

Ultra-Structural Changes of the Early Childhood Caries Starting Phases of Development

SUMMARY

In the recent 20 years, besides dramatic reduction of caries in many countries where complex programme of prevention is carried out, prevalence of Early Childhood Caries (ECC) has expressed continual growth trend. The aim of our research was to determine precisely ultra-structural changes in the enamel substance at the initial lesion of the ECC (white spot lesion), as initial change of great importance for its preventive aspect. Therefore, we directed our experiment to evaluate ultra-structural changes of the teeth enamel in primary teeth with circular caries in its opening stages of development: initial caries lesion and superficial form.

To realize the aim of our research, in patients 6 years of age, whose teeth were already in the phase of resorption, we extracted 20 maxillary incisors (10 with initial lesion and 10 with superficial form) and 20 healthy mandibular incisors, as a control group. Investigation was done at the Institute for biomedical research of the Faculty of Medicine in Nis (Serbia), with the scanning electronic microscope.

The data indicated that in the initial phase and superficial form of ECC only demineralization happened, while in the case of superficial form changes were much deeper. This speaks in favour of better understanding of ultra-structural changes of the enamel surface that happen in the initial phase of the ECC, which could help to create strategy for its successful prevention.

Keywords: Early Childhood Caries; Initial Lesion; Superficial Carious Lesion; Scanning Electronic Microscopy

Olga Kokoceva-Ivanovska, Mile Carcev

University "Ss. Cyril and Methodius"
Faculty of Stomatology
Clinic for Paediatric and Preventive Dentistry
Skopje, FYROM

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Introduction

In the recent 20 years, besides dramatic reduction of caries in many countries where complex programme of prevention was carried out^{8,11}, prevalence of Early Childhood Caries (ECC) expresses continual growth trend^{7,16}. ECC is often found under the name connected with the manner of feeding and nutrition of children, such as "Baby bottle Syndrome" or "Baby bottle caries"³⁻⁵.

Different data exist speaking about the prevalence of this caries depending on epidemiological research sites, and they go from 3% up to 45%^{15,16}. In FYR Macedonia, in the case of pre-school children, this type of caries is also widely spread. In the central area of the City of Skopje, in children of 18 to 42 months of age, there is

17.9%¹⁰ of notified caries presence that, according to criteria of the World Health Organization, is estimated as high prevalence¹². Negative trend of growth of this type of caries represents the reason for many explorers to forward their research toward clearing of its etiology, pathogenesis, treatment, and above all, preventive aspects.

According to some authors^{1,2,13}, the most important predisposing factor for appearance of this type of caries is the defect in enamel structure of primary teeth, where mineralization starts in the fourth month of foetal life. Although it has been considered that enamel is homogeneous in teeth formed before birth, with good structure and hardly prone to caries, many factors regulating human body in pregnancy (systemic diseases of pregnant women, infectious and chronic kidney illnesses,

diabetes mellitus, nutritive disorders in feeding, etc)¹⁴, could cause the disturbances in tooth enamel structure.

Clinical survey of ECC shows that this type of caries goes through several phases in its development. Starting phases of development are both: the initial form (white spot lesion) and the superficial form. The **aim** of this research was to determine precisely ultra structural changes of enamel substance at the initial lesion (white spot lesion), as initial change of great importance for the preventive aspect of this early childhood disease. To carry out this aim, we directed our experiment to evaluate ultra-structural changes of tooth enamel in primary teeth with circular caries in its opening stages of development: the initial caries lesion and its superficial form.

Material and Method

Material for this research consisted of primary teeth (maxillary and mandibular incisors) of patients of different gender, 2-6 years of age, clinically diagnosed with baby bottle caries in development phases (initial lesion and superficial form of circular caries) at the Clinic of Paediatric and Preventive Dentistry, Faculty of Dentistry in Skopje.

As for the needs for the laboratory examination, we separated samples of teeth in the period of their physiological change and we formed the following groups of samples:

10 extracted maxillary incisors with *initial lesion - white spot (macula alba)*;

10 extracted maxillary incisors with *superficial form of circular caries*;

20 extracted healthy mandibular incisors (the control group).

Extracted teeth are kept in pure alcohol (96%). Dehydration of teeth and covering by a thin layer of gold has been done on the surface by cathode dispersion technique before the analysis. Investigation is done with the scanning electronic microscope (JSM 5300, JEOL), and this procedure took place at the Institute for biomedical research of the Faculty of Medicine in Nis, Serbia. During the analysis, the enamel surface (at the initial lesion) and the boundary of the caries lesion with the healthy teeth substance (at the superficial form) was observed.

Results and Discussion

By realization of our research we came to the data concerning changes of basic tooth enamel structure in the initial phase and superficial form of the ECC. In figure 1 we give the appearance of healthy tooth enamel,

in figure 2 the tooth enamel with initial lesion is seen, and in figure 3 structure of tooth enamel in the case of superficial form is presented. The appearance of healthy tooth enamel (Fig. 1) is with smooth surface, containing adequate and genuine prisms together with inter-prismatic space. In figure 2, we can see the tooth enamel with initial lesion, which is seen as demineralised surface shown through the uneven and corrugated enamel surface (shrinking of prisms due to widening of the prismatic spaces). Figure 3 shows the structure of tooth enamel in the case of superficial caries where changes in the enamel structure are deeper and cavity has already been formed. It can be seen that in the example of initial lesion only demineralization happened, while in the case of superficial form changes are much deeper^{6,9}.

