Does the Polystomatic Gland Exist?

By

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Key words: Polystomatic gland, sublingual gland, minor sublingual glands, anterior lingual glands, Retromolar glands.

Summary: According to the P.N.A., the N.A.J. and some scholars, the sublingual gland has the ductus sublingualis major and ductus sublinguales minores. This means that the gland is a polystomatic gland. We intended to determine whether the so-called polystomatic gland exists or not.

1. According to the P.N.A., the N.A.J. and some scholars, the gl. sublingualis has the ductus sublingualis major and ductus sublinguales minores. This means the gland is a polystomatic gland. However, the formation of one gland with plural excretory ducts is embryologically impossible, in other words, the polystomatic gland does not exist.

2. Many scholars described that the gl. sublingualis was composed of the gl. sublingualis major and gl11. sublinguales minores. However, they are completely different kinds of glands. Accordingly, we suggest the terms for these glands: the gl1. sublingualis and its ductus sublingualis ("major" is useless), the gl11. sublinguales minores and their ductus sublinguales minores.

3. The N.A.V.J. and some scholars use the term gl1. sublingualis polystomatica or parvicanalaris. However, this is a group of a number of independent glands each of which has its own excretory duct. Such a gland should not be regarded as a single gland. We suggest that the term gl11. sublinguales minores and their excretory ducts should be replaced with the term the ductus sublinguales minores.

4. The gl1. lingualis anterior, gl1. retromolaris and gl1. lacrimalis are not single glands but a group of several independent glands each of which has its own excretory duct. Accordingly, they should be termed the gl11. linguales anteriores, gl11. retromolares and gl11. lacrimales such as the gl11. labiales, gl11. buccales and gl11. palatinae.

The P.N.A., the N.A.J. and some scholars disregarded the minor sublingual glands and assigned the ductus sublinguales minores to the sublingual gland. The N.A.V.J. regarded a group of independent glands (the gll. sublinguales minores) as the gl1. sublingualis polystomatica, and its excretory ducts as the ductus sublinguales minores.

We indicated the above-mentioned errors10, however, the revised edition of the N.A.J.18) keeps the same terminology unchanged. Moreover, many native and foreign textbooks show the same errors as the P.N.A. and the N.A.J.

We intended to investigate the relationship between the sublingual gland and minor sublingual glands, and determine whether the so-called polystomatic gland exists or not.
Materials and Methods

Six adult men and four Japanese macaques were used in this study. The human materials were obtained from dead bodies. These were stored in 50-60% ethyl alcohol after an intravenous injection of 4 l 10% formalin and an injection of 1 l of the same solution into the abdominal cavity. The above-mentioned embalment was performed about 18 hours after death. These dead bodies were stored for dissecting exercises by the students. The macaques were killed by a rapid intravenous injection of 1.5 cc Nembutal. The materials were taken in as fresh a state as possible and fixed in buffered formalin. The human materials were also fixed with the same solution. The tissues were embedded in paraffin and cut into sections about 6 μ in thickness. PAS and AB (pH 1.0 and 0.5) stainings were employed.

Observations


It was composed of many lobules (Fig. 1) that had one excretory duct, the ductus sublingualis. The mucous component in this gland somewhat surpassed the serous one in number. The mucous acini were composed of two kinds of cells, with type II outnumbering type I. The type I cells reacted strongly to AB (pH 0.5) while the type II cells were negative to the same stain (Figs. 2-3).


Some scholars described that the same glands were the minor sublingual gland, however, the object of this investigation was not of a simple gland but an aggregate of a number of independent small glands each of which had its own excretory duct (Fig. 4) distributed on the dorsal side of the sublingual gland. The mucous cells in these glands were far more numerous than the serous ones. Moreover, the mucous acini in the same glands were larger than those in the sublingual gland. The type I mucous cells in the minor sublingual glands greatly outnumbered the type II (Figs. 5 and 6).

3. Anterior lingual gland (man)

They were not simple glands but a group of several independent small glands with an excretory duct opening into both sides of the frenulum linguae (Fig. 7). The macaca did not have these glands.

4. Retromolar gland (Japanese macaque)

This was situated in the trigonum retromolare of the mandible and a number of independent glands each of which had its own excretory duct (Fig. 8). The mucous component in this gland surpassed the serous one, and the type I mucous cells predominated over type II cells.

