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A.V. Dvornyk, V.M. Dvornyk, Y.Y. Vodoriz, P.M. Skripnykov, I.M. Tkachenko
Poltava State Medical University, Poltava

CLINICAL FEATURES OF INFLUENCE OF DIFFERENT GROUPS OF BLEACHING AGENTS IN THE ORAL CAVITY AT DIFFERENT PERIODS AFTER THE END OF THE TREATMENT

e-mail: tkachenkoirmix@gmail.com

The purpose of the study was to assess the clinical changes in the oral cavity after using teeth bleaching systems of different compositions. Totally 65 patients were examined. All patients were 20 to 40 years old and had no severe dental and somatic pathology. This clinical study evaluated the effectiveness and side effects of two products for teeth bleaching. The difference in clinical indicators after the bleaching procedure with the selected gels on the microelement structure of oral liquid was detected. We noticed a significant difference in calcium and sodium indices in the oral fluid. Teeth bleaching agents cause tooth sensitivity manifested by changes in the oral fluid viscosity, pH, and the micronutrient composition. Depending on the bleaching agent used, the teeth bleaching procedure should be completed with remineralizing therapy.

Key words: teeth bleaching, tooth shade, aesthetics, chemical composition of enamel, hydrogen peroxide, carbamide peroxide.

А.В. Дворник, В.М. Дворник, Я.Ю. Водоріз, П.М. Скрипников, І.М. Ткаченко

КЛІНІЧНІ ОСОБЛИВОСТІ ВПЛИВУ ВИБІЛЮВАЧІВ РІЗНИХ ГРУП У ПОРОЖНИНІ РОТА У РІЗНІ ТЕРМІНИ ПІСЛЯ ЗАКІНЧЕННЯ ЛІКУВАННЯ

Метою дослідження стало вивчення клінічних змін у ротовій порожнині після застосування вибілюючих систем різного складу. Було обстежено 65 пацієнтів. Весь контингент обстежуваних знаходився у діапазоні від 20 до 40 років, всі були без вираженої стоматологічної та соматичної патології. У цьому клінічному дослідженні оцінювали ефективність і побічні ефекти двох продуктів для відбілювання зубів. В результаті проведених досліджень встановлена різниця клінічних показників при вибілюванні обраними гелями по мікроелементному складу ротової рідини, з достовірною різницею за показниками кальцію та натрію в ротовій рідині. Засоби для відбілювання зубів викликають чутливість зубів, особливо з використанням пероксиду карбаміду, що проявляється змінами в'язкості та pH ротової рідин, змінами із сторони мікроелементного складу ротової рідини за показниками іонів кальцію та натрію. Щоб уникнути негативних наслідків, процедуру відбілювання необхідно завершувати ремінералізуючою терапією в залежності від застосованого вибілюючого агента.

Ключові слова: відбілювання зубів, колір зубів, естетика, хімічний склад емалі, перекис водню, пероксид карбаміду.

The study is a fragment of the research project "Contribution of molecular clock components in the affection of periodontal tissues in case of inflammatory diseases for the development of prevention and treatment methods", state registration No. 0120U101151.

Teeth bleaching is a chemical oxidation process. During this procedure, free radicals of hydrogen peroxide are released, which causes changes in teeth' hard tissue color. This technique is famous as a non-invasive way of teeth shade improvement.

The smile's aesthetics requires studying and improvement as much as possible [7, 13]. The majority of respondents consider an imperfect smile to have a negative effect on their career, and 92 % are convinced that it contributes to success in personal life. Particular attention in this aspect is paid to the teeth shade. Methods of correcting tooth discoloration are rather diverse. Modern bleaching systems are based on using hydrogen peroxide or carbamide peroxide in combination with activating factors [6].

For a dentist, it is essential to understand the degree of enamel resistance to caries when performing a bleaching procedure. For people with a high resistance degree, the bleaching procedure is applicable. The procedure is contraindicated for patients with low and very low resistance [3].

