Schneider S. A., Suslova O. V., Saveleva N. N., Gorohivsky V. N., Tkachenko E. K. The influence of 1-α-oxycholesterol with antioxidants and calcium phosphate on the development of experimental periodontitis in rats. Journal of Education, Health and Sport. 2020;10(7):87-91. eISSN 2391-8306. DOI http://dx.doi.org/10.12775/JEHS.2020.10.07.008
https://apcz.umk.pl/czasopisma/index.php/JEHS/article/view/JEHS.2020.10.07.008
https://zenodo.org/record/3946760

The journal has had 5 points in Ministry of Science and Higher Education parametric evaluation. § 8. 2) and § 12. 1. 2) 22.02.2019.

The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 01.07.2020. Revised: 09.07.2020. Accepted: 15.07.2020.

THE INFLUENCE OF 1- α -OXYCHOLESTEROL WITH ANTIOXIDANTS AND CALCIUM PHOSPHATE ON THE DEVELOPMENT OF EXPERIMENTAL PERIODONTITIS IN RATS

S. A. Schneider[1], O. V. Suslova[2], N. N. Saveleva[3], V. N. Gorohivsky[1], E. K. Tkachenko[1]

[1]State Establishment "Institute of Stomatology and Maxillo-facial Surgery of NAMS of Ukraine"
[2]Odessa National Medical University
[3]Kharkiv National Medical University

Abstract

In experiments on 26 rats the influence of complex 1-α-oxycholesterol with antioxidants and calcium phosphate. The study was conducted on the background modeling of periodontal disease through a combination of prooxidants delagila and etilendiaminova acid chelating agent (EDTA).

Key words: simulation; antioxidants; 1-α-oxycholesterol; rats.

The most important starting point for the development of periodontitis are the processes of free radical oxidation of lipids and biopolymers membranes [1]. A modern direction in the prevention and treatment of periodontitis includes the search bioregulatory substances, failure with which are associated the molecular mechanisms of its pathogenesis. These substances include antioxidants, inhibiting lipid peroxidation processes parodontologist, including α - tocopherol and intracellular glutathione a Tripeptide containing glutamic acid. Along with antioxidants, protective effects may have a nuclear hormones –

regulators of osteogenesis. In this aspect of interest is the active form of vitamin D_3 and in particular 1,25-dioxyalkylene, which is its most active metabolite. Biological activity $1\alpha OHD_3$ due to its rapid transformation into $1,25\alpha (OH)_2D_3$ as a result of its hydroxylation in the liver 25HE-Asa.

The purpose of the present study protective effects of the complex 1-α - tocopherol and oxycholesterol, glutamic acid, and calcium phosphate during experimental periodontitis in rats.

Materials and methods

The experiment was captured 26 male white rats, Wistar breeding herd at 1.5 months of age. Four rats were kept in vivarium ration (intact group). In 22 animals (group 1, control) reproduced the calcium-deficient lipid peroxidation model of periodontitis in the period of 60 days, rats received oral delagil (chloroquine) at the rate of 0.03 g/kg of body weight of rats. Instead of drinking water, rats received a 2% solution ethylendiaminetetraacetic acid (EDTA) [2]. 8 rats (group 2) simultaneously with the modeling of periodontitis received per os for 60 days the complex: 1-α-oxycholesterol, tocopherol acetate, glutamic acid and calcium disodium phosphate with the working title of Osteovit. At the end of the experiment, rats were sacrificed by total bleeding, isolated jaws and subjected to morphometric study [3].

Objects of biochemical studies were the liver and the bone of the alveolar process.The level of peroxidation products (POL) was evaluated by the content of malondialdehyde (MDA) [4] and diene conjugates (DC) [5]. The activity of glucose-6-phosphate dehydrogenase (G_6PDH) was determined [6]. The state of the physiological antioxidant system (FAS) was evaluated by the activity of glutathione reductase (GR) [7], glutathione peroxidase (GPO) [8] and catalase [9]. The data obtained were processed statistically.

The results of the study and their discussion

Co-administration of delagila and EDTA caused a significant gain (on average 47%, $p=0.02$) of bone tissue of the periodontium of rats compared to the intact group (Fig.1).

Biochemical studies in the liver revealed a slight increase (24%) content of diene conjugates, a significant increase in the activity of glutathione reductase and G_6PDH and a tendency to decrease in the activity of glutathione peroxidase and catalase. Noteworthy is the sharp increase in activity G_6PDH, which, apparently, is of a compensatory nature associated with the activation of the pentose phosphate cycle (Fig.2).

