

EUROPEAN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH
AND MANAGEMENT STUDIES

VOLUME04 ISSUE01

DOI: <https://doi.org/10.55640/eijmrms-04-01-51>

Pages: 295-304

STUDYING THE EFFECTS OF THE ACIDITY OF BEVERAGES ON THE HARD TISSUES OF
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ABOUT ARTICLE

Key words: Home bleaching, enamel resistance, peroxides, photosensitive particles, enzymes, remineralization.

Received: 21.01.2024

Accepted: 26.01.2024

Published: 31.01.2024

Abstract: This article examines the effect of three methods of home whitening - peroxides, photosensitive particles and enzymes - on the durability of tooth enamel. The properties of the corresponding active substances, the mechanisms of their action and the effect on the structural and functional properties of tooth enamel are compared.

INTRODUCTION

Home bleaching occupies an important place among the local problems of modern dentistry [2]. This is due to the fact that today society is paying more and more attention to the aesthetics of appearance, in which a snow-white beautiful smile plays an important role, but without taking into account the structural features of the enamel, which only a dentist can evaluate how to achieve this, common methods of home whitening are also used, ignoring the possible consequences of their unregulated use [1]. Purpose: to study the effect of home bleaching systems on enamel resistance. Tasks 1. to identify the need for teeth whitening in young people aged 20-22 years; 2. to study the composition and characteristics of currently popular home bleaching systems and the mechanisms of their action; 3. to determine the effect of bleaching systems on the structural and functional properties of enamel; 4. to compare the effectiveness and safety of home bleaching products based on peroxides, photosensitive particles and enzymes.

METHODS

The analysis of scientific literature and evidence-based medicine data is carried out; 50 people aged 20-22 years were interviewed to determine the need and motivation for bleaching among young people and their knowledge about the safety of commercially available home bleaching systems. Chemical reagents (1H hydrochloric acid solution and methylene blue 1% aqueous solution) were prepared at the Department of General and Bioorganic Chemistry of the Razumovsky State Medical University. Systems with hydrogen peroxide (bleaching strips Blend-a-Med 3DWHITE Lux, Germany), systems with photosensitive particles (BlanX White Shock Treatment whitening toothpaste with LED lamp, Italy), enzyme systems (R. O.C.S. Sensation Whitening Whitening toothpaste, Russia) and medical mineralizing gel R.O.C.S. (Russia) were used as a remineralizing therapy throughout the course of bleaching. A number of preparatory procedures were performed before bleaching: 1. the level of oral hygiene was determined by the hygiene index of G.N. Pakhomov; vestibular surfaces of 12 teeth (4.3, 4.2, 4.1, 3.1, 3.2, 3.2, 3.3, 1.1, 2.1, 1.6, 2.6, 3.6 and 4.6) were stained with a dye solution (5% iodine in alcohol or 5% erythrosine in water). Staining assessment: - absence of staining - 1 point; - 1/4 of the tooth surface - 2 points; - 1/2 of the tooth surface - 3 points; - 3/4 of the tooth surface - 4 points; - the entire tooth surface - 5 points. Formula GI = total number of points/number of teeth examined. Interpretation of the results is 1.1-1.5... Good hygiene, from -1.6 to 2.0... Satisfactory hygiene, from -2.1 to 2.5... Unsatisfactory hygienic conditions, from -2.6 to 3.4... Poor hygienic conditions, from -3.5 to 5.0... Very poor hygiene [7]; 2. professional oral hygiene was carried out using the Sultan Topex endocircular brush and non-fluorinated abrasive paste; 3. patients received standard dental cleaning methods, home enamel mineralization (medical mineral gel R.O.C.S. (Russia)) was performed twice a day, morning and evening, for 20 minutes. 4. The initial color of the teeth was determined on the Vita scale based on the brightness of the enamel shade. The color was determined in natural light during the daytime from 11 to 1300 hours, while the patients were located away from the windows, and not towards them. The color of the walls, ceilings and clothes of the staff were calm pastel tones. The color of the teeth was evaluated after professional oral hygiene and with a wet tooth surface; the color was measured for 15 seconds, then a break was taken and the color was measured again [8]. 5. TER (enamel resistance test) (Okushko V.R., Kosareva L.I., Lutskaya I.K. (1983)) The rate of enamel remineralization was assessed using a test On the vestibular surface of the maxillary central incisor, cleaned of plaque and dried with saliva, a drop of 1H HCl solution with a diameter of 1-2 mm was placed along the median line at a distance of 2 mm from the incisor edge, after 5 seconds the drop was washed off with water and the enamel was dried with compressed air. A 1% solution of methylene blue was applied to the etched surface for 1 min, after which the residues were removed with a cotton swab. The intensity of staining

of the etched area was estimated according to the standard 100-point L.A. scale. Aksamita: - light blue areas - high caries resistance (<30%), - Areas with blue spots - moderate resistance to caries (30-60%), - Areas with blue spots - reduced resistance to caries (>60%) [7].

