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Oral Hygiene Index in Early Childhood Caries, Before and After Topical Fluoride Treatment

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Abstract

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Keywords: OHI-index; Early childhood caries; Initial lesion; Superficial lesion; Fluoride treatment

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BACKGROUND: Circular caries occurs in the earliest age of the children (1 - 1.5 year), immediately after the eruption of the deciduous teeth. During this period, children are too young to be able to properly implement oral hygiene. Consequently, it is at a negligible level, with plenty of soft plaque on the deciduous tooth surfaces.

OBJECTIVE: The main objective of this clinical trial was to determine the correlation between oral hygiene shown with Oral Hygiene index, and the initial stages of circular caries (initial lesion and superficial form), before and after topical fluoride treatment.

MATERIAL AND METHODS: For determination of the OHI - index we used the method of Green - Vermillion. It was determined two times in 117 patients, during the first visit and immediately before physiological replacement of deciduous teeth. Patients were two to three years old and diagnosed with initial stages of circular caries. Amino fluoride solution was applied once a week, during six months.

RESULTS: We obtained statistically significant improvement of OHI - index at the end of the test, among treated subjects from both major groups.

CONCLUSION: It can be concluded that the level of oral hygiene is correlated with the progression of changes in enamel. Topical fluoride treatment has a positive impact on reducing ECC.

Introduction

The circular cavity appears in the earliest age of the child (1 - 1.5 year), immediately after the eruption of deciduous teeth. The characteristic of this decay is that it occurs circularly in the gingival third of the tooth, and is called circular cavity [1]. Jacobi described it first in the 1862 year, and today it is also known as baby bottle caries or nursing bottle caries [2]. Meanwhile, latest scientific literature adopted term Early Childhood Caries (ECC) [3].

There are different data for prevalence of the

disease depending on the geographic territory, and they vary from 3 to 45 %. ECC is also widely present in pre-school children in Macedonia, with 17.9% in children n aged 1, 5-3 in central areas of the capital Skopje, which according to WHO is high prevalence [4].

American Academy of Pediatric Dentistry defined early childhood caries (ECC) as the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger [5]. In children younger than three years of age, any sign of smooth - surface caries is

indicative of severe early childhood caries (S - ECC). During this period the children are still too young to be able to implement oral hygiene properly. It is at a negligible level, with plenty of soft plaque on the tooth surfaces of deciduous teeth [6].

The disease has multifactorial aetiology like feeding and hygiene habits, while microbial investigations showed the presence of Mutans Streptococci (MS) and Lactobacillus. For some authors, the most important etiological factor is the defect of the structure of substantia adamantina in deciduous teeth, whose mineralisation starts in the fourth month of the fetal life [7]. Although prenatally formed substantia adamantina is healthier and homogeneous with better structure, yet some systematic, infectious and chronic diseases (diabetes, malnutrition) can have a negative impact [8]. Over 20 -50% of the mothers with pathological pregnancy have children with ECC. Premature children are with 37% higher prevalence of the disease.

Children who are breastfed have less ECC, but when prolonged it can also be concluded as a risk factor. Parents are recommended to avoid feeding bottle after the first year and to start using cups as soon as possible. Drinks with sugar (milk, tea and juices) and in between meal consumption of sugar-containing snacks or drinks should also be eliminated from the everyday diet. Infants should not be put to sleep with a bottle filled with milk or liquids containing sugars. Presence of ECC is also with higher risk of new carious lesions in the primary and permanent dentitions [9][10].

Early prevention of the disease is critical, and best treatments are brushing teeth with fluoride paste twice a day, and professionally applied topical fluoride treatments. The recommended professionally - applied fluoride treatments for children at risk for ECC who are younger than six years is five percent sodium fluoride varnish (NaFV; 22,500 ppm F) [11]. In recent decades circular cavity tends to be in an even greater prevalence and a problem for children, parents and us dentists. Therefore, we should devote special attention, in many ways.

The aim of this clinical study was to determinate the correlation between oral hygiene shown with OHI - index, and the emergence of the initial stages of the circular cavities: initial lesion (macula Alba) and superficial form, before and after topical fluoride treatment.

