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## New ways of combating demineralization: link between classic and allopathic medicine

Laura Idorași, Sandra Andreea Secoșan, Alexandru Ogodescu, Cosmin Sinescu, Cristian Zaharia, et al.

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# New ways of combating demineralization - link between classic and allopathic medicine

Authors: Laura Idorași<sup>1</sup>, Sandra Andreea Secoșan<sup>1</sup>, Alexandru Ogodescu<sup>1</sup>, Cosmin Sinescu<sup>1</sup>, Cristian Zaharia<sup>1</sup>, Adrian Tudor Stan<sup>1</sup>, Adrian G. Podoleanu<sup>2</sup>, Meda- Lavinia Negruțiu<sup>1</sup>

1. Victor Babeș University of Medicine and Pharmacy Timisoara, Faculty of Dentistry

Address: Bd. Revoluției din 1989, nr.9, 300070, Timișoara

2. University of Kent, Canterbury, United Kingdom

Corresponding author: Laura Idorași, laura.idorasi@yahoo.com

## ABSTRACT

Prevention and allopathic medicine gained attention, since it is possible for dentists to prevent demineralization, using plants and natural substances with well-known efficacy.

The purpose of this study was to present new methods for teeth remineralisation.

A selection of 10 extracted teeth was made, maintained in physiological serum, with no color fading, decay or demineralization.

Demineralisation was induced, with ortho-phosphoric acid (concentration 45 %), for one minute. The probes were visually and with optical coherence tomography (OCT) inspected.

The natural product and the bonding with additional nanoparticles of Silver were created and applied on the demineralization zone of the both groups of teeth. Each tooth in the first group had one plain surface demineralised. The second group of teeth had a cavity prepared on one of each tooth's side. The pastes were applied on the demineralised surfaces and in the demineralised cavities for two minutes. After time expired, the pasta applied on the first group of teeth was washed away; the bonding above the second group of teeth was light cured. The probes were again visually and with OCT inspected.

An improvement was observed, in remineralising the white marks on plain surfaces and in the created cavities, the OCT being able to detect different levels of remineralisation.

The efficacy of natural pasta depends on the time it is applied and the concentration of the different main substances. Also, the type of surface, plain or occlusal facets, may influence the substances' penetration ability- influencing the absorption and the scattering of the substances.

The non-invasive specific feature of these products, low costs and safety are strong positive aspects of this method of remineralisation. However, the natural process of remineralisation is a long-lasting one; perfecting the main substances in order to accelerate the process, in addition to several in vivo studies would be necessary to be fulfilled.

**Keywords:** enamel demineralization, optical coherence tomography (OCT), remineralisation methods, natural products

## 1. INTRODUCTION

Prevention and allopathic medicine gain more and more attention, since it is possible for us to easily prevent a strong demineralization, using plants and natural substances with well-known efficacy. Several studies demonstrate that Xylitol, or coconut oil may have an antimicrobial, antioxidant effect on Streptococcus colonies and on dental plaque [1, 2]. On the other side, silver and titanium particles were intensely studied, by incorporating them into dental composites and proved anti-inflammatory effects [3]. Teeth demineralization is influenced by a sum of different factors such as diet, bacteria colonization and limited usage of protective and antimicrobial agents.

The purpose of this study was to present new methods for teeth remineralisation. Nowadays, in order to remineralise the enamel, there are used several products, such as ICON (Infiltration concept- DMG America) or products containing fluorine [4,5,6].

## 2. MATERIALS AND METHODS

A number of 5 extracted teeth were selected, being maintained in physiological serum, since they were extracted, with no color fading, no decay or demineralization zone.

Demineralisation was induced on their vestibular surface, with orthophosphoric acid (concentration 45 %), for one minute (figure 1).



Figure 1. Teeth demineralization [7]

Before remineralisation, the probes were visually and with OCT inspected. It is well known that OCT device is able to detect microleakages between dental prostheses or dental restorative materials and the natural dental structures, being able to detect dental caries, even if they are localized under dental sealants, as well as dental remineralisation [5,8,9,10, 11]

Natural products were created and directly applied above the demineralization zone, *in vitro*.

Each tooth benefited from the same natural pasta, which consists of liquid calcium, coconut oil, Xylitol, baking powder, cinnamon, clay, Magnesium, mint oil, lemon and tea tree oil, as shown in figure 2. The pastes were applied directly on the demineralised surfaces, brushing it with a tooth brush, for two minutes (figure 3).

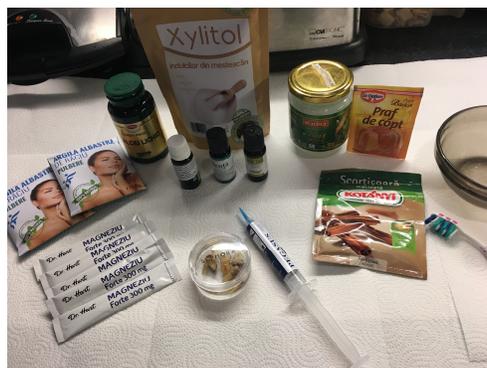


Figure 2. The ingredients used for the natural paste



Figure 3. Applying the natural product above the demineralization zone [7]

For the second group of teeth, a number of 5 teeth were selected, without any white marks or caries on their surfaces. A square cavity on one side, of each tooth, was prepared with a carbide bur no. 245, penetrating at a depth of 1.5 mm. Each square was highlighted with water-resistant marker and demineralised with orthophosphoric acid (concentration 45 %), for one minute (figure 4).



