

Research Article

Analysis of Therapeutic Efficacy of Clinically Applied Varnish

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Abstract

Purpose: Our study aims to evaluate and analyze the effect of a mineralizing varnish on the progression of the initial caries of the enamel in the primary dentition.

Materials and methods: Subject of observation - there are 200 children from the city of Varna, aged 3 to 6 years, distributed equally in standardized age groups, with the same number of boys and girls. Dental caries diagnosed with d1 and d2. *Units of observation:* Children with high caries risk of development: A group of 100 children treated with mineralizing varnish CV; Control group of 100 children. Carious teeth with threshold d1, d2 lesions. Carious surfaces with d1, d2 lesions. After processing the results and determining the highlights, the actual study was performed by processing the data with a mathematical-statistical processing package SPSS v 20.0.

Results: The results of the comparative analysis of the therapeutic efficacy of the mineralizing varnish used-Clinpro White Varnish showed a significant difference in the percentage of effectiveness ($t= -3.68$, $p<0.001$). Clinpro White Varnish showed better results after the application (64.58%).

Conclusion: The use of these medications may be beneficial for patients with dental caries of primary teeth from 3 to 6 years of age.

Keywords: Primary teeth; Mineralizing Varnish; High risk of caries development; Initial Caries

1. Introduction

Evidence for the onset of the caries lesion can be found in the form of various changes in the optical properties of the affected tooth structure. Karlson L, et al. [1] reports that methods for detecting caries changes in specialized optical devices are called optically based methods. The evidence for the effectiveness of fluoride varnish in

temporary dentition is incomplete and unconfirmed but is successful if the recommendations for excellent oral hygiene from the following morning after clinical application with varnish and low carbohydrate diet without intermediate meals are observed [2, 3].

Petersson et al. [4] in a study found that the caries reduction from varnish application was 30% (0 to 69%). Authors found that caries reduction was 33% for temporary teeth and 46% for permanent teeth. There are two main theories related to the DIAGNOcam operating mechanism. According to the first, when infrared light reaches porosity in the dental structures, due to demineralization, fluorescence light of different wavelengths is stimulated. For DIAGNOdent pen, values increase after demineralisation of enamel from caries development. The longer the demineralisation period, the greater the increase. These data are consistent with the data obtained from the studies of authors, who report in their research that continuous drying induces an increase in measured laser fluorescence results.

It should be noted that while studies agree that DIAGNOdent can be used as a means of measuring demineralization, the data on its use as a means of measuring remineralization are contradictory. Some authors say this is useful, others like Mendes FM [5] - no. This may be due to the use of various remineralizing means, the maintenance, the type and the conditions of the conducted research.

2. Objective

Our study aims to evaluate and analyze the effect of a mineralizing varnish on the progression of the initial caries of the enamel in the temporary dentition.

3. Materials and Methods

Two hundred children from 3 to 6 years of age are attending clinical practice at UMDC - Varna were included in two groups using Clinpro White Varnish (CV) mineralization fluoride varnish and a control group. The final selection of the treated children was carried out, with children with a high risk of developing caries being selected from the 300 examined children.

3.1 Subject of observation

There are 200 children from the city of Varna, aged 3 to 6 years, distributed equally in standardized age groups, with the same number of boys and girls. Total number of carious lesions treated - 80 (reversible), on teeth and surfaces. Number of treated teeth surfaces with Clinpro White Varnish - 40. Number of tooth surfaces treated with Tooth Mousse - 40.

3.2 Criteria for inclusion of children

Clinically healthy, without general and systemic diseases, without gingival and stomatitis diseases; accompanied by parents who regularly visit our ambulatory office. The patients were divided into two groups of 100 children. The first group is treated by us, to which we apply Clinpro™ White Varnish with TCP (Tri-Calcium phosphate) (CV).

4. Materials

3M ESRE Clinpro TM White Varnish is a fluoride-based varnish designed to be applied on enamel to prevent and treat early lesions. Absorption of fluoride from varnish CV is high $696 \pm 82 \mu\text{g F} / \text{cm}^3$. The release of fluoride from varnish CV is long $50 \mu\text{g} / \text{sm}^2$ and lasts for 25 hours. Clinpro is resistant to moisture and saliva. It spreads over wet teeth and sticks to them. It is recommended as an additional precaution to reduce the demineralisation of enamel in children with a high risk of caries every 3 months. The fluorinated varnish is applied to the reversible lesions. Its effect depends on the type of CV agent, the mode and duration of application / time period and the number of applications (4 times for one year with 3 minutes application) and the risk profile of the patient.

