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MORPHOLOGICAL INDICATORS OF DENTAL IMPLANTATION (EXPERIMENTAL STUDY)

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ABOUT ARTICLE

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Abstract: It is known that after tooth extraction, as a result of vertical and horizontal atrophy of the alveolar process in the defect area, the loss of bone tissue volume reaches 1/6-1/3 of the original size with the formation of a saddle-shaped ridge defect.

INTRODUCTION

In the process of prosthetics using the dental implantation method, due to a decrease in the vertical and horizontal dimensions of the alveolar process, the choice of standard sizes of dental structures is significantly reduced. During the process of prosthetics, a cosmetic defect occurs in the area of the defect at the site of the extracted tooth [3, 6, 7, 8]. A method of express implantation into the socket of an extracted tooth using screw structures made of titanium [4] and cylindrical implants with a shape memory effect [5] has been proposed. It has been proven that the processes of formation and restructuring of bone tissue are directly dependent on functional loads. Restoring chewing ability in the immediate future after the loss of a tooth (teeth) prevents atrophy of the alveolar process in the area of the socket of the extracted tooth [1]. However, the morphology of the regenerate in the area of implants with a shape memory effect installed in the socket and through the socket of a freshly extracted tooth, and the influence of osteoplastic materials on the quality of the newly formed tissue, have been poorly studied.

MATERIAL AND METHODS

The experiment involved 6 animals (pigs) aged 1.5 months, weighing 25-20 kg. In group of animals No. 1, in the process of installing implants into the socket and through the socket of an extracted tooth, collapan -L (with granule size No. 2) was used; in group of animals No. 2, plastic materials were not used. Surgical intervention and observation of animals were performed in the vivarium of the Novokuznetsk State University of Internal Medicine. Anesthesia, observation of animals before and after surgery, euthanasia using electric shock were carried out by a certified veterinarian in accordance with the current legislation of the Russian Federation, in accordance with the Declaration of Helsinki and the order of the Ministry of Health for working with experimental animals. For the experiment, 6 cylindrical four-root implants with a support cone, an intraosseous body height of 8 mm, a diameter of 3.5 mm, and 6 lamellar four-root implants with an intraosseous body height of 8 mm, a horizontal size of 25 mm were manufactured. The active elements of implants with shape memory effect are spaced oppositely at a distance of 2 mm. The height of the intraosseous head of the implant was made in exact accordance with the height of the canine crown of the experimental animal. Anesthetic management: 30 minutes after premedication , 1 ml of diazepam and 10 ml of callipsol were administered intravenously . In the area of surgical access, local anesthesia was performed with a solution of mepivocaine (1 ml - 30 mg). The right and left canines of the lower jaw were removed using forceps. Using a 3.4 mm diameter milling cutter, the hole in the extracted canine tooth on the right was deepened by 2.0 mm. In animals of group No. 1, the hole was loosely filled with kollapan -L granules. A cylindrical sterile implant with a support cone was cooled with a coolant Frisco-spray , active petals were brought into a single contour with the body and installed in a prepared bed 1 mm below the level of the alveolar process crest. The back of the implant was covered with kollapan -L granules, the mucosa was mobilized and two interrupted sutures were applied. On the left, through the socket of the extracted tooth along the ridge, a linear incision was made with releasing incisions along the slopes of the alveolar process. The mucoperiosteal flap was peeled off and, using a plate scallop implant template, the positioning of the implant was determined so that at least half the length of the implant was placed outside the socket of the extracted tooth. An implant bed was formed through the socket of the extracted tooth in the alveolar process using a cutter with a diameter of 1 mm . The tooth socket was filled with kollapan -L granules. After cooling to 0-1o C, the structure was deformed by bringing the active petals in and installed in the prepared bed. The gap-like spaces between the bone and the structure were filled with kollapan and a mucoperiosteal flap was sutured. After recovery from anesthesia, the operated animals were kept in special rooms with a total area of 15 m2 , equipped with a shower and ventilation. Regular wet cleaning and bathing of piglets were carried out. 3 hours after surgery, the first feeding is milk oatmeal. Rectal temperature 38.8-39.0° was normal. The animals were active. Examination by a

veterinarian daily. After 7 days, the pigs were transferred from the postoperative block to warm, ventilated rooms. Each group of animals was kept in separate enclosures with the experiment number indicated. Feeding pigs from 1.5 to 3 months with porridge from various grains and vegetables 3 times a day. Drinking was provided with clean water from automatic drinkers. The wounds healed 5 days after surgery. There was no suture dehiscence or suppuration in any case. The pigs grew in accordance with the functional norm. 3 months after the implantation operation, the animals, under the supervision of a veterinarian, were removed from the experiment using electric shock; the weight of the animals before slaughter was 60-70 kg. After death was declared, the lower jaw of the animals was isolated and freed from soft tissues. The degree of fixation of the implants in the alveolar process was checked mechanically: by rocking and distraction using crampon forceps. The position of all implants was stable. There were no signs of gum inflammation in the area of the implant necks. Using a circular saw, the lower jaw was cut transversely and then longitudinally at the level of the implant. For histological examination, blocks of tissue adjacent to the body, the base of the implant and from the intact area were taken. Bone blocks were marked and filled with a 7% neutral formalin solution. Histological preparations (stained with hematoxylin and eosin) were subjected to microscopic examination.

