

Dentition in Mammals

Zoology (Hons.) 2nd SEM DC4 Unit 3

Definition: The arrangement of teeth in the upper and lower jaws, mainly on the premaxilla, maxilla and dentary bones, is called dentition.

Absence of teeth:

Teeth are present in all mammals though a secondary toothless condition is found in some mammals. The adult platypus (*Ornithorhynchus*) bears epidermal teeth but no true teeth are present. In platypus embryonic teeth are replaced by horny epidermal teeth in adult. In Echidna or spiny ant-eater (*Tachyglossus*) the teeth are absent in all stages of life.

Origin and Structure of Teeth in Mammals:

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 — crown 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.

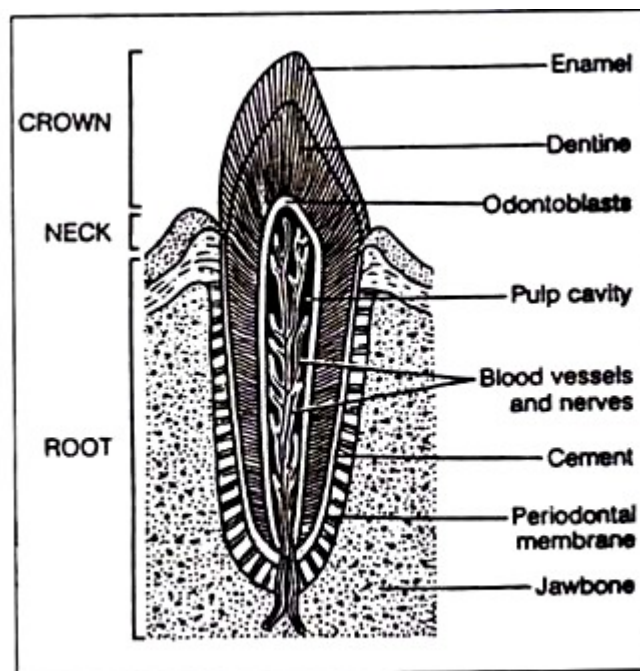


Fig. 10.127 : Structure of a tooth showing its relation with the jaw bone.

There are three kinds of tissues in a typical tooth. They are enamel, dentine and cement. Unworn crown is covered by a thin, very hard, glistening layer, called enamel. It is the hardest and heaviest tissue of the vertebrates and is composed of crystals of hydroxyapatite [$3(\text{Ca}_3\text{PO}_4)_2 \cdot \text{Ca}(\text{OH})_2$]. It is ectodermal in origin and totally acellular.

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 human dentine is composed of mainly calcium phosphate and fluoride 66.72%, organic matter 28.01% and calcium carbonate.

The root of tooth is covered by a thin layer of cement (cementum) and a vascular 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 Dentition 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).

Pinnipedians show a tendency towards homodont condition.

Heterodont:

Heterodont condition is the usual feature in mammals, i.e. the teeth are distinguished according to their shape, size and function.

B. According to the Mode of Attachment of Teeth:

Thecodont:

This type of dentition is predominant among mammals. In this condition, the teeth are lodged in bony sockets or alveoli of the jaw bone and capillaries and nerves enter the pulp cavity through the open tips of the hollow roots.

