

## The Effect of Mineralizing Fluorine Varnish on the Progression of Initial Caries of Enamel in Temporary Dentition by Laser Fluorescence

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### ABSTRACT

**Objective:** Our study aims to evaluate the effect of mineralizing fluorine varnish on the progression of initial caries of enamel in temporary dentition by laser fluorescence.

**Material and Methods:** Object of observation. 1 group - 100 children aged 3, 4, 5 and 6 years treated with Clinpro™ White Varnish with TCP (Tri-Calcium phosphate) (3M) – CV. Two groups - 100 children aged 3, 4, 5 and 6 years without treatment with varnish CV. Location of the study - University Medical Dental Center Varna, Clinical Halls for Children's Dentistry, Faculty of Dental Medicine – Varna. Units of observation: Temporary teeth, Caries lesions at level d1 and d2. After processing the results and determination of the highlights was conducted by actual survey data processing package for mathematical and statistical analysis SPSS v 20.0.

**Results:** The analysis of the results of temporary central incisors in six-year-old children showed a significant difference in the three study groups, the control group values being significantly higher than those in the treatment-treated group ( $t = 3.44, p < 0.01$ ) and those after treated with treatment with Clinpro White Varnish, TCP ( $t = 5.31, p < 0.001$ ). A significant difference showed the use of CV varnish, which showed improvement after treatment ( $t = 2.81, p < 0.01$ ). Results before and after treatment of lesions in the treated group also showed a significant difference, but better values were observed in temporary lateral incisors ( $t = 6.25, p < 0.001$  for temporary lateral incisors and  $t = 5.93, p < 0.001$  for temporary canines). The results in the study group before and after treatment also showed a significant difference in the provisional first and second molars ( $t = 7.53, p < 0.001$  and  $t = 6.32, p < 0.001$ ).

**Conclusion:** 1. All reversible lesions may regress or stagnate by reducing the accumulated pathology above this diagnostic level. 2. After the first week, DIAGNodent pen scores improved from less than three steps for d1b and d2 lesions and improved by two steps for d1a lesions. 3. Increased therapeutic efficacy of dental agents for non-invasive treatment is achieved by enhancing them with fluorides.

**Keywords:** caries, lesions d1, d2, temporary teeth, DIAGNodent Pen

### I. INTRODUCTION

In the 1980s, fluoride varnishes were widely distributed throughout Europe as a 2.26% fluorine drug and quickly found popularity in Europe and Canada for the prevention of dental caries [1]. Fluoride varnishes were not available in the USA before the early 1990s. [2]. They then gradually became available in the USA and Asia [3]. According to the World Health Organization (WHO), fluoride varnishes have a significant caries-reduction potential [4]. A major idea in the development of varnishes was to increase the time for which fluorides are in contact with the tooth surfaces, leading to increased penetration of fluoride ions into healthy and / or demineralized enamel. This also improves the absorption of fluoride from enamel [5,6]. Local fluorides reduce the solubility of the enamel by increasing fluorapatite and fluorohydroxyapatite; Inhibit plaque formation and plaque acids by inhibiting glycolysis; Serve as a buffer for acids produced by microorganisms; Reduce the synthesis of extracellular polysaccharides from plaque microorganisms; Inhibit the adsorption of salivary glycoproteins; Assist the remineralization of demineralised enamel sections; Staging the initial carious process; Contribute to the regression of an incipient caries process [7,8,9,10]. The use of the 655-nm laser diode fluorescence is regarded as a promising option for caries diagnosis despite the risk of false positives for sealed

surfaces and stained fissures [11,12]. One of the trends of modern nanotechnology in the prevention of early caries lesions is the introduction of tricalcium phosphates (TCP) in combination with fluorine. This complex is created after the interaction of  $\beta$ -TCP with organic or inorganic moieties, for example carboxylic acid and/or organic modified technology. The nanocomplex provides high levels of calcium and phosphorus in the saliva needed for the remineralization process. It has been found that tooth structures treated with TCP complex are highly acid-resistant in a repeat acid attack [13].