Discussion

According to the P.N.A.17, the N.A.J.17,18, and some scholars13,25,28, the gl. sublingualis possessed the ductus sublingualis major and ductus sublinguales minores. Other scholars3,4,5,30 described plural excretory ducts in the gl. sublingualis. This means the sublingual gland is a polystomatic gland. However, plural excretory ducts in one gland is embryologically impossible. One excretory duct in one gland is commonly accepted in embryology. The fact is that the ductus sublinguales minores are of the gl. sublinguales minores and do not belong to the gl. sublingualis. The P.N.A.17, the N.A.J.17,18, and the above-mentioned scholars3,4,5,13,26,29,30 could not find the actual characteristics of the ductus sublinguales minores. Consequently, the gl. sublingualis was regarded as a
polystomatic gland.

Hosokawa-Ogawa\textsuperscript{7}, Ishizawa\textsuperscript{14}, Kamijo\textsuperscript{20}, Kaneko\textsuperscript{21}, Setoguchi\textsuperscript{22}, and Sobotta-Becher\textsuperscript{35} described that the gl. sublingualis was composed of the gl. sublingualis major and gl. sublinguales minores. This means the gl. sublinguales minores are a part of the gl. sublingualis. Bloom-Fawcett\textsuperscript{2} and Orban\textsuperscript{27} considered that the gl. sublingualis was composed of one principal gland and a few small glands. Stöhr et al.\textsuperscript{36} recognized 5-20 gl. sublinguales minores besides the gl. sublingualis major. However, both of the glands were independent of one another and different kinds of glands.

We found two kinds of mucous cells in the salivary glands\textsuperscript{9,10,11,12}. One of them contained neutral, weak and strong acid mucopolysaccharides (type I) and the other lacked strong acid mucopolysaccharide (type II). The mucous component in the gl. sublingualis of man and the Japanese macaque somewhat surpassed the serous one in number. The type II of the mucous cell outnumbered type I. The mucous cells in the gl. sublinguales minores of man and the Japanese macaque were far more numerous than the serous ones. Moreover, the mucous acini in these glands were larger than those in the gl. sublingualis, and the type I mucous cells in the gl. sublinguales minores greatly outnumbered type II.

Incidentally, we found electron micrographs of the type I and II mucous cells were completely different from each other\textsuperscript{36}. From the above description, it is quite clear that the gl. sublingualis and gl. sublinguales minores are independent organs. Namely, the gl. sublinguales minores are not part of the gl. sublingualis. The ductus sublinguales minores are of the gl. sublinguales minores, and do not belong to the gl. sublingualis. The horse, ass and rabbit have no gl. sublingualis but possess only the gl. sublinguales minores\textsuperscript{8}. Kamijyo\textsuperscript{20} reported that 20.2% of humans lack the gl. sublingualis. The above-mentioned is an example which shows that both glands are different.

Accordingly, the P.N.A., the N.A.J. and some scholars should remove the term of ductus sublinguales minores in the gl. sublingualis, and adapt the term of the gl. sublinguales minores and their excretory ducts, the ductus sublinguales minores, independent of the gl. sublingualis. The I.N.A.\textsuperscript{16} decided on the term of the gl. sublingualis and its excretory duct, ductus sublingualis major, gl. sublinguales minores and their excretory ducts, ductus sublinguales minores. We support this view, however, “major” in the ductus sublingualis major is useless. Incidentally, Bailey-Copenhaver\textsuperscript{1}, the B.N.A.\textsuperscript{17}, Gardner et al.\textsuperscript{4}, Hatai et al.\textsuperscript{6}, Inoue et al.\textsuperscript{13}, Ito\textsuperscript{15}, N.A.J.\textsuperscript{17,18}, Okajima-Taniguchi\textsuperscript{25}, Orban\textsuperscript{27}, Osogoe-Awaya\textsuperscript{28}, P.N.A.\textsuperscript{17,18}, Rauber-Kopsch\textsuperscript{29} and Rhodin\textsuperscript{30} gave no description of the gl. sublinguales minores.

