

COMPARATIVE EVALUATION OF THE EFFECTIVENESS OF ORAL CARE PRODUCTS IN INFLAMMATORY DISEASES OF THE ORAL CAVITY, ACCOMPANIED BY TEETH HYPERESTHESIA

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ABSTRACT

Treatment of inflammatory diseases of the oral cavity is an important task of modern dentistry. Gingivitis and periodontitis are the stages of a single inflammatory process in the oral cavity and occupy a leading place in the structure of dental morbidity. Treatment of chronic generalized periodontitis includes the use of various antibacterial and anti-inflammatory drugs. However, without complying with the rules of good oral hygiene, it is impossible to achieve positive dynamics of the periodontal state. Therefore, oral hygienic education and control are mandatory in the complex therapy of periodontal diseases.

The aim of the present study was to compare the effectiveness of oral care products with anti-inflammatory effect on periodontal diseases, complicated with hyperesthesia.

The study involved 80 people aged 55-65 years with mild and moderate chronic periodontitis, which were divided into 4 groups (20 people in each) depending on the toothpastes used (No 1 "Sensitive Ultra" Splat, No 2 "Biorepair Gum Protection", No 3 "Curaprox Enzycal Zero"), the control group patients brushed their teeth without toothpaste. In dynamics, hygienic indices, bleeding indices, papillary marginal attachment, periodontal index and sensitivity indices were evaluated.

As a result of the use of toothpastes and evaluation of their effectiveness, an improvement in hygienic and periodontal indices was detected in all study groups after two weeks of use. In the control group, improvement was observed, but these changes were less pronounced.

Investigated toothpastes lead to a decrease in inflammation in periodontal tissues. In addition, it is noted that toothpastes No 1 and No 2 based on hydroxyapatite contribute to the reduction of hard tissue hyperesthesia, which in turn makes it possible to perform better oral hygiene. The use of paste No 1 showed a more significant improvement in clinical signs in control with pastes "Biorepair Gum Protection" and "Curaprox Enzycal zero" ($p \geq 0.05$). Thus, it can be stated that all studied pastes can be recommended in the treatment of inflammatory periodontal diseases for at least 14 days. But in cases of hyperesthesia, it is necessary to add pastes on the basis of hydroxyapatite to the arsenal of oral care products.

KEYWORDS: toothpastes, chronic periodontitis, hyperesthesia, hydroxyapatite.

INTRODUCTION

Among the inflammatory diseases of the oral cavity, periodontal pathology occupies a leading place. The prevalence of this pathology is 95% and has a tendency to increase, due to the development trends of modern society [Gazhva S, Guluyev R,

2012]. During periodontal inflammation, in addition to patient complaints of bleeding and discomfort, patients are increasingly complaining of increased sensitivity of hard tooth tissues. Every year the problem of prevention and treatment of hypersensitivity of teeth in inflammatory periodontal diseases is becoming increasingly important due to the increasing influence of local and General factors [Krikheli N, Kovalenko T, 2012].

According to the latest data, in Russia more than 60% of the population aged 20 to 65 years

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suffer from tooth hyperesthesia [Addy M, 2002; Kuzmina E et al., 2003; Gazhva S et al., 2012; Krikheli N, Kovalenko T, 2012]. Despite the fact that many treatment options have been proposed for this pathology, the problem still has to be fully resolved [Solovyova A, 2010].

Periodontal diseases are most often symptomatic and associated with a number of etiological factors [Solovyova A, 2010; Ulitovsky S, 2010]. Treatment of hyperesthesia should be comprehensive, taking into account systemic and local risk factors and pathogenetic mechanisms of its occurrence. The choice of the most effective means of therapy should be carried out taking into account the individual characteristics of the course of the disease and the properties of medicinal and preventive substances [Samarina Ya, 2017].

