

ORAL CAVITY

The oral cavity (O.C) and its accessory organs namely; *the tongue, teeth, salivary glands* are concerned with the *prehension, mastication and in salivation of food* i.e. they are involved in the conversion of food for palatability. The *O.C. extends from the lips into the entrance of the pharynx*. The osseous support of the mouth is provided by *premaxilla, palatine, alveoli processes of the maxilla, the horizontal part of the palatine bone dorsally, the mandibular rami laterally of the body of the mandible ventrally*.

The soft structures complying with the wall of the mouth are the cheeks laterally, the lips rostrally and the mylohyoid ventrally. Its *dorsal limit or roof is the hard palate*. Caudally, the oral cavity communicates with the oropharynx *by a narrow opening called the Isthmus faucium* formed by roof of the tongue and the soft palate, it is usually closed. *When the jaws are closed, the mouth is divided by the teeth and the alveolar processes into vestibule and oral cavity proper*. These two cavities communicates via the interdental spaces.

The part of the vestibule between the incisors and the lips is the *labial vestibule, while that between the cheek teeth and the cheek is the buccal Vestibule*. Rostrally, two narrow incisive ducts connect the oral cavity and the nasal cavity. The duct opens on the incisive papillae. The mucus membrane of the O.C. is usually pink but may be pigmented (black) in some places. It is well supplied with blood vessels and in its sub mucosa it contains serous or mucous gland know as the labial, buccal and lingual glands (depending on their location). In addition, large salivary glands are present which feed their secretions into the O.C through special ducts.

LIPS

The entrance of the oral cavity-(*rima oris*) is bounded by the edges of the upper and lower lips to unite on each side at the angle of the mouth. The lips of the domestic mammals exist for sucking, prehension of food and also *acts as a tactile organ* (sense organ). *They differ in shape and motility from specie to specie*. This is more pronounced in the upper lips (i.e movement) of the horse. The Sheep, Goat and carnivores are quite motile while those of the Ox and Pig are not all that motile. *The lips are attached to the incisive bone* (premaxilla) and the incisive part of the mandible and consist of three layers, which are: - (1) *the skin externally* (2) *middle consisting of Tendon, connective and adipose tissue*. (3) *internally the labial mucosa*.

The middle layer consists of the bulk of the lip, the internal and external layer meet at a sharp line at the edge of the lips. Labial mucosa is continuous with the base of the lip with the gum.

LABIAL GLANDS

These are small yellowish mass found in the muscular layer and are especially well developed near the angle of the mouth. They are most numerous in the horses and decreasing in no in the following sequence hose-cattle-goat-pig-dog-cats.

The skin covering the lips is similar to the skin elsewhere in the body of the carnivorous, small ruminant and the horses but usually they bear *hair*. In the pig and the Ox are areas of modified skin in the central part of the upper lips known as the rostral and the nasolabial plate respectively.

The upper lip of the carnivores and small ruminant is divided by a distinct median cleft known as the philtrum. The lower lip is usually smaller than upper lip in carnivore and pigs. In the ox and horse it presents the chin and this is a protuberance formed by muscular and adipose tissue. The osseous mental protuberance that forms the base of chin in man is absent on the mandible of domestic animal.

Blood Supply: Dorsal and deep ventral labial branch of mandibular artery:
Nerves: Mandibular and facial nerve

THE CHEEK

The cheeks form the lateral boundary of O.C and they extend from the angle of lips to a little posterior of the cheek teeth. The posterior part of the cheek is covered by the masseter muscle dorsally and they are attached to the maxilla ventrally to the rami of the mandible and blends with the labial curvature anteriorly. The cheeks, like the lips, consist of three layers which are (1) *the skin* (2) *buccal mucosa* (3) *intermediate layer of glands*.

The buccal mucosa is continuous with the gum of the cheek teeth, in ruminant and it forms cone shaped cornified papillae which are also present on the lips and are caudally directed. The buccal glands are located between the mucosa and the musculature. In addition, the middle buccal glands are found in the ox in the zygomatic arch and is called zygomatic glands. The duct of the buccal glands opens into buccal vestibule.

