Morphology of the Dorsal Lingual Papillae in the Newborn Panther and Asian Black Bear

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Summary: The dorsal lingual surfaces of a newborn panther (Panthera pardus) and two newborn asian black bears (Selenarctos thibetanus) were examined by scanning electron microscopy (SEM). The tongues of the panther and asian black bear were about 40 mm in length and about 20 mm in width. Filiform, fungiform and vallate papillae were found. The filiform papillae were distributed over the entire dorsal surface of the tongue. In the panther, the filiform papillae on margin of the lingual apex were divided into two shapes which were horny or club-shaped papillae. The filiform papillae on the midportion were larger than those on the lateral region in size. The fungiform papillae also were divided into two shapes which were hemispherical or club-shaped papillae. In the asian black bear, the filiform papillae on the margin of the lingual apex were larger than those on margin of the panther tongue. The vallate papillae in the animals of two species were located on both sides of the posterior end of the lingual body. Each papilla was surrounded by a groove and crescent pad.

Many works have been published on the three-dimensional structures of the lingual surfaces in various animals. In the order Carnivora, there have been some SEM studies of the tongues of cat (Bo- shell et al., 1982; Ojima et al., 1997), dog (Iwasaki and Sakata, 1985), mongoose (Iwasaki et al., 1987) and Japanese weasel (Furubayashi et al., 1989). Furthermore, the tongues of dog (Iwasaki and Miyata, 1989), mongoose (Iwasaki and Miyata, 1990), sea otter (Shimoda et al., 1996), bush dog (Emura et al., 2000) and masked palm civet (Emura et al., 2001) have been studied by transmission electron microscopy (TEM). Such studies reveal variations in morphology and distribution of papillae on the dorsal lingual surface among animal species.

However, there are no studies on SEM investigations of the tongues of the panther and asian black bear. The purpose of this study is, therefore, to examine three-dimensionally the dorsal lingual surfaces of the panther and asian black bear, in order to compare the results with those of previous studies on other mammals.

Materials and Methods

Tongues of a newborn panther (Panthera pardus) and two newborn asian black bears (Selenarctos thibetanus) of the order Carnivora were used in this study. The tongues were fixed in 10% formalin. Small blocks containing papillae were cut with a razor blade, postfixed with 1% osmium tetroxide for 2 h. Thereafter, the specimens were dehydrated through graded series of acetone, critical-point-dried and plasma-coated with OsO₄ before being examined under SEM (Hitachi S-3500N) at an accelerating voltage of 15 kV.

Results

The tongues of the newborn panther and asian black bear were rectangular and had a shallow apical median sulcus separating it into two lateral parts. The tongues of the three animals were about 40 mm length and about 20 mm in width.
Newborn Panther

The filiform papillae were distributed over the entire dorsal surface of the tongue. The filiform papillae on margin of the lingual apex were divided into two shapes which were horny or club-shaped papillae (Fig. 1, 1 inset). The filiform papillae on the midportion were larger than those on the lateral region in size (Fig. 1). In the central region of the lingual body, the filiform papillae were cylinder-shaped papillae rather than conical papillae (Fig. 3). The fungiform papillae were divided into two shapes, which were hemispherical or club-shaped, and were distributed among the filiform papillae on the dorsal surface and margin of the tongue (Fig. 1, 1 inset). The fungiform papillae were more densely distributed on the peripheral region of the lingual apex (Fig. 1). There were 10 vallate papillae in total. These vallate papillae were located on both sides of the posterior end of the lingual body (Fig. 5). Each papilla was surrounded by a groove and a pad (Fig. 5). In the region of the vallate papillae, the triangular filiform papillae were observed (Fig. 5).

Newborn Asian Black Bear

The filiform papillae on the margin of the lingual apex showed the numerous smooth finger-like projections and were larger than those on margin of the panther tongue (Fig. 2). In the central region of the lingual body, the filiform papillae were bud-shaped papillae (Fig. 4). There were dome-shaped fungiform papillae scattered among the filiform papillae (Figs. 1, 4). There were 7 or 8 vallate papillae in total. These vallate papillae were located on both sides of the posterior end of the lingual body (Fig. 5). Each papilla was surrounded by a groove and a pad (Fig. 5). Some vallate papillae were composed by a primary papilla which was divided into several secondary papillae by intermediate grooves (secondary papillary grooves) (Fig. 6). In the region of the vallate papillae, the triangular filiform papillae were observed (Fig. 6).

Discussion

Shimoda et al. (1996) reported that the filiform papillae on margin of the tongue of the newborn sea otter were divided into two shapes which were horny or club-shaped papillae, and the fungiform papillae also were divided into two shapes which were hemispherical or club-shaped papillae. Emura et al. (2001) described that the filiform and fungiform papillae of the tongue of the masked palm civet were larger than those of the lingual body in margin of the lingual apex. In the present study, the filiform papillae on margin of the tongue of the panther were divided into two shapes which were horny or club-shaped papillae. Furthermore, the fungiform papillae also were divided into two shapes which were hemispherical or club-shaped papillae. These findings are fairly consistent with the observations of the sea otter reported by Shimoda et al. (1996).

Many works have been published on the three-dimensional structure of the vallate papillae in the mammalian tongue. Several studies indicated that the vallate papillae showed a flattened oval shape and the papillae were surrounded by a groove and pad (Krause and Cutts 1982; Chamorro et al., 1986; Qayyum et al., 1988; Chunhabundit et al., 1992; Agungpriyono et al., 1995; Atoji et al., 1998). The vallate papillae of the cat, dog and flying squirrel were encircled by the filiform papillae in the posterior body (Boshell et al., 1982; Iwasaki and Sakata 1985; Emura et al., 1999). Equine vallate papillae were composed by a primary papilla which was divided into several secondary papillae by intermediate grooves (Chamorro et al., 1986). Sometimes, in bovine vallate papillae twin papillae were surrounded only by a primary papillary groove (Chamorro et al., 1986). In this study on the panther and asian black bear the vallate papillae were located on both sides of the posterior end of the lingual body. Each papilla was surrounded by a groove and pad. In addition, some vallate papillae of the asian black bear were composed by a primary papilla which was divided into several secondary papillae by intermediate grooves. This result is similar to the observations of the blackbuck reported by Emura et al. (1999).

Iwasaki et al. (1997) reported that the rudiments of the fungiform and circumvallate papillae, which are related to the sense of taste, were visible earlier...
than those of the filiform papillae, which are not involved in this sense. In this study on the panther and asian black bear, the filiform papillae were poor-developed, and the fungiform and vallate papillae were well-developed. Similar SEM study has been reported on the dorsal lingual surface of the nutria (Emura et al., 2001).

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References