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Materials and Method

The study was clinical trial performed on patients from the Department of pediatric and preventive dentistry at the University Dental Clinic "Ss Paneteleimon" in Skopje, Macedonia. The patients (total number 117) diagnosed with initial stages of circular caries, aged two to three years old, and were divided into two groups. The earliest stage of the circular cavity was diagnosed in two ways:

-Observing the slightest change in the transparency of the enamel in the form of white patch with no cavitations as initial lesion - macula Alba;

- Inspection and sondage of the changes in the enamel in the form of an initial cavity diagnosed as a superficial form of a circular cavity.

In both groups regular check-ups were performed once a month, including following procedures: removing of the present soft plaque from the teeth; advice for improving patient's diet; advice for maintaining proper oral hygiene; determination of the index of oral hygiene - OHI and clinical monitoring of the initial stages of the circular cavity until physiological replacement of teeth.

Patient's parents were presented with the study protocol, with a complete explanation of the procedure, and their full written consent was obtained. They were also asked to fill out a questionnaire about the usual habits of maintaining oral hygiene and frequency of daily teeth brushing.

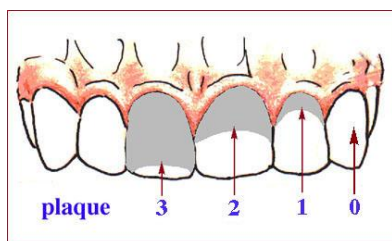


Figure 1: Method of scoring the presence of soft sediments

Determination of the Oral Hygiene Index (OHI)

OHI index (Oral Hygiene Index) shows patient's oral hygiene and express the presence of plaque on the surface of the teeth. OHI allows determination of a presence of the dental plaque, material-alba, and food residues. The most commonly

used index for determining the soft sediments is a Green – Vermillion - Hirschman index (Figure 1).

There are three stages of soft plaque presence according to the method of Green - Vermillion (Table 1). This method simply allows us to investigate and determine the numerical presence of soft plaque and classified into four classes from 0 to 3. The index was determined twice in our patients: during the first visit to the clinic when we diagnosed the disease, and immediately before physiological replacement of deciduous teeth.

Table 1: Presence of soft plaque accumulation

Points	Presence of soft plaque
0	no soft plaque presence
1	1/3 of the tooth surface covered with soft plaque
2	1/3 to 2/3 of the tooth surface covered with soft plaque
3	more than 2/3 of the tooth surface covered with soft plaque

Aminofluoride application

Aminofluoride solution (Aminfluorid otopina®, Belupo, Croatia) with 12.140% of ZV,N,Na-tri- (2 - hydroxyethyl) - Na - octadecyl - 1,3 - diaminopropane-dihydrochloride (I) and 1.135% of 1 - amino - 9 - octadecene hydro fluoride (II) (which corresponds to a total fluoride content of 1.000%), with pH 3.8, was used for topical fluoride treatment, once a week for 6 months. Both fluoride components are surface active, adhere closely to enamel, and provide long-term contact.

After a thorough cleaning of the teeth with polish paste and brush, we applied the solution with cotton for 2 minutes. Patients were advised not to take any food and liquids in next 30 minutes.

Statistical Analysis

Presented data were statistically analysed with Statistical program SPSS for Windows 7. We were using standard deviation, Student - t test, Wilcoxon Matched Pairs Test and Mann Whitney U test.

Results

We analysed the effect of teeth brushing (twice a day, for at least two minutes) for removing dental plaque with a questionnaire. The analysed data for oral hygiene maintaining habits and daily frequency of brushing teeth in children showed that most of our examinee (56%) did not brush their teeth at all. Only 32% of the patients brushed their teeth once a day and just 12% twice a day. The results from the questionnaire about oral hygiene habits in our patients are presented with the pie in Figure 2.

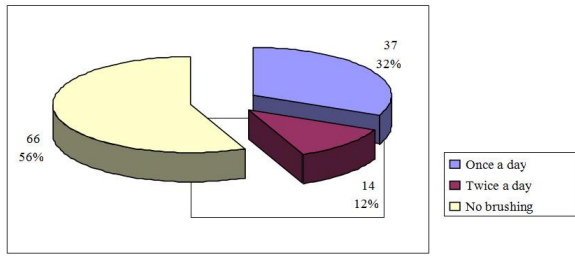


Figure 2: Daily habits for maintaining of oral hygiene and brushing teeth frequency in children

The values for OHI index were calculated during the first visit of the patients at the beginning of the investigation, and before the physiological change of the teeth. Patients with initial changes (Macula Alba) were selected, and the values of their index are shown in Table 2.

