USE OF THE REMINERALIZING GEL ROCS MEDICAL MINERALS IN DENTAL PRACTICE

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Prevention and treatment of caries and non-caries lesions by means of remineralization has been studied for many decades and has a good scientific basis. The theoretical ground for remineralization as a measure of caries prevention and treatment is based on the retention of protein matrix in dental enamel at early stage of caries (white spot) and on the possibility of its remineralization.

Taking into consideration the constant growth of caries intensity as well as growing prevalence of multiple non-caries diseases (more then 80%) and hypersensitivity, the remineralizing therapy in dental practice is of current importance.

The process of dental enamel remineralization consists of its saturation by mineral components, leading to restoration of the structure. The crystallization of hydroxyapatite takes place on the organic matrix of collagen. Active groups of this protein improve the creation of well-organized crystallization centers by means of interaction with calcium and phosphorus ions.

It’s possible to influence the process of remineralization by different means: improving oral hygiene, regular using sugar-free gum, performing fluorotherapy.

The main structural elements of teeth are calcium and phosphate, which constitute about 57.56% of mineral mass of intact enamel. Although fluoride is capable to decrease the solubility of enamel, it could hardly be considered as a structural element, because it’s content in intact enamel is about 0.15%.

In patients with early stage of fluorosis the increase of fluoride up to 0.18% is noticed. The fluoride influences process of formation of acid-resistant forms of apatite. This is the reason why remineralizing treatment is performed using formulas with calcium and phosphorus. For example, there is some evidence, that dentifrices containing calcium, phosphorus, and fluoride as soluble salts (double tube technology) have faster and better remineralizing effect, if compared with conventional fluoride toothpastes. To increase the efficacy, the remineralization therapy can be combined with products containing fluoride. There exist different regimens of their administration, but in most cases the fluoride is recommended after the course of remineralizing therapy, to prevent flow of calcium from dental enamel.

There are several conditions for effective remineralization, in particular the following: remineralizing agents should retain in oral cavity for a long time and be in contact with dental enamel. They should contain mineral substances in the form of ions or produce calcium and phosphorus ions in oral cavity.

It is well-known that some enzymes can support the remineralizing process: the insertion of phosphate and calcium ions into the enamel improves under the influence of phosphatases. Activity of these metalloenzymes is higher in the presence of chloride and magnesium ions.

Calcium glycerophosphate is the substrate for alkaline and acidic phosphatases. During its enzymatic hydrolyze the release of calcium and phosphate takes place; at the same time, some amount of energy is produced. This energy is thought to help to deliver ions into enamel. The studies conducted in CSID (Central Scientific Institute of Dentistry), using fixed alkaline phosphatase, have shown that in the presence of calcium glycerophosphate the remineralization is the most effective. This may be due to higher acceleration of formation under the influence of fixed alkaline phosphatase of apatite, in comparison with brushite or vitlokite*.

This work was aimed to study the remineralizing effect of the toothpaste ROCS Medical Minerals in patients with early stages of caries (white spot) and non-caries lesions, particularly hypoplasia of enamel and hypersensitivity.

The dentifrice gel ROCS Medical Minerals contains calcium glycerophosphate, magnesium chloride and xylitol. Due to special components, this gel has adhesive properties and retain well on dental surfaces.

* Brushite – CaHPO_4·H_2O – the secondary salt of phosphoric acid. The crystals are wedge-shaped. If pH is lower than 6, its solubility increases strongly. It is rare found in human body; is found in dentine and dental calculus.

Vitlokite – bCa(HPO_4) – the form of dehydrated phosphate, tricalcium phosphate. The crystals are rhomboid. It is found in dental calculus and in areas of caries; rare in human body.

Apatites – Ca_{3-x} [(PO_4)]_{2-x}·2x, where X can be OH, F, Cl, Br etc. Hydroxyapatities are prevalent in fauna. They constitute the basic form of phosphate of bones and teeth.
This leads to prolonged action of the formula, because there are appropriate conditions for step-by-step moving of mineral compounds into hard tissues.

**Materials and methods**

This is one-month clinical study. Participants were aged 10 – 30 years, without significant medical conditions. Each patient received 15 applications of the gel. The examination of oral cavity was conducted in accordance with the standard scheme, with completion of the individual chart. Diagnosis was made on the base of clinical and complementary assessment procedures.

Total 57 subjects were divided to 4 groups depending on the diagnosis. All the subjects had indications to remineralizing therapy. The dentifrice gel ROCS Medical Minerals was used as remineralizing agent.

- The 1st group consisted of 15 patients with early stage of caries (white spot).
- The 2nd group was made up by 19 patients with systemic hypoplasia (spotted form).
- The 3rd group consisted of 10 young subjects with significant hypersensitivity without any visible lesions (the functional insufficiency of enamel, according to IG Lukomsky).
- The 4th group consisted of 13 subjects with hypersensitivity resulted from wedge-shaped lesions, abrasion, erosions of enamel.

Before the beginning of the study each subject received professional prophylactic hygienic procedures and was trained in domestic hygiene. The baseline indexes of demineralization were calculated; the thermal sensitivity tests were performed using cold and hot water.

The indexes of demineralization were calculated after the 7th and 15th applications.

To assess the intensity of demineralization in patients with caries, white spots were dyed with methylene blue and measured by 10-point scale Aksamit.

To examine the spotted form of systemic hypoplasia, the index of remineralization (UA Fedorov) was used. Teeth were dyed by 5% solution of iodine in ethanol. The intensity was assessed in accordance with the following scale:

<table>
<thead>
<tr>
<th>Step</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 step</td>
<td>no staining</td>
</tr>
<tr>
<td>2 step</td>
<td>yellow</td>
</tr>
<tr>
<td>3 step</td>
<td>light brown</td>
</tr>
<tr>
<td>4 step</td>
<td>dark brown</td>
</tr>
</tbody>
</table>

On all visits the application of ROCS Medical Minerals was performed only after controlled toothbrushing.