Rauber-Kopsch\textsuperscript{29} described that many ductus sublinguales minores opened into the oral cavity on the sublingual fold, some entered into the ductus submaxillaris and a few ducts were united in a large duct, the ductus sublingualis major. We doubted the description that some ductus sublinguales minores entered into the ductus submandibularis and united in the ductus sublingualis major.

Gardner et al.\textsuperscript{4} reported that about 10-30 sublingual ducts opened into the oral cavity on the sublingual fold and some ducts entered into the submandibular duct. The description of the latter half is also an unacceptable opinion.

Rhodin\textsuperscript{30} considered that the sublingual glands were groups of small mixed salivary glands, with some 15 minor ducts opening along the plica sublingualis, and that one major duct opened near the opening of the submandibular duct.
The terms of the gl. sublingualis polystomatica, ductus sublinguales minores of the same gland were used by the N.A.V.J. and some scholars. Masui and Sisson-Grossmann used the gl. sublingualis parvicanalearis. This means the above-mentioned gland has many excretory ducts. However, the formation of one gland with plural excretory ducts is embryologically impossible. Strictly speaking, the same gland is group of many independent glands that have their own excretory duct. We suggest that the gl. sublingualis polystomatica should be called the gl. sublinguales minores and their excretory ducts are the ductus sublinguales minores.

The gl. lingualis anterior and gl. retromolaris are also groups of a number of small independent glands, having their own excretory duct. Therefore, both glands are not a polystomatic gland. Accordingly, the above-mentioned independent glands should be called the gl. linguales anteriores and gl. retromolares. The gl. lacrimalis is apparently one gland, however, it is composed of about 12 independent glands each of which has its own excretory duct derived from respective rudiments. Accordingly, it is not a polystomatic gland.

Because of the small quantity of connective tissue between the individual glands, the lacrimal gland has a compact structure. The same tissue in the gl. sublinguales minores, gl. linguales anteriores and gl. retromolares are well developed. Accordingly, the individual glands in the above-mentioned glands are located apart from one another.

Incidentally, the gl. palatinae, gl. labiales and gl. buccales are not regarded as polystomatic glands.

Masui and Sisson-grossmann considered that the gl. sublingualis in domestic animals was composed of two parts: one was the gl. sublingualis major with the ductus sublingualis major and the other was the gl. sublingualis parvicanalearis which was composed of the gl. sublinguales minores (Masui) or the gl. sublingualis grandicanalaris with the ductus sublingualis major and the gl. sublingualis parvicanalearis with the ductus sublinguales minores (Sisson-Grossmann). However, the so-called two parts of the gland are completely different kinds of glands in humans and macaque.

References
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Explanation of Figures

Plate I

Fig. 1. Sublingual gland of man. PAS stain. × 8.
E: Epithelium of the mucous membrane.
†: Lobule.

Fig. 2. Mucous cells in the sublingual gland of man. AB (pH 0.5) stain. × 120
A: Type I mucous cells. Strong reaction to AB (pH 0.5).
B: Type II mucous cells. Negative reaction to AB (pH 0.5).
Type II surpasses type I in number.

Fig. 3. Mucous cells in the sublingual gland of the Japanese macaque. AB (pH 0.5) stain. × 120
A: Type I mucous cells. Strong reaction to AB (pH 0.5).
B: Type II mucous cells. Negative reaction to AB (pH 0.5).
Type II surpasses type I in number.

Fig. 4. Minor sublingual glands of man. PAS stain. × 8
†: Minor sublingual gland.
B: Blood vessel.

Fig. 5. Mucous cells in one of the minor sublingual glands of man. AB (pH 0.5) stain. × 120
A: Type I mucous cells. Strong reaction to AB (pH 0.5).
B: Type II mucous cells. Negative reaction to AB (pH 0.5).
Type I greatly outnumbered type II.

Fig. 6. Mucous cells in one of the minor sublingual glands of the Japanese macaque. AB (pH 0.5) stain. × 120
The mucous cells in this figure are all Type I and strongly reacted to AB (pH 0.5).

Fig. 7. Anterior lingual gland in man. PAS stain. × 8
†: Glands which were composed of the so-called anterior lingual gland.

Fig. 8. Retromolar gland of the Japanese macaque. PAS stain. × 8
†: Independent glands each of which has its own excretory duct, and composes the so-called retromolar gland.
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Plate I