both tests the differences between groups are not statistic significant. The specimen no.5 shows the excessive values in the nanoindentation. We did not find their cause, hence we excluded it from the calculation of the mean elastic modulus.

Acknowledgements

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EXPERIMENTAL ASSESSMENT OF IONIZING RADIATION LOW DOSES IMPACT ON TEETH DEVELOPMENT

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Introduction

Scientific grounds of solving post-Chernobyl medical, biological, ecological, economic, social and other problems remain as an important task for researchers working in different fields of science.

Our research purpose is to study ionizing radiation low doses (IRLD) in the laboratory experiment.

Materials and methods

The experiments were carried out on 27 not thoroughbred white female rats. They and their litter were irradiated at the Institute of Radiobiology NAS RB by the «Gamma-rid-192/120 unit» (Gamma-defectoscope «Gammarid» manufactured by the «Isotop» Enterprise, Leningrad) unit at 110mR/h exposition power from the 1st gestation day up to material selection on the 16th, 18th, 20th gestation day and on the 1st and 3rd postnatal day. The absorbed dose was 0,38–0,56Gy. The controls were not irradiated.

The specimens were fixed in 10% neutral formalin then embedded in paraffin according to the standard method. Sagittal «serial-selective» sections [1] were stained with hematoxylin and eosin, picrofuchsin after van Gieson sum content of DNA and RNA, which was evaluated by 5-mark scale, revealed by the method of Einarson, elastic fibers - by Hart, argyrophil ones - by Bilshovsky (H.Berlov's modification) [2].

Proliferative activity was determined according to the method of A.Kazantseva [3]. The number of cellular layers also was counted. The square, thickness and length of teeth germs (TGs) were measured with «Bioscan – AT» (Model was constructed in Central Scientific-Research Laboratory, Medical Institute, Minsk) automatic image analyser. The measurements were carried in each case of control and experiment 10 times as a minimum. In all, 8329 histological specimens of foetuses' and new-born rats' heads were prepared, 2197 of them showing tooth germs. The data were analysed by variation statistics with the Student's test.

Results

While studying IRLD impact on odontogenesis we have revealed some unknown before structures in tooth germs. Thus, we described «concentric structures» in dental lamina and in the inner enamel epithelium, its appearance was delayed in experimental foetuses by IRLD action; pillow-like thickenings in the inner enamel epithelium in controls; inverted into mesenchyme dental buds in experimental rats' foetuses, focal mesenchyme cell invasion into oral cavity. We also have described undermembrane (underenamel-oblast) cellular layer for the first time. Cyst formation due to radiation exposure was revealed in the inner enamel epithelium.

IRLD suppressed considerably the proliferative activity of tooth germ cells. Total mitotic index in all age animals' groups turned out to be lower than the respective indices in the controls. Thus, in the experimental 16-day old foetuses these values were 7,61±1,32‰, in the controls 25,84±0,45‰ ($p<0,001$); in 18-day old 19,93±0,55 and 30,85±0,47‰ ($p<0,001$); in 20-day old 12,15±3,12 and 12,84±0,33‰ ($p>0,05$); in 1-day old rats 3,43±0,72 and 6,62±0,67‰ ($p<0,05$); in 3-day old 2,99±0,19 and 7,28±0,0‰ ($p<0,001$) respectively. Indices differences are statistically significant, except those ones in the 20-day old foetuses (FIG.1).

In the irradiated experimental animals the cellular layers number in basic tooth germ components was reduced. In the experimental 16-day old foetuses and in the controls these values were 10,35±0,65 and 20,37±1,59 ($p<0,05$); in 18-day old 16,97±1,10 and 24,95±1,35 ($p<0,05$); in 20-day old 27,53±5,00 and 32,60±2,40 ($p>0,05$); in 1-day old rats 6,70±0,61 and 16,20±0,30 ($p<0,001$); in 3-day old animals 7,93±0,64 and 15,65±0,05 ($p<0,001$) respectively. We have revealed statistically significant indices differences in all experimental animals, except those ones in 20-day old foetuses (FIG.2).

Using «Bioscan – AT» automatic image analyser we determined enamel organ surface to be the most considerably reduced in the rats exposed to IRLD during ante- and prenatal development periods. In experimental 16-day old

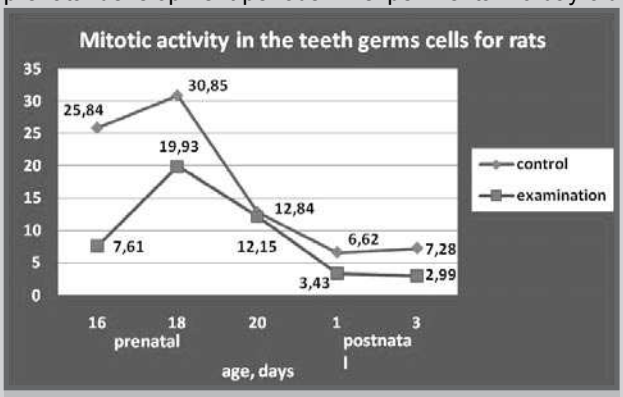

FIG.1. Mitotic activity in the dental germs cells for rats.