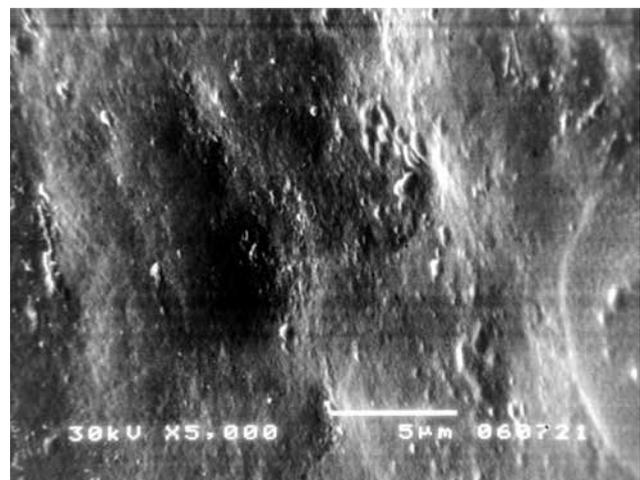


Figure 1. Healthy tooth enamel

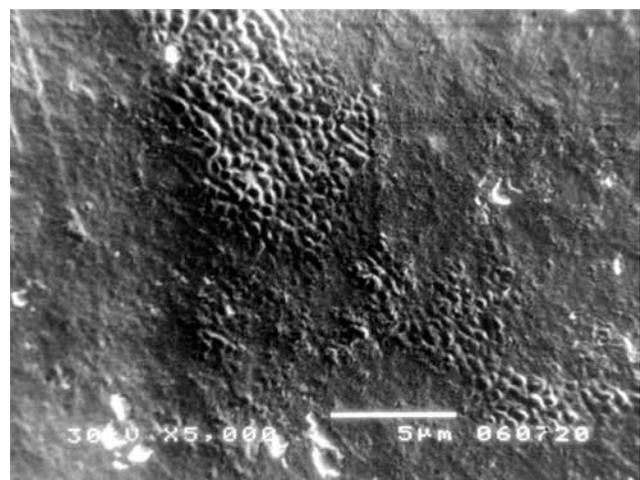


Figure 2. Initial lesion

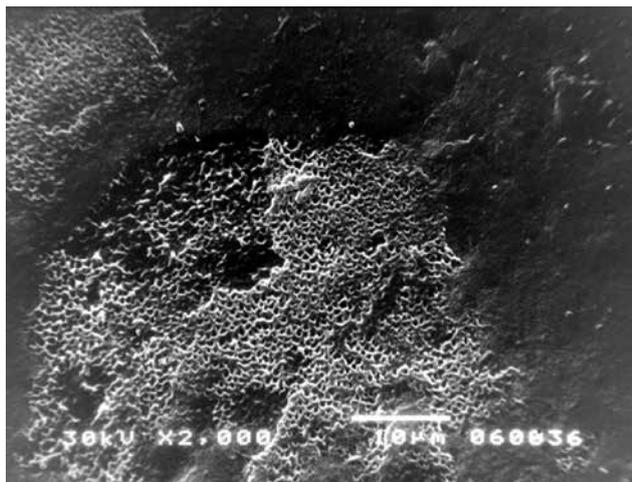


Figure 3. Superficial carious lesion

In the developed countries, as a result of effective and well timed implementation of primary preventive measures, the ECC has relatively low prevalence of 3%¹⁵. In the undeveloped countries, because of lack of information on adequate way of feeding, and due to no solid oral hygiene, the prevalence of the ECC is up to 45%¹⁶. In the FYR Macedonia, in pre-school children, this type of caries is also widely spread. In the central area of the City of Skopje, in children of 18 to 42 months of age, there is 17.9%¹⁰ of notified caries presence that, according to criteria of the World Health Organization, is estimated as a high prevalence¹². Taking into consideration the number of dentists and dental universities, this is overly high prevalence.

Application of primary preventive measures could successfully prevent the ECC, but parents and dentists should have an important role in that process, too^{5,8,11}.

In most cases, the ECC is diagnosed in the advanced phase, when dentist can not manage with the consequences that clinically occurred³. The first priority is diagnosing it in the early phase of its clinical evolution - white spot lesion, when implementation of primary preventive measures could contribute to biological reparation of the initial lesion and prevention from carious lesion extending and occurrence of complications¹².

Conclusion

Acquired results from this research speak in favour of better understanding of ultra-structural changes at the enamel surface that happen in the initial phase of the ECC. This could help in creation of strategy for its successful prevention.

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Correspondence and request for offprints to:

Dr. Olga Kokoceva-Ivanovska
University "Ss. Cyril and Methodius"
Faculty of Stomatology
Clinic for Paediatric and Preventive Dentistry
Skopje, FYROM
E-mail: olga.kokoceva@gmail.com