Figure 4. Cavity preparation and demineralization

A pasta made of 5 drops of Evetric bonding (Ivoclar Vivadent) combined with 4 scoops of silver powder, was applied after washing away the acid and cured for 30 seconds (figure 5, 6).



Figure 5. The pasta applied above the tooth



Figure 6. Light-curing the pasta for 30 seconds

After time expired, the natural pasta was washed away and the probes in the first group were again visually and with OCT inspected, using the *en face* Time Domain OCT device at the Department of Prostheses Technology and Dental Materials, Faculty of Dentistry, Victor Babeş University of Medicine and Pharmacy Timișoara, Romania (figure 4).

The probes from the second group were inspected in the same ways, without washing away the silver-bonding light-cured pasta. The calibration of the device was done in the following way: Time Domain OCT, with SLD emitting at 1300 nm, with a spectral bandwidth of 65 nm, C scans at 18 degree angle. In order not to influence, in any way, the images, each tooth was placed in a special stand, made of silicone. The device performed series of slices, at different levels, the captured images being analysed with the ImageJ software.



Figure 7. The OCT device and one of the silicone stands

### 3. RESULTS

In this study, an improvement in remineralising the white marks, on teeth plain surfaces, with the natural pasta, was observed (figures 5, 6). The OCT device was able to detect the different levels of remineralisation, in all the studied cases. The demineralised zones can be observed as spots with reduced refraction index on the OCT images; after remineralising them, the surfaces appeared to be more compact (figure 7).

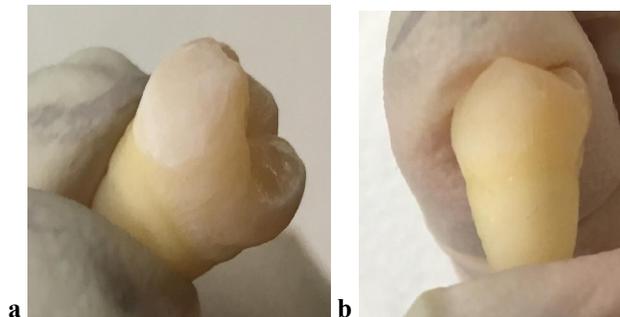


Figure 8. a. Demineralised zone, before applying the product [7]; b. The same zone, after applying the product [7]



Figure 9. a. Demineralised zone, before applying the product [7]; b. The same zone, after applying the product [7]

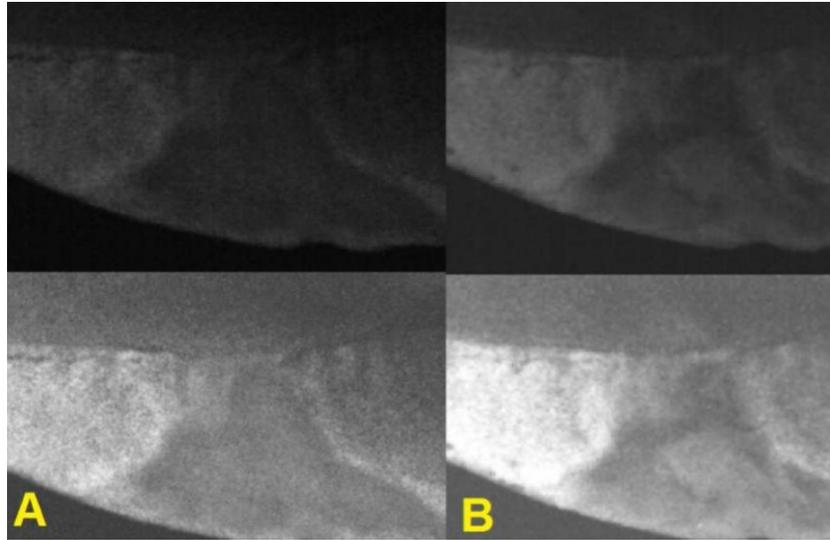


Figure 10. OCT images before (A) and after (B) remineralisation

#### 4. DISCUSSION

The efficacy of the natural pasta depends on the time it is applied on the surfaces and on the concentration of the different main substances. The efficacy of the silver-bonding pasta depends on the capacity of silver nanoparticles to penetrate the dentinal tubules and their continuous releasing of silver antimicrobial properties, in time. Also, the type of surface, plain or occlusal facets may influence the substances' penetration ability, influencing its absorption and scattering.

#### 5. CONCLUSION

The non-invasive specific feature of these products, low costs and safety above the environment are strong positive aspects of this method of remineralising dental white marks. However, the natural process of remineralisation is a long-term one and perfecting the main substances in order to accelerate the process, in addition to several in vivo studies would be necessary to be fulfilled.

On the other side, if the tooth's demineralization is deeper, it is important for us to know if we can stop caries evolution following less invasive protocols, such as an improved bonding placed under the composite restoration, in small cavities.

The OCT noninvasive investigation method proved to be efficient in detecting the different levels of demineralization and remineralisation of the enamel, in all the studied cases.

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*The authors declare that, in this study, was no conflict of interests.*

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