

Short Paper

Anatomical and histological study of molar salivary gland in domestic cat

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Summary

The gross and microscopic anatomy of the molar salivary gland of the domestic cat was studied. In this research, five pair of molar glands from five male adult cats were used. In cat, the molar gland was elongated rectangle shape and was located obliquely in the submucosal fossa of the inferior lip, near the oral commissure. The dorsal border of the molar gland was attached to the masseter muscle and posterior facial nerve. The ventral border was located in the angle of the anterior and transverse facial veins near the buccal part of the buccinator muscle. The caudal end of the gland neighboring the anterior facial vein and cranial end was close to the transverse jugular vein. The mean length and width of the left gland were 11.5 ± 0.3 mm and 3.4 ± 0.3 mm, respectively. The mean length and width of the right gland were 9.2 ± 0.8 mm and 4.1 ± 0.8 mm, respectively. The mean length of the left gland was larger than the right and the difference was significant ($P < 0.001$). In the histological findings the molar gland was surrounded with a dens irregular connective tissue capsule. The septa of the connective tissue from the capsule extended into the gland, dividing the organ into lobes and lobules. The secretory cells made up seromucous units and the mucous cells were predominant. The cells were arranged as compound tubuloacinar type. Most of the tubular units were long and branched, and there were no intercalated or striated ducts.

Key words: Cat, Histology, Molar salivary gland, Morphology

Introduction

The salivary glands are classified as major and minor. The major salivary glands; parotid, submandibular, sublingual, and zygomatic in carnivores and molar in cat, are large and located some distance from the buccal cavity; their excretory ducts are long. Their secretion, saliva, is serous or and mucous in character, and is produced in large quantities eg., 40-50 liters a day in the horse and ox. During mastication the saliva is mixed with food, aiding in the formation of the bolus and acting as lubricant during swallowing. In general, the major salivary glands of the herbivores are better developed than those of the carnivores. The salivary glands may be classified on the basis of their secretions as serous, mucous, or seromucous (mixed) glands. The distribution of these

types varies from species to species (Nickel *et al.*, 1979; Konig and Liebich, 2004). The minor salivary glands are located in the wall of the oral cavity and oropharynx, having very short ducts. They are named based on location i.e., labial, lingual, buccal and palatine and do not have connective tissue capsules. The minor salivary glands are only locally important (Banks, 1993; Pasquini *et al.*, 1996; Bacha and Bacha, 2000).

Recognition of normal as well as abnormal oral structures is important in the management of feline oral pain. Normal anatomic structures that may be mistaken for pathologic conditions include the incisive papilla and molar gland (Du Toit and Nortje, 2004).

In the literature, the morphology and histology of major salivary glands of other animals have been studied (Poddar and

Jacob, 1977, 1978; Pinkstaff, 1980). Young and Van Lennep (1978), and Pinkstaff (1980) have observed considerable diversity in the structure of major salivary glands of different species of mammals at both light and electron microscopic levels. There is no information about the morphology and histology of the molar salivary gland in domestic short hair cat. Detail and applied knowledge of anatomy on a regional basis is required to avoid inadvertent nerve damage during surgery and resulting litigation. The main purpose of the present study is to describe normal anatomical and histological findings of the molar salivary gland in domestic short hair cat. Results of this research can be used for applied anatomy in cat, especially oral examination.

Materials and Methods

Five adult male domestic cats (range of b.wt. 2-2.5 kg) were used. The cats were caught from the urban area of Mashhad, Iran and were anesthetised with pentobarbital and then euthanized by an overdose of the same drug. The research protocol was approved by the Ferdowsi University ethical committee. The left and right molar salivary glands were quickly excised and dissected free from adhering tissues. The topography of the gland in relation to other structures was studied and then the length and width to the nearest millimeter were recorded for each gland in two sides using caliper device. For histological studies, the glands were cut into small portions and were fixed in 10 percent buffered formalin for 24 h, followed by alcohol dehydration and embedded in paraffin. Sections (5 µm) of the glands were stained with haematoxylin and eosin and studied at light microscope level.

Results

In domestic cat, the molar gland was elongated rectangle shape and was located between the orbicularis oris muscle and the mucous membrane of the lower angle of the mouth, near the oral commissure. The dorsal border of molar gland was attached to the masseter muscle and the posterior facial nerve. The ventral border was located at an angle to the anterior and transverse facial

veins near the buccal part of the buccinator muscle. The caudal end of the gland neighbored the anterior facial vein and its cranial end was close to the transverse jugular vein (Fig. 1). The molar gland had a brownish-gray, granular appearance and received its arterial supply mainly from the ventral labial artery.

The mean length of the left gland was 11.5 ± 0.3 mm and the mean width was 3.4 ± 0.3 mm. The mean length of the right gland was 9.2 ± 0.8 mm and the mean width was 4.1 ± 0.8 mm. The mean length of the left gland was larger than the right and the difference was significant ($P < 0.001$). There was no significant difference between the mean weight and the thickness of the cat molar gland on the right and left sides (Table 1).

Table 1: Dimensions of cat molar salivary gland on the left and right sides, (n = 5)

Parameter	Mean \pm SD	
	Left	Right
Length (mm)	$11.5 \pm 0.3^*$	9.2 ± 0.8
Width (mm)	3.4 ± 0.3	4.1 ± 0.8
Thickness (mm)	0.2 ± 0.01	0.2 ± 0.02
Weight (mg)	59.2 ± 1.5	57.2 ± 1.5

*Significant difference between left and right sides ($P < 0.001$)

In histological studies, the molar salivary gland in domestic short hair cat is composed of compound tubuloacinar units with a seromucous nature. The parenchyma was composed of long, branched tubuloacinar secretory units that were predominately mucous secreting. The gland was surrounded with a dens irregular connective tissue capsule. The septa of the connective tissue from the capsule extend into the gland and divide it into lobes and lobules. Intercalated and striated ducts were not present, and the interlobular ducts had a two-layered cuboidal epithelium. There were a small number of serous acini and serous demilune in the molar gland, and most of the secretory units were tubulated and mucous (Figs. 2 and 3).

