

## INVESTIGATIONS ON THE SHAPE AND SIZE OF MOLAR AND ZYGOMATIC SALIVARY GLANDS IN SHORTHAIR DOMESTIC CATS

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### Summary

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The investigation was carried out on five male adult domestic shorthair cats. The zygomatic gland in the cat was with an oval shape with indented borders. It was located on both sides of the head, between the dorsal-medial regions of the zygomatic arch, ventral region of the eyeball and laterally to the masseter muscle. The mean length of the gland was  $8.10 \pm 1.14$  mm and  $8.42 \pm 0.99$  mm for left and right sides respectively in rostrocaudal direction. The mean width of the gland was  $19.40 \pm 1.14$  mm (left side) and  $19.10 \pm 0.89$  mm (right side) in dorsoventral direction. The molar gland was elongated and located obliquely in the submucosal fascia of the inferior lip, near the oral commissure. The dorsal border of the molar gland was attached to masseter muscle and posterior facial nerve. The caudal end neighbored the anterior facial vein and the cranial end was close to the transverse jugular vein. The mean length of the molar gland was  $20.40 \pm 1.14$  mm and  $19.90 \pm 1.14$  mm and the mean width:  $5.90 \pm 0.74$  mm and  $5.80 \pm 0.83$  mm on the left and right side, respectively. There was no significant difference between the dimensions of molar and zygomatic salivary glands from left and right sides.

**Key words:** cat, molar salivary gland, morphology, zygomatic salivary gland

### INTRODUCTION

In most animals, there are three major paired salivary glands: the submandibular, the sublingual and the parotid glands. In the cat, two other glands, a molar and a zygomatic, are considered to be part of the salivary system. They differ one from another in the relative abundance of serous and mucous acini, and in the length of the various ducts. The minor salivary glands are located in the submucosa of different parts of the oral cavity. The secretions of the major and minor salivary glands are called saliva. On the basis of the weight of the glands producing it, the volume of saliva exceeds that of other

digestive organs by as much as 40 times. In the absence of saliva, infections and caries would develop in the oral tissues. The salivary glands also secrete IgA and potassium, and resorb sodium (Aspinall & O'Reilly, 2004; Konig & Liebich, 2004). In several mammalian species such as dogs, cats, rats, mice, hamsters and ferrets, the zygomatic salivary gland was similarly described (Poddar & Jacob, 1977; 1978; Frey *et al.*, 2001). There is no detailed information about the morphology of molar and zygomatic salivary glands in cats. The goal of this study was to describe the normal anatomical findings of these glands in domestic shorthair cats.

## MATERIALS AND METHODS

Five adult male domestic shorthair cats weighing 2–2.5 kg were caught from the urban area of Mashhad, northeastern Iran. The cats were anaesthetized with pentobarbital (36 mg/kg, i. p.) and then euthanized by an overdose of the same drug.

The left and right molar and zygomatic salivary glands were quickly excised and dissected free from adhering tissue. The topography of gland with relation to other structures was studied. The length and width to the nearest millimeter were recorded for each gland on two sides and compared.

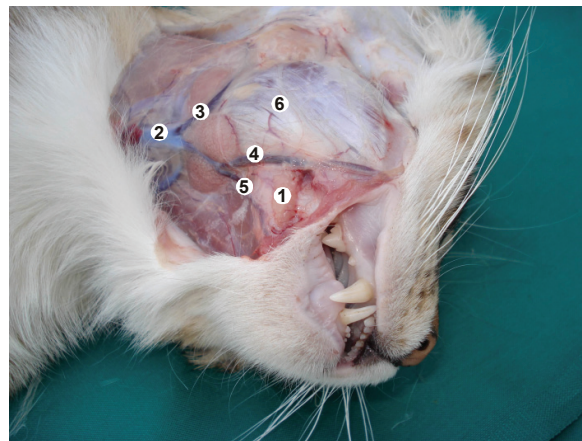
The data for left and right sides were analysed by the *t*-test using the Sigma Stat statistics software.

## RESULTS

In domestic shorthair cats, the molar gland occurs at the angle of the jaw and is located immediately beneath the skin and embedded in the surrounding connective tissue. Its shape in cat was rectangular

and located obliquely. The dorsal border of molar gland is near to the masseter muscle and the posterior facial nerve. The caudal end of gland neighbours the anterior facial vein and its cranial end is close to the transverse jugular vein (Fig. 1). The mean length of the gland was  $20.40 \pm 1.14$  mm and  $19.90 \pm 1.14$  mm on left and right sides, respectively. The mean width was  $5.90 \pm 0.74$  mm and  $5.80 \pm 0.83$  mm on left and right sides respectively (Table 1). There was no significant difference between dimensions from the left and right sides. The rostral part was narrower than caudal part (Fig. 2).

