeds for example

If however these horses try to eat grass or hay they produce long spiral boluses of rope like consistency that may lead to oesophageal obstruction but are generally spat out by the horse

Factors that influence mastication movements include fibre and moisture content of the diet

Brachygnathia

Brachygnathism — malocclusion in which the mandible is shorter than the maxilla; also called parrot mouth

Defect can be limited to incisor malocclusions it is unusual for parrot-mouthed individuals to have difficulty grazing or feeding except for those cases in which the lower incisors impact and start to lacerate the palatine mucosa

They can develop incisor related periodontal disease and an exaggeration of rostral hooks on 1/6 and 2/6 and caudal ramps/hooks on 3/11 4/11

Prognathism

Prognathism — developmental orthodontic abnormality in which the lower jaw is longer than the upper jaw

Seen more commonly in small horse breeds

In severe cases there maybe nasal or nostril deformity as a result of the shortening of the pre-maxilla and maxillary bones. Consequently nasal collapse, obstruction and stertorus breathing may occur. Mucosal pressure sores may occur on the mandibular diastema

Diastema

Approximately 2-5mm wide interdental gap food impaction will occur. Massive and prolonged forces of mastication in the horse will cause progressively deeper food impaction and secondary periodontal disease will result.

It will be recognised by finding food fibres packed in two small spaces between the cheek teeth

Periodontal Disease

Caused by

Teeth not in proper opposition

Chronic dental overgrowths particularly on the lateral aspect of mandibular cheek teeth — oral food entrapment

Presence of supernummary cheek teeth displaced/rotated cheek teeth

Midline fractured cheek teeth. Spontaneous fractures mainly seen in upper cheek teeth due to enamel decussation are less prominent and established in upper cheek teeth.

Normal food and saliva movement around the oral cavity is essential to a healthy mouth as food stagnation at gum level will lead to periodontal infection. Painful condition will lead to quidding, bad breath in severe case, tooth loss.

TOOTH DEVELOPMENT, ERUPTION AND STRUCTURAL CHANGES

Teeth are formed from two major cells that come from the embryonic cell layers;

Ectoderm

The ectoderm will differentiate into the oral epithelium from which enamel will develop.

Mesoderm

The mesoderm will differentiate into mesenchyme. Mesenchyme will be a connective tissue and the remaining structures of the tooth will be developed here.

(Differentiate means development from the one to the many, the simple to the complex, modification of body parts for performance of particular functions)

Therefore the ectoderm and mesoderm cells will differentiate into the odontoblasts, ameloblasts and cementoblasts

Each tooth comes from a tooth germ/tooth bud.

Each bud consists of the;

Enamel organ — produces enamel

Dental papilla — produces dentin

Dental sac — produces the periodontal ligaments that will secure the neck of the tooth to the rim of the alveolus, produces cementum, nourishes and protects the tooth

Early stages of tooth development can be divided into the

Bud stage

Cap stage

Bell stage

Odontoblasts produce dentin

Ameloblasts produce enamel

Cementoblasts produce cementum

Odontoblasts, ameloblasts and cementoblasts are all end cells meaning that they cannot differentiate any further

Eruption

Eruption is the process through which the forming tooth comes into and tries to maintain occlusion. There are three things that influence tooth eruption Root growth — as the root is being formed it will apply pressure to the alveolar bone Hydrostatic pressure — this is relating to fluids at rest or to the pressure they exert or transmit

Pulling of the periodontal ligaments — these ligaments are what secures the neck of the tooth to the rim of the alveolus. Once the tooth comes into occlusion the ligaments secure to the tooth within the alveolus, dampening occlusal pressure

The alveolar bone plays an important role in eruption as well as exfoliation. The alveolar bone is very flexible and must constantly remodel itself to accommodate the constant changes of the tooth referring to its size and shape.

Through the stages of tooth development, bud, cap and bell stage up to eruption, trauma to the tooth bud can have an effect on the permanent dentition. When cells are proliferating and becoming specialised it is apparent that if there is any trauma this may effect the size and shape of the tooth. For example you still may get a tooth but new parts may become differentiated, this causing supernumerary cusps or roots. This may not affect the function of the tooth.

Trauma can also cause a tooth bud to become misplaced. It is important that there is no trauma during eruption of the tooth because a deciduous tooth is the blue print for the permanent tooth in the placement in the dental arcade.

Exfoliation/Shedding

This process is caused by the reabsorption of the roots and a loosening of the connective tissues in response to the pressure exerted by the growing and erupting permanent tooth germ.

Two stages of pressure that effect the exfoliation of deciduous teeth

First pressure is against the bone, separating the alveolus; this makes room for the eruption of the permanent tooth

Second pressure is directed against the root surface of the deciduous tooth. This is important because cementum is attached to the periodontal ligaments; therefore as reabsorption of the root occurs there becomes less connective tissue holding the deciduous tooth in place.

Premature removal of deciduous teeth will affect permanent dentition in the following ways;

Early removal may cause loss of blood supply to the central infundibular connective tissue and cementocytes thus stopping deposition of cementum

Cementum on the outside of the tooth is where the periodontal ligaments attach if production is stopped the tooth may not have the structural support it needs to stay in occlusion

Function of the dental sac is to protect the developing tooth and to supply nourishment early removal of deciduous tooth can cause premature rupture of the sac causing tooth to become malnourished and open to bacteria or infection. This will have a direct impact to the permanent tooth which may result in surgical removal of the tooth or it may not erupt and die off

Early removal of the deciduous tooth can also cause teeth to become embedded/unerupted. This condition happens because there is a lack of eruptive forces. Remove cap early removes major factors of eruption which is pressure. An impacted tooth is one that is prevented from erupting by some physical barrier in the eruption path, caused by premature loss of deciduous teeth.

Problems Associated with retained deciduous premolars

Impede eruption of the permanent teeth causing periapical swelling

Peridontitus can be a result of abnormal dental wear precipitated by conditions that

caused poor mastication including improperly shed deciduous premolars

Smell/foul breath — food lodged between permanent and deciduous teeth

Lacerations of the buccal walls and tongue

Painful mastication- loss of food when eating

Objections to the bit

Haemorrhage from the oral cavity and quidding

Weight loss

Behavioural problems

Goals of Dental Equilibration

Comfort during mastication

Maximise masticatory efficiency

Minimise effects of dental disease on health and productivity. By early identification and correction of dental abnormalities that impede mastication identify oral pathogens to invade vital tissues or accelerate dental attrition

Optimise the bio-mechanics of mastication to maximise the useful life of the teeth