**Objective:** Our study aims to evaluate the effect of mineralizing fluorine varnish on the progression of initial caries of enamel in temporary dentition by laser fluorescence.

## II. MATERIAL AND METHODS

Two hundred children from 3 to 6 years of age attending clinical practice in Varna were included in two groups using Clinpro™ White Varnish with TCP (Tri-Calcium phosphate) (3M) (CV), mineralization fluoride varnish and a control group. The final selection of the treated children was conducted, with children with a high risk of developing caries being selected from the 300 examined children. The examinations at the beginning and every three months up to the twelfth month inclusive were conducted by the pediatric dentist specialist. Results were scored on teeth and surfaces. Before we performed the clinical application of fluoride varnish, we applied diagnostics by laser fluorescence, with the measurements performed with DIAGNOdent Pen.

### Diagnostic scale

d1a - white enamel lesion, visible with drying, d1b - white enamel lesion, visible without drying, d2 - white small enamel, cavity lesion, d3 - dentin caries, d4 - dentine caries with pulp involvement, A - active (d1a, d1b, d2), NA - inactive (d1a, d1b, d2)

Reversible caries lesions - (d1a, d1b, d2)

Irreversible caries lesions - d3 and d4

Differential diagnosis with Non-cariou lesions – dental fluorosis, hypo-mineralized spots, amelogenesis and enamel erosions.

**Object of observation:** 1 group - 100 children aged 3, 4, 5 and 6 years treated with Clinpro™ White Varnish with TCP (Tri-Calcium phosphate) (3M) – CV

2 group - 100 children aged 3, 4.5 and 6 years without treatment with varnish CV

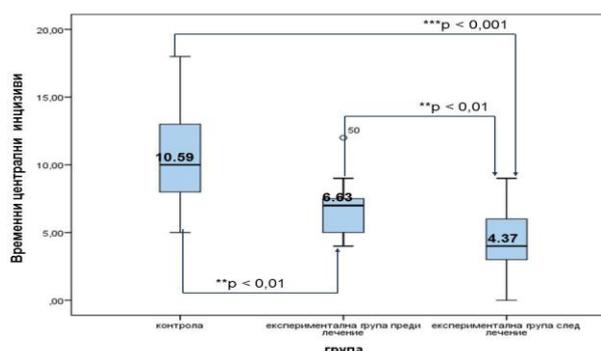
**Units of observation:** Temporary teeth, Caries lesions at level d1 and d2

**Location of the study:** University Medical Dental Center-Varna, Bulgaria;

Clinical Halls for Children's Dentistry, Faculty of Dental Medicine – Varna. The study has been 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 was made. All patients examined and treated from the two study groups were given a comparative analysis of the results of the study using appropriate statistical methods. After processing the results and determination of the highlights was conducted by actual survey data processing package for mathematical and statistical analysis SPSS v 20.0.

## III. RESULTS

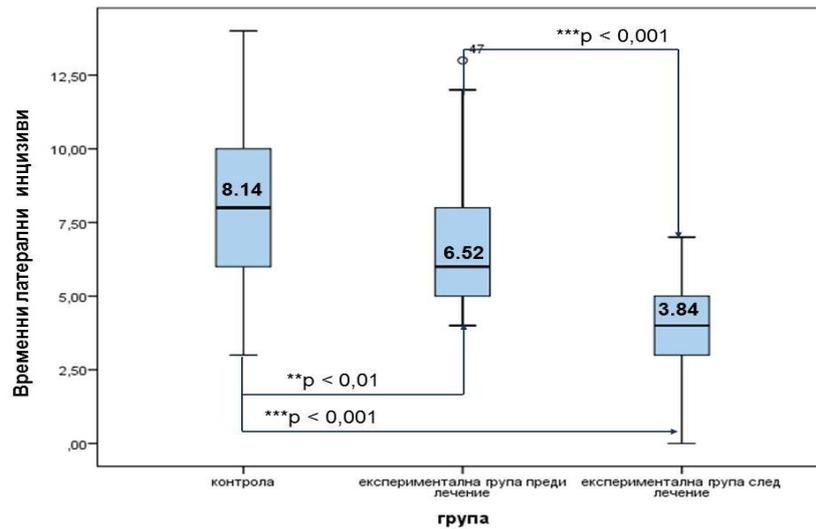
The analysis of the results of temporary central incisors in six-year-old children showed a significant difference in the three study groups, the control group values being significantly higher than those in the treatment-treated group ( $t = 3.44$ ,  $p < 0.01$ ) and those after treated with treatment with Clinpro White Varnish, TCP ( $t = 5.31$ ,  $p < 0.001$ ). A significant difference showed the use of CV varnish, which showed improvement after treatment ( $t = 2.81$ ,  $p < 0.01$ ) (Figure 1).



