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Calcium and fluoride hygiene products in remineralization of teeth enamel of young and elderly people

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ABSTRACT

Background. Based on the composition of toothpaste, dentists and dental hygienists provide recommendations to patients on the choice of toothpaste, depending on the presence of dental pathology. At the same time, a comparative assessment of the use of calcium and fluoride toothpastes in adults, taking into account their age, has not yet been studied.

The purpose of this study is to investigate the effectiveness of tooth enamel remineralization in young and elderly patients using calcium and fluoride toothpaste.

Material and methods. The study involved 80 people, of which 40 were in the young age group (19–43 years old) and 40 were in the elderly age group (61–74 years old). Based on the purpose of the study, three research groups were formed. After the initial dental examination and professional oral hygiene, the subjects of the control group performed individual oral hygiene with their usual toothpastes. The second and third groups (young and elderly people) performed individual oral hygiene using a calcium-containing toothpaste with hydroxyapatite or a fluoride-containing toothpaste with a fluoride ion content of 1450 ppm. The functional resistance of tooth enamel was assessed twice: at the initial visit to the dentist and 45 days after the initial examination. The enamel resistance test (TER test) was used to determine the dynamics of tooth enamel resistance.

Results. It was found that patients of all groups had a high level of caries resistance during the clinical study. In young people, the effectiveness of using calcium-containing and fluoride-containing toothpaste in terms of remineralization was the same. For older people, regular use of fluoride-containing toothpaste for 45 days was 14.27% more effective than calcium-containing toothpaste.

Conclusion. The use of calcium and fluoride toothpastes by young people increases enamel mineralization by 17.54 and 15.49%, respectively, over a period of 45 days. In contrast, the use of calcium and fluoride toothpastes by older patients increases enamel mineralization by 7.24 and 21.52%, respectively, over the same period of time. For young people living in regions with low fluoride levels, it is advisable to use calcium-containing toothpastes daily. For older people, fluoride-containing toothpastes are recommended.

Keywords: young people, elderly people, teeth, tooth enamel, tooth enamel resistance, oral hygiene, toothpaste, Saint Petersburg

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Кальциевые и фтористые средства гигиены в реминерализации эмали зубов у молодых и пожилых людей

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РЕЗЮМЕ

Актуальность. Выбор зубной пасты обычно производится в зависимости от наличия или отсутствия стоматологической патологии. В то же время до сих пор не дана сравнительная оценка использования кальциевых и фтористых зубных паст у взрослых людей с учетом их возраста.

Цель исследования — изучить эффективность реминерализации эмали зубов у молодых и пожилых пациентов с применением кальциевой и фтористой зубных паст.

Материалы и методы. В исследовании приняло участие 80 людей: 40 молодых (19–43 года) и 40 человек пожилого возраста (61–74 года). Испытуемые контрольной группы после первичного стоматологического осмотра и профессиональной гигиены полости рта осуществляли индивидуальную гигиену с обычными для них зубными пастами. Вторая и третья группы (молодые и пожилые люди) проводили индивидуальную гигиену рта с помощью кальцийсодержащей зубной пасты с гидроксиапатитом или фтористой пасты с содержанием фторид-иона 1450 ppm. Оценку функциональной резистентности эмали зубов проводили дважды: при первичном обращении пациентов к стоматологу, а также через 45 суток от первичного осмотра. Для определения динамики резистентности эмали зубов применяли тест эмалевой резистентности (ТЭР-тест).

Результаты. У пациентов всех групп на протяжении клинического исследования отмечен высокий уровень кариесорезистентности. У молодых людей эффективность от применения в аспекте реминерализации кальцийсодержащей и фтористой зубных паст была одинакова. Для людей пожилого возраста регулярное применение фтористой зубной пасты на протяжении 45 суток было эффективнее кальцийсодержащей на 14,27%.

Выводы. Применение кальциевой и фтористой зубных паст молодыми людьми повышает минерализацию эмали за 45 суток соответственно на 17,54 и 15,49%, в то время как у пожилых пациентов кальциевые и фтористые зубные пасты повышают минерализацию эмали за аналогичный период времени соответственно на 7,24 и 21,52%. Для молодых людей, проживающих в регионах с пониженным содержанием фторид-иона, целесообразно ежедневно применять кальцийсодержащие зубные пасты, а людям пожилого возраста — фтористые зубные пасты.

Ключевые слова: молодые люди, пожилые люди, зубы, эмаль зуба, резистентность эмали зуба, гигиена полости рта, зубная паста, г. Санкт-Петербург

Как цитировать
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INTRODUCTION

Currently, a wide range of toothpastes is available for adults of all ages, differing in composition and various effects on the organs and tissues of the oral cavity [1, 2]. Based on toothpaste composition, dentists and dental hygienists provide patients with recommendations for selecting toothpaste depending on the presence of dental pathology: dental caries, inflammatory periodontal diseases, dentin hypersensitivity, dry mouth syndrome, etc. [3, 4]. Maintaining and increasing the functional resistance of dental enamel is important for adults of all ages [5–7]. At the same time, a comparative assessment of the effectiveness of calcium-containing and fluoride toothpastes in adults, taking age into account, has not yet been conducted.

