NUCLEO-CYTOPLASMIC AND NUCLEOLO-NUCLEAR RATIOS IN BASAL CELLS OF THE EPITHELIUM OF THE REGENERATING GINGIVAL MUCOUS MEMBRANE

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Nucleo-cytoplasmic and nucleolo-nuclear ratios were studied in the basal cells of the epithelium of the regenerating gingival mucous membrane of adult rats 12 h, and 1, 3, 5, 14, 28, and 45 days after removal of three upper cheek teeth. Some general features and, at the same time, certain differences in the course of regenerative processes following injury to the gum and of certain internal organs are demonstrated.

Previous investigations [1-3] showed that a change in the nucleo-cytoplasmic and nucleolo-nuclear ratio in the regenerating kidney and pancreas is characterized by certain special feature. The nucleo-cytoplasmic ratio in cells of the convoluted tubules of the regenerating kidney shows little or no change in connection with the proportional increase in area of the cytoplasm and nucleus, while in the collecting tubules, it rises sharply because of disturbance of the proportional growth of the cytoplasm and nucleus. The character of the change in the nucleo-cytoplasmic and nucleolo-nuclear ratio in the acinar cells of the regenerating pancreas is determined by the greater increase in the cytoplasm and nucleus, whereas in the islet cells, the greatest decrease takes place in the area of the cytoplasm and the rate of change in area of the nucleus and nucleolus is identical.

EXPERIMENTAL METHOD

Experiments were carried out on male albino rats weighing 110-150 g. The experimental (35) animals, from which three upper cheek teeth were removed on the left side, and the control (35) animals were sacrificed in groups of five at a time, 12 h and 1, 3, 5, 14, 28, and 45 days after operation. Material was fixed by Bouin's method. Paraffin sections were stained with hematoxylin-eosin. The outlines of the nucleoli, nuclei, and cytoplasm of the basal cells of the epithelium were drawn from sections of the gingival mucous membrane and the areas of these shapes were determined by weighing. The number of nucleoli per nucleus was counted and the nucleolo-nuclear and nucleo-cytoplasmic ratios for the studied cells were determined.

EXPERIMENTAL RESULTS

The results given in Table 1 show that the nucleo-cytoplasmic ratio increased from the beginning of the experiment because of an increase in area of the cytoplasm. These changes are evidently associated with the development of edema and a reactive state of the cell. This is shown by restoration of the normal nucleo-cytoplasmic ratio 3 days after operation. On the 3rd, 5th, and 14th days of the experiment, a persistent increase in the nucleo-cytoplasmic ratio was observed, reaching a maximum 3 days after operation (an increase of 29%). This increase in all cases took place because of an increase in area of the nucleus (this increase also reached a maximum of 33% 3 days after the operation). On the 28th and 45th days of

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TABLE 1. Nucleo-cytoplasmic and Nucleolo-nuclear Ratios in Basal Cells of Epithelium of Gingival Mucous Membrane in Rats Following Extraction of Teeth and in Control

Time of observation	Group of animals	Mean area (in μ^2)			Ratio		Number of nucleoli per nucleus
		of nucleolus	of nucleus	of cytoplasm	nucleolo-nuclear	nucleo-cytoplasmic	
12 h	Experimental	1,9	38,8	34,2+	0,04	1,13+	1,07
	Control	1,8	38,1	25,5	0,04	1,49	1,06
1 day	Experimental	3,1+	40,0	35,9	0,07	1,11	1,12
	Control	2,5	36,1	32,0	0,06	1,12	1,02
3 days	Experimental	2,1	49,3+	31,6	0,04	1,57+	1,11+
	Control	2,1	37,1	30,4	0,05	1,22	1,03
5 days	Experimental	2,1	45,3+	29,8	0,04	1,52+	1,05
	Control	2,1	37,1	29,8	0,05	1,24	1,03
14 »	Experimental	2,1	41,0+	29,2	0,05	1,41+	1,06+
	Control	2,1	36,2	29,8	0,05	1,22	1,02
28 »	Experimental	2,1	39,5	28,3	0,05	1,35	1,05
	Control	2,1	38,5	28,3	0,05	1,36	1,03
45 »	Experimental	2,1	38,5	28,9	0,05	1,33	1,04
	Control	2,1	38,5	28,2	0,05	1,36	1,03

Note. A + sign denotes statistically significant differences present between experiment and control.

the experiment, the nucleo-cytoplasmic ratio, like the area of the nucleus and cytoplasm, returned to normal. Consequently, the nucleo-cytoplasmic ratio in basal cells of the epithelium of the regeneration gingival mucous membrane increased mainly because of an increase in size of the nucleus.

The nucleolo-nuclear ratio was unchanged throughout the experiment. However, 24 h after the operation, a small increase in area of the nucleolus (by 24%) was observed, but the even smaller increase in area of the nucleus (by 11%) was not statistically significant. This led to a temporary increase in the value of the nucleolo-nuclear ratio at that time. It is interesting to note that the number of nucleoli per nucleus showed a tendency to increase (by 10%) on the 1st day of the experiment. The difference between the experimental and control values at this time was almost statistically significant ($P = 0.094$). The number of nucleoli per nucleus was increased by a statistically significant margin only 3 and 14 days after the operation. Consequently, the nucleolo-nuclear ratio in the basal cells of the epithelium of the regenerating gingival mucous membrane was unchanged despite an increase both in the area of the nucleus and in the area of the nucleolus at certain times. The increase in number of nucleoli per nucleus coincided largely with the period of increase in size of the nuclei.

These results show that, just as in objects studied previously [1-3], changes in the nucleo-cytoplasmic ratio in basal cells of the regenerating gingival mucous membrane do not give a complete picture of the process, and changes in the mean areas of nucleus and cytoplasm must be analyzed separately.

The decrease in the nucleo-cytoplasmic ratio at the beginning of the experiment was due to an increase in area of the cytoplasm, while the increase in this ratio in the period of intensification of regeneration was entirely due to an increase in area of the nucleus. Despite the fact that the nucleolo-nuclear ratio in the present case was unchanged, the most intensive manifestation of regenerative processes was accompanied by an increase in the number of nucleoli per nucleus and an increase in size of the nucleolus at the beginning of the experiment.

Hence, the results of the study of the nucleo-cytoplasmic and nucleolo-nuclear ratio in the basal cells of the epithelium of the regenerating gingival mucous membrane reveal some common features but, at the same time, some differences in the course of regeneration following injury to the gum and to some internal organs.

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