

Dentition: It's Role in Age Determination in Domestic Animals

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Dentition pertains to the development of teeth and their arrangement in the mouth. In particular, it is the characteristic arrangement, kind and number of teeth in a given species at a given age. That is the number, type, and morpho-physiology (that is, the relationship between the shape and form of the tooth in question and its inferred function) of the teeth of an animal. Dentition is generally used as an indicator of age when actual birth dates are not available. Eruption times and wear of the teeth are the major factors used to estimate animal's age. The identification of eruption is the emergence, penetration or piercing of the tooth or teeth through the gingiva (the gum line). With a knowledge of the age at which the teeth appear, the time for shedding temporary or milk teeth and their replacement with permanent teeth, and the changes in form which result from natural wear, the approximate age of farm animals can be determined. An animal may not be capable of consuming adequate nutrients to maintain acceptable body condition or weight without proper dentition. Broken, missing, or heavily worn teeth may cause an animal to excessively dribble feed from its mouth or to have a difficulty harvesting forage during grazing or grinding forage during rumination. Dental problems that affect forage and feed consumption may be the cause of rapid body condition and weight loss relative to other cattle in the herd.

The productive life of farm animals is comparatively brief, the height of their usefulness being limited to a few years. For this reason the returns from livestock tend to decrease with advanced years. The age of animals, therefore is a matter of utmost importance to the breeder the seller, and the buyer. Physical changes within the body are constant. They affect the general outward appearance and disposition and within certain limitations, it is not difficult by mere general appearance to distinguish the young animal from one that has reached maturity, or even to determine the approximate age of an old animal. Changes which take place in the teeth, however, afford the best opportunity of determining the age.

Origin and Structure of Teeth:

Teeth have evolved from denticles which are released from armour near the margins of the mouth as ossification in the integument. A typical mammalian tooth can be distinguished mainly into two regions-crowns and root. The crown is the exposed part of the tooth and situated above the root and in the old age it is generally subject to wear. The root is the hidden part in the gum which is anchored in the socket or alveolus of the jaw bone. The tooth encloses a pulp cavity that contains blood vessels, nerves and connective tissue. The junction of crown and root is called neck. there are three kind of tissues in typical tooth.

1.Enamel:

Unworn crown is covered by a thin, very hard, glistening layer called enamel. It is hardest and heaviest tissue of the vertebrate and is composed of crystals of hydroxyapatite. It is hardest and heaviest tissue of the vertebrate and is composed of crystals of hydroxyapatite. It is ectodermal in origin and totally acellular.

2.Dentine:

Below enamel, a hard dermal bony substance layer is found, called dentine. It is harder than bone but softer than enamel. The ivory is a specialised dentine and hard creamy - white substance, found in elephant, hippopotamus, walrus and narwhals tusks. The dentine is composed of mainly calcium phosphate and fluoride 66.72%, organic matter 28.01% and calcium carbonate.

3.Cementum:

The root of tooth is covered by a thin layer of cement (cementum or Crusta petrosa) and a vascular periodontia membrane of strong connective tissue fibres (Sharpey's fibres). Cement is a nonvascular bone and usually acellular. It is softer than dentine and is rich in collagenous fibres. It wears rapidly when exposed. The pulp cavity is lined by a layer of bone cells, called odontoblasts. Both dentine and cement are mesodermal in origin.

Types of Dentitions in Mammals:

A. Classification According to the Shape and Size of the Teeth:

- ✚ **Homodont:** Homodont or isodont type of teeth is a condition where the teeth are all alike in their shape and size, e.g. the toothed whales (Odontoceti). Fishes amphibians reptiles and in the extinct toothed birds, the homodont or isodont condition is observed.

- ✚ **Heterodont:** Heterodont condition is the usual feature in mammals i.e. the teeth are distinguished according to their shape, size and function. Except mammals heterodont condition is found in Port Jackson Shark (Heterodontus), in several reptiles, specially among mammal-like reptiles.