The presence of hyperesthesia of the teeth complicates oral hygiene, which leads to the refusal of patients from tooth brushing, which in turn aggravates the course of the inflammatory process [Labovkina L, Mikheeva E, 2009; Ulitovsky S, 2009; Thoe E, Saltykova Y, 2011]. Thus, for patients with periodontitis, complicated with hypersensitivity of teeth, an important stage of treatment is a rational selection of oral care products that have an anti-inflammatory effect and provide a comfortable feeling during oral care [Bulkina N, 2011; Yanushevich O, Voronov Yu 2011; Akulovich A, 2013; Goncharova E, 2015; Adams S et al., 2017]. Despite the variety of means used for these purposes, the most effective ones that could be used for the treatment of patients with manifestations of hypersensitivity of teeth have not been fully determined. The most popular and affordable oral care products included in the complex therapy of inflammatory periodontal diseases remain toothpastes containing various active ingredients [Docimo R et al., 2009; Hamlin D et al., 2009]. In the dental market, in recent years, toothpastes have appeared, containing both hydroxyapatite and herbal preparations complexes [De Melo Alencar C, et al., 2019]. Depending on the manufacturer, the composition of pastes and the percentage of active components may be different. Due to the fact that toothpastes based on HAP have low abrasive index, in most cases they are the therapy of choice in the treatment of hyperesthesia of hard tissues, especially arising against the background of in-

flammatory processes in periodontal tissues. Improving the hygienic condition of the oral cavity helps to reduce inflammation [Gazhva S, Guluyev R, 2012].

Thus, the purpose of our study was a comparative assessment of oral care products containing plant components and hydroxyapatite, which have an anti-inflammatory effect on periodontal tissue and reduce the hyperesthesia of hard dental tissues.

MATERIAL AND METHODS

Study design: The study was randomized, cohort, prospective, and controlled. The inclusion of patients in the study was carried out based on the following criteria:

- availability of written informed consent of the patient to participate in the study;
- patient age 55-65 years;
- presence of clinical signs of chronic generalized periodontitis of mild and moderate severity;
- the presence of hyperesthesia of hard tooth tissues;
- the presence of at least 20 permanent teeth;
- previously held occupational hygiene.

Non-inclusion criteria:

- the presence of removable dentures in the mouth;
- previously conducted surgical periodontal treatment, complicated by hyperesthesia.

Exclusion Criteria:

- persons who refuse to participate in the study at any of its stages;
- persons with chronic somatic diseases and allergic reactions to toothpaste.

To evaluate the effectiveness of the toothpaste during hyperesthesia of the teeth, toothpastes No 1 "Sensitive Ultra" Splat (Russia), No 2 "Biorepair Gum Protection" (Italy) and No 3 "CuraproxEnzycal zero" (Switzerland) were used.

We examined 164 patients aged 55-65 years, 80 of whom were included into the study.

All patients were divided into four groups of 20 people each. Patients of the first group used paste "Sensitive Ultra", the second group was recommended to use paste "Biorepair Gum Protection" and in the third group – paste "Curaprox Enzycal zero". Patients of the fourth group (control group) performed oral hygiene using only a toothbrush (Table 1).

Clinical examination included an assessment of

TABLE 1

The composition of the toothpastes used in the study by the patients.

Name of toothpaste	Producing country	Active substance	Composition
“SensitiveUltra” Splat	Russia	Hydroxyapatite	Zinc-substituted hydroxyapatite SP, WHITE SYSTEM BIO, zinc gluconate, essential oils of lemon, grapefruit and peppermint, extract of walnut leaves and Bisaboil, extract of bifidobacteria
“Biorepair Gum Protection”	Italy	Hydroxyapatite	Biorepair particles, zinc-substituted hydroxyapatite, hyaluronic acid, witch hazel extract, calendula and spirulina
“Curaprox Enzycal zero”	Switzerland		Enzymes amyloglycosidase, glucose oxidase, lactoperoxidase

the state of hard tissues of teeth, periodontal tissues, state of the oral mucosa, determination of the level of oral hygiene, bleeding indices and periodontal indices, Schiff's test. The resorption of alveolar bone was assessed using panoramic radiographs. Based on the clinical and radiological methods of the study, the patients were diagnosed with chronic, generalized periodontitis of mild or moderate severity.

The hygienic state was determined using the Silness-Loe index, based on determining the amount of soft plaque in the gum area using a probe. The method was carried out in the area of the teeth of Ramfjord from the vestibular and oral surfaces.

To assess the gingival bleeding, probing of the gingival sulcus was performed and the Sulkus bleeding index (SBI) was used [Muhlemann H, Son S, 1971].

To determine the severity of inflammation in the periodontal tissues we used papilla, marginal gingiva and attached gingiva (PMA) index in the modification of Parma [Parma C, 1960].

The periodontal condition was assessed using the periodontal index (PI) [Russel A, 1960] for each tooth from 0 to 8 points. The degree of inflammation, the depth of the pocket and the mobility of the teeth were noted.

