Protection of Demineralized Enamel Surfaces in Temporary Teeth Using Fluorinated Varnishes

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Temporary teeth are often neglected because uninformed patients consider them less important since they are to be replaced anyway. That is the reason why dental enamel with its high mineral content, is susceptible for the demineralization process. Extracting temporary teeth before the normal replacement period is allowed only in certain situations when the normal development of permanent teeth is affected. Tooth remineralization may be performed in the dental practice using desensitizing gel or varnish applications. The aim of this paper was to prove the effectiveness of fluorination and desensitization products on temporary teeth. We used 30 temporary teeth extracted at the time of complete root lysis. Teeth were randomly classified into 3 groups of 10 and for each group a desensitizing fluorinated substance was chosen (Profluorid Varnish, Bifluorid 10 and FluoroDose). In order to assess results we performed SEM analysis. Varnishes are clinically proven to provide at least 25% caries prevention in moderate to high risk children, adolescents and adults when applied between 2 and 4 times annually. In the case of Bifluorid 10 which also contains CaF₂, a more pronounced amorphic 5 µ layer may be observed on the enamel surface. A thicker layer does not represent a therapeutic benefit as fissures lead to an easier elimination from the treated surface thus failing to offer the required protection.

Keywords: enamel, fluorination, remineralization, varnish, SEM

Experimental part

Material and method
This study examined the in vitro effect of fluoride containing substances on artificially demineralized dental enamel. For this, we used 30 temporary teeth extracted at the time of complete root lysis. Teeth were randomly classified into 3 groups of 10 and for each group a desensitizing fluorinated substance was chosen. Informed consent for using extracted teeth for research purposes was obtained from parents or legal guardians of patients. Each teeth group was treated with one of the following desensitizing substances: Profluorid Varnish (Voco), Bifluorid 10 (Voco) and FluoroDose.

All the 3 varnishes are available as monocomponents which offers a major advantage over bicomponent systems. Mixing bicomponent systems frequently leads to errors. Errors have negative effects on the physical pressure, brushing may become painful, and the patient is tempted to perform a superficial brushing. Dental caries is regarded as a dynamic process occurring at the bacterial plaque-tooth interface. The transformation of an initially non-cavitory, reversible carious lesion into a cavity is the consequence of a disrupted balance between permanent demineralization and remineralization processes. In the case of temporary teeth, pain causes discomfort in these small patients, as well as loss of appetite, apathy, rejection of dental brushing which leads to aggravation. This is why effective measures must be put in place to reduce these inconveniences. Tooth remineralization may be performed in the dental practice using desensitizing gel or varnish applications or at home, through a rigorous dental hygiene and the use of fluorinated toothpastes or special gels. The aim of this paper was to prove the effectiveness of fluorination and desensitization products on temporary teeth.

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REV.CHIM.(Bucharest) • 67 • No. 4 • 2016 http://www.revistadechimie.ro 757
proprieties of the material and influence clinical success. Very many desensitizing materials contain liquids which must be mixed before application leading to the following potential problems: use of too small or too large liquid quantities, air bubbles, temperature variations, and many other factors. Another important issue for systems based upon organic solvents are volatilization related incidents. Instead of water, many materials contain solvents such as ethanol, acetone or ethylene acetate. These substances are highly volatile. Monocomponent products also avoid mistakes during mixing unequal quantities as they are available as single dose blisters. Also, monocomponent systems prevent cross contamination.

Another major advantage consists in the lack of additional working stages which is essential in the case of children who are easily bored during treatment and cease to collaborate adequately with the dentist.

The 3 chosen varnishes adhere to moist dental surfaces and are saliva tolerant. This quality is also important as children often present oral breathing and demineralized surfaces are moisturized.

Dental varnishes are generally comprised of natural gum resin, sodium fluoride, various solvents, flavor additives, sweetener and pigments. The fluorination agent contained in desensitizing varnishes is generally formed of: sodium fluoride (NaF), calcium fluoride (CaF₂), stannous fluoride(SnF₄), sodium monofluorophosphate(Na₂FPO₃), zinc hexafluosilicat (ZnSiF₆) and sodium hexafluosilicat (Na₅SiF₆).