B. According to the Mode of Attachment of Teeth

- ✚ **Thecodont type:** dentition is the rule among mammals. In this condition the teeth are lodged in bony sockets or alveoli of the jawbone and capillaries and nerves enter the pulp cavity through the open tips of the hollow roots. Except mammals, thecodont type of teeth is found in crocodiles and in some fishes (Haddock, Garpike and Barracuda).
- ✚ **Acrodont:** The teeth are fused to the surface of the underlying jawbone. They have no roots and are attached to the edge of the jawbone by fibrous membrane e.g., fishes, amphibians and some reptiles (Sphenodont, Calotes, Draco, Agama, Uromastix, Moloch horridus and some snakes).
- ✚ **Pleurodont:** The teeth are attached to the inner-side of the jawbone. The tooth touches the bone only with outer surface of its root. In acrodont and pleurodont types of dentition, there are no roots and nerves and blood vessels do not enter the pulp cavity at the base, e.g. Necturus (Amphibia) and some reptiles (Iguana, Xenosaurus, Mexico, Anguis, Ophisaurus etc).

C. According to the Succession or Replacement of Teeth

The teeth can be divided into three categories:

Among mammals the first two categories are found.

- **Monophyodont:** When only one set of teeth develops in their life time. e.g., Marsupials retain all their milk teeth except last premolars, the toothed whales (Odontoceti), some rodents (e.g., squirrels), certain insectivores (e.g., moles).
- **Diphyodont:** In most mammals two sets of teeth are found. The first temporary set of teeth, called deciduous teeth, milk teeth or lacteal teeth, are lost or replaced by a second set of teeth, termed permanent teeth. In bats and guinea-pigs the milk teeth are lost even before birth. In milk teeth the molars are absent.
- **Polyphyodont:** The teeth are replaced continuously throughout life, e.g., most lower vertebrates replace their teeth, generation following generation (Dogfish, snakes).

Types of Teeth:

In heterodont condition the teeth can be distinguished into four types. They are Incisors, Canines, Premolars and Molars

- ✚ **Incisors:** situated anteriorly on the premaxilla in upper jaw and tips of dentaries in lower jaw. They are conical, single-rooted and monocuspid. They are used for cutting or cropping. Incisors may be totally absent in sloth or absent on upper jaw in sheep and ox. In rodents and lagomorphs, the incisors are chisel-shaped, open rooted and continue to grow throughout life.
- ✚ **Canines:** lie immediately behind the incisors. They are single in each half of the jaw. They are large-pointed, long-crowned with a single root. They are used for piercing and tearing the flesh of the prey (dog). Mainly seen in carnivorous mammals.
- ✚ In rodents and lagomorphs, the canine is absent, leaving a space in-between incisors and premolars, called diastema. Any gap within the dental series is called diastema. In horses, the canines are relatively small. In carnivores (dogs, tigers and lions) the canines become spear-shaped and used for piercing and tearing the flesh. They are generally used for holding and piercing in relation to both feeding and fighting.
- ✚ **Premolars:** Following the canines there are premolars or bicuspid teeth. These have two roots and two cusps. The premolars are used for grinding the food materials.
- ✚ **Molars:** lie behind the premolars, have two or more roots and several cusps. Molars are used for crushing food; premolars and molars are collectively called “Cheek teeth”.
- ✚ In carnivores the number of cheek teeth is often reduced and, in some cases, (Fissipedia) last upper premolar and first molar in lower jaw are modified into chisel-shaped sharp cusps, called Carnassial teeth, used for cracking bones and shearing tendons. The last molars in each jaw of man are called wisdom teeth and its eruption is often delayed.

Cusp patterns of cheek teeth:

The molars contain many cusps on their surface. The cusps/ cones are raised tiny structures or ridges on the occlusal surface. Depending upon the feeding habit and the type of food taken the premolars and molars of recent eutherians have undergone changes in their shape

and cheek teeth are recognized into following names of the cusps, molars are recognised in different names.

- (i) **Triconodont:** Molars possess 3 cones or cusps arranged in anteroposterior lines. This type of molar teeth found in the fossil Mesozoic mammals, e.g., Triconodon.
- (ii) **Trituberculate:** The molars contain three cones or tubercles, arranged in the form of a triangle. It also found among fossil Mesozoic mammals, e.g., Spalacotherium.

Depending upon the feeding habits and the type of food taken (trophic specialization), the premolars and molars of recent eutherians have undergone changes in their shape and cheek teeth are recognised into the following names.