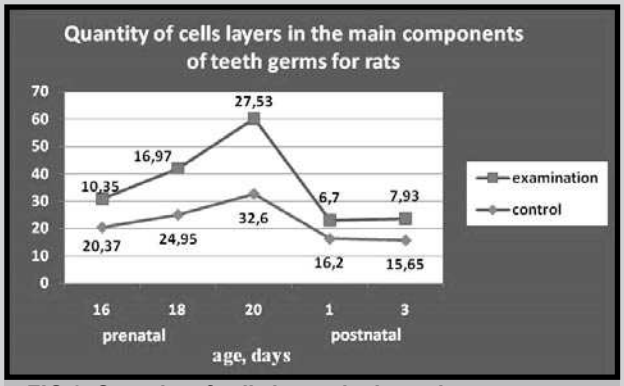

FIG.2. Quantity of cells layers in the main components of dental germs for rats.

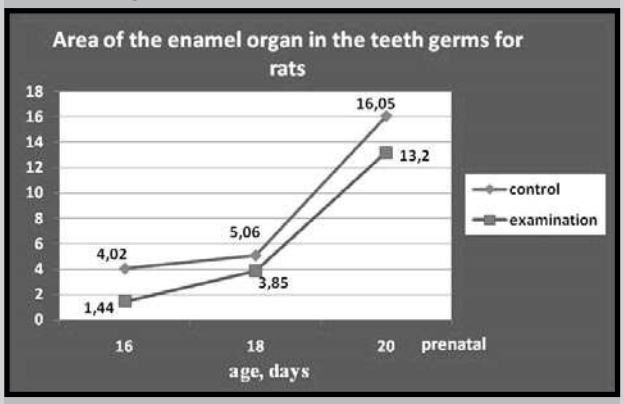

FIG.3. Area of the emamel organ in the dental germs for rats.

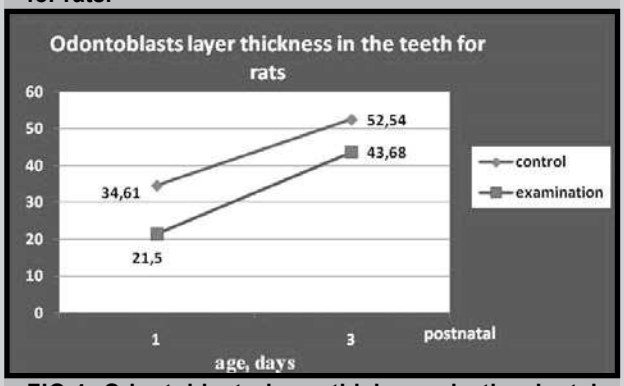

FIG.4. Odontoblasts layer thickness in the dental germs for rats.

foetuses and in the controls the indices were 1,44*±0,10 and 4,02±0,66μm²l (p<0,001); in 18-day old foetuses 3,85±0,46 and 5,06±0,51μm² (p>0,05); in 20-day old 13,20±0,62 and 16,05±0,70μm² (p<0,01). The differences are statistically significant, except those ones in the 18-day old foetuses (FIG.3).

In the postnatal period, the odontoblast layer thickness showed maximal changes compared to those ones in other basic tooth germ structures. In 1-day old experimental rats and in the controls the indices were 21,50±1,27 and 34,61±2,94μm (p <0,001); in 3-day old 43,68±2,31 and 52,54±2,60μm (p<0,05) respectively. Indices differences are statistically significant (FIG.4).

Conclusion

IRLD reduced proliferative activity, cellular layers number and, in the majority of cases, tooth germ structure thickess; caused oedema, vacuolization, discomplexation, cell differentiation delay.

* All parameters of squares text must be multiplied by 10^4

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FINITE ELEMENT ANALYSIS OF ONCOLOGY KNEE ENDOPROSTHESIS

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Abstract

This paper presents a finite element simulation of an oncology knee-joint endoprosthesis in a various degrees of flexion. The simulation has been made in accordance with an ISO 14243 [1-3]. A model of the knee implant (produces by ProSpon, s.r.o. [4]) consists of following parts: femoral stem, femoral replacement, femoral component, PE bushings, and tibial plateau. Results for four positions of flexion (1.53deg, 8.13deg, 15.31deg and 26.33deg) gave better understanding of strain and stress distribution along the endoprosthesis and pointed out also the most crucial areas requiring the attention. These foundlings are useful for individual design of the knee-joint prosthesis and for further development.

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Introduction

Finite element method (FEM) has become a useful tool while study of several reasons of implant's fractures and defects. It is also a valuable and effective tool for biomechanical devices development. Quite fast and easily modifiable models allow studying wide range of problems (static, dynamic) while using different boundary conditions (type of loading).

Fractures and malfunctions of joint and bone implants has different causes. Generally, they can be sorted by two causes – biological and mechanical. Among the biological sources of implant demages, especially implant loosening and infection are well described in literature. In contrary, a stem fracture or a UHMWPE parts defect are typical causes of mechanical defects (see FIG.1).

To understand better the mechanical reasons for oncology knee implants destruction, the presented study has been made. All boundary conditions are in accordance with ISO 14243-3: 2004 [3], where a manner of mechanical testing is defined.