THE HARD PALATE

The osseous palate and the mucosa that covers its oral surface is known as the hard palate or palatum durum. The hard palate is bounded laterally and rostrally by the upper dental arch. Its tough mucosa in the horse has rich venous plexuses and is continuous laterally with the gums and caudally with the means of the mucous membrane of the soft palate. The hard palate is divided into two symmetrical halves by a median palatine raphe which is usually in form of a shallow groove. In the dog it is an indistinct median crest. On either side of the palatine raphe are the transversely directed palatine ridges also called rugae palatinae, the ridges are cornified. In the ox the palatinae, the ridges differ with species. It is 6-10 pairs in dogs, 7 pairs in cats, 20-23 pairs in pigs, 15-20 pairs in Ox in sheep 14 pairs, goat 12 pairs, horse 16-18 pairs in the pig and in the horse the palatine ridges extend to the soft palate.

Generally

(1) *Mucosa lacks glands but in dogs and ruminant glands are found in the caudal portion and in the pigs glands are found in the rostral portion.* (2) *The mucosa is generally pigmented (black) in all domestic animals. The incisive papillae is the central prominence just behind the dental pad in the ruminant. The incisive papillae is outrightly absent only in the horse. The hard palate lies opposite the dorsum of the tongue and with its ridges, it assists the tongue during prehension, mastication and bolus movement into the oropharynx.*

THE TONGUE

Is a large muscular organ located in the floor of the mouth, between and above the rami of the mandible; the shape differs slightly from species to species.

Function

It is a very mobile and versatile organ, it is essential for

1. prehension
2. sorting of solid foods in some animals
3. intake of liquid in other (.e.g) lapping of liquid in carnivores)
4. sucking in the new born,
5. tactile organ capable of mechanical and chemical selection of food by means of the taste bud.
6. It is necessary in mastication and deglutition.
7. Some specie use the tongue to rid themselves of insect an in scratching themselves
8. grooming of their hair coat.

STRUCTURE OF TONGUE

The tongue consist of (1) mucous membrane (2) glands (3) muscles, blood vessels and (4) nerves. The mucus member of the tongue has a dense submucosa by which it adheres to the adjacent tissue. Along the ventral and lateral surface, the mucous membrane is thin and delicate, on the dorsum where the wear is greatest, the mucosa is thick and rough bearing modifications of the epithelium more especially in the ruminant and the cat. Numerous papillae named according to their shape are found on the mucous membrane.

The filiform and conical papillae have mechanical functions while fungiform, vallate and foliate papillae serve mainly a gustatory function (taste).

PAPILLAE OF THE TONGUE

1) Filiform papillae:

They are soft, horny threads covering the dorsum of the tongue in pigs and horse giving a *velvety appearance*. In ox, sheep, cat and the filiform are small and directed caudally and heavily cornified.

Conical papillae are scattered among fillfrom papillae in the ox, goat and sheep especially on the torus linguae. The root of the tongue is generally free of filiform papillae except in carnivores and pigs.

2) Fungiform Papillae

These are less numerous but larger than filiform. They contain taste buds i.e. they are gustatory papillae, they are distributed over the dorsum especially along the borders.

3) Vallate Papillae

Located on the dorsum rostral to the root of the tongue they are large and surrounded by a circular clefts and the do not project above the surface. Serous glands are found in the neighbourhood of this papillae, this are either submucosa or intermuscular in position. *They are believed to provide neutral environment* for the taste bud. The number of vallate papillae varies with species: pigs and horse have a pair, carnivores have 2-3 on each side, ox have 8-17, sheep 18-24, goat 12 –18.

4) Foliate Papillae

This are located on the border of the tongue immediately rostral to the palatoglossal arch-a thick mucosa folding connecting the root of the tongue with the ventral surface of the soft palate. They form series of parallel leaves separated by small furrows. They are most prominent in pigs and horse, rudimentary in dogs, cats and ox, but absent in other ruminant.

In the depth of the furrows are taste buds deep to the foliate papillae are also some, serous glands.

The mucosa over the root of the tongue is characterized by presence of lymphatic tissues and may appear as diffused, solitary and aggregated lymph nodules or tonsillar follicles. They are collectively called lingual tonsils.