- (a) **Bunodont:** When the cusps in the cheek teeth remain separated and rounded, the tooth is called bunodont. In man and in some omnivore mammals the cheek teeth are bunodont type and they are used in grinding the food material.
- (b) **Lophodont:** The cusps are joined to form ridges or lophs. e.g., cheek teeth of elephant. These teeth are used to grind all sorts of plants and grasses.
- (c) **Secodont:** When the cheek teeth are with sharp cutting crowns. e.g., in terrestrial carnivores. These teeth possess cutting edges and used for cutting and shearing the flesh.
- (d) **Selenodont:** Cheek teeth with crescent-shaped cusps. e.g., in ruminants and horses (perissodactyla), used for grinding the plant matter.
- (e) **Brachyodont:** Tooth with a low crown and comparatively long root, e.g., Man.
- (f) **Hypsodont:** The crown is high, and the roots are short and open, e.g., Horse, incisor of elephants.

Dental Formula

S	Animals	Deciduous	Permanent
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1.	Ox	2(Di 0/3, Dc 0/1, Dp 3/3) =20	2 (I 0/3, C 0/1, P 3/3, M 3/3) =32
2.	Sheep/goat	2 (Di 0/4, Dc 0/0, Dp 3/3) =20	2 (I 0/4, C 0/0, P 3/3, M3/3) =32
3.	Horse	2 (Di 3/3, Dc 0/0, Dp 3/3) =24	2(I3/3, C0-1/0-1, P3/3, M3/3) = 36/40
4.	Dog	2 (Di 3/3, Dc 1/1, Dp 3/3) =28	2 (I 3/3, C 1/1, P 4/4, M 2/3) =42
5.	Cat	2(Di 3/3, Dc 1/1, Dp 4/4) =32	2 (I 3/3, C 1/1, P 4/4, M 2/3) =42
6.	Pig	2 (Di 3/3, Dc 1/1, Dp 3/3) = 28	2 (I 3/3, C1/1, P 4/4, M 3/3) =44
7.	Camel	2(Di 3/3, Dc 1/1, Dp 4/4)=32	2 (I 1/3, C 1/1, P 3/2, M 3/3) =34

The number of teeth in any particular species remains constant but varies in different species. So, the number of teeth is expressed by a sort of equation and is called dental formula. This constancy of the number of teeth has become a tool to the taxonomist for the purpose of classification. The dental formula is expressed by the number of each type of teeth in each half of the jaws. The teeth of the upper jaw are placed as numerators and in the lower jaw as denominators. The numerators and denominators are separated by a horizontal line. The kind of teeth is indicated by initial letters i, c, Pm, m indicating incisor, canine, premolar and molar, respectively. For further simplification the initial letters are often omitted. When a certain type of tooth is absent, a zero is used to indicate the fact.

Dental Formula of some domestic animals:

Dentition in Cattle:

Cattle at maturity have 32 teeth, of which 8 are incisors. All incisors are in the lower jaw. The two central incisors are called pinchers; the next two, first intermediates; the third pair, second intermediates or laterals; and the outer pair is known as the corners. In place of the upper incisor teeth there is a thick layer of the hard palate called the dental pad. Internal face of incisors of the calf at 1 month. In the calf at birth two or more of the temporary or first set of incisor teeth are present. Within the first month the entire eight incisors have appeared. Internal face of incisors at 2 years. As the animal approaches 2 years of age the central pair of temporary incisor teeth or pinchers is replaced by the permanent pinchers. At 2 years these



teeth attain full development. Internal face of incisors at 3 years. At about 2 1/2 years the permanent first intermediates, one on each side of the pinchers, are cut and are usually fully developed at 3 years. Internal face of incisors at 4 years. At 3 1/2 years the second intermediates or laterals are cut. They are on a level with the first intermediates and begin to wear at 4 years. Internal face of incisors at 5 years. At about 4 1/2 years the corner teeth are replaced. At 5 years the animal usually has the full complement of incisors with the corners fully developed. Internal face of incisors at 12 years. At 5 or 6 years there is a leveling of the permanent pinchers, the pinchers usually being leveled at 6 years and both pairs of intermediates partially leveled and the corner incisors showing wear. At 7 or 8 years there is a noticeable wearing of the pinchers; at 8 or 9 years of the middle pairs; and at 10 years of the corner teeth. Internal face of incisors at 12 years. At 5 or 6 years there is a leveling of the permanent pinchers, the pinchers usually being leveled at 6 years and both pairs of intermediates partially leveled and the corner incisors showing wear. At 7 or 8 years there is a noticeable wearing of the pinchers; at 8 or 9 years of the middle pairs; and at 10 years, of the corner teeth. After the animal has passed its sixth year, the arch gradually loses its rounded contour and becomes nearly straight by the twelfth year. In the meantime, the teeth have gradually become triangular in shape, distinctly separated, and show progressive wearing. This condition becomes more marked with increasing age.