RESULTS AND DISCUSSION

According to the earliest literature on teeth whitening, this conservative cosmetic dental procedure originated in the USA. The modern history of bleaching dates back more than 100 years. Two main agents were used: hydrochloric acid and hydrogen peroxide. A huge number of scientists have tested various bleaching methods using different concentrations of agents. However, home bleaching appeared only in the late 60s of the 20th century. For this purpose, 10% carbamide peroxide is used, which is placed in a mouth guard specially made for each patient. The mouth guard was invented by orthodontist Bill Kruzmeier after he saw a patient with inflamed gums [9]. Bleaching is a chemical oxidation process that changes the color of enamel and dentin from dark to light. Indications for teeth whitening: 1. tooth color above A2 on the Vita scale; 2. age-related discoloration of teeth; 3. "tetracycline teeth"; 4. mild generalized enamel hypoplasia; 5. mild localized enamel hypoplasia; 6. variegated fluorosis with a tinge; 7. discolored demineralized teeth; 8. discolored teeth due to injury; 9. discoloration of teeth due to age; 10. discoloration of teeth due to age; 11. discoloration of teeth due to age; 12. discoloration of teeth due to age; 13. discoloration of teeth due to age. Absolute local contraindications to teeth whitening: 1. temporary seals; 2. bleaching agents can cause pulpitis if they penetrate close to the pulp; 3. Enamel erosion; 4. moderate or low enamel resistance; 5. Low or moderate enamel resistance to bleaching agents; 6. Low or moderate enamel resistance to bleaching agents; 7. Low or moderate enamel resistance to bleaching agents; 8. low or moderate resistance of enamel to bleaching agents; 9. low or moderate resistance of enamel to bleaching agents. Local relative contraindications to teeth whitening: 1. loss of enamel due to pathological or age-related tooth erosion, deep cracks on the enamel surface; 2. exposed tooth necks, wedge-shaped defects; 3. processes of orthodontic treatment; 4. unsterilized oral cavity (secondary caries, inflammatory periodontal diseases in the acute stage) [3, 6]. Enamel is the hardest tissue in our body. The enamel covering the crown of the tooth and performing a protective function is formed by enamel prisms and interprismal material, which are structural and functional units. Enamel consists of organic and inorganic substances. The organic matrix is formed by non-collagenic enamel proteins, which are divided into two types: enamellins and amelogenins. It also includes glucosaminoglycans, proteoglycans and lipids. The inorganic matrix is dominated by hydroxyapatite (75%) and less carbonatapatite (12.06%), chlorapatite (4.35%) and fluorapatite (0.63%). The interprism material includes enamel bundles and

lamellae, which are zones of low mineralization, and spindles (elongation of odontoblasts), which are responsible for hyperalgesia [3, 10, 11, 12]. In fact, the color of enamel varies from person to person, but it changes with age. This is mainly influenced by lifestyle and nutrition. The use of coloring substances and bad habits, such as tea, coffee, chocolate, sauces, juices and berries, inevitably leads to darkening of the enamel due to the accumulation of coloring pigments in it. According to our survey of young people aged 20-22 years, 40% would like to bleach at home and 50% of them they are motivated by advertising in the media, 20% by the experience of acquaintances and only 30% by the fact that there are real indications for this procedure. A detailed study of the formulations and recommendations of manufacturers showed that as part of the company's marketing activities, contraindications, side effects and negative effects on the oral organs of the active substance are not indicated, as a result of which, after improper self-selection of bleaching agents, many patients are forced to seek help from a dentist to eliminate undesirable effects, It was concluded that after self-selection of bleaching agents However, many patients are forced to seek help from a dentist to eliminate undesirable effects. Thus, it was found that almost half of young people want to whiten their teeth at home, but their motivation is mainly due to the influence of advertising in the media, and more than half trust what is written on the packaging and are not aware of the dangers and risks associated with the uncontrolled use of bleaching systems, They are not aware of the risks and dangers, related to the uncontrolled use of bleaching systems. Classification of home whitening methods: 1. professionally at home (under the supervision of a dentist); 2. actually at home (independent use of various non-professional products); 1) based on hydrogen peroxide (teeth whitening strips Blend-a-Med 3DWHITE LUXE, (Germany). Active ingredients: - hydrogen peroxide - oxidizing agent (5.25%) - sodium hydroxide - acid neutralizing agent Mode of action: the action of special teeth whitening strips is based on the use of peroxide gel. Hydrogen peroxide begins to release atomic oxygen, which penetrates into enamel and dentin, causing oxidative degradation of the accumulated pigment. At high concentrations, hydrogen peroxide destroys the organic components of the matrix and increases the number of micropores in the enamel, which diffuses light and makes teeth visually whiter [4]. 2) Based on photosensitive microparticles (BlanX White Shock Treatment whitening system - LED Whitening toothpaste with Activator lamp, Italy). Active ingredients: - ActiluX microparticles containing nano-hydroxyapatite and a patented substance that bleaches when exposed to light (in fact, light bleach); - Icelandic lichen extract - has antibacterial properties and prevents plaque formation; - coumadula extract - antibacterial and anti-inflammatory effect; - parabens, SLS, polyethylene glycol; - does not contain fluoride. Method of action: microparticles are activated by sunlight and enter into a photochemical reaction with oxygen and water present in the environment (air humidity and saliva), forming radicals that are safe for the body, but destroy foreign organic