The most modern professional methods of teeth bleaching include chemical, laser and photo-initiated bleaching. Those techniques differ in availability, quality, the need for remineralizing therapy before and after bleaching [2] and the presence of hyperesthesia, tissue heating and total time consummation.

The modern literature reflects various clinical and experimental aspects of the bleaching system's effect on the structure of teeth hard tissues, which were performed to establish the relationship between enamel morphology, the chemical composition of teeth hard tissues and subsequent manifestations of bleaching systems on the oral cavity [1, 4]. The purpose of the study was to conclude the advisability and priority of teeth bleaching agents usage as well as the prescription of the treatment regimen for restoration of the chemical structure of the enamel after the bleaching procedure.

For this reason, the bleaching gel effect was studied on hard tooth tissues. To achieve the purpose of the study, indices of prevalence and intensity of dental hyperesthesia, enamel resistance test, and mineral metabolism of oral fluid were applied. Special attention was paid to the changes in the organic matrix of intermaxillary prisms, leaching of calcium and phosphate, and expansion of superficial and deep layers of enamel, which leads to changes in hydrodynamic processes in tooth enamel.

Researchers have found that the cause of the negative impact on the tooth hard tissues, which leads to the appearance of micro erosions, is not the actual chemical composition of the peroxide bleaching compound but its acidity (pH). It was found that the pH of various professional bleaching systems ranges from 3.7 to 11.2. The data obtained in experimental studies indicate that the pH of the composition is neutral or close to neutral in the modern bleaching systems [5].

However, regardless of the constant improvement of existing and the search for new methods of bleaching, it is impossible to avoid negative consequences after their application, such as:

– Demineralization and dehydration of tooth tissues.

– Increasing emission of macro-and microelements from the superficial layer of enamel.

– Violation of the mineral composition of oral fluid manifests by a decrease in calcium, magnesium, copper, zinc, manganese and iron concentration.

The most common complication of bleaching systems which causes the most significant discomfort to the patient is the persistent teeth hyperesthesia. In most cases, the composition of the oral fluid must change after changing the enamel's chemical composition during the bleaching process. Therefore, changes in the oral fluid viscosity and hyperesthesia of hard tissues, which depend on the composition and concentration of the bleaching system, must happen.

The purpose of the study was to establish the clinical changes in the oral cavity after using teeth bleaching systems of different compositions.

Material and methods. We examined 65 patients. The entire contingent of participants ranged in age from 20 to 40 years old without severe dental and somatic pathology. All participants signed an informed consent after the whole oral and written explanation of the procedure.

Patients were divided into 2 groups: group I (N=31), where 35 % hydrogen peroxide was used; group II (N=34), where 44 % carbamide peroxide was used.

All participants were studied on the micronutrient composition of oral fluid before the procedure of professional teeth bleaching and 24 hours immediately after the bleaching protocol to study the dynamics of changes in ion concentration.

To record the effectiveness of teeth hyperesthesia elimination after bleaching, we used the index of dental hyperesthesia intensity. Shade assessment was performed immediately after the end of the treatment, using the universal Vita shade scale and the Lumen shade guide. The procedure was repeated for 3 months [10].

We have selected the most modern bleaching technique proposed for chairside clinical bleaching. This method includes bleaching with a cold-light LED lamp (Philips ZOOM! White Speed). 35 % hydrogen peroxide (H2O2) gel and 44 % carbamide peroxide gel ($CO(NH2)_2$• H_2O_2) were selected as bleaching agents.

The enamel resistance test (by V.R. Okushko, L.I. Kosareva, 1983) establishes the functional resistance of enamel to acid. The test can be used as a primary diagnostics to assess the effectiveness of remineralizing therapy during dispensary observation and treatment of patients. A simplified index of oral hygiene – OHI-S (Oral Hygiene Indices Simplified) by J.C. Green and J.K. Vermillion was used to determine oral hygiene conditions. Periodontal tissue status index assessment was performed using the PMA (papillary-marginal-alveolar) index. The level of hyperesthesia intensity was also assessed.

