Morphology of the lingual papillae in the chimpanzee

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Summary: We microscopically examined the dorsal lingual surface of an adult chimpanzee (*Pan troglodytes*). The tongue of the chimpanzee was about 13 cm long. Filiform papillae were distributed over the entire dorsal surface of the lingual body. There were many fungiform papillae scattered among the filiform papillae. At the posterior end of the lingual body, a triangular arrangement of the vallate papillae, with the apex of the triangle directed posteriorly, was observed. The filiform papillae on the lingual apex consisted of a main papilla and secondary papillae. The filiform papillae on the lingual body had several pointed processes. There were dome-shaped fungiform papillae scattered among the filiform papillae. The vallate papillae were surrounded by grooves and were flattened-oval shaped. Many foliate papillae were observed on the posterolateral regions of the tongue.

Many studies have reported on the structures of the lingual surfaces of various animals. In the order Primates, there have been a few studies of the tongues of monkeys (Kubota and Hayama, 1964; Arvidson, 1976; Iwasaki et al., 1988; Emura et al., 2002). Such studies have revealed variations in the morphology and distribution of papillae on the dorsal lingual surface among these species.

However, no scanning electron microscopic (SEM) studies of the tongue of the chimpanzee have been carried out. The purpose of this study is, therefore, to examine three-dimensionally the dorsal lingual surface and the connective tissue core of the chimpanzee, in order to compare the results with those of previous reports on other mammals.

Materials and Methods

The tongue of one adult chimpanzee of the family Homiidae was used in this study. The tongue was fixed in 10% formalin. Small blocks containing papillae were cut with a razor blade and post-fixed with 1% osmium tetroxide for 1 h. Thereafter, the specimens were dehydrated through a graded series of acetone exchange fluids and critical-point-dried. To examine the three-dimensional connective tissue structure of the lamina propria of the

mucosa, some of the samples were washed in distilled water after fixation and macerated in 3.5N HCl at 35°C for 3 d. After maceration, the tissues were washed in distilled water, post-fixed in 1% osmium tetroxide for 1 h, and dehydrated in a series of acetone exchange fluids and critical-point-dried. All specimens were sputtered with Pt-Pd before examination by SEM (Hitachi S-3500N, Tokyo, Japan) at an accelerating voltage of 10 kV.

Results

Macroscopically, the tongue of the chimpanzee was about 13 cm long. Filiform papillae were distributed over the entire dorsal surface of the lingual body (Fig. 1). There were fungiform papillae scattered among the filiform papillae (Fig. 1). At the posterior end of the lingual body, a triangular arrangement of the vallate papillae, with the apex of the triangle directed posteriorly, was observed (Fig. 1).

SEM analysis revealed that the filiform papillae on the lingual apex consisted of a main papilla and secondary papillae (Fig. 2a). The filiform papillae on the lingual body had several pointed processes (Fig. 2c). There were dome-shaped fungiform papillae scattered among the filiform papillae (Fig. 2a,c). The connective tissue cores of those filiform papillae consisted of processes of various

Fig. 1. Macrograph of a chimpanzee tongue. A = lingual apex. B = lingual body. R = lingual root. Arrow = vallate papillae.

size, while these of the fungiform papillae had several ditches (Fig. 2b, d). The vallate papillae were surrounded by grooves and were flattened-oval shaped (Fig. 3a). The connective tissue cores of the vallate papillae were covered with numerous small spines (Fig. 3b). Many foliate papillae were observed on the posterolateral regions of the tongue (Fig. 3c). After removing epithelium from the foliate papillae many small spines became apparent (Fig. 3d).

Discussion

Kullaa-Mikkonen and Sorvari (1985) reported that filiform papillae of the human tongue consisted of two parts: the body and hairs, and each filiform papilla had 6–10 hairs. Iwasaki et al. (1988) reported that the filiform papillae were distributed over the entire dorsal surface of the squirrel monkey tongue except for the lingual radix zone, and a flattened circular area was located in the center of the filiform papillae, and was encircled by several pointed processes. Furthermore, the structure of the filiform papillae was almost identical in any area of the dorsal surfaces

Fig. 2. (a) The filiform papilla on the lingual apex has a main papilla and secondary papillae. (c) The filiform papillae on the lingual body has several pointed processes. (a, c) There are dome-shaped fungiform papillae scattered among the filiform papillae. (b, d) The connective tissue cores of those filiform papillae consist of processes of various size, while these of the fungiform papillae has several ditches. Fu = fungiform papilla.

of the tongue. Iwasaki et al. (1992) reported that filiform papillae of the Japanese monkey, which were densely distributed all over the dorsal surface of the lingual body, were crown-shaped, with a central, circular area that sloped in the anterior direction and several branches that surrounded it in a semicircle from the back of the central area. Emura et al. (2002) reported that the filiform papillae of the lingual apex of the savanna monkey had a conical shape, and that of the lingual body had a filiform papilla with several pointed processes. In this study, the filiform papillae on the lingual apex consisted of a main papilla and secondary papillae. The filiform papillae on the lingual body had several pointed processes.

Krause and Cutts (1982) reported that the foliate papillae in the opossum were not observed, and that elongated mucosal folds with numerous, irregular, finger-like projections were present on the posterolateral borders where

Fig. 3. (a, b) The vallate papillae are surrounded by grooves and were flattened-oval shaped. The connective tissue core of the vallate papillae is covered with numerous small spines. (c, d) Many foliate papillae were observed on the posterolateral regions of the tongue. After removing epithelium from the foliate papillae many small spines become apparent. V = vallate papilla.

the foliate papillae were normally found in other species. In this study, the foliate papillae, which had some ridges separated by deep grooves, were found on the posterolateral aspect of the posterior part of the tongue. This result was the same as that observed in the flying squirrel and nutria (Emura et al., 1999, 2001).

Many studies have described the three-dimensional structure of the vallate papillae in the mammalian tongue. In particular, several studies have shown that the vallate papillae are flattened and oval in shape and are surrounded by a groove and a 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; Emura et al., 2013). The vallate papillae of the cat, dog, and flying squirrel have been found to be encircled by filiform papillae in the posterior body (Boshell et al., 1982; Iwasaki and Sakata, 1985; Emura et al., 1999).

Equine vallate papillae are composed of a primary papilla that is divided into several secondary papillae by intermediate grooves (Chamorro et al., 1986). Occasionally, in bovine vallate papillae, twin papillae are surrounded only by a primary papillary groove (Chamorro et al., 1986). The vallate papillae of the bush dog are surrounded by a groove and a crescent pad, and on the dorsal surfaces of these papillae, small conical papillae have been observed. In addition, some vallate papillae of the Asian black bear have been shown to be composed of primary papillae that are divided into several secondary papillae by intermediate grooves (Emura et al., 2001).

The lingual papillae of the chimpanzee tongue resemble that of the Japanese monkey than those of the human.

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