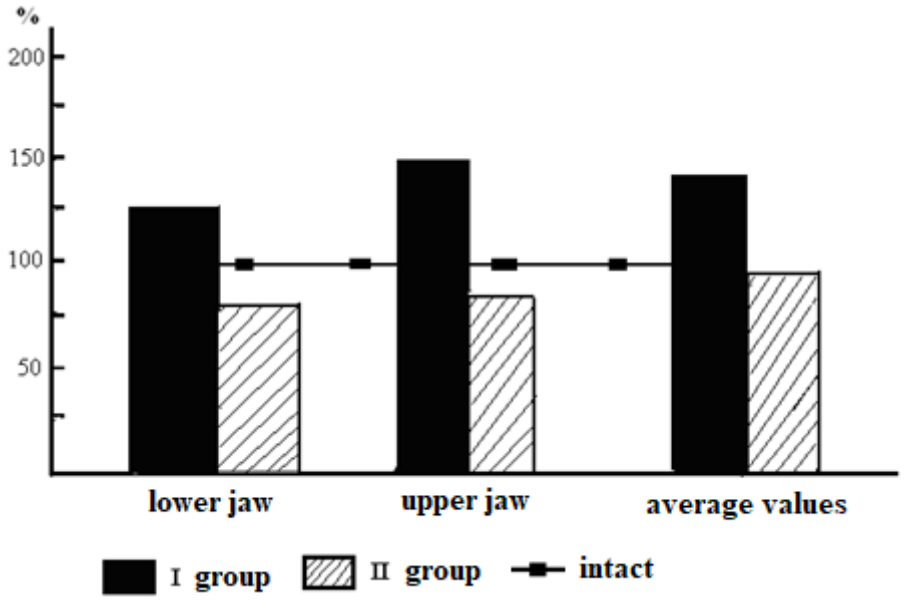

Fig. 1. Osteovit effect on bone resorption in periodontal experimental periodontitis

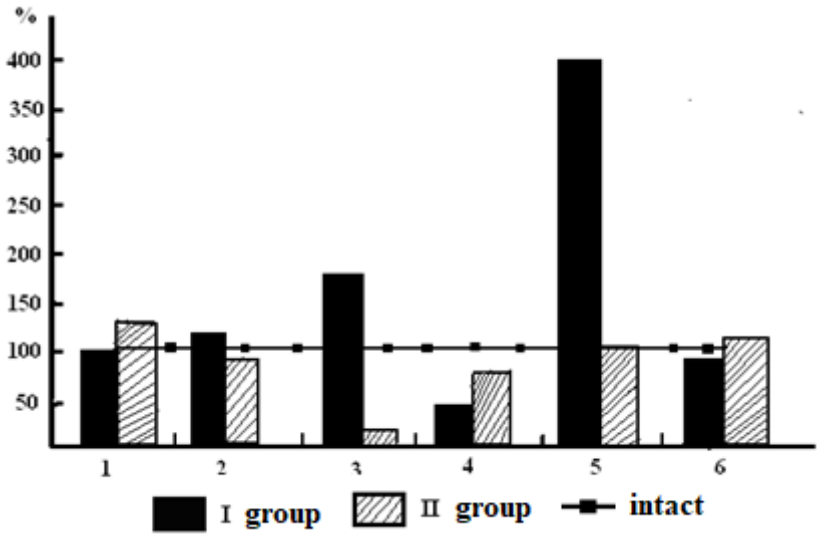

Fig. 2. Osteovit influence on the content of LPO products and as FAS in the liver of rats with experimental periodontitis (1-MDA, 2-DK, 3-GR, 4-GPO, 5- G_6PDH, 6-katalase)

Under the influence of a combination of delagila and EDTA in the alveolar bones of rats showed a significant increase (32.2%, p=0.05) content of diene conjugates and insignificant decrease in the activity of glutathione peroxidase and G_6PDH (Fig.3).