Control group

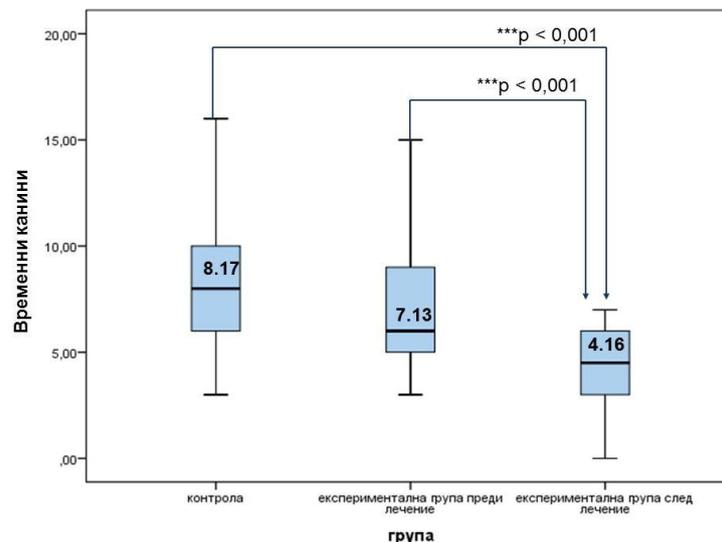
Test group prior to treatment ; Test group after treatment

**Fig. 1.** Boxplot graphs of a comparative analysis of the results between treated and control groups for temporary central incisors of 6 year old children



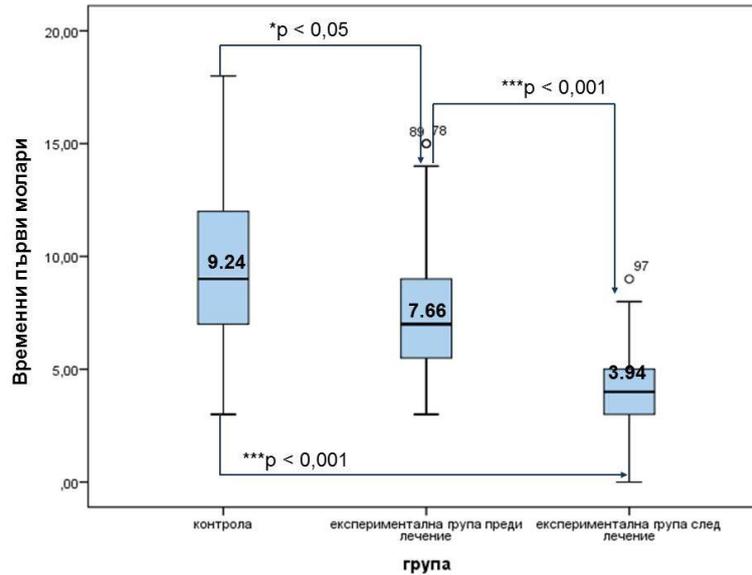
**Control group                      Test group prior to treatment; Test group after treatment**  
**Fig. 2.** Boxplot graphs of a comparative analysis of the results between treated and control groups for temporary lateral incisors of 6 year old children

