A Comparative Gross Anatomical Study on the Tongue of Musk Deer (*Moschus moschiferus*) and Goat (*Capra hircus*)

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Introduction

Tongue of ruminants is highly mobile and protrusile. It has an important function in prehension of food. Gross anatomy of tongue of domestic animals and black bear has been reported (Dyce *et al.*, 1996; Habel, 1975; Nickel *et al*., 1979 & Khan *et al*., 1991). Literature available on the liver, heart, lungs and trachea of musk deer has been reported (Lone, *et al*., 1988; Khan, *et al*., 1999, 2000). Keeping in view the paucity of information regarding the wild life anatomy, the present investigation was carried out to study in detail the comparative gross anatomical features of the tongue of musk deer and goat.

Materials and Methods

Materials comprised of tongues of four adult Musk deer of either sex brought for post mortem examination by Wildlife Department, Kashmir at the Faculty of Veterinary Sciences and Animal Husbandry. Six tongues from adult goats of either sex were collected from local slaughter houses. The organs from both the species were preserved in 10% formalin for the comparative study.

Results and Discussion

Tongue of musk deer consisted of root (Radix linguae) which sloped ventrally towards the base of epiglottis, body (corpus linguae) and free rostral portion, the apex (Image 1[w]). Root and body were wide, attached to the floor of the mouth, and presented distinct dorsal, ventral and lateral surfaces. These findings were in accordance with those observed by (Nickel, *et al*., 1979). In Musk deer apex was free, pointed and had a rounded margin whereas in case of goat it was more rounded.

Ventral surface was connected to the floor of the oral cavity by a median fold, frenulum linguae. Caudal portion of the tongue formed an elliptical prominence, the torus linguae which was pointed at centre, defined by well developed transverse lingual fossa, which was less pronounced in Musk deer as compared to goat and sheep (Baba and Khan, 2003). A well defined deep median groove existed on the apex of the tongue from tip half way in Musk deer (Image 1[w]) which was almost negligible in case of goat.

Mucous membrane of the tongue presented numerous papillae filiform, conical, fungiform and vallate. Apical half of the dorsum rostral to the torus, was covered by filiform papillae which were soft in Musk deer giving it a smoother appearance. However in case of goat these papillae were horny, pointed and presented a rough appearance of the dorsum. Scattered among filiform papillae, some of the papillae were modified in to broad and flat projections as lenticular papillae, these papillae perform mechanical function. The fungiform and vallate papillae have gustatory role were scattered among the filiform papillae in Musk deer. However, in case of goat, root was free of papillae.

Circumvallate papillae 5 to 12 in number (Image 1[w]) were located just rostral to the root of the tongue, forming an irregular double row in case of Musk deer. Their number varied from 8 to 17 in goat and 18 to 24 in sheep (Nickel, *et al.*, 1979).

Folliate papillae were absent in both Musk deer and goat. A very prominent marginal zone of conical and lenticular papillae on the lateral sides from apex to the body were distinctive feature of the Musk deer tongue. No such zone was present in the goat.

Lingual glands were embedded in the musculature, and were most numerous on the root, along the border and on the lateral surfaces. The mucosa over the root was characterized by presence of diffuse lymphatic tissue. Intrinsic lingual muscles originated and terminated in the deep, superficial, longitudinal, perpendicular and transversely oriented muscle fibres blended with one another. Extrinsic muscles genioglossus, hyoglossus and styloglossus had bony attachments and radiated from the latter on the tongue.

Genioglossus appeared as fan shaped muscle separated from its fellow muscle on the opposite side by the lingual septum. It draws the tongue rostrally and ventrally and produces a well developed median groove on the dorsal surface at the apex in Musk deer. However, in goat no such groove was observed. Long, slender styloglossus muscle along the ventrolateral aspect was very distinct. It shortened the tongue when acting together and elevated the tongue laterally (Image 2[w]). Ventrolateral to the root of tongue was wide hyoglossus muscle inserted between the genioglossus medially and styloglossus laterally which caused the tongue to contract and be drawn caudally.