Dentition in Sheep and Goat:

Mature sheep and goats have 32 teeth, of which 24 are molars and 8 are incisors. There are no tusks and, like those of cattle, all the incisors are in the lower jaw. As in the case of cattle, also the two central incisor teeth are called pinchers; the adjoining ones, first intermediate, the third pair, second intermediates; and the outer ones, corners. The temporary incisors are readily distinguished from the permanent ones by their smaller size and milky whiteness. In the new-born animal none of the teeth may have made their appearance though sometimes the two pinchers and also the two first intermediates are pressing through the gums or even have cut through. In a few days these teeth and the second intermediate incisors will appear, followed somewhat later by the corners, thus giving the animal, by the time it is 3 months old, a full set of completely developed temporary incisor teeth. Animal under one year old (no permanent teeth). One year old (2 permanent teeth). Two years old (4 permanent teeth). Three years old (6 permanent teeth). Four years old (8 permanent teeth). Old animal,

more than four years old. When the animal is between 12 to 15 months of age the temporary pinchers are replaced by the two permanent ones. The shedding of the first temporary intermediates and their replacement by permanent teeth indicate that the animal is approaching its second year. The replacement of the second temporary intermediates by the permanent ones takes place when the animal is about 3 years old. The two temporary corner incisors are replaced by permanent teeth as the sheep reaches the age of 4 years. All the permanent teeth are then present, and the animal has what is termed a “full mouth. After this time there is a distinct and progressive increase in size of the spaces between the teeth, which gradually become worn to stubs and frequently attain an unnatural and uneven length. In old sheep some teeth may be broken or loose; in such cases the animal is said to have a broken mouth.

Dentition in Horse:

The mature male horse has 40 teeth. Twenty-four of these are molars or grinders, 12 are incisors or front teeth, and 4 are tushes or pointed teeth. The 2 central incisors are known as centrals or nippers; the next 2, 1 on each side of the nippers, are called intermediates or middles, and the last, or outer pair, the corners. The tushes are located between the incisors and the molars. They are not usually present in the mare, and accordingly she may be considered to have a total of 36 teeth rather than 40, as in the male. The young animal, whether male or female, has 24 temporary teeth, commonly called milk teeth, as they are much whiter than the permanent teeth. These milk teeth consist of 12 incisors and 12 molars. The molars are 3 back teeth on each side of both the upper and the lower jaw. The milk teeth are shed and replaced by permanent teeth at fairly definite periods, which serve as an index in determining the age of young colts. The temporary central incisors or nippers may be present at birth, A); otherwise, they appear before the colt is 10 days old. They are two in each jaw. At the age of from 4 to 6 weeks the two temporary intermediates, upper and lower, appear. These teeth immediately adjoin the nippers. When the colt is from 6 to 10 months old the corner or outer incisors, two above and two below, are cut. This gives the young animal a full set of temporary front teeth. By the time the colt has reached the age of 1 year the crowns of the central incisors show wear. In another 6 months the intermediates or middles become worn, and at 2 years all the teeth are worn. During, following 6 months there are no changes which will distinguish the exact age. At about 2 1/2 years, the shedding of the milk teeth