THE TONGUE MUSCLES

Lingual muscles may be divided into the (1) *intrinsic lingual muscles* and (2) *Extrinsic lingual muscles*

The *intrinsic* are not attached to the skeleton while the *extrinsic* originate from the skeleton and enter and tongue from behind and below then blend with fibres of lingual muscles proper inside the tongue. A thin median lingual septum divide the tongue into symmetrical halves.

LINGUAL MUSCLES PROPER (INTRINSIC)

These consist of deep and superficial; *longitudinal transverse and perpendicular fibre bundles*, the longitudinal bundles extend in both superficial and deep layer from the apex to the roof of the tongue. Transverse fibres run side to side and muscle fibres acting singly or in unison can alter the shape of the tongue e.g. *contraction of the muscle and transverse fibers* simultaneously result in the *lengthening of the tongue*. The contraction of the *longitudinal fibre* cause the *shortening of the tongue*. The interaction of the extrinsic and intrinsic muscles lead to a range of lingual movements and shapes.

Extrinsic muscles include the (1) Genioglossus (2) Hyoglossus (3) Styloglossus

FORM AND STRUCTURE OF THE TONGUE

The surface of the tongue opposite the palate is the *dorsum lingual*. The free rostral portion is the apex. The apex present the dorsal and ventral surface ...meet in either a sharp or a rounded border. *The ventral surface is constricted to the floor of O. C. by a median fold called frenulum linguae*. Caudal to the apex and representing the bulk of the tongue is the body called *the corpus linguae* followed by the root called the *radix linguae*. Both the body and the root lie in the intermandibular space. *The tongue is anchored to the mandible and the hyoid apparatus by extrinsic muscles*. In the ruminant the caudal portion of the dorsum is raised to form an elliptical prominence called *torus linguae*. Rostral to this in the ox is a funnel shaped structure or depression called the *fossa linguae*. The tongue contain a slender bars of cartilage in the median plane just below its mucus membrane of its dorsal surface.

In the dog, the dorsum of the tongue is divided by a median groove called *sulcus medianus* into two equal halves, the apex contains the characteristic *lyssa* which is a median filiform structure embedded in the musculature along the ventral surface of the apex. They are (found) also at the lateral and ventral surface of the tongue.

SUBLINGUAL FLOOR OF THE ORAL CAVITY

This is a *crescent shaped space that becomes visible when the tongue is raised*. It consists of a *rostral prefrenular part and two lateral sublingual recesses* which extend caudally between the mandible and the tongue. The prefrenular part lies inside the arch of the incisor teeth and is supported ventrally by incisive part of the mandible. Its mucous membrane forms the median frenulum linguae for connection with the ventral surface of the tongue. On either side

of the frenulum but slightly more rostral are sublingual caruncles. They vary with species in shape, size and position and are often absent in the pigs. *Mandibular and major sublingual salivary ducts open on the sublingual caruncles.*

In the horse and goat small para-caruncular glands are found near the sublingual caruncles. The lateral sublingual recesses are bounded laterally by the lower cheek teeth and gum and medially by the lateral surface of the tongue. Along the floor of each recess lies the polysomatic sublingual salivary gland inside the fold of sublingual membrane. The duct of the polysomatic gland opens at the edge of the fold.

PHARYNX

The pharynx is a *funnel shaped musculo-membranous passage that connects the oral cavity with the oesophagus and the nasal cavity with the larynx*, the concave roof of the pharynx is related to the base of the cranium. The pharynx is related is pushed away from the sphenoid and the longus capitis and the rectus capitis ventralis muscles by the guttural pouch while the lateral wall of the pharynx is related to the stylohyoid and pterygoid and in the horse also the glutural pocuches. The floor of the pharynx extend from the roof of the tongue over and around the laryngeal cartilages of the larynx. *The rostral portion of the pharyngeal cavity is divided by the soft palate into the dorsal naso-pharynx and ventral oropharynx.* The narrower caudal portions of the pharyngeal cavity is known as the laryngopharynx. *The free border of the soft palate and the paired pharyngeal arches surrounds the intra-pharyngeal opening which is located above the entrance to the larynx. Through this opening, the naso pharynx communicates with the laryngopharynx.*