Laboratory methods of saliva examination for electrolyte composition (K+, Na+, Cl-, Ca++, pH) were performed for all patients the day before the bleaching procedure and 1 day after the procedure.

The material was gathered for laboratory testing on patients` empty stomachs, at the same time in the morning, without primary teeth brushing. Saliva was transported within 2 hours after sampling. After that, the laboratory performed the analysis of these samples. Convergys ISE comfort Analyzer M05 (S/No. CT-ISE-comfort-2693) for 5 electrolytes (K+, Na+, Cl-, Ca++, Li+, pH) was used to perform this laboratory study. Quantitative data obtained during the examination of patients was introduced to an Excel table and processed by mathematical statistics methods using the calculation of mean sample values (M), standard deviation (σ) and errors of mean values (m) in groups of subjects. Frequency tables were built for semi-quantitative and qualitative indicators [11]. Statistical significance of differences in the results obtained for different groups was determined using the U Mann-Whitney nonparametric criterion [11]. The probability of differences was determined using the Wilcoxon method for related samples. The significance

rate was set at $p<0.05$. The calculations were performed using "Microsoft Excel 2007" and "SPSS for Windows. Release 13.0" software.

Results of the study and their discussion. The mean age of patients in group I was 29.206±1.128 years. The average teeth quantity was 29.706±0.291, and the average DEF index (decayed, extracted, filled) was 2.706±0.252. In group II, the mean age of patients was 28.903±1.041 with 29.355±0.330 of teeth and a median 2.774±0.273 DEF index, respectively. Data analysis revealed that patients had no significant differences in age, number of teeth, and DEF index.

The results of clinical examination of patients revealed that there is a difference in the bleaching effectiveness with selected gels of 35 % hydrogen peroxide (H_2O_2) and 44 % carbamide peroxide ($CO(NH_2)_2 \bullet H_2O_2$) on the trace element composition of oral fluid, with a significant difference in calcium and sodium. Before the treatment, the Na level was 19.474±0.953 (for group I). While, after the bleaching procedure, the Na level was 18.994±0.862. For group II, the initial level of Na was 20.432±0.70, while, after the treatment process, the rate was 18.839±0.789. We noted significant differences in the parameters within the group, which characterizes the decrease in Na ions and, as a consequence, a decrease in water on the enamel surface, which will lead to hyperesthesia of the teeth after the bleaching procedure. Also, we noted the difference between the parameters after treatment between groups. This proves the changes in oral fluid, namely the amount of Na and how consequence, different clinical effects. Changes in the trace element composition also concerned the amounts of P, which was 0.293±0.040 and 0.277±0.042 (for group I), and 0.321±0.056 and 0.329±0.061 respectively (for group II). That is, due to the use of different gels for bleaching, the electrolyte composition of the mouth fluid also changes.

Thus, it can be seen from the mentioned data of oral fluid studies we have the opportunity to note significant changes in phosphorus and sodium rates at ($p>0.05$) in both groups of patients. We also have the opportunity to find a significant difference between the number of sodium ions before the bleaching procedure and after its completion in group II (Table 1).

Table 1

Dynamics of concentration changes in oral fluid ions before the procedure of professional teeth bleaching and 24 hours after the bleaching protocol

Trace elemental composition of oral fluid	Group I (N=34)	Group II (N=31)
K (before bleaching)	9.120±0.571	10.373±0.739
K (in 24 hours)	8.259±0.571	10.088±0.645
Ca (before bleaching)	0.667±0.068	0.704±0.044
Ca (in 24 hours)	0.659±0.073	0.821±0.093
P (before bleaching)	0.293±0.040*	0.321±0.056*
P (in 24 hours)	0.277±0.042*	0.329±0.061*
Na (before bleaching)	19.474±0.953*, **	20.432±0.701*
Na (in 24 hours)	18.994±0.862*	18.839±0.789*, **