The zygomatic or infraorbital gland is present deep to the masseter and related to the orbit in the infra-temporal fossa (Fig. 3). It has an oval shape with indented borders (Fig. 4). The gland opens by several small ducts into the vestibule opposite the upper molar teeth. The mean length of the zygomatic gland in domestic shorthair cat was  $8.10 \pm 1.14$  mm (left side) and  $8.42 \pm 0.99$  mm (right side) in rostrocaudal direc-



**Fig. 1.** Topography of molar salivary gland in the domestic shorthair cat. 1. molar gland; 2. external jugular vein; 3. posterior facial vein; 4. anterior facial vein; 5. transverse jugular vein; 6. masseter muscle.

**Table 1.** Dimensions of molar and zygomatic salivary glands of domestic shorthair cats (left and right sides). Data are presented as mean  $\pm$  SD (min-max), n=5

Salivary gland	Dimension (mm)	Left side	Right side
Molar	Length	20.40 $\pm$ 1.14 (19–22)	19.90 $\pm$ 1.14 (18–21)
	Width	5.90 $\pm$ 0.74 (5–7)	5.80 $\pm$ 0.83 (5–7)
Zygomatic	Length	8.10 $\pm$ 1.14 (7–10)	8.42 $\pm$ 0.99 (7–9)
	Width	19.40 $\pm$ 1.14 (18–21)	19.10 $\pm$ 0.89 (18–20)



**Fig. 2.** Molar salivary gland in the domestic shorthair cat – lateral aspect.

tion. The mean width was 19.40  $\pm$  1.14 mm and 19.10  $\pm$  0.89 mm on left and right sides, respectively, in dorsoventral direction (Table 1). There was no significant difference between dimensions of zygomatic salivary gland on both sides.

**DISCUSSION**

In addition to the diffuse salivary tissue located within the walls of the oral cavity, the cat has several paired salivary glands. The consolidation of buccal glands at the angle of the mouth is described separately as the molar gland. The dorsal buccal glands of the cat are consolidated to form the distinct zygomatic salivary glands, which is located in the ventral part of the orbit (Hudson & Hamilton, 1993).

The zygomatic gland is quite inadequately presented in the available veterinary anatomical literature. In the anatomical literature the gland is described only in carnivores (Nickel *et al.*, 1975; Dellmann



**Fig. 3.** Topography of zygomatic salivary gland in the domestic shorthair cat.



**Fig. 4.** Zygomatic salivary gland in the domestic shorthair cat – lateral aspect.

& Eurell, 1998; Adams, 2004; König & Liebich, 2004). According to authors, the zygomatic gland is a homologue of the dorsal gland shifted to the orbital region. However, the reasons for such a displacement are still unknown. It has been generally believed that the domestic species such as ruminants have no zygomatic salivary gland, except for some carnivores. In roe deers, similarly to carnivores, zygomatic salivary gland has been reported. The zygomatic gland of roe deer is a polystomatic gland and amounts to 0.02% of body weight (Frey *et al.*, 2001).

Among animals, rabbits have four pairs of salivary glands: the parotid, the submaxillary, the sublingual, and the zygomatic. The zygomatic salivary gland is not present in humans and many other species. In the mouth of dogs and cats, food is grasped with the teeth and roughly chopped up into smaller chunks (Brewer, 2006). Food is mixed with saliva, secreted from salivary glands located under the tongue, at the back of the mouth, behind the ear and under the eye. The primary function of saliva in the cat and dog is lubrication of food so that it is easily swallowed. The enzymes in the salivary glands vary across species. Some animals

have no amylase activity (sheep, pig), whereas others have only traces of activity (dog). The amylase activity in the rabbit is comparable to that of humans and rats. Galactosidase activity in the salivary glands of the rabbit is comparable to that in the hog, dog, or rat. The parotid or submaxillary salivary glands of the human have no galactosidase activity (Tartaglian & Waugh, 2002).

Most studies usually focused on parotid and submandibular glands. However, the film of mucin, that protects the oral structures and is responsible for the feeling of oral comfort, is produced by the submucosal glands. The zygomatic and molar glands are particularly large in carnivores such as the ferret. The secretory acini of these glands are predominantly mucous.

The gross and microscopic anatomy of the major salivary glands of the ferret was studied. In ferrets, the location of molar gland was similar to that in cats. There were no intercalated or striated ducts. A zygomatic gland was also present. It was predominantly mucous too and there were no intercalated or striated ducts (Poddar & Jacob, 1977). The nature of molar gland in cats was similar to the sublingual gland in other animals.

To sum up, it could be suggested that the molar and zygomatic glands in domestic shorthair cats were well developed and could be classified as major salivary glands. The small number of animals used in this study did not allow us to draw a definite conclusion about the difference of size between the left and the right sides.

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