PHARYNGEAL OPENINGS

1. A paired choanae rostrally connects the nasopharynx with the nasal cavity.
2. Paired pharyngeal opening of the auditory tube connects with auditory tube and thus the middle ear.
3. A slit like opening which is called aditus pharyngeus leads from the O.C into the oropharynx and bounded laterally by the palatoglossal arches, dorsally by the soft palate and ventrally by the root of the tongue.
4. The additus laryngeus is located caudoventrally to the open... is surrounded by rostral pharyngeal cartilage which projects upward from the floor of the laryngopharynx when the animal swallows, the opening is closed by the epiglottis.
5. The entrance to the oesophagus which at the caudal end of the laryngopharynx.

Both respiratory air and food are channel through the pharynx. The air passes from the cavity to the larynx and in the opposite direction during expiration. Food passes from the oral cavity to the oesophagus during swallowing and in ruminant in a reverse direction during regulation. Food crosses the respiratory passage in the pharyngeal cavity in the laryngopharynx. The pharynx and related structure direct the air/food towards their proper destination.

NASO-PHARYNX (dorsal part of pharynx when divided by soft palate)

Is the part of respiratory channel its lie dorsal to the soft palate and extend from the choane to the intra-pharygeal opening. The roof of the naso pharynx is concave from front to back and from side to side. In ruminant it is divided dorsally by the medial pharyngeal septum. The slit-like pharyngeal opening of the auditory tubes are the lateral wall of the naso-pharynx.

OROPHYARNX (ventral part of pharynx when divided by soft palate)

Is also known as *isthmus faucim* is the part of the digestive track although air passes through it at times when animal cough or breath through the mouth. The oropharynx extend from pharyngeal entering at the level of the palatoglossal artues to the base of epiglottis, it roof is formed by the soft palate and its floor is the roof of the soft palate contract the roof of the tongue and the lumen of the oropharynx is obliterated during swallowing however, the palate is lifted away from the tongue and the bolus can pass through oropharynx.

LARYNGOPHARYNX

This is common to respiratory and digestive channel is the caudal continuation of oropharynx and extend from the base of the glottis to the level of the cricoid cartilage, it contains the rostral part of the larynx on each side of the base of the epiglottis are the piriform recess that continues the floor of the oropharynx around the laryngeal entrance, *the caudal part of laryngopharynx that is covered by the caudal laryngeal constrictor is known as the vestibulum oesophagi*. In the carnivores the caudal extent of the laryngopharynx is marked by an annular fold of mucus membrane.

WALL OF THE PHARYNX

The pharyngeal wall consist from the inside out of

1. mucous membrane
2. fascia
3. layer of pharyngeal muscle
4. muscle fascia
5. Tunica adventitia

The mucus membrane lining the nasopharynx is similar to that of respiratory region of the nasal cavity, it is slightly folded and contains glands and regional accumulation of lymphoid tissue. The remaining pharyngeal wall is like that of the O. C. At the entrance of oesophagus the mucosa overlies an extensive venous plexus. The fascia between the mucossa and pharyngeal muscle is thin is attached to the pharyngeal raphae while the fascia on the outside of the pharyngeal muscle is thicker.

Pharyngeal muscles: they are striated and consist of series of bilateral pairs. They function under the swallowing reflex and are not under direct voluntary control except for stylopharyngeus caudalis which is a dilator. The pharyngeal muscles are constrictors and are also inserted on the pharyngeal raphae. As regards their insertionss and origins there is little or no specie difference.

The muscles are in two groups

ROSTRAL CONSTRICTOR

Pterygopharyngeus: Origin: Pterygoid bone

Palatopharyngeus: Origin: Edge of the palatine and pterygoid bones.