*significance at ($p>0.05$) within the group,

** significance at ($p>0.05$) between groups I and II.

No significant differences between groups were found in the oral fluid viscosity study. Indices of group I were 2.835±0.133, for group II – 3.22±0.206, with a significant difference in indices received before and after the treatment. That also indicates the relationship between all components of the oral cavity. As for pH between groups I and II, there was a significant difference 24 hours after the end of treatment – 7.577±0.137 (for group I) and 8.002±0.120 (for group II). On the contrary, to the viscosity index, there is a significant difference between groups after treatment. This can be associated with different compositions of bleaching gels and features of their use.

We also studied the DEF index, which did not differ significantly for groups I and II and was 2.706±0.252 for patients of group I at the mean age of patients 29.206±1.128 and number of teeth 29.706±0.291. So, the index for the group was a sign of the relationship between viscosity and DEF, which was not observed for both groups I and II. Viscosity values for group II were 2.823±0.190 and 2.974±0.881 with a significant difference between parameters before and after treatment within the group. The relationship between the DEF index and viscosity within group II was not determined.

Teeth bleaching products vary depending on the effects on the main parameters of the oral cavity, especially if carbamide peroxide 44 % ($CO(NH_2)_2 \bullet H_2O_2$) is used. The changes in viscosity and pH of oral fluid and changes in micronutrient composition of oral fluid in terms of calcium and sodium were noted.

When using these teeth bleaching products, some preparations must be carried out to minimize changes in pH, viscosity and trace elements composition of oral fluid by prescribing compounds that reduce sensitivity and contribute to the mineralization of hard tissues.

Evaluating the pH and viscosity of the oral fluid in the research groups before treatment and 24 hours after its completion, we can say that changes in these parameters differed both within groups and 24 hours after the bleaching procedure was completed (Table 2).

Table 2

Parameters of oral fluid pH and viscosity in patients of groups I and II before and after the treatment (24 hours after the bleaching procedure)

Studied parameters	Group I (N=34)		Group II (N=31)	
	Before the treatment	In 24 hours	Before the treatment	In 24 hours
Viscosity	2.835±0.133	3.22±0.206*	2,823±0.190	2.974±0.881*
Oral fluid pH	7.73±0.175	7.577±0.137***	8.020±0.201	8.002±0.120***

*significance at (p>0.05) within the group,

** significance at (p>0.05) between groups I and II.

Analysis of the study's results revealed statistically significant deviations in phosphorus and sodium levels at (p>0.05) in both patients' groups. We also have the opportunity to find a significant difference between the number of sodium ions before the bleaching process and after its completion in group II. The obtained data correlate with research data of other researchers regarding the use of laser teeth bleaching with carbamide and hydrogen peroxide [12]. Also, comparing the obtained data, we may mention that the choice of bleaching gel also significantly affects the trace element composition (according to some parameters) and the enamel microhardness using laser bleaching [14]. In addition, we mention that the changes in pH and viscosity of the oral fluid can be compared with another study, which substantiated the influence of bleaching systems on the hardness, roughness and color parameters of the enamel [9]. Based on the above data, the bleaching procedure should be completed with remineralizing therapy, depending on the bleaching agent used to avoid negative consequences. Therefore, we are currently considering changes in enamel and oral cavity and changes in the concentration of bleaching agent, its composition and methods of application to reduce adverse effects on teeth and oral cavity and application of preventive measures for the consequences management [4].

Conclusion

The oral cavity is a balanced system that supports its own balance due to the coordinated work of all its components. Changes play a significant role in the structure of the enamel elements such as sodium, phosphorus and calcium. Their number causes changes in the structure of the hard tissues in the teeth. This has a direct connection with the morphological features of their structure. During teeth bleaching, the replacement of ions in the area of the hydroxide group on the combination of carbon with oxygen, fluorine, chlorine or water molecules happens.

