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## EDS – Quantitative Microanalysis Of Calcium And Phosphate In The Initial Lesion Of A Circular Caries Before And After The Topical Fluoride Treatment.

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### ABSTRACT

Early detection and treatment of the circular caries in initial phase, white spot -macula alba, enables its total elimination. The aim of this study was to examine the changes in the mineral composition in this stage, before and after the application of the local fluoride remedy. Deciduous incisors were extracted, and three groups of teeth samples were made. First group with untreated teeth, ten maxillary incisors with an initial lesion, the second control group of 20 healthy mandibular incisors and the third group of samples treated by local fluoride remedy, ten maxillary incisors with an initial lesion – white spot. The laboratory examinations were completed within the Institute of Medical Diagnostics and Research in the Biomedical and Natural Sciences, at the Faculty of Medicine in Nis, with Energy Dispersed Spectrometer (EDS). Quantitative microanalysis of the mineral composition in the enamel of teeth samples were made. Analysis of the mineral structure of some samples showed significant effect of the topical fluoride treatment which increases the presence of calcium and phosphate values in the dental enamel. This remineralizing process in the initial lesion, had obtained a mineral composition of the enamel very similar to the one of a healthy tooth.

**Keywords:** enamel, initial lesion, remineralization, fluoride.

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## INTRODUCTION

In the early childhood at age 1 to 1.5, immediately after the teeth eruption, a special form of caries which spreads only over the deciduous teeth, often appears. It is a circular caries which has an increasing tendency in the last decade. It makes problems to the children, their parents and the dentists, and needs a special attention [1, 2]. In the modern world terminology it is known as “Early childhood caries” [3, 4, 5].

In everyday dental practice, due to the unbalanced diet and the lack of oral hygiene in the early childhood [6,7], we face the problem of diagnosing the advanced circular caries [8]. The main reasons for this study were the high and continual increase of this prevailing caries [9,10] as well as the unclear etio-pathogenic mechanisms of its appearing. The prevention of the circular caries is very important for the healthy and normal growth of the child’s organism [11].

Taking into consideration the fact that the early detection and treatment of this type of caries means also a total elimination of the same, the main objective of the research was pointed to the examination of the changes in the mineral composition of the enamel in its initial stage – initial lesion (macula alba), before and after the application of the local fluoride preparation: We defined the mineral composition (Ca, P, Ca/P) of the enamel in the deciduous teeth with an initial lesion of circular caries and compare it with the healthy deciduous teeth. Quantitative microanalysis of the mineral composition (Ca, P, and Ca/P) in the teeth enamel after the fluoride topical treatment, in relation to untreated one, was also performed.

## MATERIALS AND METHODS

The teeth were extracted during the period of its physiology change and 3 groups of teeth samples were made. The first tested group with untreated teeth samples, 10 extracted maxillary incisors with an initial lesion – white spot (macula alba), the second tested group was control teeth group, 20 extracted healthy mandibular incisors and the third tested group of treated samples with topical fluoride treatment, ten extracted maxillary incisors with an initial lesion – white spot (macula alba). For topical fluoride treatment, amino fluoride solution was used, once a week, during the period of 6 months.

The laboratory examination of the deciduous teeth samples was completed within the Institute of Medical Diagnostics and Research in the Biomedical and Natural Sciences, at the Faculty of Medicine in Nis, with Energy Dispersed Spectrometer. Quantitative microanalysis of the material was performed by energy dispersed spectrometer EDS - based on the measurement and the determination of the characteristic

X – ray generated during the interaction between the primary pencil of electrons and the given sample.

In the EDS System analysis, all the teeth samples (the untreated one and the one treated with the topical fluoride treatment) underwent the examination of the mineral composition of the enamel (Ca, P, in correlation to Ca/P) in the initial lesion (macula alba) and in the healthy part of the enamel. After defining of the mineral composition (Ca, P, Ca / P) in the enamel samples with an initial lesion (untreated and treated), a comparative study was made in a relation to the mineral composition in the healthy teeth (control group). Statistical Analysis of the obtained results like Student t-test, Analysis of Variance (ANOVA) and Tukey HSD-test were made.

## RESULTS AND DISCUSSION

The results from the overall EDS – analysis and the statistically processed data are presented in the tables.

The analysis of a variance (ANOVA) confirmed the statistically important differences of the average Ca (%) values between the untreated teeth and the healthy mandibular incisors (F=84,999 p=00001). The treated teeth and the healthy mandibular incisors (F=31,054 p=0, 00015). The analysis by Tukey HSD test confirmed that there was no significant difference only between the treated teeth with an initial lesion in the healthy surrounding enamel and the control group of teeth.

