COMPARATIVE CHARACTERISTICS OF THE EFFECT OF REMOVAL OF THE SALIVARY AND LACRIMAL GLANDS ON POSTTRAUMATIC REGENERATION OF BONE TISSUE

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As our previous investigations showed [4, 5], removal of the salivary glands leads to considerable disturbances of the mineral metabolism in the teeth and bones. These changes cause, in particular, a marked disturbance of the growth and regeneration of the continuously growing teeth of rats (incisors) [6].

No detailed description of the structure of the salivary glands in rats is present in the Soviet literature; moreover, the widely used textbook by P. P. Gambaryan and N. M. Dukel'skaya [7] contains a serious mistake: the lateral orbital or lacrimal gland has been taken as the parotid gland. This error has had the result that in several experimental investigations [1, 2], and in particular in our own [8], the orbital gland has been removed instead of the parotid gland. It has been noted that the lacrimal glands also are a convenient subject for experiment.

Because of the foregoing facts, we have undertaken a comparative investigation of the influence of the submaxillary, parotid, and orbital glands on the mineral metabolism during regeneration of bone tissue. Besides our own investigations, some of which have been published [8], no information on this subject could be found in the literature. Some excellent descriptions of the structure of the salivary and lacrimal glands were used in the course of the present investigation [3, 9-11].

METHODS

Three series of experiments were carried out on 207 albino rats. In series I both submaxillary salivary glands were removed from the animals, in series II—both parotid glands, and in series III—both orbital lacrimal glands. After the wounds had completely healed, some of the experimental and control animals were subjected to graded bone injury—cutting with a No. 5 drill in the middle third of the right femur. The rats were sacrificed at intervals of 4 to 32 days after the operation, and 24 h before sacrifice all the animals received an injection of $Ca^{45}Cl_2$ in physiological saline, in a dose of 5000 pulses / min/g body weight. After sacrifice of the rats the femora were removed and the radioactivity of samples of bone tissue was determined. The results were expressed as percentages of relative activity (RA) and analyzed by the usual statistical methods.

Four groups of rats were used in each series of experiments: group 1—control animals (intact group); group 2—animals from which the glands were removed; group 3—intact animals subjected to bone injury; group 4—animals subjected to both removal of glands and bone injury. The ratios between the mean values of RA in the rats of groups 2 and 1 and in the rats of groups 4 and 3, expressed as percentages, and also the significance of the differences between these groups are given below.

RESULTS

The experiments of series I showed that after removal of the submaxillary salivary glands the intensity of incorporation of Ca^{45} into the intact femora remained essentially unchanged at first, and then fell sharply, keeping considerably below the corresponding control level (12th day—76.3%, $P < 0.02$ and 32nd day—77.5%, $P < 0.02$).

Removal of the submaxillary glands and simultaneous injury to the bone was accompanied by a sharp decrease in the intensity of incorporation of Ca^{45} into the bone tissue on the 8th day (60.1%, $P < 0.001$), followed by a tendency for this index to return to the normal level.

In series II, after removal of the parotid glands the dynamics of incorporation of Ca^{45} into bone tissue on the whole showed no difference from the pattern observed after removal of the submaxillary glands, although there were differences of detail. For example, depression of the calcium metabolism in the regenerating bones developed sooner—on the 4th day (68.2%, $P < 0.05$). On the 12th day of the experiment the incorporation of Ca^{45} into the regenerating bone tissue remained depressed (81.1 , $P < 0.05$), after which it showed a tendency to return to normal. In contrast to this, the incorporation of Ca^{45} into the damaged bones following removal of the parotid glands fell by a significant amount only on the 12th day (71%, $P < 0.01$) and remained low throughout the experiment (24th day —61.3%, $P < 0.01$; 32nd day—74%, $P < 0.05$).

In series III, after removal of the orbital glands the incorporation of Ca^{45} into the traumatized femora returned to the control level after an initial decrease on the 12th day (72.3%, $P < 0.002$). So far as the changes in the calcium metabolism in the traumatized bones after removal of the orbital glands are concerned, at first the incorporation of Ca^{45} into the regenerating bone tissue showed a tendency to fall, but after the 24th-28th day it exceeded the control level by 17-25%, although these differences are not statistically significant.

The results demonstrate the important role of the salivary glands in the regulation of the salt metabolism in calcified tissues in both normal and pathological conditions. The orbital glands have a similar, but less marked, effect on mineral metabolism.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