In order to objectively assess the severity of hyperesthesia in the control and study groups, a Schiff air test was performed before treatment, after 7, 14 days and a month of use of the pastes studied. The sensitivity assessment was performed in the area of all teeth and the average values were calculated for each patient.

During the study, all participants underwent controlled tooth brushing, as a result of which all patients were trained in the rules of individual hy-

giene and received advice on oral care.

The subjects used only the proposed toothpaste for brushing their teeth twice a day (morning and evening) for 1 month, a toothbrush of medium hardness.

Control examinations were carried out after 7 days, 14 days, after 1 month. At each visit, a mandatory assessment of the hygienic level of the Silness-Loe index, determination of the bleeding index of the gingival sulcus SBI, periodontal indices (PI according to Russell), Schiff's test were carried out.

The data obtained during the study of patients used pasta “Sensitive Ultra”, “Biorepair Gum Protection” and “Curaprox Enzycal zero” are listed in table 2, respectively and control group are presented in table 2.

Statistical processing of the results was carried out by generally accepted statistical methods using the standard block of statistical programs Microsoft Excel (2007) and SPSS Statistics 23. Mean values (M) and standard deviation of the characteristic (m) were calculated for the description of quantitative traits. Values are in the form of $M \pm m$.

RESULTS AND DISCUSSION

During the initial examination, all patients complained of bleeding gums when brushing their teeth and taking solid food, bad breath, and painful reaction of the teeth in response to various stimuli. The dynamics of the assessed indices is presented on figure 1.

Analyzing the change in the hygiene index in different groups, it can be noted that after 2 weeks from the beginning of the study, the hygienic condition significantly improved in groups 1, 2 and 4. In

TABLE 2

Dynamics of the indices changes in the patients used different pastes				
	Beginning of research	1 week	2 weeks	1 month
PASTE "SENSITIVE ULTRA" (GROUP 1)				
Hygienic index	1.9±0.07a	1.6±0.05a	1.4±0.05ab	1.1±0.07b
Papilla, marginal gingiva and Attached gingiva (PMA) index(%)	56±1.44a	51±1.27a	49±1.04ac	22±1.34b
Periodontal index (PI)	3.6±0.15a	3.5±0.17a	3.2±0.2b	3.1±0.2b
Sulkus bleeding index (SBI)	1.9±0.09a	1.7±0.07a	1.5±0.07ab	1.2±0.07b
Shiff'sindex	1.5±0.11a	1.5±0.11ba	1.2±0.11b	0.7±0.07b
"BIOREPAIR GUM PROTECTION" (GROUP 2)				
Hygienic index	1.6±0.08a	1.5±0.07a	1.2±0.07b	1.0±0.06b
Papilla, marginal gingiva and Attached gingiva (PMA) index(%)	56±2.57a	54±2.45a	50±2.5b	45±2.6b
Periodontal index (PI)	3.4±0.18a	3.3±0.18a	3.1±0.2b	2.9±0.2b
Sulkus bleeding index (SBI)	1.9±0.09a	1.8±0.08a	1.5±0.08b	1.3±0.08b
Shiff'sindex	1.5±0.08a	1.4±0.09a	1.1±0.07b	0.8±0.05b
PASTE "CURAPROX ENZYCAL ZERO" (GROUP 3)				
Hygienic index	1.8±0.07ac	1.5±0.07a	1.4±0.07ab	1.2±0.06b
Papilla, marginal gingiva and Attached gingiva (PMA) index(%)	62±1.2a	56±1.54a	50±1.54ba	47±1.82b
Periodontal index (PI)	2.8±0.11a	2.6±0.11a	2.4±0.10b	2.2±0.11b
Sulkus bleeding index (SBI)	1.8±0.06a	1.6±0.06a	1.4±0.07ba	1.2±0.06b
Shiff'sindex	1.5±0.05b	1.8±0.05a	1.6±0.05b	1.5±0.05b
CONTROL PATIENTS (GROUP 4)				
Hygienic index	1.8±0.05a	1.7±0.05a	1.6±0.05b	1.5±0.04b
Papilla, marginal gingiva and Attached gingiva (PMA) index(%)	57±1.25a	54±1.28a	51±1.1b	49±1.15b
Periodontal index (PI)	3.2±0.12a	3.1±0.12a	3.1±0.10b	3.0±0.11b
Sulkus bleeding index (SBI)	1.8±0.04a	1.6±0.04a	1.5±0.04b	1.4±0.03b
Shiff'sindex	1.8±0.06b	1.9±0.06a	1.8±0.08ab	1.7±0.05b

NOTES: a, b, c - the letters indicate homogeneous groups: groups whose letters coincide do not differ reliably among themselves on the corresponding index

group 3, a significant improvement was observed after 1 week of using the toothpaste. Most likely, patients in this group were more motivated to improve the hygienic condition of the oral cavity.