**Table1. The average Ca (%) values in the enamel and significant differences between untreated and treated teeth**

Localization of the probe	Untreated teeth		Treated teeth		Student – t- test p
	Average	SD	Average	SD	
In the part of the enamel with an initial lesion	<b>24.020</b>	<b>1.073</b>	<b>26.885</b>	<b>1.522</b>	<b>0.00012*</b>
The healthy part – the surrounding enamel with an initial lesion	<b>29.778</b>	<b>0.914</b>	<b>31.109</b>	<b>1.568</b>	<b>0.03245*</b>
Healthy mandibular incisors (KG)	<b>31.722</b>	<b>1.410</b>	*Significant differences		

**Table2. The average P (%) values in the enamel and significant differences between untreated and treated teeth**

Localization of the probe	Untreated teeth		Treated teeth		Student – t- test P
	Average	SD	Average	SD	
In the part of the enamel with an initial lesion	<b>14.188</b>	<b>0.523</b>	<b>15.573</b>	<b>0.853</b>	<b>0.00036*</b>
The healthy part – the surrounding enamel with an initial lesion	<b>15.400</b>	<b>0.452</b>	<b>15.916</b>	<b>1.052</b>	<b>0.1717</b>
The healthy mandibular incisors (KG)	<b>16.110</b>	<b>0,936</b>	*Significant differences		

The analysis of a variance (ANOVA) confirmed the statistically important differences of the average P (%) values between the untreated teeth and the healthy mandibular incisors (F=14,836 p=0, 000049). The treated teeth and the healthy mandibular incisors (F=1,393 p=0, 2567). According to the Tukey HSD Test there were statistically important differences only at the untreated samples with an initial lesion between the part with the lesion and the healthy surrounding enamel, and the part with the initial lesion and the control group

**Table 3. The average Ca / P (%) values in the enamel and significant differences between untreated and treated teeth**

Localization of the probe	Untreated teeth		Treated teeth		Student – t- test P
	Average	SD	Average	SD	
In the part of the enamel with an initial lesion	<b>1.692</b>	<b>0.025</b>	<b>1.726</b>	<b>0.027</b>	<b>0.01016*</b>
The healthy part – the surrounding enamel with an initial lesion	<b>1.933</b>	<b>0.040</b>	<b>1.958</b>	<b>0.09</b>	<b>0.45434</b>
Healthy mandibular incisors (KG)	<b>1.970</b>	<b>0.045</b>	*Significant differences		

The analysis of a variance (ANOVA) confirmed the statistically important differences of the average Ca / P (%) values between the untreated teeth and the healthy mandibular incisors (F= 129,366 p=0, 00001), and he treated teeth and the healthy mandibular incisors (F=49,610 p=0, 00019). The Tukey HSD Test confirmed that there were no statistically important differences only between the healthy surrounding enamel of the initial lesion and the control group.

We found some comparable data in the studies, related to the mineral composition of the deciduous teeth enamel [9]. The results we had obtained from the analysis of the mineral composition of the healthy teeth enamel are in accordance with their researches, based on the method XRMA (X-Ray Micro Analysis), i.e. micro analysis with X-Rays, in healthy deciduous teeth. We applied a similar method which was based on micro analysis with X-Rays. As for the mineral composition of the enamel in the initial lesion of the circular caries, we haven't found any comparable data, since the dental problems with the deciduous teeth have been not developed yet. The obtained results showed that the presence of the minerals (Ca, P and Ca/P ratio) on the examinees with initial lesion, not treated with the topical fluoride treatment, was considerable lower, than its presence on the healthy teeth.

The overall EDS – analysis of the mineral structure of some groups of samples showed significant effect of the topical fluoride treatment which increased the presence of some minerals in the dental enamel and showed significant remineralizing process of the initial lesion [5]. Some of the tested teeth had obtained a mineral composition of the enamel very similar to a healthy tooth [6].

### CONCLUSION

It can be concluded that:

- The values of calcium and phosphate were significantly decreased on the samples with initial lesion in a relation to the control group (healthy teeth);
- In the samples treated by topical fluoride treatment the values of these two minerals were much higher, compared to the untreated samples;
- The early detection of the circular caries in the initial stage and its prevention with the topical fluoride treatment, could bring a complete reparation of the initial lesion and a disappearance of the white spot i.e. *restate ad interim*.

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