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Relationship between the Catecholamine and Protein Content in the Submaxillary Salivary Gland Tissues of and Mucosa over the Secretory Cycle for Chronic Inflammation of the Oral Soft Tissues

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Chronic inflammations of the oral cavity are characterized by an increased content of immunoglobulins, lysozyme, and enzymes in the saliva [1,6]. This provides for the antibacterial defense of the surface of the oral mucosa. On the other hand, the formation of defense mechanisms inside the tissue hampers generalization of the inflammatory process. Enhancement of neurotrophic effects, optimization of the blood flow, and the use of vitamins as activators of enzyme synthesis have been shown to step up the nonspecific defense of the organs and tissues [4].

In this connection it was of interest to elucidate the content of catecholamines and proteins in the salivary gland tissues (SGT) and in the oral mucosa (OM) for basal and induced secretion and in the saliva for induced secretion during chronic inflammation of the oral soft tissues.

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MATERIALS AND METHODS

The experiments were carried out on 140 nonpedigree rats of both sexes weighing 160 g. The animals were divided into the following experimental groups: 1) intact rats with basal secretion; 2) intact rats with induced secretion during 40 min (pilocarpine in a dose of 1 mg/kg, subcutaneously); 3 and 4) rats with basal and induced secretion, respectively, during chronic inflammation of the oral soft tissues. Chronic inflammation was caused by injection (under sterile conditions) of 0.1 ml of 2% carragenan solution into the submucosa of the left transitional fold of the vestibular maxillary aspect at the site corresponding to the location of the first molar.

For the synchronization of secretory activity of the salivary glands, all the animals were de-

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TABLE 1. Catecholamine Content (ng/g Tissue) in Tissues of Submaxillary Salivary Glands and Oral Mucosa and Their Content (ng/ml Saliva) in and Excretion (ng over 40 min) with the Saliva for Chronic Inflammation of Oral Soft Tissues ($M \pm m$)

Object of investigation		Basal secretion of saliva		Induced secretion of saliva	
		intact rats	rats with chronic inflammation	intact rats	rats with chronic inflammation
Glandular tissue	NE	2524.7±197.6 (17)	2482.2±202.2 (9)	1800.0±213.7 (15) p	3022.6±305.1 (9) p_3
	EP	99.5±9.6 (17)	73.1±10.1 (9)	84.3±8.7 (15)	180.6±14.9 (9) p_1, p_2, p_3
OM	NE	251.3±39.1 (12)	206.4±17.6 (9)	109.3±10.6 (15) p	420.3±43.1 (9) p_1, p_2, p_3
	EP	60.1±8.3 (12)	89.2±10.3 (9) p_1	41.9±7.2 (15)	72.8±7.4 (9) p_3
Saliva: concentration	NE	–	–	0.96±0.17 (13)	1.05±0.21 (9)
	EP	–	–	0.49±0.12 (13)	1.20±0.22 (9) p_3
excretion	NE	–	–	0.43±0.10 (13)	0.30±0.03 (9)
	EP	–	–	0.20±0.05 (13)	0.47±0.06 (9) p_3

Note. Here and in Table 2: p_1, p_2, and p_3 denote reliable differences vs. intact rats with basal secretion, rats with basal secretion during chronic inflammation, and intact rats with induced secretion, respectively. Number of animals shown in parentheses.

prived of food for 24 h before the acute experiment, water being given ad libitum. Tissue sampling was performed under anesthesia (nembutal, 40 mg/kg) from the left (ipsilateral) salivary gland and OM. The mixed saliva was preliminarily collected in the animals with induced secretion during 40 min. In the material obtained the protein content was determined after Lowry [5], and the epinephrine (EP) and norepinephrine (NE) content was studied by the method of high-performance liquid chromatography on a Millichrom chromatograph with electrochemical detector [2]. The results were statistically processed using Student's t test.

RESULTS

During local inflammation of the oral soft tissues, massive edema was practically absent, and in the zone of carragenan inoculation an infiltration approximately 7 mm long was noted. As is seen

TABLE 2. Protein Content (mg/g Wet Tissue) in Tissues of Submaxillary Salivary Glands and Oral Mucosa and Excretion (μg over 40 min) and Concentration (μg/ml Saliva) of Protein in Saliva for Chronic Inflammation of Oral Soft Tissues ($M \pm m$)

Experimental conditions	Glandular tissue	Mucosa	Saliva	
			excretion	concentration
Intact rats with basal secretion	61.4±3.3 (11)	26.2±2.1 (11)	–	–
Intact rats with induced secretion	58.8±3.6 (11)	37.0±4.1 (11) p_1	748.5±96.1 (9)	1571.2±62.9 (9)
Rats with basal secretion during chronic inflammation of oral soft tissues	56.4±4.4 (9)	65.7±8.5 (9) p_1	–	–
Rats with basal secretion during chronic inflammation of oral soft tissues	35.8±4.8 (9) p_1, p_2, p_3	48.3±9.8 (9) p_1	1089.5±154.6 (9) p_3	1108.6±120.1 (9) p_3

from Table 1, the content of biogenic amines in the SGT for basal salivary secretion was unchanged vs. the control level, their content (especially that of EP) being slightly elevated in the OM. Another picture was observed for induced salivary secretion. In intact rats the content of NE in the SGT dropped during the secretory cycle, whereas in chronic inflammation the concentration of NE remained on the initial level. At the same time, in contrast to intact rats, the EP concentration in the SGT markedly increased, and the NE concentration rose in the OM, while the EP content was unchanged during chronic inflammation. The dependence of the tissue trophics on the content of catecholamines [3] provided the basis for determination of the concentration and excretion of EP and NE with the saliva during chronic inflammation of the oral soft tissues. As is seen from Table 1, during the secretory cycle, the concentration of EP increased in rats with chronic inflammation.

Since the enhancement of tissue trophic effects is attended by an increased activity of the DNA-RNA-protein system in the cells, it was of interest to study the protein content in the SGT and OM for basal and induced secretion and in the saliva for induced secretion. The experimental data showed that during chronic inflammation of the soft tissues of the oral cavity, the protein content in the SGT was unchanged for basal secretion and markedly dropped for induced secretion (Table 2). The protein content for induced secretion in the OM of intact rats rose, whereas during chronic inflammation it was unchanged and increased in the case of basal secretion. During the secretory cycle, protein excretion with the saliva in intact rats was lower as compared to the animals with chronic inflammation. The absence of correlation between the protein content and its excretion with the saliva and the presence of proteins in the SGT and OM provides evidence that no appreciable amounts of proteins are likely to be delivered to the mucosa, at least during the secretory cycle. These data correlate with the increased content of catecholamines, mainly of NE in the mucosa and EP in the SGT. The latter attests to the enhancement of neurotrophic processes in the named tissues, this marshalling the defense mechanisms preventing the generalization of the acute inflammation and its transformation into chronic inflammation.

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