To compare the effectiveness of the CV varnish, we investigated the effectiveness of both varnish and Tooth Mousse paste. Applications were performed on smooth surfaces and surfaces with lesions d1 and d2. The children in the group are treated with the mineralization fluoride varnish by the application. Replications are every 3 months, with a total duration of one year. We both standardized the two groups before the survey. Subgroups of all children aged 3 to 5 years wash their teeth with toothpaste containing 500 ppm F and "pea". Subgroups of children aged 6 years use a toothpaste containing 1000 ppm F and "pea". All children adhere to dental hygiene twice a day - morning and evening. Children have three main meals during the day and two intermediate meals with breakfast and fruit. Parents and children have received instructions from us to observe hygiene twice a day - in the morning and in the evening to wash their teeth and maintain dietary dieting without intermediate carbohydrate meals.

The reading of the lesion values of the initial caries was carried out with DIAGNOdent Pen in order for the experiment to be accurate, clear and reliable. The examinations at the beginning and every three months up to the twelfth month inclusive were conducted by specialist pediatric dentistry. The results were scored on teeth and surfaces. Prior to the clinical use of fluoride varnish and Tooth Mousse, we applied a diagnosis by laser fluorescence, with the measurements performed with DIAGNOdent Pen.

4.1 Activity and reversibility of the carious process

4.1.1 Object of observation: Dental caries diagnosed with d1 and d2.

4.1.2 Units of observation: Children with a high risk of caries development: A group of 100 children treated with mineralizing varnish CV; Control group of 100 children; Carious teeth with threshold d1, d2 lesions. Carious surfaces with d1, d2 lesions.

- a) Subject of research - diagnosis and treatment of the initial caries of the temporary teeth by the application of mineralizing varnish as a means of prevention and non-invasive treatment.
- b) Our goal is to determine the volume of active and reversible caries lesions.
- c) Material: 200 children from the city of Varna, aged 4 to 6 years old, distributed equally in standardized age groups, with the same number of boys and girls.
- d) Criteria for inclusion of children: 3 to 4 years of age, 5 and 6 years of age; healthy, accompanied by parents without systemic, gingival and oral mucosal diseases; regularly attending our ambulatory office.

- e) Method - visual diagnostic method, dental chair, mirror, lighting, water and air. *Surveillance*: Specialists in pediatric dentistry; *Carious status*: The carious status of the children was diagnosed and recorded on teeth and surfaces with a diagnostic threshold d1a.
- f) *Diagnostic criteria*: Criteria for activity - d1a, d1b caries lesions under the plaque, pre-location, with loss of gloss and smoothness, lack of clear boundaries; Criteria for stationary - d1a, d1b lesions - with smooth surfaces, with brilliance and clear boundaries.

4.1.3 Signs of observation: Diagnosis is also performed with a DIAGNOdent Pen instrumental test for each child and each carious lesion.

4.1.3.1 Time and place of study: Study time: 2015-2016.

4.1.3.2 Location of the survey: The survey is conducted in: 1. Faculty of Dental Medicine - Clinical Halls of DDM, Varna. 2. University Medical Center, FDM - Varna. 3. The study is authorized by the Ethics Committee of the Scientific Research at the Medical University of Varna and informed consent of each parent, respectively for each child-patient, is made.

4.1.3.3 Data Registration: Clinical cards conforming to WHO cards are made to reflect the data from the clinical study and the oral hygiene status. After processing the results and determining the highlights, the actual study was performed by processing the data with a mathematical-statistical processing package SPSS v 20.0.

5. Results

Following the application of Clinpro White Varnish on the enamel surfaces, an average reduction of 6.15 (\pm 2.03 SD) was found (Table 1). The results in the enamel structure are reduced by two steps after the CV application. After the remineralization, average reduced and improved values of 5.58 (\pm 2.04 SD) were obtained. The healthy enamel surfaces of temporary teeth with values from 0 to 3 did not show significant differences in values after the Tooth Mousse application. Surfaces with increasing values from the DIAGNOdent Pen enamel measurement showed significant differences after the Tooth Mousse application.

| Dental materials | Clinpro White Varnish | Tooth Mousse |
|----------------------------------|-----------------------|----------------------------------|
| Indicators | | |
| Number Surfaces of primary teeth | 40 | 40 |
| Average decrease (in 60 min.) | 6.15 \pm 2.03 | 4.72 \pm 1.39 (for 10 minutes) |
| Efficiency in % | 64.58 \pm 16.71 | 70.36 \pm 15.94 |

Table 1: Changes in laser fluorescence measurements obtained for enamel after dental application.