Group 1 was treated with PROFLUORID VARNISH VOCO single dose.

PROFLUORID VARNISH VOCO is a transparent desensitizing varnish containing 5% sodium fluoride (NaF) which is rapidly released and it is used for applications on demineralized enamel and exposed dentine. It adheres to moist dental surfaces and it is moisture and saliva tolerant. The substance is recommended for both temporary and permanent teeth. It is used to treat hypersensitive teeth and for sealing dentinal tubules. [5] NaF varnish was first introduced in the United States in 1964. [6] The first generation available was a yellow colored resin considered the standard of care for 25 years. [7]

Group 2 was treated with BIFLUORID 10 single dose.

BIFLUORID 10 single dose is a rapidly desicating dental suspension which adheres very well to tooth enamel and dentin. It seals the exposed prisms and dentinal tubules for a long period of time. It forms a water resistant layer protecting the tooth against chemical and thermal stimuli. It is applied in thin layers, left to dry for 10-20 s. It contains sodium and calcium fluoride. NaF, CaF₂, Are recommended for tooth whitening in order to avoid the unpleasant effects of further sensitization but also in the case of dental preparation for prosthetic purposes. Applied after polishing, immediately protects the tooth and replaces the natural compounds on its surface. It has a high fluoride release for effective fluoridation, ph-neutral and remains on the tooth surface for a long period of time. [8]

Group 3 was treated with FluoroDose.

FluoroDose contains 5% NaF, and it is used for treating dentinal hypersensitivity but may be considered effective in preventing dental caries as well (ADA). This type of varnish is easily and rapidly applicable offering the patient the maximum FDA approved dosage. Even though a professional brushing is not necessarily required before its application, it is recommended that teeth to be cleaned at least by tooth brush. It persists on the dental surface at least 6-8 h for an optimal fluoride absorption, it does not require tooth isolation and the patient may leave immediately after application. [9]

The stages were as follows:
- Teeth cleansing with dental brush under continuous water flow followed by teeth drying.
- Acid etching for 60 s with 37% phosphoric acid 3M ESPE.
- Washing under water flow for 20 s followed by drying under water/air flow.
- Checking for demineralization shown by white spot lesions.
- Teeth sectioning with diamond disc adapted to contra angle handpiece with internal water cooling system.
- Treatment of one half of each tooth with desensitizing substance.
- Comparative SEM analysis of samples.

Half of each sectioned tooth was used as control while the other half was treated with the desensitizing substance. In order to assess results we performed SEM analysis for all samples, comparing the treated and untreated halves.

Results and discussions

When 37% phosphoric acid was used for 60 s, we observed a pronounced demineralization of the enamel surface, with generalized pattern of inter-prismatic dissolution. [10] (fig.1, 3, 5). This aspect was obtained in all demineralized samples. The results obtained after treating demineralized surfaces with the 3 varnish variants are shown in the following figures:
Conclusions

Following SEM analysis, we observed that by using all the 3 selected substances, acid etched enamel prisms were covered by a protective pellicle. This pellicle ensures the isolation of the demineralised enamel from the oral environment and prevents the sensitivity at thermal or mechanical stimuli and also prevents the occurrence of early carious lesions by the remineralisation due to fluoride release.

Topical fluoride applications are very important for both permanent and temporary teeth. There are numerous studies demonstrating that fluoride varnishes are highly effective in preventing carious lesions and, in fact, topical fluoride application together with general fluoride administration is included among the 4 caries prevention measures as established by the WHO. [11] Varnishes are clinically proven to provide at least 25% caries prevention in moderate to high risk children, adolescents and adults when applied between 2 and 4 times annually [7]. In the case of Bifluorid 10 which also contains CaF₂ together with NaF, a more pronounced amorphic 5µ layer may be observed on the enamel surface.

A thicker layer does not represent a therapeutic benefit as fissures lead to an easier elimination from the treated surface thus failing to offer the required protection.

References

4. HIGHAM, S. Caries Process and Prevention Strategies: Demineralization / Remineralization. Continuing Education Units. Dentalcare.com
7. PACE BRINKER, S., Indication of in-Office Topical Fluoride Varnish, Foam and Gels, CPS Magazine

Manuscript received:19.10.2015