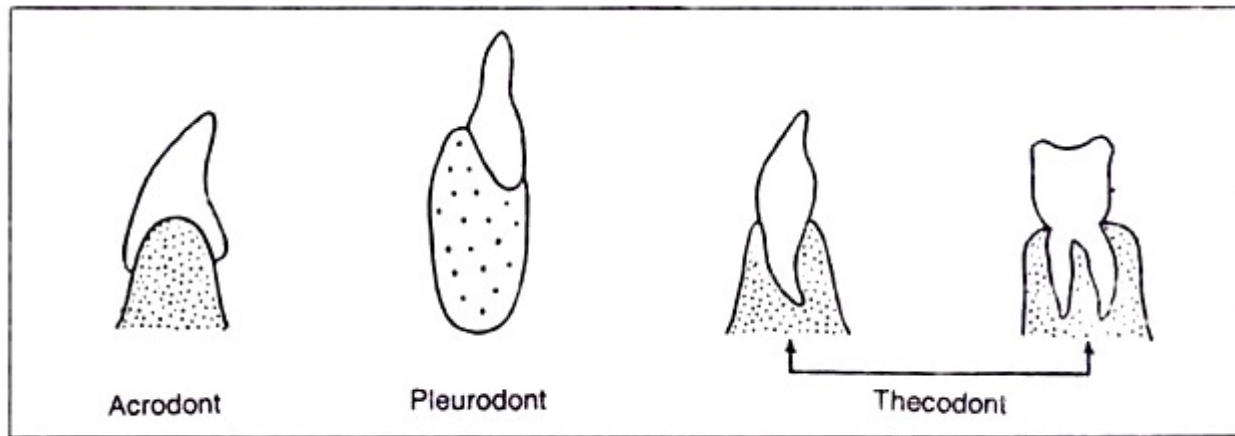


Fig. 10.128 : Mode of attachment of teeth.

Among vertebrates except thecodont, acrodont and pleurodont type of dentition is found.

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.

Pleurodont:

Teeth are attached to the inner-side of the jawbone. The tooth touches the bone only with the 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.

C. According to the Succession or Replacement of Teeth:

The teeth can be divided into three categories:

- (i) Monophyodont
- (ii) Diphyodont and
- (iii) Polyphyodont.

Among mammals the first two categories are found.

(i) Monophyodont:

In some mammals, only one set of teeth develops in their life time and this condition is called Monophyodont, 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). Among platypus, sirenians and toothless whales develop only one set of teeth (monophyodont dentition). These teeth may not erupt (some whales) or, if they develop are usually shed shortly afterward.

(ii) 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.

(iii) Polyphyodont:

In this condition, 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 4 types. They are incisors, canines, premolars and molars.

(i) Incisors:

They are 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.

(ii) Canines:

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). Sometimes the canines are used in holding the prey, 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.

(iii) 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.

(iv) Molars:

Molars lie behind the premolars. They 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 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 are raised tiny structures or ridges on the occlusal surface. The cusps are called cones.

Depending upon the feeding habit 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.

(i) Bunodont:

When the cusps in the cheek teeth remain separate and rounded, the tooth is called bunodont (mound + tooth). In man and in some omnivore mammals the cheek teeth are bunodont type and they are used in grinding the food material.

(ii) Lophodont:

If the cusps are joined to form ridges or lophes, the tooth is called lophodont. The cheek teeth of elephant are of lophodont type. There is an intricate folding of enamel and dentine. These type of teeth are used to grind all sorts of plants, and also grasses.

