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Comparative Analysis of Caries Lesions of Two Groups of Children By Clinical Examination with Laser Fluorescence

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Abstract
Background: *Varnish, when brushed onto the teeth, provides a highly concentrated dose of fluoride and maintains prolonged contact with enamel to inhibit caries.*
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: *A significant difference was found between the average lesion scores in the control and experimental groups after treatment with CV ($t = 4.206$, $p = 0.001$), whereas the children in the experimental group had a significant reduction in the lesions of the temporary central incisors. In the four-year-old children, we found a significant difference between the mean values of the treated children before and after non-invasive treatment with CV ($t = 2.043$, $p < 0.01$). The analysis of temporal canine lesion values in four-year-old children showed a significant difference between both the control group and the pretreatment group ($t = 2.357$, $p = 0.001$).*
Conclusion: *1. 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. 2. 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

Varnish is used for caries prevention among children and adults as an off-label use in the U.S. In 1994 the U.S [1]. Food and Drug Administration (FDA) approved its use as a cavity liner and for treating hypersensitive teeth [2,6]. Varnish, when brushed onto the teeth, provides a highly concentrated dose of fluoride and maintains prolonged contact with enamel to inhibit caries [3,4,5]. Fluoride varnish must be applied professionally and has been used for over 30 years since its introduction in the 60s [7,8].

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 (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-carious 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

When examining the mean values of temporal central incisions lesions in three-year-old children, we found a significant difference between the mean values of control and experimental children before non-invasive CV treatment ($t = 2.043$, $p < 0.05$). Of the control group had significantly higher values (Average value of children in the control group - 12.00 ± 5.83 vs. average value of children in the pre-treatment experiment group 7.25 ± 3.19). A significant difference was found between the average lesion scores in the control and experimental groups after treatment with CV ($t = 4.206$, $p = 0.001$), whereas the children in the experimental group had a significant reduction in the lesions of the temporary central incisors;

(Average value of children in the control group - 12.00 ± 5.83 vs. average value of children in the experimental group after treatment of 3.55 ± 1.51). A difference was also found in measuring the average lesion score in children in the experimental group before and after the treatment, the difference being approximately 2 times lower in post-treatment lesions ($t = 3.109$, $p < 0.01$) (Figure 1) .

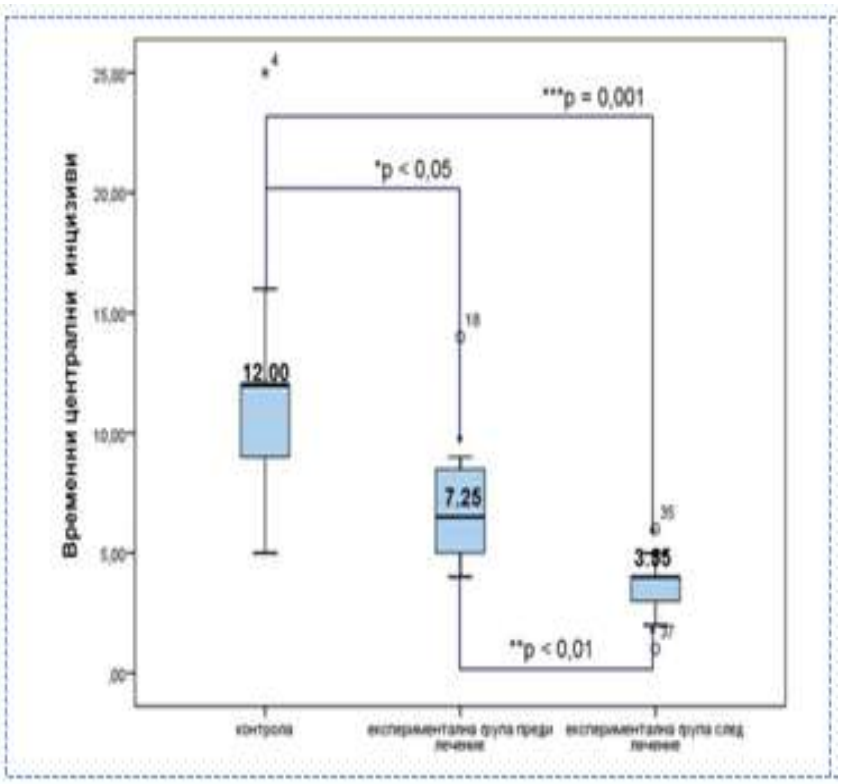

Fig.1. Boxplot graphs of a comparative analysis of the results between the experimental and control groups for the temporary first incisions of 3 year old children

In the four-year-old children, we found a significant difference between the mean values of the treated children before and after non-invasive treatment with CV (t = 2.043, p < 0.01).