Stylopharyngeus rostralis: O:- stylohyoid

Hyopharyngeus: O:- caudal end of thyrohyoid

CAUDAL CONSTRICTOR

Thyropharyngeus: O- Thyroid Lamina

Cricopharyngeus: O: lateral surface of cricoid cartilage

DILATOR

1) Stylopharyngeus caudalis

O:- medial surface of the dorsal 3rd of the stylohyoid

I:- lateral wall of the pharynx

SOFT PALATE

Is a substantial musculo-mucosa cell forming the caudal conformation of the hard palate. *It extends to the pharyngeal cavity dividing the rostral portion into the nasopharynx and oropharynx. The soft palate of the horse is exceptionally long and except during swallowing, its free border is wedged against the base of the epiglottis causing the rostral surface of the epiglottis to lie against the dorsal surface of the soft palate. The horse seems unable to raise the soft palate from this position. Hence, it is very difficult or impossible for the horse to breath through its mouth.*

PALATOGLOSSAL ARCHES

Two mucosa pillars that connect the soft palate with the wall of the tongue and form lateral boundaries of additus pharyngeus. The mucosa of the ventral surface of the soft palate contains varying amounts of lymphoid tissue, deep to the mucosa is a thick layer of glands. *Three paired muscles re responsible for the movement of the soft palate.*

(1) Median palatinues

O:- free borders of palatine bone

I:- Caudal border of the soft palate

A:- to strengthen the palate

(2) Tensor veli palatini

O: muscular process of the tympanic part of the temporal bone

I:- in the aponeurosis of the soft palate

A: To tense and strengthened the rostral part of soft palate

(3) Levator Veli palatini

O:- Temporal bone

I: Medial plane of the soft palate

A: To raise the soft palate towards the base of the cranium.

TEETH

The dentition of domestic mammals consists of two dental arches but the shape, the arrangement and of teeth vary from species to species. Among the mammals generally the dentition is an *important criteria for identifications and classification*, also because of their permanent teeth are among the most *important paleontological features* ((development of animal relative to their evolution). The *teeth are the principal organ of mastication and function together with the jaws, masticulatory muscles, lips and tongue in the prehension or mastication of food.*

The dentition of an animal is always *intimately related to its mode of nutrition*, hence such terms as carnivores, omnivores, herbivores, dentitions. In some species the teeth has developed into a formidable weapon e.g. Lion, cats. The relatively simple *unspecialised brachydont tooth* consist of a *recognizable crown* (corolla dentis) which is the free dorsal portion of the tooth projecting into the mouth, a *root (radix dentis)* which is the embedded portion and a

slightly constricted neck (called) the collum-dentis) between the crown and root at the gum line.

In hypsodont tooth i.e. the tooth that is more specialised than the brachydont tooth, the crown and the neck are not easily distinguished so we have the body and the root. The body has a free portion that is surrounded at its base by the gum and an embedded portion that is usually long in the young animal. The tusks of a boar (pig) also consists a long body, partly exposed and partly embedded but has no root in the strict sense. The root is firmly implanted in the dental alveoli of the mandible, incisive bone, and the alveolar process of the maxilla. The anchorage is by means of periodontum which consist of the strong collagenous bundles transversing the space between the alveolar wall and the root by their orientation they prevent the tooth from being pressed into it socket during mastication.

The mammalian teeth are composed of three substances, (1) *the dentine*, (2) *the enamel* (3) *cement*

(1). The dentine is hard yellowish white osseous tissue constitute the bulk of the tooth and contain the dental cavity in its centre. *In the cavity is the dental pulp which is a mass of delicate connective tissues fines between vessel and nerves.*

(2). The enamel- is the hardest substance in the body. In *brachydont enamel is covered by a thin cuticle and envelopes only the short exposed crown. In hypsodont teeth the cuticle covers also the embedded portion but not the short root. The enamel of the hypsodont cheek tooth usually form prominent longitudinal folds.*

(3) The cement infest the root of the teeth

The surfaces of the tooth which faces its antagonist in the opposite jaw is the *occlusal surface*. While the surface. Facing the adjacent teeth is the *contract surface*. The one towards the 1st incisor is the *mesial surface* and the one the opposite side is the *distal contact surface*. The *vestibular surface* faces the lips and cheek, while the *lingual surface*, is in contact with the tongue. The opening of the apex of the root is the apical foramen and it leads through the root canal into the dental cavity.