Evaluating our assumptions and based on the results of clinical examination of patients, we can say that there is a difference in the effectiveness of 35 % hydrogen peroxide (H2O2) and 44 % carbamide peroxide (CO (NH_2) 2 • H_2O_2) bleaching gels on the trace element of oral fluid with the significant difference in calcium and sodium.

Teeth bleaching agents cause tooth sensitivity, especially when carbamide peroxide is used i.e. the viscosity and pH of oral fluid changes in the micronutrient composition of oral fluid in terms of calcium and sodium.

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O.V. Dienha, N.V. Malekh, O.A. Makarenko, T.O. Pyndus[1], A. Jenča[1], S.A. Shnaider
State Establishment "The Institute of stomatology and maxilla-facial surgery National academy of medical sciences of Ukraine", Odesa
[1]Pavol Jozef Safarik University and Academy of Kosice, Košice

BIOCHEMICAL PARAMETERS OF ORAL FLUID OF CHILDREN WITH HYPERTROPHIC GINGIVITIS DURING DENTAL TREATMENT

e-mail: oksanadenga@gmail.com

The study is dedicated to assessing the impact of the developed treatment-and-prophylactic complex on the biochemical parameters of the oral fluid of children with hypertrophic gingivitis. The study involved 30 children aged 13–16 years with a diagnosis of hypertrophic gingivitis. The conducted studies testify to the rather high efficiency of the proposed treatment-and-prophylactic therapy for children with hypertrophic gingivitis, which included a universal natural biological complex of drugs with a broad therapeutic and prophylactic effect. The developed therapeutic and prophylactic complex helped to normalize the biochemical parameters of oral fluid in children, improving antioxidant protection, reducing the intensity of inflammation, the degree of lipid peroxidation, the level of contamination of the oral cavity and increasing non-specific antimicrobial protection.

Key words: children, periodontal tissue diseases, dental disease, biochemical markers, oral fluid.

О.В. Дєньга, Н.В. Малех, О.А. Макаренко, Т.О. Пиндус, А. Єнча, С.А. Шнайдер

БІОХІМІЧНІ ПОКАЗНИКИ РОТОВОЇ РІДИНИ ДІТЕЙ З ГІПЕРТРОФІЧНИМ ГІНГІВІТОМ У ПРОЦЕСІ СТОМАТОЛОГІЧНОГО ЛІКУВАННЯ

Дослідження присвячено проведенню оцінки впливу розробленого лікувально-профілактичного комплексу на біохімічні показники ротової рідини дітей з гіпертрофічним гінгівітом. В дослідженнях приймали участь 30 дітей віком 13–16 років з діагнозом гіпертрофічний гінгівіт. Проведені дослідження свідчать про достатньо високу ефективність запропонованої лікувально-профілактичної терапії для дітей з гіпертрофічним гінгівітом, яка включала універсальний природний біологічний комплекс препаратів з широкою лікувально-профілактичною дією. Розроблений лікувально-профілактичний комплекс сприяв у дітей нормалізації біохімічних показників ротової рідини, покращуючи антиоксидантний захист, зменшуючи інтенсивність запалення, ступінь перекисного оксислення ліпідів, рівня обсіменіння порожнини рота та підвищуючи неспецифічний антимікробний захист в ній.

Ключові слова: діти, захворювання тканини пародонту, стоматологічне захворювання, біохімічні маркери, ротова рідина.

The work is a fragment of the research project "Correction of pathogenetic mechanisms of disorders of carbohydrate and lipid metabolism in the body and tissues of the oral cavity in patients depending on environmental and nutritional factors affecting carbohydrate and lipid metabolism", state registration No. 0118U006966.

Periodontal diseases are the most common inflammatory processes in the human population [8, 11, 12]. In one form or another, they occur in more than half, and, according to some estimates, in more than 80 % of the adult population of the planet [13]. General risk factors for periodontal disease can be divided into hereditary and acquired (including socio-economic factors, poor oral hygiene, cigarette smoking and diabetes) [7]. Gingivitis, the initial, most common and reversible form of the disease, is characterized by