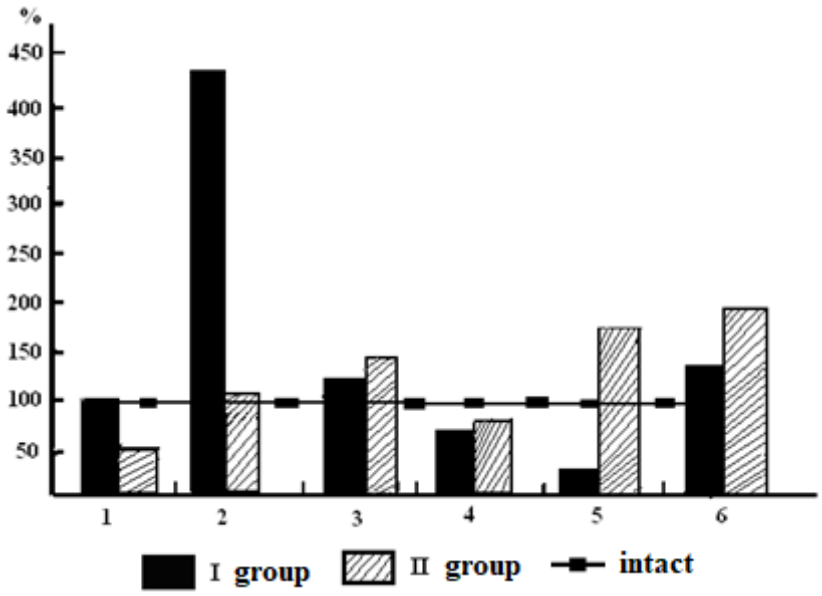

Fig. 3. Osteovit influence on the content of LPO products and as FAS in alveolar bones of rats under experimental periodontitis (1-MDA, 2-DK, 3-GR, 4-GPO, 5- G_6PDH, 6-katalase)

Application Osteovit peroxide on the background of Sa-deficient model of periodontitis caused a significant decrease (on average 60%, p=0.003) of bone resorption of periodontitis rats compared with the control group (delagil+EDTA) (Fig.1). Under the action of Osteovit in the liver and alveolar bones of rats significantly decreased the content of LPO products in the liver revealed a significant decrease in the content of diene conjugates (38%, p=0.02), in the bone of the alveolar process – HMM (54%, p=0.04) (Fig.2, 3). In the alveolar bones G_6PDH activity was significantly increased (30%, p<0.001), which is connected, apparently, with the activation of anabolic processes in the bone tissue of the jaws of rats (Fig.3). At the same time in the liver the activity of this enzyme relative to the model decreased, coming to data of the intact group (Fig.2). The activity of antioxidant enzymes – glutathione reductase, glutathione peroxidase and catalase were increased (28%,10% and 98%, respectively) (Fig.3).

Conclusion

Studies have shown that under the influence of Osteovit significantly decreased bone resorption in periodontal and normalized biochemical manifestations of the experimental model of periodontitis, presumably due to the combination of osteotropic effects 1-α-oxycholesterol and actions of antioxidants. 1αOHD3 complex with antioxidants and

phosphate calcium is protected as a composition for the prevention and treatment of periodontitis by the patent of Ukraine [10].

References

1. Voskresensky O.N., Tkachenko E. K. Rol` perekisnogo okisleniya lipidov v patogeneze parodontita [The role of lipid peroxidation in the pathogenesis of periodontitis]. Dentistry, 1991; 4; 6-10. (in Russian)

2. Patent 22879 Ukraine. Sposi`b modelyuvannya parodontitu [Method for periodontitis]. Promislova Vlasnist, 1998; 3; 1-8. (in Ukrainian)

3. Nikolaeva A.V. Vliyanie nekotory`kh nejrotropny`kh sredstv na sostoyanie tkanej parodonta pri razdrazhenii verkhnego shejnogo simpaticheskogo yzla [The influence of some neurotropic drugs on the condition of periodontal tissues in case of irritation of the upper cervical sympathetic]: Avtoref.dis..kand.med.nauk. Kharkov, 1967; 28. (in Ukrainian)

4. Vladimirov Y.A., Archakov A.I. Perekisnoe okislenie lipidov v biologicheskikh membranakh [Lipid peroxidation in biological membranes]. M.Science, 1972; 230. (in Russian)

5. Stalnaya I.D. Metod opredeleniya dienovy`kh kon`yugaczij nenasy`shhenny`kh vy`sshikh zhirny`kh kislot [Method for the determination of diene conjugations of unsaturated higher fatty acids]. Modern methods of biochemistry,1977;63-64. (in Russian)

6. Kornberg B., Horecer A, Glucoso-6-phosphate dehydrogenase. Method. Ensimol.,1955; 1; 322-325.

7. Putilina E. F. Opredelenie aktivnosti glutation-reduktazyn [Determination of the activity of glutathione reductase]. Methods of biochemical studies,1982; 181-183. (in Russian)

8. Pakhomova V., Kozlyanina N., Kryukova G. Sposob opredeleniya aktivnosti glutation-peroksidazy` v biologicheskikh tkanyakh [A method for determining the activity of glutathione peroxidase in biological tissues]. A.S. 922637 of the USSR. MKI 01 33/48. Publ. 04/25/82, Bull. 15; 2. (in Russian)

9. Tkachenko E.K. Regulyatornaya funkcziya i patogeneticheskoe znachenie peroksidazy` slyuny` [Regulatory function and pathogenetic significance of salivary peroxidase]. M., 1985; 24. (in Russian)

10. Voskresensky O.M., Tkachenko E.K. Sklad dlya profi`laktiki i` li`kuvannya parodontitu [Warehouse for prevention and periodontitis]. Patent 21697 AA61K 31/195, AA61K 31/355. Decl. 12/04/95; Publ. 01/20/98.