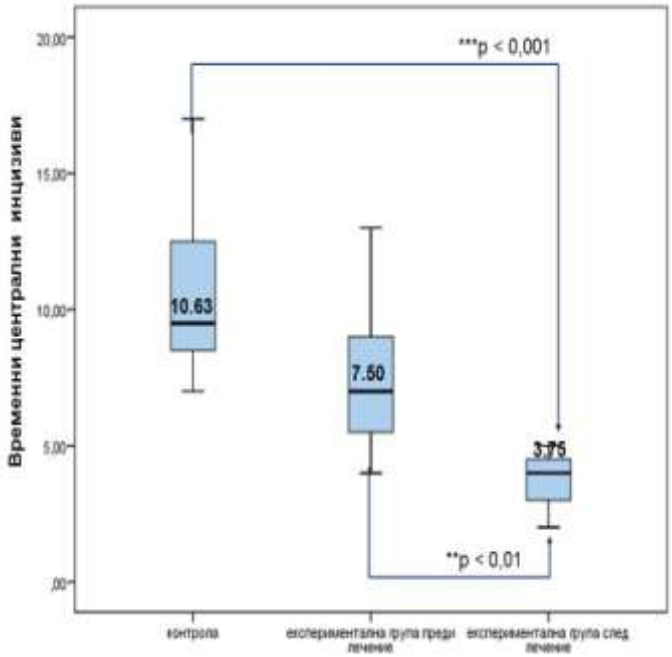

Fig.2. Boxplot graphs of a comparative analysis of the results between the experimental and control groups for the temporary first incisions of 4 year old children

In the analysis of the average values of temporary lateral incisors, a significant difference was found between the control group and the experimental post-treatment (t = 5.715, p = 0.001), with 3.8-times lower lesion values following the Treatment (Average value of children in the control group - 9.50 ± 2.08 vs. average value of children in the experimental group after treatment 2.50 ± 1.29). We also found a significant difference in the lesion value in children from the experimental group before and after treatment with CV (t = 2.964, p <0.05), in which case we observed a difference of approximately 3 times in favor of the results after treatment (average Children from the experimental treatment group before treatment - 7.25 ± 3.01 vs. mean value of children in the experimental group after treatment 2.50 ± 1.29) (Figure 3). A significant difference was found between average lesion scores in the control group and those in the treated group after treatment with CV (t = 4.206, p < 0.001) (Figure 4). In the analysis of the mean values of temporary lateral incisors, a significant difference was found between the control group and those in the treatment group after the treatment (t = 5.715, p < 0.01), observing 2.8-times lower values of post-treatment lesions (Average value of children in the control group - 11.75 ± 2.08 vs. average value of children in the study group after treatment 2.00 ± 1.29) (Figure 4).

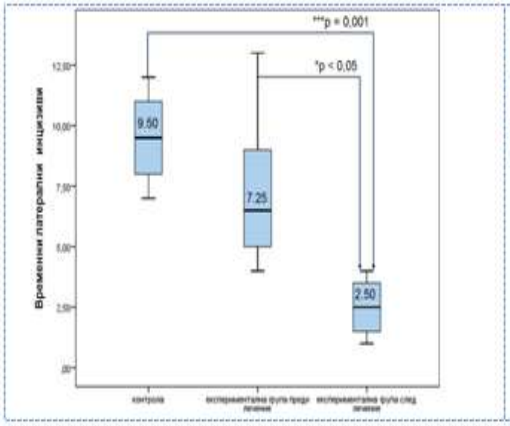

Fig.3. Boxplot graphs of a comparative analysis of the results between experimental and control groups for temporary lateral incisors of 3 year old children