The results of the comparative analysis of the therapeutic efficacy of the mineralizing varnish used - Clinpro White Varnish showed a significant difference in the percentage of effectiveness ($t = -3.68$, $p < 0.001$). Clinpro White Varnish showed better results after the application (64.58%) (Table 1).

| Dental materials | No standard coefficient β | Standard coefficient β | p | Adjusted R^2 |
|-----------------------|---------------------------------|------------------------------|-------|----------------|
| Clinpro White Varnish | 0.040 | 0.332 | 0.036 | 0.087 |
| Tooth Mousse | 4.342 | 0.380 | 0.016 | 0.122 |

Table 2: Dependence between the efficiency achieved and the decrease in fluorescence in the individual types of dental materials.

The results of Table 2 show that univariate regression analysis achieves a low dependence observed at Clinpro White Varnish ($\beta = 0.332$) and only affects 8.70% of the change in efficacy. This result of the varnishes during the experimental period may be related to their fluorine release pattern. CV shows a high level of fluorine separation at an earlier stage of application but also shows a high level of fluorine separation during the middle and late measurement stages (high density, fast drying and waterproof). The results of the analysis are presented in Table 2. The results of the applied varnish for the clinical treatment of lesions d1 and d2 have a statistically significant reduction in enamel demineralisation of the lesions. CV protects the enamel surface after treatment and professional prophylaxis but has greater protection in terms of reducing the depth of caries development in d2 lesions.

6. Discussion

In order to prove the effectiveness of our varnished CV, with the 3, 6, 9 and 12 months of application compared to a control group, it is important to note that the effect is only on active caries lesions because they are only reversible. A conservative, non-invasive or minimally invasive approach to the clinical management of dental caries requires diagnostic techniques capable of detecting the amount of early caries when their progression can be stopped and turned to remineralization.

The analysis of the results of our study after treatment with varnish CV shows the presence of an average pathology with a d1b diagnostic threshold for the age of 3 to 6 years. Even in primary teeth, where the time to fully detect the risk factors of the oral environment is low, the presence of reversible stages of dental caries has been proven to be a regulated process. According to Peneva M [6], if the preventive approach to the change in balance in the factors of the oral environment starts much earlier, the pathology of temporary teeth and irreversible carious lesions will be less [6]. The benefits to children's health and their psychological attitude are also significant Lertpimonchai [7, 8]. From here, we can prove that prevention and non-invasive treatment will reduce the incidence of caries pathology in a permanent dentition. Easy and painless, non-surgical treatment creates a positive attitude towards children to dental manipulations [9].

Similar results of caries reduction were obtained by other means such as gels - 1999 by Kukleva-Todorova M, other types of varnishes (Kanocolit-T), Tooth Mousse paste-2012 by Peneva M, solutions (1960-1980) etc. [6]. Varnishes have been applied and scientifically tested in rats as well. They were also studied in the USA- 1990, in Brazil- 1975, 2012 and others [10]. The results of other authors conducting research with varnishes are presented on the Table 3.

| Authors | Own Study Damyanova 2015 | Marinho et al. 2005 | Tewati et al. 1991 | Seppa et al. 1987 | Similarly, Koch et al. 1979 |
|---|--|------------------------|-----------------------|----------------------|-----------------------------------|
| Rs (Caries Reduction) | 64.58% | 46% | 74% | 21% | 30% |
| Meta-analyzes of 15 clinical studies | Rs=38% for primary dentition, to Rs=46% for permanent dentition. Only one clinical study found that fluoride varnish was effective in remineralisation of active enamel lesions in primary dentition [11]. | | | | |

Table 3: The authors' results investigated the effectiveness of fluorine varnishes.

7. Conclusion

The use of these medications may be beneficial for patients with dental caries of primary teeth from 3 to 6 years of age. Mineralizing varnish is a healing agent that can achieve greater efficacy (64.58%) due to the content of tricalcium phosphate fluoride.

Conflict of Interest

The authors declare that they have no conflict of interest.

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