cellular structural and functional transformations are the basis of the abundant adaptive powers of the cells whose aim is to preserve homeostasis relative to external and internal environmental factors.

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HISTOMORPHOLOGICAL EVALUATION OF EFFECTIVENESS OF ANESTHESIA DURING PREPARATION FOR CROWNING TEETH

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KEY WORDS: anesthesia; preparation of teeth; histomorphological changes.

Pain is a subjective sensation and it may be difficult [2] or almost impossible [3] for an objective assessment of pain to be given. The genesis and conduction of a nociceptive impulse and the formation of a sensation of pain are impossible without the material substrate, consisting of receptors, sensory nerve fibers, and nerve cells [1, 4, 5]. Hence the great scientific and practical importance of histomorphological assessment of the effectiveness of anesthesia with procaine, trimecaine, celnovocain and lidocaine during the preparation of teeth for crowning.

EXPERIMENTAL METHOD

Experiments were carried out on 16 mongrel dogs with an intact maxillodental system, aged from 10 months to 20 years, which were divided into four groups, with four dogs in each group. Nerve-block anesthesia was carried out on the animals of group 1 with 10 ml of 2% procaine solution, on the animals of group 2 with 2% celnovocain solution, in the dogs of group 3 with 2% trimecaine solution, and in the animals of group 4 with 2% lidocaine solution. With an electric drill the tip of which revolved at a speed of 5000 rpm, three teeth of the lower jaw of each dog were prepared for complete metal crowns. When the hard tissues of the teeth were polished, the same conditions were observed as during preparation, and the tooth meanwhile was cooled with water. The animals were killed under morphine-thiopental anesthesia by exsanguination through the femoral artery. The gasserian and

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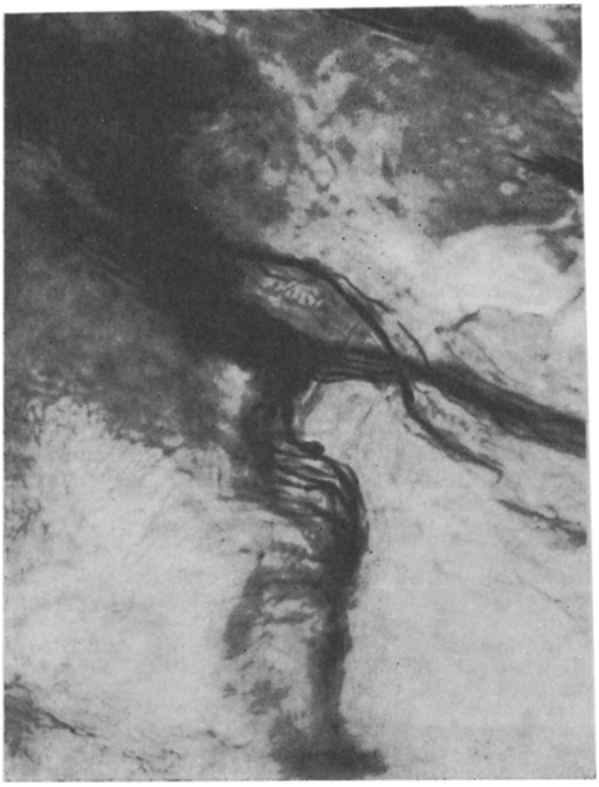

Fig. 1. Hyperimpregnation, irregularity of outlines, and varicosity of axons of nerve fibers in the pulp of a tooth prepared under anesthesia with 2% procaine solution. Impregnation with silver by Bielschowsky—Gros method, 400×.

superior cervical sympathetic ganglia, the inferior ganglion of the vagus nerve, the teeth, and the periodontal tissues were fixed in a 10% solution of neutral formalin (8 dogs) or in Shabadash's fluid (8 dogs). Fragments of the lower jaw with the teeth were decalcified in a 25% solution of Trilon B. The corresponding ganglia, teeth, and periodontal tissues of 8 dogs not subjected to these procedures served as the control. Sections through the ganglia, teeth, and periodontal tissues were stained with hematoxylin-eosin, by Van Gieson's and Nissl's (ganglia) methods, impregnated with silver nitrate by the Bielschowsky—Gros and Rasskazova methods, and tested for RNA by Brachet's method, glycogen by Shabadash's method, and acid mucopolysaccharides by the methods of Steedman and Hale. For the enzyme-chemical control the sections were incubated with bovine ribonuclease. amylase, and bacterial hyaluronidase. The number of changed neurons was counted in two central sections through the ganglia stained by Nissl's method and two central sections of the ganglia impregnated with silver nitrate by the Bielschowsky—Gros method. The numerical results were subjected to statistical analysis with determination of significance from Student's tables.

EXPERIMENTAL RESULTS

Compared with the control, in many small arteries, precapillaries, and veins of the odontoblastic and subodontoblastic layer of the coronal pulp of the prepared teeth of the animals of group 1, dilatation of the lumen and congestion were observed. Capillaries with an empty lumen and with no visible changes in the endothelium were seen, and were probably reserve vessels. Axons and terminal branches of nerve endings of various shapes in the pulp of the crown of the tooth reduced silver diffusely and stained a deep black. They appeared thickened and coarsened. In many nerve fibers of the subodontoblastic plexus close to the pulp horns, and also in many of the thick myelinated nerve fibers of the central layer of the pulp and periapical region of the periodontium, neurohistological signs of irritation appeared: increased argentophilia, irregularity of outlines, unevenness of caliber, and varicose thickenings along the course of the axis cylinders. Hyperimpregnation and vari-