RESULTS

In group of animals No. 1 (implantation was performed using collapan -L), the structures were surrounded by bone tissue, which did not differ from the surrounding bone. Bone tissue was difficult to separate from the intraosseous body of the cylindrical implant. In the area of the legs of the plate ridge implant standing in the tooth socket, the structure of the bone tissue was looser (cellular), but was separated from the structure only with the help of a scalpel. In group of animals No. 2 (implantation without the use of valve -L), the position of the dental structures in the jaw was stable, there was no mobility. After crossing the lower jaw at the implant-bone interface, it was revealed that the cylindrical implant was adjacent to bone tissue of the same structure as the adjacent areas of the lower jaw bone. Around the lamellar scallop implant, areas of fairly dense cartilage tissue and bone tissue of a lamellar nature were observed. After longitudinal splitting of the jaw, it was revealed that the formation of the tooth next to the implant was not impaired. When studying histological preparations in animals of group No. 1, it was revealed that in preparations from sections in the area of the tooth socket, the lamellar scallop implant is surrounded by newly formed bone tissue with a pronounced trabecular network, a significant number of vessels and cellular elements. In preparations made from sections at the level of the legs of plate ridge implants installed outside the tooth socket, the bone tissue is mature with formed osteons, mostly not closed. There are a small number of vessels and cellular elements,

mainly along the periphery of the preparations. There are foci of mineralization between the osteons. On preparations of the bone adjacent directly to the body of the cylindrical implant, a thin border of loose connective tissue is visible. Bone tissue includes closed and open osteons with wide spaces of interstitial tissue rich in cellular elements.

There are especially many cellular elements in the areas immediately adjacent to the implant. When studying preparations made from sections in the area of the base of cylindrical implants, newly formed cancellous bone of a cellular structure with a significant number of cellular elements, a pronounced trabecular network, and foci of ossification in the interstitial substance is determined. As a result of the study of histological preparations of animals from group No. 2, it was revealed that in the area of the tooth socket, the lamellar scallop implant is surrounded by a connective tissue capsule of considerable thickness, to which the newly formed regenerate is adjacent at the stage of restructuring of cartilage tissue into bone . Along the periphery of the preparations, a trabecular network is visible , which is unevenly embedded in the form of spurs into the cartilage tissue with inclusions of connective tissue. Outside the tooth socket, the implant is surrounded by a capsule with longitudinally oriented thick collagen fibers, poor in cellular elements. Under the capsule, newly formed bone tissue is determined, rich in vessels and cellular elements, single forming osteons, wide spaces of interstitial substance with a significant number of cellular elements, and areas of mineralization. In the area of the back of the plate scallop implant, newly formed bone tissue is formed in the form of a visor with radial orientation of trabeculae, a significant number of cellular elements, the number of which increases towards the center of the preparations. Inclusions of cartilaginous cellular elements in the form of separate groups are visible. The interstitial spaces are wide with areas of mineralization. Along the periphery of the preparations, the structure of the bone tissue takes on the characteristic appearance of lamellar bone. On histological preparations made from tissues taken in the area of cylindrical four-root implants in animals of group No. 2, a characteristic appearance of cortical bone is revealed, which borders on the newly formed cancellous bone. On preparations from tissue sections in the area of the implant legs, there is cancellous bone with many vessels, including significant ones, a pronounced trabecular network with wide spaces of interstitial substance with areas of mineralization. The degree of mineralization of bone tissue as an indirect sign of its maturity was determined by the content of calcium and phosphorus elements in biological samples of peri-implant tissues of the intact bone area in animals of groups No. 1 and No. 2 3 months after the implantation operation. Analysis of the presence of calcium and phosphorus elements in experimental animals was carried out using a Quant'X 600 spectrometer. Quantitative elemental analysis in biosamples was carried out according to the dependence of the intensity of X-ray characteristic radiation on the concentration of the element using

calibration curves determined experimentally. The relative error of quantitative analysis did not exceed 0.01%. A comparative assessment of the quantitative content of calcium and phosphorus elements in the studied samples indicates that the mineralization of peri-implant tissues in the area of the extracted tooth socket is significantly higher in experimental animals of group No. 1 compared to similar samples in group of animals No. 2. Student's t-test allows us to recognize the differences between groups as statistically significant ($p < 0.05$).

CONCLUSIONS

Thus, the results of the experimental study indicate that in animals of group No. 2, 3 months after the installation of plate ridge implants through the socket of a freshly extracted tooth without the use of osteoplastic material, a significant amount of cartilage and connective tissue is determined on histological preparations taken from peri-implant tissues in the area of the tooth socket , bone beams developing enchondrally , with a significant decrease in the mineralization of the regenerate. When using osteoplastic material, after 3 months the structure and mineralization of the regenerate practically corresponds to the intact bone of the lower jaw. Thus, the use of osteoplastic material (kollapan -L) improves the morphology of peri-implant tissues. 3 months after implantation using collapan -L, the mineralization of the bone regenerate in the area of the tooth socket corresponds to normal bone tissue.

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