AIM

The aim of this study was to evaluate the effectiveness of enamel remineralization in young and elderly patients depending on the use of calcium- or fluoride-containing toothpastes.

MATERIALS AND METHODS

The study involved 80 participants, of whom 40 belonged to the young age group (19–43 years) and 40 to the elderly age group (61–74 years). Three study groups were formed. The first (control) group was divided into two subgroups according to age. Subgroup 1A consisted of young individuals, and subgroup 1B consisted of elderly individuals. After an initial dental examination and professional oral hygiene procedures, these patients performed individual oral care using their usual toothpaste.

The second group consisted of young people. Half of this group (2A) was advised to perform individual oral hygiene using a calcium-containing toothpaste with hydroxyapatite, and the other half was advised to use a fluoride toothpaste with a fluoride ion content of 1450 ppm.

The third group consisted of elderly individuals. Half of these individuals (Group 3A), as in the second study group, were advised to perform individual oral hygiene with a calcium-containing toothpaste with hydroxyapatite, while the other half were advised to use a fluoride toothpaste containing 1450 ppm fluoride ions. The distribution of patients by gender within the groups is shown in Figure 1.

The groups included only patients with satisfactory oral hygiene, at least 20 natural teeth in both jaws that were not covered by artificial crowns, and compensated dental caries (DMFT index (Decayed, Missing, and Filled Teeth) did not exceed 5). All patients included in the study were born in St. Petersburg, reside there, and used tap water for drinking. All patients underwent professional oral hygiene before the start of the study. Patients in the second and third study groups were recommended exclusively domestic calcium-containing and fluoride toothpastes, respectively. The functional resistance of tooth enamel was assessed twice: at the initial visit and again 45 days after the initial examination. The TER test was used to evaluate changes in tooth enamel resistance over time [8].

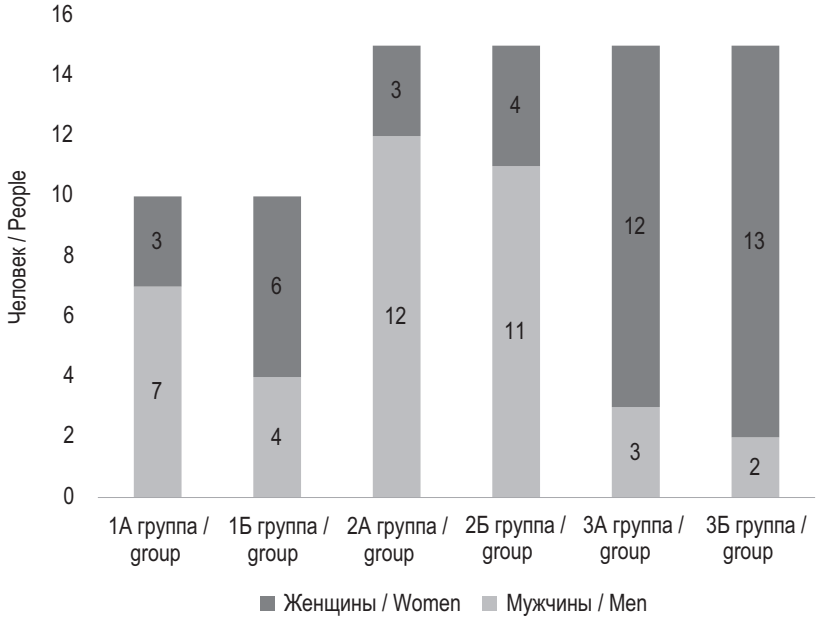

Fig. 1. Distribution of patients in the study groups by age, sex and toothpaste type

Рис. 1. Распределение пациентов в группах исследования с учетом возраста, пола и типа пасты

The study fully complied with the ethical standards of the Committee on Human Experimentation, the 1975 Helsinki Declaration and its 2000 revision.

Statistical analysis was performed using the standard software package STATISTICA for Windows, version 7.0. The significance level for testing the null hypothesis (absence of significant differences or factor effects) was set at $p<0.05$.

RESULTS AND DISCUSSION

Evaluation of tooth enamel resistance in the control group showed that, at the baseline, the functional enamel resistance in young and elderly people was 2.09±0.19 and 2.20±0.18 conventional units ($p \leq 0.05$), respectively. After 45 days, there were no statistically significant differences in the enamel resistance indicators. In young and elderly people, the functional enamel resistance was 2.10±0.17 and 2.19±0.19 conventional units ($p \leq 0.05$), respectively. Throughout the study, all patients in the control group demonstrated a high level of caries resistance (Fig. 2).