In addition, it should be noted that, despite the improvement in hygiene in all groups relative to baseline values, more pronounced dynamics was

observed in groups using toothpastes in relation to the control group, using only a toothbrush. Probably, the components that make up the toothpastes, have an additional positive impact.

To assess the effectiveness of toothpastes containing in its composition, in addition to hydroxyapatite, components that have anti-inflammatory

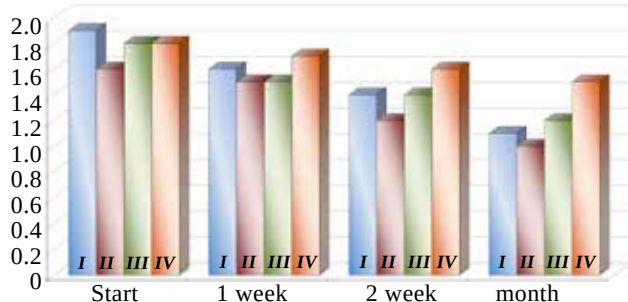
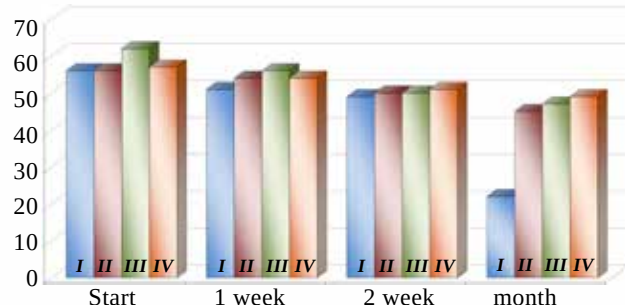
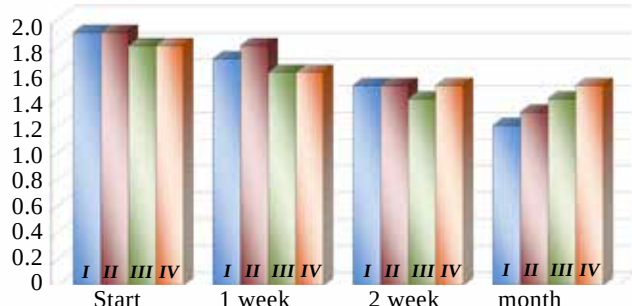
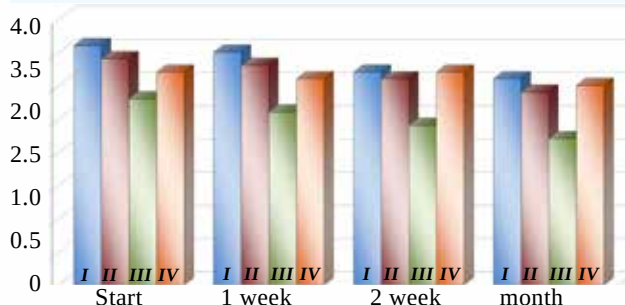
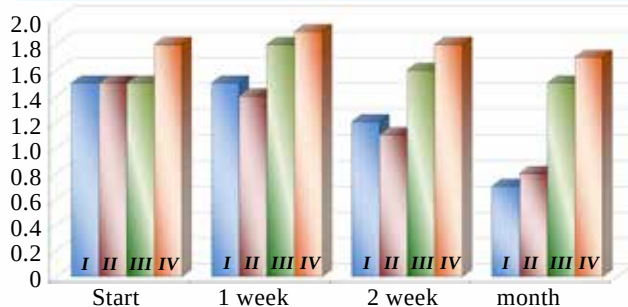
Hygienic index**Papilla, marginal gingiva and Attached gingiva****Sulkus bleeding index****Periodontal index****Shiff's index**

FIGURE 1 Dynamics of the hygienic index, PMA, SBI, PI and Schiff index changes in study and control groups (I, II, III and IV respectively)

effects were used to determine the PMA index. Analyzing the dynamics of changes in the PMA index, we can state a significant decrease in these values in all groups after 14 days. During the study in patients of group 1, there was a marked improvement in the condition of periodontal tissues (reduction of hyperemia, edema, disappearance of pain, reduction of bleeding), as evidenced by a decrease in the studied index from $56\% \pm 1.44$ to $22\% \pm 1.34$ ($p = 0.000$). Patients of groups 2 and 3 also showed a significant decrease in the PMA index from $56\% \pm 2.57$ to $45\% \pm 2.6$ ($p = 0.000$) and from $62\% \pm 1.2$ to $47\% \pm 1.82$, respectively. However, in some cases, patients noted a slight soreness and bleeding gums when brushing teeth. In the control group revealed a similar pattern.