Brachydont teeth is one with well developed root and short crown, they complete their growth shortly after eruption. During development they have large dental cavity and wide root canals both of which are filled with a pulp rich in vessels and nerves. After growth ceases, there is deposition of secondary dentine which narrows 1st the apical foramen and later the entire dental cavity from the crown towards the root. In contrast to this are those that have no root in the strict sense e.g. *tusks of boar* and the *incisors of rodent*. The wide dental cavity remains wide open proximally and they continue to grow throughout the animals life time. Growth usually keeps pace with the wearing of the occlusal surface. If there is no wear at the distal end of teeth, the teeth will grow out of proportion. The cheek teeth of the ruminant and horse lies between the 2 extremities in shape and growth pattern.

TYPES OF TEETH

The incisor (i) are embedded in the incisive bone (part of mandible) they are followed caudally by canine (c) and these by a more complex cheek teeth which consist of a rostral group of premolar (PM) and the caudal group molar (M).

DENTAL FORMULA

This is an abbreviated statement of the number of teeth of each dental type in an animal which helps in comparing dentition among mammalian species. The formula uses I for

incisor C-canine M – molar PM- Premolar. The symbol is followed by number that indicate how many teeth of that type are present. Beginning at the median plane the dental formula list the permanent teeth of one side. In the deciduous teeth the cover case letter is used for the symbol proceeded by a D e.g. Di 1 is the deciduous incisor next to the median plane. Because dentition is the same on both side the formula lists only one side and is enclosed in parenthesis and multiplied by two to arrive at the number of teeth. The number above the lines are for the teeth of upper jaw and those below for the lower jaw. pigs has the most complete dentition among domestic mammals and so dental formula is a follows

Species	Deciduous	Permanent teeth
Pigs	$2\left(\begin{array}{ccc} Di & Dc & Dp \\ \hline 3 & 1 & 3 \\ 3 & 1 & 3 \end{array}\right) 28$	$2\left(\begin{array}{ccc} I & C & P & M \\ \hline 3 & 1 & 4 & 3 \\ 3 & 1 & 4 & 3 \end{array}\right) 44$
Dogs	$2\left(\begin{array}{ccc} Di & Dc & Dp \\ \hline 3 & 1 & 3 \\ 3 & 1 & 3 \end{array}\right) 28$	$2\left(\begin{array}{ccc} I & C & P & M \\ \hline 3 & 1 & 4 & 3 \\ 3 & 1 & 4 & 3 \end{array}\right) 42$
Cats	$2\left(\begin{array}{ccc} Di & Dc & Dp \\ \hline 3 & 1 & 3 \\ 3 & 1 & 2 \end{array}\right) 26$	$2\left(\begin{array}{ccc} I & C & P & M \\ \hline 3 & 1 & 3 & 1 \\ 3 & 1 & 2 & 1 \end{array}\right) 30$
Ruminant	$2\left(\begin{array}{ccc} Di & Dc & Dp \\ \hline 0 & 0 & 3 \\ 4 & 0 & 3 \end{array}\right) 20$	$2\left(\begin{array}{ccc} I & C & P & M \\ \hline 0 & 0 & 3 & 3 \\ 4 & 0 & 3 & 3 \end{array}\right) 32$
Horse	$2\left(\begin{array}{ccc} Di & Dc & Dp \\ \hline 3 & 1 & 3 \\ 3 & 1 & 3 \end{array}\right) 28$	$2\left(\begin{array}{ccc} I & C & P \\ \hline 3 & 1 & 3(4) \\ 3 & 1 & 3 \end{array}\right) 40$

Dogs: For the list 1st three weeks of life the dog has no teeth, thereafter the deciduous begins this is complete after ½ months except p1 (1st premolar) upper and lower is appears 3½ to 6 month of age (in dog the list 1st premolar is not replaced) replacement of teeth in dogs.

Di 1-3 – 3-5months
D c 1 – 5-7 months
Dp 1 – not replaced
Dp 2-4 – 5-6 months
M 1-3 – 4-7 months

Cats:- In cat eruption and replacement are similar to the dogs.

NB:- In pigs Di 3 and Dc are present at birth and often cause injury to sow’s mammary gland during suckling.

Ruminant: Dental pad replaces the incisor and canine in the upper jaw.