Arteries of tongue comprised lingual and sublingual branches of the linguofacial trunk. Lingual veins comprised linguofacial and maxillary branches. It was innervated by five pairs of cranial nerves, mandibular branch of the trigeminal (V), facial (VII), glossopharyngeal (IX), vagus (X), and hypoglossal nerve (XII), the XII is the only motor supply, and other four are sensory, mediate gustatory, tactile, pain and temperature stimuli.

On the basis of these findings it was concluded that tongue of Musk deer was smooth as compared to that of goat. It presented 5 to 12 vallate papillae, a well distinct marginal zone of conical papillae on lateral sides and a distinct median groove on the apex. These observations make it distinguishable from that of goat.

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[w] see images in the websupplement at www.zoosprint.org

Tusk Trimming in an Elephant under General Anaesthesia

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The tusks are modified incisors and are composed of dentine (ivory). Early in development, the tusks have enamel cap, but this is rapidly worn away, leaving only the dentine surrounding the pulp canal. The pulp canal extends upto 2\3rd of the length of the tusk. Because of the protruding nature, the trunk and the tusk are prone to injury. Trimming of the tusk is usually done in case of overgrown sharp ones and also to make a tusker docile under proper restraint. The present paper describes tusk trimming in a captive elephant of Nandan Kanan Zoo.

A bull elephant" Nandan" developed bilaterally overgrown sharp tusks (Image 1[w]). Being a trained elephant it was commanded to lie down, but it did not cooperate for trimming of the tusk. Hence 1 ml of Immobilion LA (2.45 mg of Etorphine hydrochloride &10 mg of Acepromazine maleate) was injected intramuscularly (Image 2[w]). The elephant was recumbent and in deep sleep with snoring sound within 3 minutes. Then both the tusks were trimmed with a hawk saw by using a thumb rule practiced at the Zoo. The length of the tusk to be retained is equal to circumference of tusk at the level of lips converted to length plus 2 inches.Pouring of cold water was done at the cut edges. Continuous monitoring of body temperature showed elevation of 0.5 degree centigrade. Hence ice water pack was placed on the cranium to bring down the temperature. The animal was continued to be in sitting posture for more than 2 hours. Hence 2 ml of Revivon (Diprenorphine hydrochloride, 3mg/ml) was injected intravenously and the animal stood up immediately.

On 28.11.1997 the same "Nandan" killed its mahout by goring while the handler was standing without the "Ankush". Hence thereafter the animal was always kept chained. It again developed overgrown tusks.So it was decided to trim the tusk on 7.12.2004. in standing sedation using a mixture of 500mg of xylazine hydrochloride and 200 mg of ketamine hydrochloride administered intramuscularly. After 5 minutes the animal was in standing sedation with symptoms of drooling of eyes, supporting the trunk on the ground and reduced fanning of the ear. The tusks were trimmed using a hawk saw safely without movement applying the same thumb rule (Image 3[w]). It was revived with 70 mg of Yohimbine hydrochloride administered intravenously.

In the above case at first instance the animal was made to be in recumbency through command by the handler. One ml of Immobilion LA was injected with an apprehension of excitement, muscular tremor and rigidity before falling while using Immobilion as indicated in horses by Thurmon (1993). In the 2nd instance as the elephant is unpredictable in view of previous history of killing its mahunt, it was decided to trime the tusks in standing sedation. Administration of xylazine and ketamine mixture provided excellent sedation. The elephant retained its standing posture by placing its hind limbs wide apart to maintain balance.Head was lowered with reduced flapping of ears which could be stopped by holding the lower portion of the fan of the ear (Image 4[w]). Due to sedation movement of trunk and tail were absent. This facilitated easy trimming of the tusk and administration of Yohimbine reversed the sedation within 3 minutes as observed by Sarma(1994) while studying the effect of general anaesthesia using xylazine and ketamine mixture in elephants.

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[w] see images in the web supplement at www.zoosprint.org

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