

# ROLE OF THE PARASYMPATHETIC NERVES IN REGULATION OF PERIODIC SECRETION OF SALIVA IN DOGS

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Division of the auriculotemporal nerves and chorda tympani causes dissimilar changes in the periodic activity of the parotid and submandibular salivary glands. The periodic rhythm of saliva secretion in the submandibular glands is determined principally by parasympathetic nervous influences.

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The mechanisms of regulation of periodic secretion of saliva [8, 9] have not yet been studied.

I have previously shown that division of the vago-sympathetic trunk in the neck is accompanied by an increase in periodic salivation on the side of division with changes in the qualitative composition of the saliva [9].

In this investigation periodic salivation was studied after unilateral division of the auriculotemporal nerve and chorda tympani.

## EXPERIMENTAL METHOD

Experiments were carried out on 11 dogs with chronic fistulas of the ducts of the submandibular salivary glands and bilateral fistulas of the parotid ducts. Gastric fistulas of Basow type were also formed in 10 of these animals. Concurrently with the recording of the periodic contractions of the stomach by a balloon-graphic method, the secretion of saliva was recorded in drops by means of an electronic counter on the drum of a kymograph or the secretion was collected in graduated tubes and the volumes recorded every 10 min.

After a study of the background of periodic activity of the stomach and secretion of saliva in 5 animals the auriculotemporal nerves were divided, and in 6 other dogs the chorda tympani was divided along with the lingual nerve. In addition, division of the chorda tympani was carried out in one of these animals after preliminary division of the left vago-sympathetic trunk in the neck. As a result of regeneration of the fibers of the divided vago-sympathetic trunk, of compensatory influences of collateral sympathetic pathways, and of an increase in the sensitivity of denervated structures, in periods of gastric contraction a marked exophthalmos was found on the side of the operation, and moderate enophthalmos in periods of relative rest. The taking of food was accompanied by the development of a pronounced enophthalmos which persisted until gastric contraction began. These changes in the eye were used as an indirect index of the direction of the neurohumoral changes in the mechanism controlling periodic activity [1].

## EXPERIMENTAL RESULTS

After unilateral division of the auriculotemporal nerves salivation in response to food as to negative stimuli disappeared, as other workers have also described [3, 5]. Salivation in response to pilocarpine was reduced during the first week after the operation, after which the level of secretion rose on the intact side. The response of the salivary glands to stimulation of the oral cavity was found from the 15th-28th day after division of the nerves. Periodic salivation appeared somewhat later (Fig. 1), and with fluctuations on different days of the experiment, it reached the level of salivation on the intact side increasingly frequently after 2-5 months.

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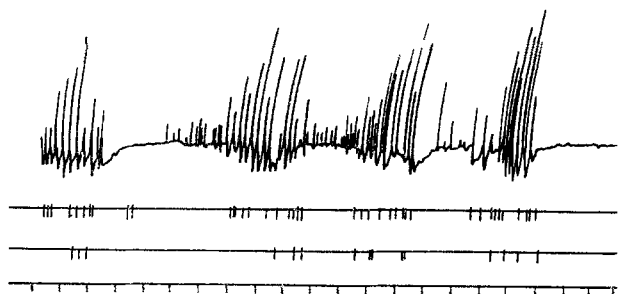


Fig. 1. Periodic secretion of saliva by the parotid salivary glands on the 36th day after division of the auriculotemporal nerve. From top to bottom: contractions of fasting stomach, periodic salivation on side of intact nerve, periodic salivation on side (left) of divided nerve, time marker 10 min.

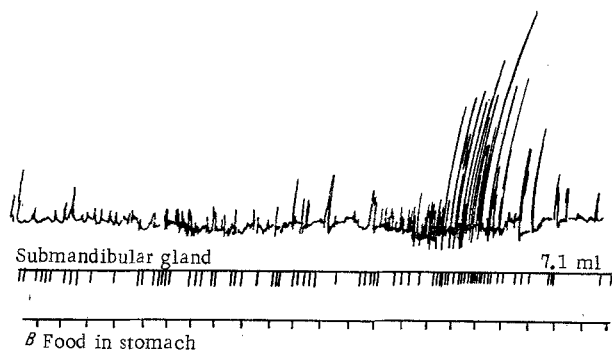


Fig. 2. Paralytic secretion of saliva by submandibular salivary gland 13 days after division of chorda tympani. From top to bottom: appearance of first (incipient) period of gastric contractions with food present inside the stomach, paralytic salivation with an increase in the secretion of saliva during a period of gastric contractions, time marker 10 min.

confirmed by experiments on 4 dogs from which the superior cervical sympathetic ganglia were removed unilaterally. Under these conditions, in late stages after the operation the enophthalmos diminished slightly with each period of work and increased in the period of relative rest of the stomach. The taking of food was accompanied by an increase in the enophthalmos and marked relaxation of the nictitating membrane. So far as the causes of this fluctuating increase in paralytic salivation after chordotomy are concerned, they are evidently associated with the periodic increase in the blood concentration of acetylcholine [4, 6] and adrenalin-like substances [2, 13], or with humoral influences of the hypothalamus, whose regulatory role in the working of the submandibular glands has been recognized by many investigators. A less probable explanation is the participation of "third" nervous pathways, unknown to anatomy, the existence of which has been postulated by some workers [3, 12, 15].

The recovery of periodic salivation after division of the nerve trunks must certainly be due to functional restitution of their fibers [5, 10], because repetition of the operation led to disturbance of the restored rhythm of salivation. The parasympathetic nerves thus predominantly form the rhythm of periodic activity of the salivary glands.

Consequently, selective activation of the salivatory centers by the functional system regulating the phases of periodic activity of the alimentary tract determines the level of this pattern of salivation in individual dogs.

Division of the chorda tympani together with the lingual nerve gave a different effect. In the absence of response reactions of the mixed salivary glands to stimulation of the oral cavity, paralytic salivation appeared after 1-2 days [10, 11, 14, 15], and reached a maximum in the second week after chordotomy, persisting in individual animals for 16-56 days. A characteristic feature of this type of salivation was its marked increase (especially in 3 dogs) during periodic contractions of the stomach (Fig. 2). This fluctuating pattern was most pronounced 2-3 weeks after operation. Later, secretion of saliva gradually began to cease altogether in periods when the stomach was at rest, so that the salivation became periodic in character.

In the dog on which chordotomy was performed after division of the vago-sympathetic nerve, periodic contractions of the stomach were not accompanied by such a regular increase in paralytic salivation as was found in dogs with intact nerve trunks. On individual days of the experiment a tendency was observed for continuous salivation to develop in the parotid gland.

As mentioned above, in this animal periods of gastric contractions and secretion of saliva were accompanied by the development of marked exophthalmos, contraction of the nictitating membrane, and an increase in pulse rate, while periods of relative rest of the stomach, on the contrary, were accompanied by the development of enophthalmos, relaxation of the nictitating membrane, and by slowing of cardiac activity. All this was clear proof that periods of work of the salivary glands and of gastric contractions coincide with activation of, not only cholinergic [1, 4, 6, 7], but also adrenergic [2, 13] structures. This conclusion was also

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