The first group of the patients was treated with amino fluoride varnish, and the control group was the patients whose parents did not accept fluoride treatment but wanted regular checkup and plaque removal. The total number of the examinee with the initial lesion was 61, of which 31 untreated and 30 treated with a topical fluoride treatment.

Table 2: Values of OHI-index in untreated and treated subjects with initial lesion (MaculaAlba)

Initial lesion (macula alba) examinee (N = 61)							
Non-treated 31			Treated 30				
Evaluation period	OHI-index			Evaluation period	OHI-index		
First visit %	0-1	1.1-2	2.1-3	First visit %	0-1	1.1-2	2.1-3
	3	7	21		2	11	17
Before physiological replacement	9.68	22.58	67.74	Before physiological replacement	6.67	36.67	56.67
	15	11	5		21	9	0
	48.39	35.48	16.13		70.00	30.00	0.00

In both patients groups (untreated and treated) with *initial lesion*, there was statistically significant difference of OHI - index compared with the first visit and at the time for physiological replacement of teeth (Wilcoxon Matched Pairs Test: Z = 4.197; p = 0.00027; Wilcoxon Matched Pairs Test: Z = 4.622; p = 0.000038). In the period before the physiological replacement of teeth or the end of the examination, examinees got evident significant OHI-index improvement.

The values of OHI index were also calculated in patients diagnosed with a *superficial form* of circular cavities untreated and treated with topical fluoride treatment, and they are presented in Table 3. We examined 53 patients, of those 30 were treated and 26 non - treated (control group).

Table 3: Values of OHI - index in untreated and treated subjects with superficial form

Examinee with superficial formation (N = 56)							
Non-treated 26			Treated 30				
Evaluation period	OHI-index			Evaluation period	OHI-index		
First visit %	0-1	1.1-2	2.1-3	First visit %	0-1	1.1-2	2.1-3
	0	7	19		1	8	21
Before physiological replacement %	0.00	26.92	73.08	Before physiological replacement %	3.33	26.67	70.00
	12	10	4		18	10	2
	46.15	38.46	15.38		60.00	33.33	6.67

In both groups with superficial form patients with high OHI index (2.1 - 3) were most present, with approximately 70% of an examinee.

The patients treated with topical fluoride treatment had significant improvement of OHI - index in the period before the physiological replacement of teeth at the end of the test (Wilcoxon Matched Pairs Test: Z = 4.540; p = 0.00006).

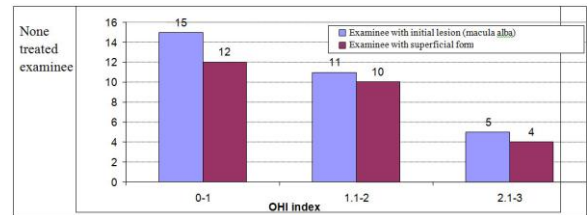


Figure 3: Comparison of untreated subjects with initial lesions and superficial form of caries

Figure 3 is related to a comparison of OHI index between the untreated subjects with initial lesions and superficial form of circular cavities, prior physiological replacement teeth (at the end of the test). We got a statistically significant improvement of OHI index, respondents from initial lesion group (Mann-Whitney U Test: Z = 2.366, p = 0.01796).

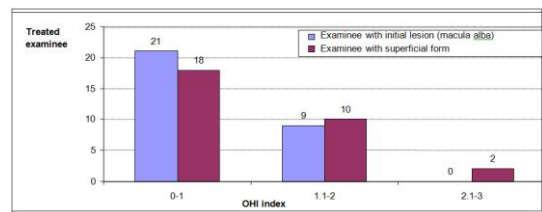


Figure 4: Comparison of treated subjects with initial lesions and superficial form of caries

Figure 4 shows a comparison of OHI index in examinee treated with topical fluoride treatment, in the same period (before physiological replacement of teeth, the end of the test). Among the patients with initial lesions and superficial form of circular cavities, we found a statistically significant difference (Mann - Whitney U Test: Z = 2.803; p = 0.0050) of OHI - index. The index is significantly lower in subjects with the initial lesion. There were no patients with the initial lesion and OHI - index (2.1 - 3).