begins and at 3 years the temporary central nippers, two above and two below, are replaced by the permanent central incisors. At 4 years the four permanent intermediates have taken the place of the four temporary middles. When the animal is 4.5 years old the shedding of the four corners begins, and at 5 years the permanent teeth which replace them are well of but not in contact. At 6-year-old horse the corners incisors are on a level with the adjoining teeth, with a well/marked dental cavity or “cup” showing practically no wear. The nippers show wear over the entire surface; the “cup” though visible shows indications of gradual disappearance and at this stage is without a hollow. Not only the nippers as well as the middles show wear at 7 year of age. Each upper corner tooth has an indentation caused by wear from the corresponding lower tooth, resulting in downward triangular projection of the posterior edge. This projection is commonly termed “dovetail”. In the 8-year-old horse all the incisors worn, the cup has entirely disappeared from the nippers, but shows to a slight extent in the middles, and is still well marked in corners. At this stage what is termed the “dental star” makes its appearance as a yellow transverse line just back of the front edge of the table, or flat surface, of the nippers and middles. Between the ages of 9 and 13 years there is a gradual change in the contour of the tables of the incisors. In a 9-year-old animal the nippers take on a more or less rounded contour; the dental cavity or cup has disappeared from all but the corners; the dental star is found in both the nippers and middles and in the former is near the center of the table. At 10 years the middles become rounded, and the dental star, now seen on all the incisors, is near the center of both the nippers and middles. At 11 or 12 years the corners have a somewhat rounded form, and the dental star approaches the center of the table. As the horse reaches 13 years of age all the lower incisors are unmistakably rounded, the dental star is found in the center of all the tables, and the enamel rings which formerly surrounded the cups have entirely disappeared. In a horse about 14 years of age the tables of the incisors begin to change from a rounded to a triangular contour. This change occurs in the nippers at 14 years, in the middles at 15 years, and in the corners at 16 or 17 years. During the following 4 years after the appearance of the triangle there is a gradual approach of the tables to the form of a rectangle. The teeth during this period are usually elongated and directed obliquely. The dental arch also becomes contracted and pointed and the under edges of the lower jaw are thin and sharp as compared with their appearance in a young horse.



Should the animal live more than 20 years, these conditions become more marked and are accompanied by excessive wear and loosening or loss of molars.

Dentition in Swine:

A mature hog has 44 teeth. Out of these, 12 are front teeth or incisors, and 6 are in the upper and 6 in the lower jaw. Four others lie in the open spaces back of the incisors and are known as tusks, or tushes. They are usually more prominent in the male than in the female. Back of each tush is a tooth commonly called the premolar, and immediately back of this on each side of the upper and lower jaws there are 6 molars, the first 3 in each row sometimes being termed premolars. As in the horse, the incisors are grouped in three pairs in each jaw and are termed centrals, intermediates, and corners in accordance with their relative positions. The young pig at birth usually has 8 teeth. These consist of the 2 tusks and 2 corner incisors on each jaw. They are all sharply pointed and are sometimes known as needle teeth. It is a common practice to cut them off, about halfway between the gum and point of the tooth in the new-born pig in order to avoid discomfort and injury to the nursing sow. When the pig reaches the age of 4 or 5 weeks the central temporary incisors appear, two in the upper and two in the lower jaw. As the animal approaches the age of 6 to 8 weeks the two intermediate incisors will have cut through the gums of the lower jaw between the corners and the centrals and will be fully grown at 3 months. As the pig passes 6 months of age the temporary corner incisors are shed, and the permanent corners appear. Shortly after 9 months the permanent tusks take the place of the temporary tusks. At approximately 12 months the central permanent incisors replace the temporary centrals, and the lower teeth appear. During the next 3 months the first 3 temporary molars, on each side of upper and lower jaw, will be shed. These are immediately back of the premolars, which in turn are back of the tusks. When these temporary molars, 12 in all, have been replaced by permanent molars, the pig has attained the age of at least 15 months. As a rule, the shedding of the temporary intermediate incisors and the appearance in their places of the permanent ones are indications that the hog is approximately 18 months of age. By the time the animal has reached the age of 20 months these intermediate incisors will be in line with the centrals. As there is no further shedding or eruption of teeth, the age of hogs beyond 20 months of age cannot be so easily estimated. At 2 years, however, the incisors, including the intermediates, will show wear, and the sixth or last molars (one upper and one lower on each side) will be fully up and about to come in



contact. After 2 years it is difficult to judge the age of swine by the teeth. However, except in the case of breeding and exhibition animals, it is not often important to know the exact age of mature hogs. It is possible, however, to associate progressive wear of the teeth with the advance in age. Aged swine show considerable wear of the teeth, especially of the molars.

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