The PMA index improvement was observed throughout the entire observation period, but not all changes were significantly significant, which is reflected in the tables.

Analyzing the dynamics of the SBI index, we can trace a similar pattern. During the study period in the study group, there was a significant decrease in the SBI index from 1.9 ± 0.09 at the initial examination to 1.2 ± 0.07 ($p = 0.000$) in a month. In groups 2 and 3, similar indicators changed from 1.9 ± 0.09 to 1.3 ± 0.08 ($p = 0.000$) and from 1.8 ± 0.06 to 1.2 ± 0.06 , respectively. In the control group, this indicator decreased from 1.8 ± 0.04 to 1.4 ± 0.03 ($p = 0.000$).

After a month of research, when comparing bleeding values, a significant difference was observed only between groups 1 and 4 ($p = 0.01$).

Another criterion for evaluating the effectiveness of the test tooth pastes on periodontal tissue was the Russell Periodontal Index (PI). An improvement in the indices of this index was noted in all subjects. However, positive dynamics are most likely associated only with a decrease in the inflammatory response in soft tissues.

PI index evaluates the condition of both soft tissue and bone structures. However, without comprehensive treatment, it is not possible to talk about a significant improvement in the values of this index. Conducting high-quality hygiene undoubtedly leads to a decrease in inflammation in the soft tissues, which was also recorded during the study.

When analyzing the nature of changes in dental

hyperesthesia, a significant decrease in the index was observed in 1 and 2 groups of the study, using pastes with hydroxyapatite. In 3 and 4 groups after a week of the study, an increase in sensitivity was recorded, which reached baseline values after a month of study.

Thus, the use of toothpastes, regardless of their composition, undoubtedly leads already after 14 days to a significant improvement in the hygienic condition of the oral cavity and, as a consequence, a decrease in inflammatory phenomena in the soft tissues of the periodontium. This is confirmed by the positive dynamics of the PMA, PI, and SBI indices. Studies ranging from 14 days to one month revealed further improvement in the hygienic condition of the oral cavity and a decrease in tooth sensitivity in patients of all groups ($p = 0.000$). The use of toothpastes with low PDA, containing in its composition hydroxyapatite led to a decrease in hyperesthesia after 2 weeks from the start of use in the first two groups. However, a more pronounced effect was observed when using toothpaste "Sensitive Ultra".

Patients of the study groups noted the pleasant taste of all toothpastes, a persistent feeling of breath freshness after their use, the absence of bleeding gums when brushing teeth, starting from the third week of use.

At the control dental examinations, no signs of local irritation of the components of both toothpastes on the oral mucosa were detected.

CONCLUSION

Thus, during the comparative evaluation of the pastes studied, toothpastes were found to contribute to the reduction of inflammatory phenomena in periodontal tissues, as evidenced by a significant decrease in the studied indices from the second week of use. Toothpastes "Sensitive Ultra" and "Biorepair Gum Protection" contribute to the reduction of hard tissue hyperesthesia, however, using paste "Sensitive Ultra" showed a more significant improvement in clinical signs compared to pastes "Biorepair Gum Protection" and "Curaprox Enzycal zero", but there were no statistically significant differences between the groups. It should also be noted that an important role for the prevention of dental diseases is played by increasing patient motivation for quality oral care and regular visits to the dentist for the purpose of monitoring.

Summarizing the written above, we can recommend all toothpastes in the complex therapy of patients with inflammatory periodontal diseases. When hyperesthesia of the teeth occurring on this background, hydroxyapatite-based toothpastes are the toothpastes of choice.

