Age Related Changes in Dentition

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Incisors

The foal has three deciduous incisors in each quadrant which erupt at birth (01's), 4-6 weeks (02's) and 6-9 months (03's). These deciduous incisors are smaller, whiter and have shallower and wider infundibula than their permanent counterparts, which erupt at about 2½ years (01's), 3½ years (02's) and 4½ years (03's). In younger horses the incisors are curved such that they are convex labially. The incisors also taper toward their apices, such that with continued eruption in older horses individual incisors are narrower and more triangular in shape. The occlusal angle between maxillary and mandibular incisors, decreases from about 180° after eruption to about 90° by 15 years of age.[1]

The occlusal surfaces of the incisor infundibula, which are normally incompletely filled with cementum, gradually darken with age as they become compacted with decomposing food material. The age at which the infundibula wear out can vary, depending on the depth of the infundibula and the rate of incisor wear.[2-4] Once worn out, the distal infundibular enamel ring known as the 'enamel spot' is seen on the lingual aspect of the incisor, until it in turn is fully worn away. These features have long been used for the ageing of horses with the first known record of ageing of horses by their incisors dating back to 600BC in China.[5] This 'art' of ageing was refined over the years and is well illustrated in a book on horse dentition by Sydney Galvayne published in 1886. Recently, however, new scientific evidence by many authors has brought this traditional technique into dispute and it is now accepted that ageing of horses by their incisors is very inaccurate after 6 years of age.[2,4,6]

The 'dental stars' that appear on the labial aspect of the incisor occlusal surfaces are areas of regular secondary dentine surrounding small areas of irregular secondary dentine that have been deposited in the former pulp cavities.[7] Once again there is variation in the age at which these initial thin brown transverse lines appear, but they generally appear sequentially in the 01's, 02's and 03's. This variation in age of appearance is dependent on the depth of primary dentine above the pulp cavities and the rate of occlusal wear. In donkeys, the appearance of these dental stars occurs a few months earlier than in horses.[8] With continued wear, these dental stars become more oval in shape and also move more centrally in the occlusal surface.

The shapes of the incisor occlusal surfaces also alter with age, changing from oval after eruption, to round to triangular and to oval again with extreme age. Due to narrowing of the incisors towards the apex, diastemata can develop in older horses with resultant accumulation of food and grass. However, this rarely causes a problem as there is limited 'packing' of food into periodontal pockets as these teeth are not used for grinding.

Cheek teeth

Equids are born with three cheek teeth in each arcade (06s-08s). The approximate times of permanent cheek teeth eruptions are tabulated below:

Tooth	06	07	08	09	10	11
Eruption time (in years)	2 1/2	3	4	1	2	3 1/2

Deciduous "caps" refer to the occlusal remnants of deciduous teeth and are normally shed at the time of permanent cheek teeth eruptions. Occasionally, they may cause discomfort due to looseness or impaction of food between them and the erupting permanent tooth and they may need to be removed. However, it has to be remembered that premature removal of caps will interfere with infundibular cement deposition in the underlying permanent upper teeth and may predispose to the development of cemental hypoplasia. Differential eruption times of opposing teeth may result in focal dental irregularities with overgrowth of the tooth that erupted first (usually the maxillary cheek tooth), that may remain dominant or even increase in dominance throughout the horse's life. The presence of cemental hypoplasia within the infundibula in maxillary cheek teeth may weaken them and predispose them to becoming worn down prematurely. Additionally, it will predispose them to developing infundibular cement caries and even possibly a sagittal fracture. Effectively the 08s are the youngest teeth and the 09s are the oldest teeth, hence the 09s are more likely to be the first to wear down.

Overcrowding of the dental arcade at eruption may result in *developmental* teeth displacements that may be seen at a young age. These are typically bilateral and may include a degree of tooth rotation. These displacements are often severe and are usually associated with large acquired overgrowths on the opposing teeth. In older horses *acquired* teeth displacements are seen more commonly in the mandibular 10s and 11s and are usually less severe displacements with smaller overgrowths. However, both forms of displacements are accompanied by diastemata and possible painful food pocketing that leads to periodontal disease.

The long reserve crowns of the maxillary cheek teeth are embedded within the maxillary bone and rostral and caudal maxillary sinuses. The rostral and caudal maxillary sinuses are almost completely filled with the reserve crown and apices of the caudal three to four cheek teeth in horses of less than eight years of age.[9] As these hypsodont teeth continue to erupt, the reserve crown shortens, with a resultant increase in the volume of these sinuses. The locations of these teeth are slightly variable in different equid species, but as a general rule the apices of the 06s and 07s are outwith the sinuses, the 08-09's are in the rostral maxillary sinus and 10-11's in the caudal maxillary sinus.

Mandibular bony distensions called 'eruption cysts' typically occur at three to four years of age at the time of eruption of the lower 07s and 08s, respectively. The underlying mandibular cortex can undergo considerable thinning and some horses will develop

periapical infections at these sites, commonly 6-12 months after eruption.[10] Large eruption cysts are more common in lighter ponies and may be exacerbated by retention of deciduous teeth, dental overcrowding and vertical impactions. Maxillary eruption cysts occur at the same time in the upper 07s and 08s but are less noticeable due to the presence of the overlying muscles.

Equid teeth normally erupt and wear down at about the same rate (2-3mm a year) such that teeth are constantly in occlusal contact. Secondary dentine is continually laid down within the pulp cavity, which also prevents pulpal exposure at the occlusal surface. With excessive occlusal wear or alternatively, injury to the odontoblasts (responsible for secondary dentine production), the pulp may become exposed at the occlusal surface, and this may lead to apical infections. The depth of secondary dentine at the occlusal surface varies between horses, but in general it increases with age. It is for this reason that caution should be exercised when reducing large overgrowths in young horses.

The pulp cavity in a young equid cheek tooth is very large. With increasing age it divides into smaller pulp chambers as secondary dentine deposition commences.[1,11] From two to four or five years after eruption, mandibular CT have a distinct apically located, common pulp chamber that communicates with the pulp horns.[7,11] The number of pulp horns per cheek tooth has been well described, with 5 pulp horns present in the 07s-10s, 6 pulp horns in the 06s and 11s and 7 pulp horns in the maxillary 11s.[7] Six to eight years after eruption, with the deposition of secondary dentine, the endodontic system is divided into two compartments. Each compartment consists of a root canal, a pulp chamber and the two or three pulp horns.[11] It has also been shown that pulp horn communication is more common in younger horses and in mandibular cheek teeth. This would indicate that endodontic treatment should be more successful in older horses and in particular, in maxillary cheek teeth.

Due to continued cementum production around the roots, older equid teeth are mainly composed of cementum.[1,12] When most or all of the enamel is worn away, the softer dentine and cement is quickly worn flat and this leads to the condition referred to as ‘smooth mouth’ in geriatric horses, as due to lack of enamel there is no differential wear on the occlusal surface to create an irregular grinding surface.

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