A tendency to reduce lesion values is also seen in temporary lateral incisors and temporary canines (Figures 2 and 3). The highest values were observed in the control group (8.14 for temporary lateral incisors and 8.17 for temporary canines), which significantly differ from the values in the treatment group prior to treatment ( $t = 2.93$ ,  $p < 0,01$  for temporary lateral incisors) and after treatment with CV varnish ( $t = 8.59$ ,  $p < 0.001$  for temporary lateral incisors and  $t = 7.16$ ,  $p < 0.001$  for temporary canines). Results before and after treatment of lesions in the treated group also showed a significant difference, but better values were observed in temporary lateral incisors ( $t = 6.25$ ,  $p < 0.001$  for temporary lateral incisors and  $t = 5.93$ ,  $p < 0.001$  for temporary canines).

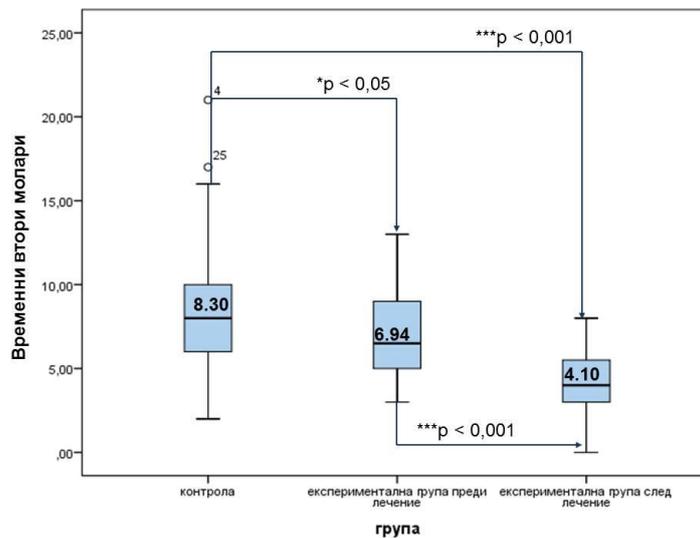


**Control group                      Test group prior to treatment ;Test group after treatment**  
**Fig. 3.** Boxplot graphs of a comparative analysis of the results between treated and control groups for temporary canines of 6 year old children

The lesion values of temporary first and second molar in six year old children show a difference in the groups of approximately 2 units, more pronounced in temporary first molars (Figures 4 and 5).



**Control group                      Test group prior to treatment ; Test group after treatment**  
**Fig. 4.** Boxplot graphs of a comparative analysis of the results between treated and control groups for temporary first molars of 6 year old children



**Control group                      Test group prior to treatment ; Test group after treatment**  
**Fig. 5.** Boxplot graphs of a comparative analysis of the results between treated and control groups for temporary second molars of 6 year old children

The lesions of the control group showed significantly higher values in both the first and the second molar compared to the lesion values of the test group before ( $t = 2.30, p < 0.05$  and  $t = 2.08, p < 0.05$ ) and after treatment ( $t = 8.81, p < 0.001$  and  $t = 6.77, p < 0.001$ ).

The results in the study group before and after treatment also showed a significant difference in the provisional first and second molars ( $t = 7.53, p < 0.001$  and  $t = 6.32, p < 0.001$ ) Figures 4 and 5.

#### IV. CONCLUSION

1. All reversible lesions may regress or stagnate by reducing the accumulated pathology above this diagnostic level.
2. After the first week, DIAGNOdent pen scores improved from less than three steps for d1b and d2 lesions and improved by two steps for d1a lesions.
3. Increased therapeutic efficacy of dental agents for non-invasive treatment is achieved by enhancing them with fluorides.

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Dobrinka Damyanova. "The Effect of Mineralizing Fluorine Varnish on the Progression of Initial Caries of Enamel in Temporary Dentition by Laser Fluorescence." *American Journal of Engineering Research (AJER)*, vol. 6, no. 9, 2017, pp. 39–43.