The teeth of the upper jaw forms the upper dental arch and does of the lower jaw forms the lower dental arch. Each arch is interrupted between the incisors and check teeth by a white inter dental space called the *diastema*. *Animal are said to be isognathous (equal jaw)* when their upper and lower jaw are of the same width and when centric occlusion, the whole occlusal surface of the upper teeth makes contact with the whole occlusal surface of the lower teeth. Teeth are said to be a *anisognathous* when the lower jaw and with it the dental arch is narrower than the upper jaw.

MORPHOLOGY OF THE TEETH

1. The Haplodont (Brachydont): - *Is the simple unspecialised tooth type* that has a conical crown, a slightly constricted neck and a simple conical root. In domestic animal except the horse this type with such slight modification as chisel shaped for shovel shaped crown is found in the I and C in shape and growth pattern they are *brachydont* i.e they are fully developed and have ceased growth at the time of eruption. Check teeth of domestic mammals has a more complex type of two in terms of shape and growth pattern this include the following.

Tuberculosectorial Type: Characteristics of carnivores, it is a multi tubercular tooth capable with its antagonist in starting or cutting of food.

Bundodont Type: Characteristics of omnivores such as pigs. It is also multi tubercular but has a flatter occlusal surface. It is suitable for crushing food

This two brachydont types of teeth have low enamel covered crowns and well developed root and their growth is completed at the time of eruption.

2. **Hyposodont:** This is *highly specialised type in the herbivores* resulting from an invagination of enamel on the occlusal surface of the tooth, *this invagination is known as infundibula*. This infundibula and their surrounding dentine are semi lunar on cross-section in ruminant: *their check teeth are known as selenodonts (or moon shaped)*. In solipeds the enamels on the occlusal surface form pronounced fold and ridges hence their teeth are known as *zophodont* (ridge shaped). This check teeth continues to grow in height for several years after eruption resulting in hyposodont type with a rather high tooth body. When growth ceases a short root remains. During wearing of this type of tooth the enamel fold on the occlusal surface. Wears off living two enamel crest, this crest are harder than adjacent dentine and cement and they stand out over the recessed substance providing coarse grinding surface. This surface is essential for mastication of hard fibrous plant food.

GUMS

The part of oral mucosa that are intimately united to the periosteum (covering of the bone) of the alveola processes of the jaw are known as the gum (gingivae). The gum closely and encircle the neck of the teeth and exchanges fibre with the alveola periosteum. In the ruminant the gum is modified to form the dental pad (Pulvinus dentalis) that replaces the upper incisors.

ORBIT AND OCCULAR ADNEXA

The bovine orbit is surrounded with bone; the bony covering is complete in bovine than that seen in the horse the eyes protrude beyond the margin of the orbit and with that aid of the eye movement has a visual field of about 360°. The bones that forms the orbit consist of the (1) *frontal bone*, (2) *the lacrimal bulla* which is a projection of the lacrimal bone. The bone covering provided by the lacrimal bone is quite thin. The *frontal bone forms the roof of the orbit*, the maxilla assist in forming with the lacrimal bone the rostroventral wall of the orbit, the temporal bone does not form any portion of the orbit of the Ox unless the zygomatic process of squamous temporal bone would be considered as a protection for the orbit contact.

ACCESSORY OCCULAR ORGANS

The eyelids are quite thick and consist of lower and upper lid. The eyelids have cilia, but the cilia are shorter at the lower lids. *The tarsal glands* are prominent but are well embedded within the tissue of the lids. The orbicularis oculi are well developed. The median and lateral attachment near the limbus of the eyelids may be found muscular fibres which takes a circular course around the palpebral fissure. The superficial muscles that act on the movement of the lids are the *Frontalis* For the upper lid ; *Malaris* for lower lid and the orbicularis oculi
The superficial muscles are under the motor control of the 7th nerve.