Discussion

The results from the questionnaires for oral hygiene maintaining and daily frequency of brushing teeth in children were correlated with the test results of Louloudiadis, Maatouk and Markova [12][13][14][15]. Their investigation showed low oral hygiene habits and a statistically significant increase

of the ECC, which means that the number of affected teeth in the mouth of one sick child is increasing over the years.

According to some authors diagnosing early stages of this type of disease, prevention with fluoride treatment, together with the application of other preventive measures provide maximum benefits. Most importantly they have to be applied in the initial stage because of the fast development of the circular cavities. In this phase, by removing the cause for carries (dental plaque) on the one hand, and taking maximum precautions (good oral hygiene and topical fluoride treatment) on the other hand, we create conditions for dominating of remineralisation process to the demineralisation [16].

Professional applying of topical fluorides is effective in caries prevention, but the mechanisms are not yet well understood. Calcium fluoride (CaF_2) is probably main deposit product on enamel, and it possesses cariostatic mechanism. CaF_2 releases F ions that are subsequently incorporated into enamel as fluorhydroxyapatite (FHAP) or fluorapatite (FAP) [17].

In the first stage of the initial lesion, with no cavity presented yet, changes begin to occur in the subsurface layer of enamel. Preventive methods can completely repair and demineralise the lesion at this stage with complete extinction of the white spot - restitution ad integrum [18].

Vulovich in his in - vitro study has simulated acid demineralisation enamel area and used abrasive fluoride toothpaste directly to it. It was concluded that the mechanical effect of brushing reduced demineralisation of the enamel surface. Caries control measures must be established as the first step towards caries reduction, which will cause long-term changes in the oral environment, with the aim of transforming it from cariogenic to non - cariogenic [19].

His findings completely correlate with our investigation, because most of the initial changes in our patients were completely restored after regular controls with topical fluoride treatment. The positive cariostatic effect was also achieved by maintaining regular oral hygiene and improved hygiene and dietary regimen in the control group of the patients not treated with a topical fluoride treatment. Removal of the cryogen plaque inhibited the process of demineralisation, which resulted in biological repair of macula Alba, and stopped further progression of a carious process in the already created cavity [20][21][22].

Beside local benefits of the fluoride treatment in the process of remineralisation of the enamel, it also influenced the soft plaque reduction. In the group of patients with topical fluoride treatment, it showed a positive effect on the index of oral hygiene (OHI - index). The process of remineralisation occurs when the pH of dental plaque rises. The presence of fluoride

reduces the critical pH by 0.5 pH.

Results in the present study demonstrated that education of the parents of children with high risk of developing caries is also very important part of our investigation. Our findings are similar to those saying that traditional health education may be insufficient to change parents' behaviour about their at-risk children. While some parents of children with ECC are unaware of the aetiology of this disease, others are well motivated, and the results in their children are unavoidable [23][24].

The important part of the investigation was advising parents about the importance of dietary regime. Bad diet and nutrition may interfere with the balance of tooth demineralisation and remineralisation in several ways. A diet rich in sugars and other fermentable carbohydrates, which are metabolized to acids by plaque bacteria, result in low pH and the growth of the acidogenic and aciduric bacteria (mutans streptococci). On the other side, a diet lower in added sugars and fermentable carbohydrates and high in calcium-rich cheese may favour remineralisation [25][26][27].

In the developed countries as a result of the effective and well-timed implementation of the primary preventive measures, the Early Childhood Caries has a relatively low prevalence of 3% [15]. In undeveloped countries, lack of information on the adequate way of feeding and no solid oral hygiene is the reason for the prevalence of the Early Childhood Caries is up to 45% [28-30].

From the analysis of the results obtained, it can be concluded that: - the level of oral hygiene is correlated with the progression of changes in enamel; - oral hygiene and fluoride treatment significantly influence in lowering of the soft layers; and - for the treatment group of patients, topical fluoride treatment has a positive effect on the index of oral hygiene (OHI).

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