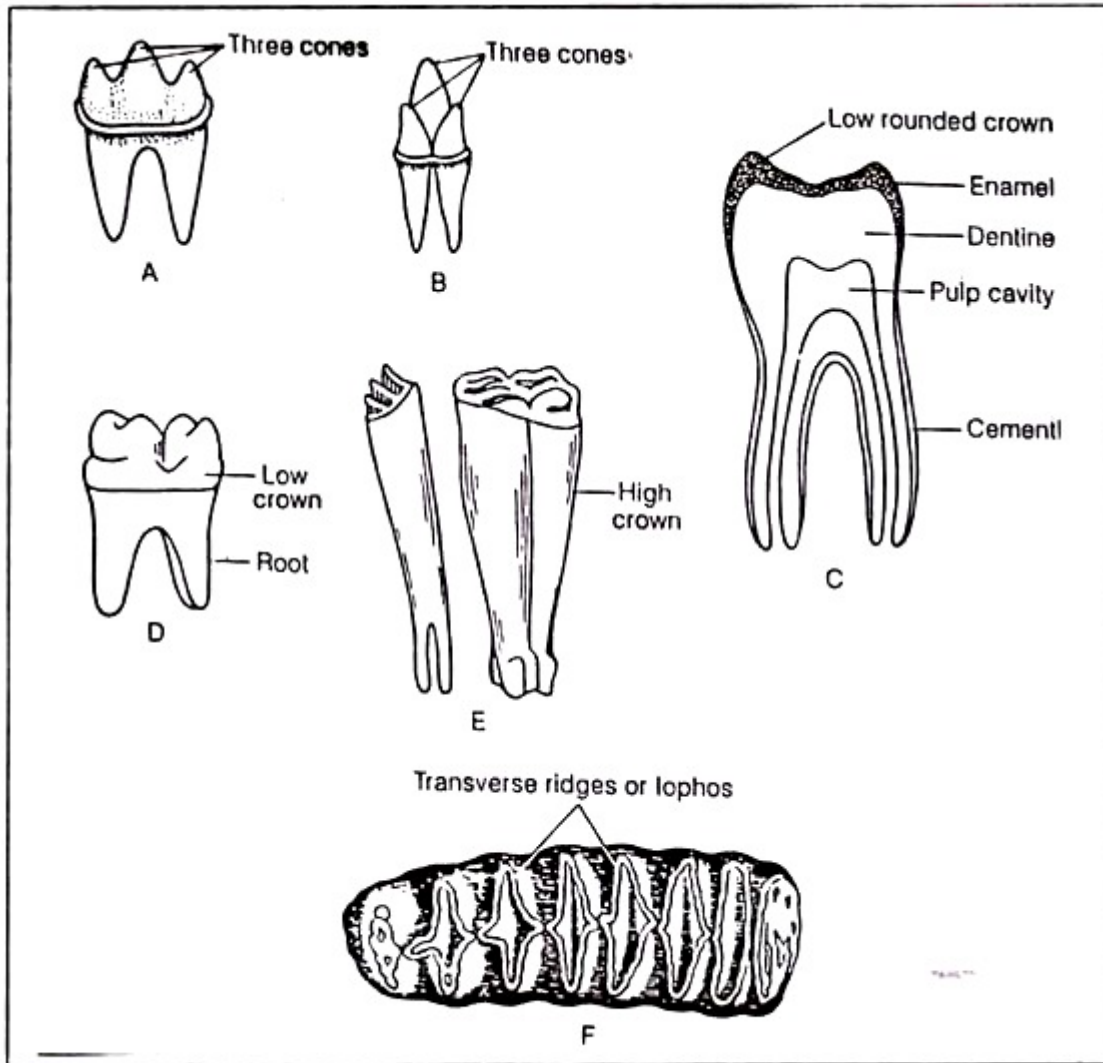


Fig. 10.129 : Modifications of cheek teeth : A. Triconodont tooth. B. Trituberculate tooth. C. V.S. of a bunodont molar. D. Brachydont molar. E. Hypsodont molar. F. Lophodont teeth.

(iii) Secodont:

When the cheek teeth are with sharp cutting crowns, the teeth are called secodont. This condition of teeth is present in terrestrial carnivores. These teeth possess cutting edges and are used for cutting and shearing the flesh.

(iv) Selenodont:

Cheek teeth with crescent-shaped cusps are known as selenodont. In ruminants and horses (perissodactyla), the teeth are selenodont (crescent shaped moon + tooth) type and are used for grinding the plant matter.

(v) Brachydont:

A tooth with a low crown and comparatively long root is called brachydont (short + tooth) Example- Man.

Hypsodont:

When the crown is high and the roots are short and open

Example- Horse, incisor of elephants.

Dental Formula:

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.

The kind of teeth is indicated by initial letters i, c, Pm, m indicating incisor, canine, premolar and molar, respectively. When a certain type of tooth is absent, a zero is used to indicate the fact.

$$\text{Kangaroo (Macropus)} \frac{3.1.2.4}{1.0.2.4} = 34.$$

$$\text{Australian native cat (Dasyurus)} \frac{4.1.2.4}{3.1.2.4} = \frac{11}{10} = 42.$$

$$\text{American opossum (Didelphys)} \frac{5.1.3.4}{4.1.3.4} = 50.$$

Family Suidae (e.g., Pigs) and horses bear primitive eutherian type of teeth.