REFERENCES

1. Adams SE, Arnold D, Murphy B, Carroll P, Green AK., et al. A randomised clinical study to determine the effect of a toothpaste containing enzymes and proteins on plaque oral microbiome ecology. *Sci Rep*. 2017; 7: 43344.
2. Addy M. Dentine hypersensitivity: new perspectives on an old problem. *Int Dent J*. 2002; 5: 367-375.
3. Akulovich AV, Yalyshev RK, Matelo SK. [Comparative evaluation of anti-inflammatory activity of toothpastes on the basis of medicinal plant extracts and chlorhexidine] [Published in Russian]. *Periodontology*. 2013; 18(1): 19-23.
4. Bulkina NB. [PRO-ARGIN Technology: pathogenetic treatment of dentin hypersensitivity] [Published in Russian]. *Zhurnal "Novoe v stomatologii"*. 2011; 5: 50-51.
5. De Melo Alencar C, de Paula BLF, Guanipa Martins Silva C, Cople Maia L. Clinical efficacy of nano-hydroxyapatite in systematic review and meta-analysis. *J Dent*. 2019; 82: 11-21.
6. Docimo R, Montesani L, Maturo P, Costacurta M, Bartolino M. Comparing the efficacy in reducing dentin hypersensitivity of a new toothpaste containing 8.0 % arginine, calcium carbonate, and 1450 ppm fluoride to a benchmark commercial desensitizing toothpaste containing 2 % potassium ion: an eight-week clinical study in Rome, Italy. *J Clin Dent*. 2009; 20(4): 137-143.
7. Gazhva SI, Guluyev RS. [The prevalence and intensity of inflammatory periodontal diseases] [Published in Russian]. *Obozreniye. Stomatologiya*. 2012; 1: 13-14.

8. *Gazhva SI, Sharova NN, Kirillova TA, Eremina DA.* [The use of toothpastes for the treatment of dentin hyperesthesia (review)] [Published in Russian]. Modern problems of science and education. 2012; 3.
9. *Goncharova EI.* [Medicinal plant preparations in the treatment of diseases of the oral mucosa] [Published in Russian]. Russian Dental Journal. 2015; 19(4): 55-57.
10. *Hamlin D, Williams KP, Delgado E, Zhang YP, De Vizio W, Mateo LR.* Clinical evaluation of the efficacy of a desensitizing paste containing 8 % arginine and calcium carbonate for the in-office relief of dentin hypersensitivity associated with dental prophylaxis. Am J Dent. 2009; 22(Sp Is A): 16A-20A.
11. *Krikheli N, Kovalenko TV.* [Tooth sensitivity] [Published in Russian]. Russian Stomatology. 2012; 5(2): 38-41.
12. *Kuzmina EM, Kuzmina IN, Krikheli NI, Nekrasova OI.* [Increased sensitivity of the teeth] [Published in Russian]. Dental Forum. 2003; 1(2): 33-38.
13. *Labovkina LA, Mikheeva EA.* [Professional oral hygiene, problems of tooth hypersensitivity] [Published in Russian]. Pediatric dentistry and prevention. 2009; 1: 13-16.
14. *Muhlemann HR, Son S.* Gingival sulcus bleeding - a leading symptom in initial gingivitis. Helvetica Odontologica Acta. 1971; 15(2): 107-113.
15. *Parma C.* [Paradontopathien] [Published in German]. Leipzig JA Parth. 1960; 203p.
16. *Russel AL.* Indices for recording periodontal disease. WHO\DH\33, Geneva. 1960; 1-26.
17. *Samarina YaP.* [Dentin hypersensitivity] [Published in Russian]. Medical sciences. 2017; 4: 88-91.
18. *Solovyova AM.* [Dentin Hypersensitivity: the problem and the ways of their solution] [Published in Russian]. Clinical Dentistry. 2010; 1: 48-50.
19. *Thoe EA, Saltykova YG.* [Innovative technology for the prevention and treatment of dentin hypersensitivity when carrying out professional hygiene of the oral cavity in patients with periodontal diseases] [Published in Russian]. Institut stomatologii. 2011; 2: 32-34.
20. *Ulitsky SB.* [Hypersensitivity attacks] [Published in Russian]. Dentistry Today. 2009; 9: 23.
21. *Ulitsky SB.* [Increased sensitivity of teeth and quality of life] [Published in Russian]. Zhurnal "Novoe v stomatologii". 2010; 2: 14-15.
22. *Yanushevich OO, Voronov YuN.* [Efficacy of ozone and aminopterin in the treatment of hyperesthesia of dentin] [Published in Russian]. Stomatologiya dlya vsekh. 2011; 2: 18-19.