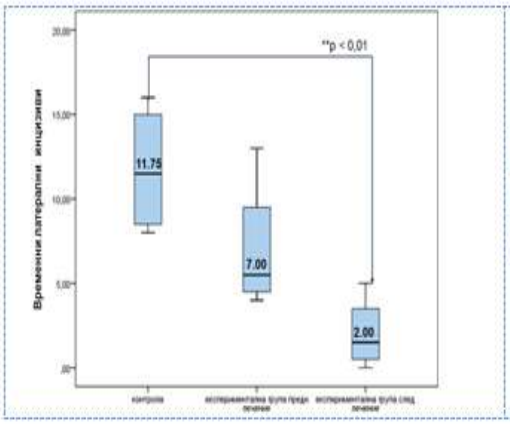

Fig.4. Boxplot graphs of a comparative analysis of the results between experimental and control groups for temporary lateral incisors of 4 year old children

Analysis of temporal canine lesion values in three-year-old children showed a significant difference between both control and experimental pre-treatment ($t = 2.357$, $p < 0.05$) and between the control group and the children from the experimental post-treatment group($t = 5.234$, $p < 0.001$), the difference 1.5 times before treatment increased to 3.2 times after treatment (Average value of children in the control group - 10.16 ± 2.92 vs. average value of children in the experimental group before treatment - 6.66 ± 2.16 and the average value of children from the experimental group after treatment $3{,}16 \pm 1{,}47$) (Fig. 5).

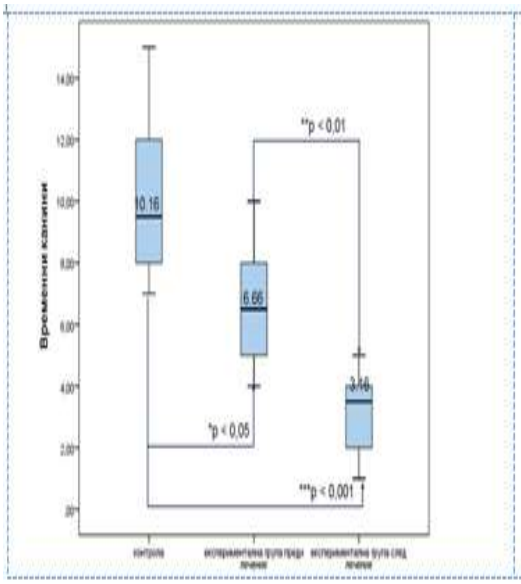

Fig.5. Boxplot graphs of a comparative analysis of the results between experimental and control groups for temporary canines of 3 year old children

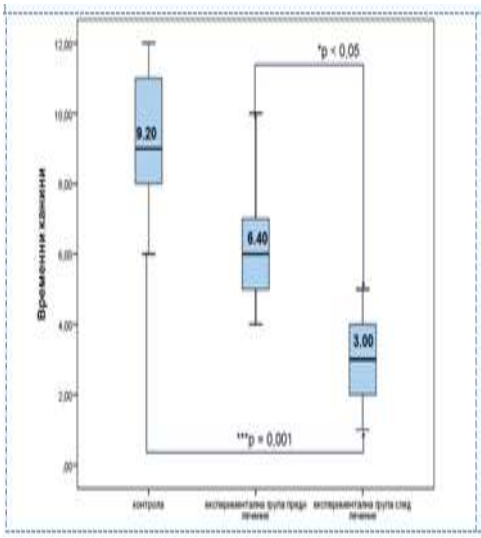

Fig.6. Boxplot graphs of a comparative analysis of the results between experimental and control groups for temporary canines of 4 year old children

The analysis of temporal canine lesion values in four-year-old children showed a significant difference between both the control group and the pretreatment group (t = 2.357, p = 0.001) and between the pre- and post-treatment group (t = 5.234, p< 0.05), the 1.4-times difference before treatment increased 2-times after treatment (children in the control group - 9.20 ± 2.92 vs. average value of children in the treatment group with varnish before treatment - 6.40 ± 2.16 and average value of children in the same group after treatment 3,00 ± 1,47) (Fig. 6).