molecules, including plaque. Nanohydroxyapatite fills microcracks in tooth enamel and provides a connection between the tooth surface and Actilux whitening agents; 3) enzyme-based (R.O.C.S. Sensation Whitening toothpaste, Russia). Active substances: - calcium glycerophosphate - remineralizing effect - xylitol (n/microbial effect, increases the remineralizing ability of calcium glycerophosphate and magnesium chloride) - bromelain - proteolytic enzyme (pineapple). - Magnesium chloride has an anti-inflammatory, astringent and drying effect. The mechanism of action of enzyme bleaches is to remove plaque and surface stains on the enamel. Enamel remineralization also brightens the tooth surface by compressing the crystal lattice of hydroxyapatite; R.O.C.S. Medical Minerals gel (Russia) was used to remineralize enamel in three subjects. Active substances: - calcium glycerophosphate - remineralizing effect - xylitol - increases the remineralizing ability and suppresses the activity of bacteria - magnesium chloride - anti-inflammatory, astringent and drying effect. Reduces bleeding and bad breath. Method of action: the gel forms an invisible protective layer on the teeth, penetrating into the tooth structure and having a strengthening effect. According to the literature [3, 5, 13], some components in the composition of bleaching dental products can reduce the resistance of enamel to acids, thereby increasing the sensitivity of teeth to cariogenic factors and increasing the hypersensitivity of enamel. In this regard, evidence-based medicine claims that in Europe, teeth whitening can only be performed from the age of 18 and only on the recommendation of a dentist, bleaching agents containing more than 0.1% hydrogen peroxide are sold strictly by prescription, bleaching procedures are carried out only under the supervision of a professional doctor, only under the supervision of a professional doctor, and home bleaching is not recommended even by proven means. After a detailed study of the composition of the above bleaching agents, it was concluded that Blend-a-Med 3DWHITE Luxe is a real bleaching agent due to the presence of 5.25% hydrogen peroxide, but also contains substances such as sodium hydroxide and sodium lauryl sulfate, which are aggressive and harmful to mucous membranes and can lead to mucosal atrophy. In the BlanX White Shock Treatment bleaching system, the active ingredient is ActiluX particles, which, when exposed to light, form radicals that destroy organic molecules, which makes this system a real bleaching agent. R.O.C.S. Sensation Whitening Toothpaste is not a true bleaching agent. This is due to the fact that the gloss of the enamel is due to the enzymatic removal of accumulated plaque (the so-called pseudo-bleaching) and an increase in the optical density of the enamel as a result of the action of remineralizing components. To study the effectiveness of the home bleaching system, three volunteers were selected with the same conditions: the enamel was prepared in accordance with the steps described above, and its initial TEP was 10%, which corresponds to high resistance. Three groups of bleaching agents were also selected, according to which, in the process of teeth whitening, patients also underwent a course