At the beginning of the study, the assessment of tooth enamel resistance in patients of the second group showed that, in young people, the functional enamel resistance was 2.11±0.18 conventional units in subgroup 2A and 2.13±0.19 conventional units in subgroup 2B ($p \leq 0.05$). After 45 days, statistically significant changes in the enamel resistance indices were observed in both subgroups 2A and 2B. Thus, in young people of subgroup 2A, the TER test value was 1.74±0.18 conventional units, and in patients of group 2B it was 1.82±0.19 conventional units. This indicates a positive trend in the degree of tooth enamel mineralization ($p \leq 0.05$).

In elderly patients of the third group, the indices of functional resistance of enamel were 2.21±0.19 in subgroup 3A and 2.23±0.17 conventional units in subgroup 3B ($p \leq 0.05$), respectively. After 45 days, a significant positive improvement in functional enamel resistance was registered only in subgroup 2B, where elderly patients used fluoride toothpaste; the index was 1.75±0.17 ($p \leq 0.05$). In elderly patients of subgroup 3A, who used calcium-containing toothpaste, a positive trend in enamel mineralization was also noted, since at the end of the study, their TER test index was 2.05±0.18 (Fig. 2). It should be noted that patients in the second and third study groups, as well as those in the first group, demonstrated a high level of caries resistance throughout the study, regardless of age.

The data obtained indicate that young and elderly individuals with satisfactory oral hygiene demonstrated high levels of caries resistance despite low fluoride concentrations in drinking water. In young adults, regular use of hydroxyapatite and fluoride toothpastes resulted in improved enamel mineralization. No significant differences were found in the final TER test results, demonstrating the effectiveness of both calcium-containing and fluoride toothpastes used for daily oral hygiene. For elderly patients, fluoride toothpaste was more effective in terms of tooth enamel mineralization: it remineralized enamel 14.27% better (with an observed increase in enamel mineralization of 21.52%) than calcium-containing toothpaste, which resulted in an increase in enamel mineralization of 7.24%.

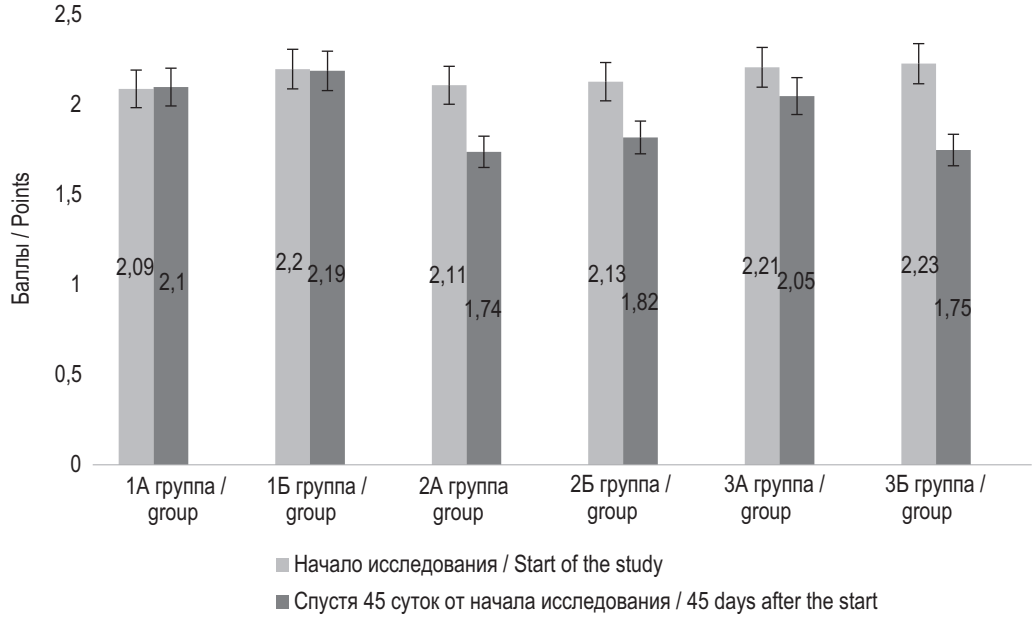

Fig. 2. Characteristics of the functional resistance of tooth enamel in patients during the study, points

Рис. 2. Характеристика функциональной резистентности эмали зубов у пациентов в ходе проведенного исследования, баллы

CONCLUSION

1. In young adults, the use of calcium-containing and fluoride toothpastes increased enamel mineralization by 17.54% and 15.49%, respectively, over 45 days, while in older adults, calcium-containing and fluoride toothpastes increased enamel mineralization by 7.24% and 21.52%, respectively, over the same period.

2. For young adults living in regions with low fluoride levels in drinking water, daily use of calcium-containing toothpastes is recommended, while fluoride toothpaste is recommended for older adults. This approach may improve the caries resistance of natural teeth and optimize dental health of adults of all ages.

ADDITIONAL INFORMATION

Author contribution. All authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

Competing interests. The authors declare that they have no competing interests.

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Consent for publication. Written consent was obtained from the patient for publication of relevant medical information within the manuscript.

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Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

Информированное согласие на публикацию. Авторы получили письменное согласие пациентов на публикацию медицинских данных.

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