The palberal conjuntival may be pigmented near the marginal of the lids but at the fornix pigmentation is lacking. The bulbal conjunctival may show considerable pigmentation near the muscles of the eyes. The conjunctival of the Ox may contain isolated noddles of lymphatic tissue or accessory lacrimal gland. The fold of mucosa that covers *the 3rd eyelid can be seen in the median angle of the eye*. This fold of tissue covers an underlining T shaped Cartilage surrounding the cartilage and particularly the shaft is the glandular tissue of the semilunar fold of the conjunctiva (Nictating membrane). *Hardner's gland* which is a special deep gland of the 3rd eye lid only in the pigs.

LACRIMAL APPARATUS

Lacrimal apparatus consist of (1) lacrimal gland, (2) lacrimal canal, (3) Lacrimal sac (4) Lacrimal caruncle (5) Naso lacrimal ducts.

Lacrimal gland are lobulated in appearance but have two distinct area, the dorsal portion thick while the ventral portion is thin. The glands cover the lateral and dorsal surface of globe and empties through a number of duct: 6-8 large ducts and several smaller ducts near the fornix of the conjunctiva of the upper lid. Lacrimal gland secretes gland. Lacrimal caruncle is seen in the medial angle of the eyes, it may be yellow or dark brown in color depended on pigmentation.

Lacrimal canal of Ox measures to 1-1-15 cm in length and have an arch shaped course from the puncta lacrimale to the lacrimal sac.

Lacrimal sac is formed by the confluence of lacrimal canal which may be 5-8mm in diameter. Nasolacrimal duct is about 12-15 in length and usually takes a straight course, the terminal portion is 3-4 mm wide is found between the two cartilaginous sheeth of the alar cartilage and rostral projection of the parietal cartilage. It opens near the lateral wall of the nostril.

THE PERIORBITA

This is a *fibrous sheath covering the eye ball, it has a deep and superficial layer. The deep layer of the fascia is attached at the base of the trochlear cartilage. The deep fascia joins with the superficial after passing under the rectus dorsalis muscle and the lacrimal gland.*

EXTRINSIC MUSCLES

The 7 muscles of the orbit include:
dorsal, -ventral, -medial, and lateral recti muscles
Dorsal and ventral oblique muscles
And the retractor bulbi muscle

EYEBALL

The eyeball is made up of three tunics enclosing refracting area. The three tunics are the (1) external fibrous middle vascular and (3) inner nervous tunics.

The external fibrous tunic consists of the anterior avascular transparent *cornea* and the posterior vascular *opaque sclera* (white of the eye). The cornea projects well beyond the bony orbit in the ox and possesses five layers just as in other animals. The cornea may have some pigment in its periphery. The cornea and iris are not extensive in ox.

The vascular tunic consists of three parts:

(1) choroids (2) ciliary body (3) Iris

The choroids of the ox do not vary from the choroids of other dominant animals. It is expected that the layers are distinct and the connective tissues are pigmented. *Tapetum* is present in nocturnal animals but absent in man, monkey and pigs. The tapetum in cattle is roughly angular.

Ciliary body consists of a ciliary ring, ciliary process and a ciliary body. The ciliary body is better developed in ox and horse, the longitudinal fibres of the ciliary body are well developed but the radial fibres and the circular fibres are poorly developed in ox. In the ox there are 90-110 ciliary processes that measure 3-5cm in length and are of varying width.

Iris of a bovine eye, there are a great number of delicate folds, the pupil is transversely oval in outline. There are projections of the iris which are held by the papillary sphincter, this structure contains connective tissue, between vessels and epithelium. The pupil of ox is held immobile by radially arranged fibres.

Inner nervous tunic is the *retina*; the nervous coat consists of three parts: (1) pars optica retina (2) Pars ciliaris retina and (3) pars iridica retinae. The ciliary and iridica parts lack photoreceptor cells.

There are blood vessels in the fibrous layer of retina. The ox has pigment epithelium in the retina except the areas where the retina overlies the tapetum, the optic disc is the part of emergence of the optical nerve after its fibres have penetrated the outer layer of the bulb. The retina has about 10 years. There are three to four veins radiating from the optic disc.

CHAMBER OF THE EYES

The anterior chamber of the eye is enclosed anteriorly by the cornea and posteriorly by the iris and lens. The anterior chamber communicates through the pupil with the posterior chamber and horse. Lies between these two extremities in shape and growth pattern.