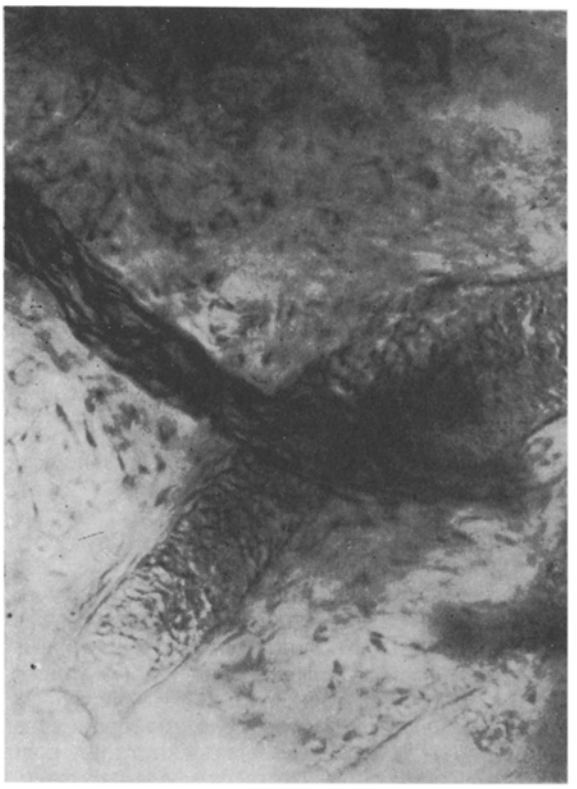

Fig. 2

Fig. 3

Fig. 2. Congestion of blood vessels, hyperargentophilia, unevenness of outlines, and varicose thickenings in axons of nerve fibers of the pulp in a tooth prepared under anesthesia with 2% celnovocain solution. Impregnation with silver by Bielschowsky–Gros method, 400×.

Fig. 3. Unchanged nerve fibers and vessels in the pulp of a tooth prepared under anesthesia with 2% trimecaine solution. Impregnation with silver by Bielschowsky–Gros method, 280×.

cosity were particularly clearly visible in the axons of nerve fibers accompanying blood vessels, and in their terminal ramifications, which were shaped like bristles, small pinheads, and rings weaving around the walls of the vessels and forming a plexus around them (Fig. 1).

The reaction of the nucleoli and cytoplasm of the odontoblast and nerve cells of the ganglia for RNA, and of the cytoplasm of the odontoblasts and neurons for glycogen was strongly positive. In all ganglia the number of changed nerve cells was statistically significantly increased ($P < 0.001$).

In the coronal pulp of the polished teeth of the animals of group 2 congested and dilated small arteries, precapillaries, capillaries, and veins were observed. Besides intact neurons, many perivascular nerve fibers and endings in the pulp of the teeth and the periapical region of the periodontium were hyperargentophilic, with irregular outlines and with varicose thickenings (Fig. 2). The intensity of staining of the RNA granules in the nucleoli and cytoplasm of the ondontoblast and nerve cells of the ganglia, and also of glycogen granules in the cytoplasm of the ondontoblast and neurons was increased. The number of changed nerve cells in all ganglia studied was significantly increased, but less significantly ($P < 0.01$) than in the dogs of group 1.

Vessels of the microcirculation in the pulp and periodontium of the prepared teeth of the animals of groups 3 and 4 were moderately congested and had a normal lumen. Reserve capillaries were frequently found. Most nerve fibers and endings of the pulp and periodontium showed no structural changes (Fig. 3). Only sometimes in axons of solitary unmyelinated nerve fibers and their terminal branches was it possible to see small swellings with continuous neurofibrils, clearly visible under the microscope. The RNA, glycogen, and hy-

aluronic acid content in the pulp of the teeth and in the ganglia was unchanged. In all ganglia the difference in the number of changed cells from the control was not statistically significant ($P > 0.5$).

Analysis of the results of this investigation enabled the various local anesthetics studied to be arranged in the following order of increasing effectiveness for preventing histomorphological changes in the teeth, periodontal tissues, and ganglia when used in preparing teeth for metal crowning: procaine, celnovocain, trimecaine, and lidocaine. By contrast with procaine and celnovocain, local anesthetics of the xylidine series (trimecaine and lidocaine) block the conduction of nociceptive impulses along perivascular nerve fibers of the teeth and periodontal tissues. The facts described above indicate that trimecaine and lidocaine can be recommended for extensive use in the practice of orthopedic stomatology during preparation of teeth for crowning.

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SCANNING ELECTRON MICROSCOPY AND X-RAY MICROANALYSIS OF THE EFFECT OF CHOLERA TOXIN ON THE SMALL INTESTINE OF SUCKLING RABBITS

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KEY WORDS: scanning electron microscopy; x-ray microanalysis; small intestine; cholera toxin.

Ultrastructural changes in the epitheliocytes of the small intestine during the development of a rapid intestinal dehydration syndrome have now been well studied by transmission electron microscopy [1, 2, 6]. However, information on changes in the surface of the small intestine caused by the action of cholera toxin is still fragmentary [9]. Furthermore, in cholera, liquid and HCO_3^-, Na^+, and to a lesser degree, K^+ ions accumulate in the intestinal lumen [11]. So far, however, the question of changes in ion transport in different parts of the villi and their differential involvement in this pathological process remains in doubt.

It was accordingly decided to study the normal structure of the surface of the epithelium of the small intestine in suckling rabbits and its changes under the influence of cholera toxin, and also to investigate the distribution of elements in sections by the aid of x-ray microanalysis.

EXPERIMENTAL METHOD

The action of cholera toxin was studied in experiments according to the method in [8]. Cholera toxin, obtained from *Vibrio cholerae* strain 569 B, Pakistan line, Inaba serotype

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