Although the gel can be used at home, the applications were conducted in dental clinic, under the control of qualified staff, to avoid data errors (in case of patient’s violation from recommended regimen) and to standardize the conditions of experiment. The applications were performed using custom trays. Duration of each application was 15 minutes; at the end of this time patients just spitted out the remnants of the gel, without the irrigation of the mouth. The subjects were recommended to refuse from eating and drinking during one hour (in accordance with manufacturer’s recommendations).

**Results and discussion**

The significant clinical results were obtained in all monitored groups. The remineralizing effect was noticed in patients with caries as well as with non-caries lesions.

**Early stage of caries (white spot)**

At the baseline, white spots obtained dark-blue color during staining (7.3 steps). After the 7th procedure white spots were still present but they didn’t stained by methylene blue. After the 15th procedure of remineralizing therapy using ROCS Medical Minerals, white spots disappeared in 80% cases (figure 1).

![Figure 1](image_url)  
**Figure 1.** Dynamics of remineralization during the use of ROCS Medical Minerals in patients with early caries (staining with methylene blue)

**Spotted form of systemic hypoplasia**

At the baseline, the average index of remineralization (IR) of hypoplastic spots was 3.2 steps. After the 7th procedure the IR decreased to 2.1 steps. After the 15th application the average IR reached 1 steps (figure 2).
The revealed dynamics of the index shows high remineralizing potential of the used gel. It is known, that for the complete disappearance of hypoplastic spots the long course of remineralizing therapy is needed (more then 6 months). The patients interested in continuation of treatment were recommended to conduct applications at home. The hypoplasia of enamel is malformation based on the metabolic imbalance in developing teeth. This is the result of derangements in two related processes: secretion of organic matrix by enameloblasts and weakened process of mineralization of enamel prisms. The investigator LI Georvieva showed the evidence of decreased content of calcium and phosphate in the superficial layer of enamel in cases of spotted hypoplasia. The risk of caries in the presence of hypoplasia is significantly higher. So, the remineralizing therapy in patients with this form of non-caries lesion can be considered as prophylaxis of caries.

Symptoms of hypersensitivity

After the 2nd procedure 82% of subjects noticed the decrease of painful reaction to stimuli. In the 4th group of patients (hypersensitivity related to wedge-shaped lesions, abrasion and erosions) the fast decrease of painful reaction was noticed by 93% of subjects. This result is comparable with the efficacy of electrophoresis with calcium glycerophosphate.

The duration of the course of remineralizing therapy depends on the clinical manifestation of disease. In patients with caries (white spot stage) treatment can last several weeks. In patients with spotted forms of non-caries lesions treatment can last up to several months, and if lesions are connected with systemic diseases or conditions, the courses of remineralizing therapy can be conducted several times a year. Some of the patients continued their treatment, and the final results for each patient are not reflected in this work. We aimed to formally assess the efficacy of new commercially available formula.

After 8-10 applications of ROCS Medical Minerals all subjects noticed teeth whitening and appearance improvement, brilliance enhancement. Before the study patients were not told about the possibility of such changes. Moreover, having wide experience in remineralizing therapy, we never noticed such results. Also, we did not meet such data in literature related to other formulas. The found phenomenon should be paid particular attention, because it makes remineralizing procedures more appealing for our patients. The visible improvement of teeth color was noticed in all age groups. It is important to remind that, in accordance with Russian law, bleaching procedures cannot be performed for children under the age of 18, even if parents’ consent was obtained. In dental practice, we often face teenagers’ requests for bleaching. The defined phenomenon may help us to solve problems of this group of patients.

Conclusions

1. Topical use of ROCS Medical Minerals resulted in remineralizing effect in patients with early stages of caries as well as with non-caries lesions.
2. White spots (early stage of caries) completely disappeared in 80% cases after 15 applications of the dentifrice.
3. 15 procedures of remineralizing therapy with ROCS Medical Minerals are enough for mineralizing of white hypoplastic spots.
4. Most patients with hypersensitivity (82% and 93% in two groups) noticed significant reduction of painful reactions after two 15-minutes applications.
5. All subjects noticed significant improvement of teeth appearance: whitening and brilliance enhancement.

References

1. Боровский Е.В., Леонтьев В.К. / Биология полости рта. М: Медицинская книга, Издательство НГМА, 2001
2. Федоров Ю.А., В.А.Дрожжина, Клиника, диагностика и лечение некариозных поражений зубов // Новое в стоматологии, 10/ 97 (60)
3. Федоров Ю.А.c соавт. Диспансеризация больных с множественным карисом зубов, Санкт-Петербург 1988
4. Федоров Ю.А. Гигиена полости рта для всех. /Поли Медиа Пресс/, Санкт-Петербург, 2003
5. Соловьева А.М., Матело С.К., Купец Т.В., Лечебно-профилактические аспекты употребления жевательной резинки./ Учебно-методическое пособие, 2003
10. Буланова Е.Л., Сунцов В.Г. Сочетанное воздействие фторидов и кальцийфосфатсодержащих препаратов на течение кариозного процесса.// Карие зубов и его осложнения. Материалы юбилейной конференции. Омск, 1995, стр. 6-8
11. Бочарева О. И. Стоматологический статус и изменение активности щелочной фосфатазы в слюне при язвенной болезни желудка и двенадцатиперстной кишки. // Стоматологический Вестник №10, 2003
12. Житков М.Ю. Влияние иммобилизованной щелочной фосфатазы слюны на процессы реминерализации. // Стоматология, №5, 1999: 12-15