$$\text{Horses and Pigs} \frac{3.1.4.3}{3.1.4.3} = 44.$$

$$\text{Bat} \frac{2.1.0.4}{3.1.0.3} = 32.$$

$$\text{Old world monkeys} \frac{2.1.2.3}{2.1.2.3} = 32.$$

$$\text{Sheep, cow and goat} \frac{0.0.3.3}{3.1.3.3} = \frac{6}{10} = 32.$$

$$\text{New World monkeys} \frac{2.1.3.3}{2.1.3.3} = 36.$$

$$\text{Except common marmoset, Callithrix} \frac{2.1.3.2}{2.1.3.2} = 32.$$

$$\text{Cat} \frac{3.1.3.1}{3.1.2.1} = \frac{8}{7} = 30.$$

$$\text{Dog and Bears} \frac{3.1.4.2}{3.1.4.3} = \frac{10}{11} = 42.$$

$$\text{Seals } \frac{3.1.4.1}{2.1.4.1} = \frac{9}{8} = 34.$$

$$\text{Walrus } \frac{1.1.3.0}{0.1.3.0} = \frac{5}{4} = 18.$$

$$\text{Rat } \frac{1.0.0.3}{1.0.0.3} = 16.$$

$$\text{Guinea-pig } \frac{1.0.1.3}{1.0.1.3} = 20.$$

$$\text{Hare and Rabbit } \frac{2.0.3.3}{2.0.2.3} = \frac{8}{7} = 30.$$

$$\text{Hyrax } \frac{1.0.4.3}{2.0.4.3} = \frac{8}{9} = 34.$$

$$\text{Elephant } \frac{1.0.0.3}{0.0.0.3} = \frac{4}{3} = 14.$$

Unusual Teeth in Mammals:

(i) Elephant's tusk:

The elephant's tusks are the second pair of incisors in the upper-jaw. The lower incisors disappeared. The tusks are made of ivory which is a specialized dentine. The upper incisors have no root and they grow to form tusk. Both sexes of African elephants have tusks but in India only males bear tusks. Tusks are used in offence and defense.

(ii) Pig's tusk:

In wild boar the upper canines are enlarged to form stout tusks. The warthog (*Phacochoerus*) of Africa bears 4 upward curving tusks. These are transformed canines of both jaws. These are used for digging in the soil for storage roots and tubers of the plants.

(iii) Barking deer's tusk:

The male muntjaks and musk deer possess tusks which are the enlarged form of upper canine teeth. These are used for self defence.

(iv) Walrus's tusk:

They are the modified form of upper canines. The primary function of the tusks is to break the clams on the ocean floor.

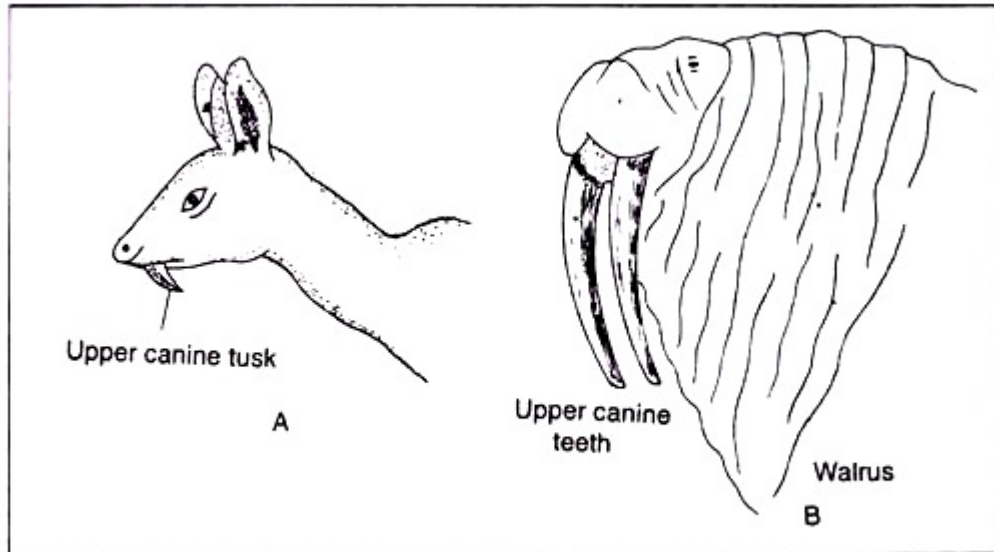


Fig. 10.131 (A-B) : A. Tusk of male musk deer, B. Tusk of walrus. The tusks are modified upper canine teeth in both cases.