Discussion

Dogs and cats have four pairs of salivary glands: parotid, mandibular, sublingual, and

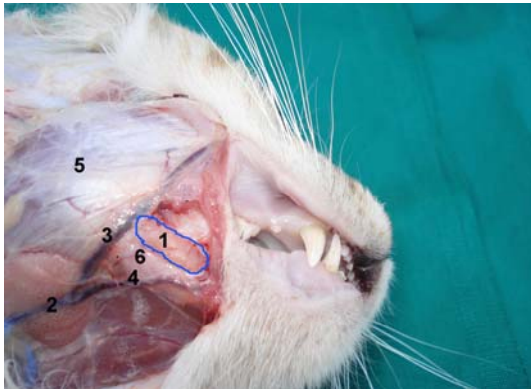


Fig. 1: Topography of molar salivary gland in domestic cat. 1: Molar gland, 2: External jugular vein, 3: Anterior facial vein, 4: Transverse jugular vein, 5: Masseter muscle, and 6: Buccal part of buccinator muscle

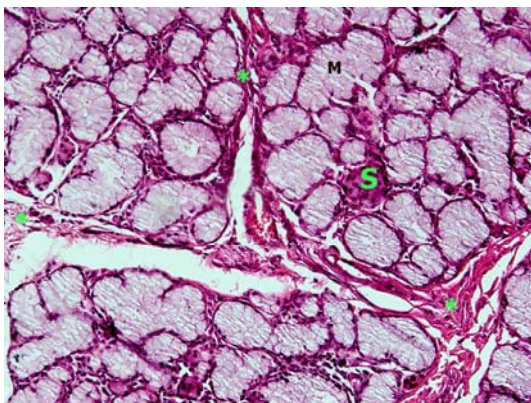


Fig. 2: Cat molar gland composed of serous (S) and mucous (M) secretory units separated by connective tissue (*) (H&E, ×320)

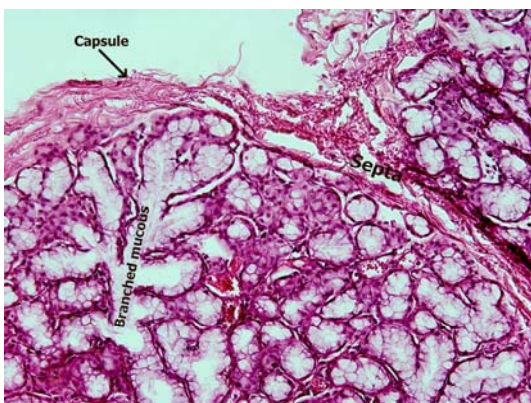


Fig. 3: Showing the cat molar gland with collagen fibers in capsule. Fibers extended to parenchyma and divided gland into lobes and lobules (H&E, ×320)

zygomatic. Cats have an additional pair, the molar salivary glands. Each gland has its own duct that carries saliva from the gland

to the mouth cavity. Saliva keeps the inside of the mouth lubricated, makes the swallowing of food easier, and contains enzymes that can help begin the digestion of food. In animals that pant, saliva also aids in cooling animals through evaporation off of the tongue (Martinez-Madrigal and Micheau, 1989; Hudson and Hamilton, 1993).

Most studies have usually focused on the parotid and submandibular glands, however the film of mucin, which protects the oral structures and is responsible for the feeling of oral comfort, is produced by the submucosal glands. The molar gland is particularly large in cat and its secretory unit was predominantly mucous.

Comparisons between the mixed salivary glands (seromucous) with mostly mucous units in sublingual, zygomatic and molar glands, purely serous parotid and mostly serous in submandibular gland, showed the acetylcholine synthesis, in terms of concentration, to be three to four times higher in the mucous glands than in the parotid and submandibular glands (Khosravani *et al.*, 2007).

In domestic cat, the molar gland was single in each side and located superficially near the angle of the mouth. It was elongated rectangle and opened by several small ducts into the vestibule opposite the lower molar teeth. It was predominantly mucous and there were no intercalated or striated ducts. The gross and microscopic anatomy of the major salivary glands of the ferret was studied. In ferret, the location of the molar gland was similar to cat and predominantly mucous has been reported. There were no intercalated or striated ducts. Also, the zygomatic gland was present. It was also predominantly mucous and there were no intercalated or striated ducts. The author suggested that, histology and nature of the molar gland in cat is similar to the sublingual gland in other animals.

In another study, the membranous bulge lingual to the mandibular molar tooth was examined microscopically in cats and found to contain a small mixed salivary gland. This gland was a tubuloacinar gland with multiple small openings through several short ducts to the surface of the lingual membrane. Mucous acini were predominant

with a few serous demilunes (Okuda *et al.*, 1996). In the results, we concluded that the domestic cat, such as other breeds, has a distinctive molar salivary gland. Also, the gland has a separate capsule with lobe and lobule and is classified in the major salivary glands.

As the molar gland is located near the oral commissure between the muscle fibers and submucosa, the distance of secretory drainage of the gland to the oral cavity is very short. Secretory materials of the molar gland empty into the oral cavity by several small ducts.

The author suggested that, other salivary glands such as parotid, submandibular and sublingual have an important role in saliva secretion. In comparison with the molar gland the recent glands are very large and are composed of many secretory lobes and lobules. Contrary to the molar gland, the paranchyme of these glands needed different ducts for collecting and transporting secretory materials.

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