of remineralizing therapy with R.O.C.S. medical mineral gel and used indifferent toothpaste. Clinical case 1 (group based on hydrogen peroxide). Dissatisfaction: unsatisfactory color. Objective assessment of oral hygiene according to Pakhomov G.N.: 2.17 - unsatisfactory level of oral hygiene, initial tooth color A2. initial TER 10% (high enamel caries resistance). As a result of bleaching, the patient complained about the sensitivity of the enamel to cold, hot and sour food. The final color of the teeth is A1 (a change of 3 tones), the final TER is 30%, which corresponds to a moderate resistance of the enamel to caries (a decrease in the resistance of the enamel by 3 times). Recommendations for the care of bleached teeth are given. Remineralizing therapy using R.O.C.S. medical mineral gel was repeated for 14 days. Clinical case 2 (group with photosensitive microparticles). The main complaint: unsatisfactory color tone. Objective assessment of oral hygiene according to Pakhomov G.N.: 1.75 - satisfactory level of oral hygiene; initial tooth color A2; initial TER 10% (high enamel caries resistance). Complaints about the sensitivity of the enamel to cold as a result of bleaching. The final tooth color is B2 (a two-tone change), the final TER is 30%, moderate enamel caries resistance (enamel caries resistance is reduced by one third). Recommendations were given on the care of bleached teeth, repeated 14-day remineralizing therapy using medical mineral gel R.O.C.S. Clinical case 3 (group of enzymes) was prescribed. The main complaint: unsatisfactory color tone. Objective assessment of oral hygiene according to Pakhomov G.N.: 1.83 - satisfactory level of oral hygiene; initial tooth color A2; initial TER 10% (high enamel caries resistance). Bleaching results: unsatisfactory, final tooth color B2 (two tone change), final TER 10% (no change in enamel resistance). Recommendations for the care of bleached teeth are given. Recommendations for the care of bleached teeth: - For 2 weeks after bleaching, follow a clean diet and exclude dark-colored foods (chocolate, tea, coffee, wine, berries and juices). Bleaching with hydrogen peroxide (Fig. 1) is the most effective of the options (three-tone bleaching), but has significant disadvantages (a three-fold decrease in enamel resistance, reaching a limit of 30%, increased sensitivity to all irritants). Bleaching with photosensitive particles also whitens the enamel, but the effect is two tones lower. At the same time, enamel resistance suffers (TER drops to 30%, which corresponds to the resistance of the average enamel). The average caries resistance of enamel (corresponding to values above 30%) is an absolute contraindication to bleaching procedures, therefore, repeated application of these techniques (based on the action of hydrogen peroxide and photosensitive particles) on enamel is highly undesirable, since irreversible changes in its structure may occur. It should be noted. This is due to the fact that the composition of these whitening dental products includes aggressive substances that destroy the structural components of the enamel. In this case, parallel remineralizing therapy will not correct the situation. Enzyme-based whitening differs from the first two groups in that it does not have an aggressive effect on the hard tissues of the teeth (there are no complaints and, most importantly, the

resistance of the enamel does not change) and is comparable to the effect of true whitening systems based on photosensitive fine particles (color change is two tones lighter) It is quite effective. In any case, the use of whitening toothpastes and home remedies should not be unlimited and should be carried out after consultation and under the supervision of a specialist, especially with the use of additional research methods such as TER.

CONCLUSIONS

1. The share of people who want to whiten their teeth at home was 40% of all respondents, of whom 50% were motivated by advertising in the media, 20% by the experience of acquaintances, and only 30% actually had indications for teeth whitening. At the same time, 65% of respondents are unaware of the negative effects on enamel of bleaching substances contained in modern products. The 2 most popular home bleaching systems are: 1) true teeth whitening systems that change the color of teeth (based on peroxide and photosensitive particles), 2) teeth lightening systems (based on peroxide and photosensitive particles). 2) systems that lighten teeth due to more intensive cleaning of the enamel surface (based on enzymes), 3. Real bleaching systems affect the enamel, reducing its resistance (by 3 times), approaching the threshold corresponding to the average resistance of the enamel, increasing permeability due to oxidation of the protein matrix and causing sensitivity. Cleansing toothpastes more actively remove surface pigments (plaque) due to the enzymatic effect, they lighten the teeth; 4. 4. The most effective (bleaching by 3 tones), but aggressive method is a system based on hydrogen peroxide (complaints of hypersensitivity, reduction of TER to 30%), and the safest (complaints of sensitivity, no change in TER) complaints, without changing TER) and at the same time a fairly effective method of home bleaching (two-tone bleaching), the results of which are comparable to the effects of using a system based on photosensitive microparticles, but this is an enzyme-based system and does not apply to true bleaching agents; 5. 5. Self-home bleaching is not recommended. Its choice and course of application should be carried out under the supervision of a specialist with dynamic monitoring of the resistance of the tooth enamel of a particular patient.

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