Analysis of average lesion scores in children in the experimental group before and after treatment showed that there was a decrease in the values of approximately 2 times (t = 3.280, p< 0.01) (Average value of children in the experimental group before treatment - 6.66 ± 2, 16 vs. average value of children in the experimental group after treatment of 3.16 ± 1.47) (Figure 7).

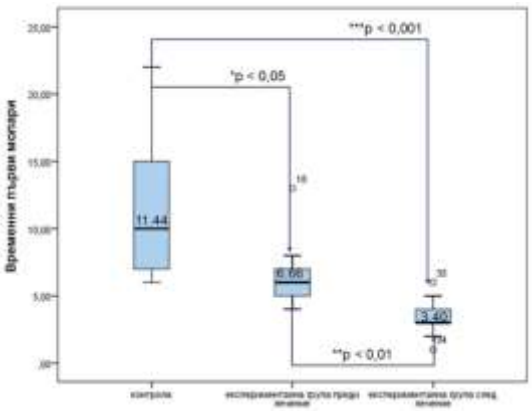

Fig.7. Boxplot graphs of a comparative analysis of the results between the experimental and control groups for the temporary first molar of 3 year old children

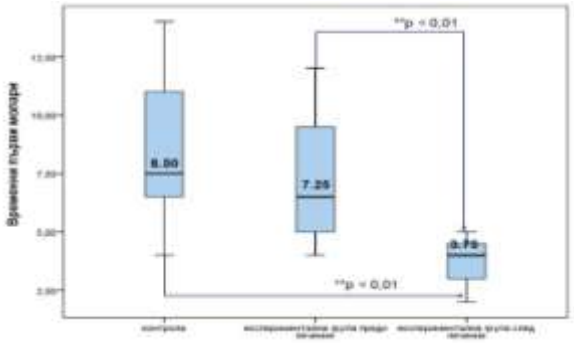

Fig.8. Boxplot graphs of a comparative analysis of the results between the experimental and control groups for the temporary first molar of 4 year old children

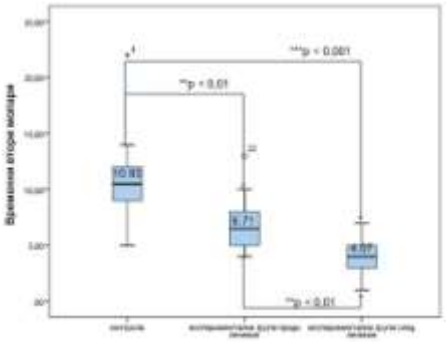

Fig. 9. Boxplot graphs of a comparative analysis of the results between experimental and control groups for temporary second molars of 3-year-olds

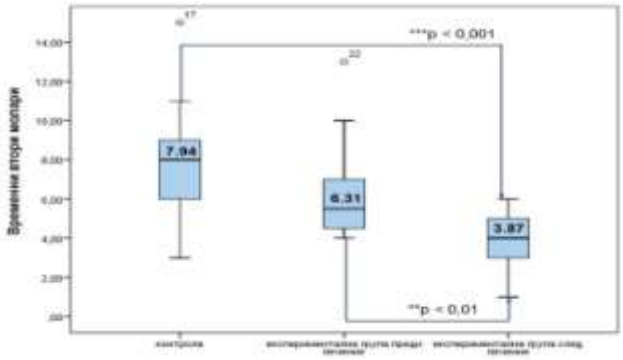

Fig. 10. Boxplot graphs of a comparative analysis of the results between experimental and control groups for temporary second molars of 4-year-olds

Analysis of average lesion scores in children in the treatment group before and after treatment showed that there was a decrease in the values of approximately 2 times ($t = 3.280$, $p < 0.01$) (Average value of children in the treatment group before treatment - 6,31 ± 2.16 vs. average value of children in the same group after treatment of 3.87 ± 1.47) (Figures 8 and 10).

IV. Conclusion

1. 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. 2. Increased therapeutic efficacy of dental agents for non-invasive treatment is achieved by enhancing them with fluorides.

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