

DYNAMICS OF ORAL HYGIENE AND GINGIVAL STATUS DURING A COMPREHENSIVE GROUP PREVENTIVE ORAL HEALTH PROGRAM IN CHILDREN

Paediatric Dentistry

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ABSTRACT

Aim: To monitor the dynamics of oral hygiene and gingival status during a comprehensive group preventive oral health program for children. **Materials And Methods:** The study included 106 children aged 11-13 years. Oral hygiene status (FMPS) and gingival status (FMBS) were assessed for all children. The comprehensive preventive program was conducted over 4 visits within 1 month, through a motivation module and an education module. **Results:** The oral hygiene and gingival status of the studied children improved gradually during the program, with plaque accumulation being minimal 1 month after the beginning of the program, affecting approximately 30% of the tooth surfaces. The gingival status in all children showed a presence of bleeding on probing, involving approximately 13% of the gingival units, which is considered as gingival health.

KEYWORDS

Oral disease prevention in children, group preventive program, motivation for maintaining oral health in children.

INTRODUCTION:

Maintaining oral health during childhood is a prerequisite for the future dental well-being of an individual, just as early growth and development predict many aspects related to health throughout life. This is the reason why children are a primary focus of preventive measures aimed at promoting good oral health, as well as the development of approaches for the prevention of oral diseases in childhood [1].

Creating conscious behavior for maintaining oral health is a key factor in oral prevention, and the childhood and adolescent are the most suitable for establishing correct habits and behaviors related to oral health [2,3]. The efforts of dental professionals in this regard are directed towards creating programs for promoting oral health, which, according to the World Health Organization (WHO), should be school-based, as they cover a larger segment of the population [4].

School-based oral health promotion programs typically include modules for education on topics related to oral health or oral hygiene programs, which are often implemented independently or in isolation from each other [5,6]. Although the effectiveness of these programs has been researched and shows good results, a protocol for conducting such programs that can be applied in a school environment without disrupting the educational process has not yet been developed. Moreover, most available literature sources focus solely on education related to oral health topics, without relying on the children's prior theoretical preparation, which is crucial for creating conscious healthy behaviors [7,8,9]. There is still a lack of data on the specific structuring of oral prevention programs that address different age groups of children, where cognitive abilities, as well as oral health risk factors, can vary significantly.

To evaluate the effectiveness of oral health promoting programs, the dynamics of oral hygiene and gingival status in children included in such programs are typically monitored in clinical settings, which shows the program's effectiveness and whether there has been a change in the children's health habits related to maintaining oral health.

AIM:

The aim of this study is to monitor the dynamics of oral hygiene and gingival status during a comprehensive group preventive oral health program in children.

MATERIALS AND METHODS:

Materials

For the purpose of this study, we examined 106 children aged 11-13 years, students from Hristo Botev Primary School in Blagoevgrad, Bulgaria. The children were evenly distributed by gender and age ($\chi^2 = 0.709, p > 0.05$).

The inclusion criteria for the children in the study were: signed informed consent from a parent, approved by the Ethics Committee (Contract No. D-168/03.08.2023), no systemic diseases, no fixed orthodontic appliances, and no antibiotic use in the last three months.

Other Materials Used In The Study

- Dental plaque disclosing solution PlacAid, which reveals old (stains red) and new (stains blue) dental biofilm;
- Electronic periodontal probe **PA-ON (Orangedental)** for assessing oral hygiene and gingival status during the program;
- Interactive educational materials;
- TePe plaque search disclosing tablet for plaque visualization, as well as Colgate junior smiles toothpaste and toothbrushes for home use;
- Plastic models for demonstration and training (Fig. 1).



Fig. 1 Plastic models for demonstration and training

Methodology

1. Clinical Method

All children were examined in the school's dental office according to a schedule set by their teachers, in line with their academic workload. Initially, a dental status was recorded by registering carious lesions with a diagnostic threshold using the ICDAS codes 03, 04, and 05 (non-cavitated and cavitated).

Immediately after, a gingival status was recorded using the **full mouth bleeding score (FMBS)** index, to assess the presence/absence of gingival bleeding upon probing (Fig. 2). Probing was performed on all fully erupted permanent teeth at four gingival points – three vestibular and one oral.

To assess oral hygiene status, the **full mouth plaque score (FMPS)** index was used. With the help of a cotton swab soaked in plaque disclosing solution, the tooth surfaces were stained, and the presence/absence of plaque accumulation was recorded for all fully erupted permanent teeth. The staining in the gingival third of the tooth crown was recorded in three vestibular areas and one oral area.

The data from the clinical examinations were manually entered by the examiner and transferred into the software of the electronic periodontal probe, which automatically calculates the values of the individual clinical indices.



Fig. 2 Probing to assess gingival status

The clinical examination of all the children included in the study was conducted during 4 visits at intervals defined by the preventive program. At the end of each visit, professional oral hygiene was performed using a toothbrush and polishing paste to remove the plaque indicator liquid.

2. Methodology of the Group Oral Health Prevention Program for Children

The goal of the applied comprehensive oral health preventive program was to create motivated, informed, and correct behavior and habits related to the main oral diseases – dental caries and gingival inflammation, in a group setting.

The sequence of visits and modules of the preventive program is presented in the following table (Table. 1).

Table 1 Program Design

I. Assessment	Full mouth plaque score + full mouth bleeding score	
Motivation and education(after 3 days)	I module Motivation	II module Education
	1. Interactive method – Power Point presentation 2. Game method – „What did I remember?“	1. Interactive method for education (video) 2. Demonstration method (on plastic model) 3. Game method - „How is it done?“
II. Assessment (after 1 week)	Full mouth plaque score + full mouth bleeding score	
III. Assessment (after 1 week)	Full mouth plaque score + full mouth bleeding score	
IV. Assessment (after 1 month)	Full mouth plaque score + full mouth bleeding score	

In the **first module** of the program, emphasis was placed on motivating the children by providing appropriate and relevant information. Using an interactive method with a PowerPoint presentation, the children were introduced to the main oral diseases, as well as the causes of their development. Special attention was given to the role of the children themselves in preventing dental caries and gingival inflammation through adherence to specific rules for proper health behavior. After the presentation, a game called "What did I remember?" was conducted, where the children were engaged in analyzing and interpreting the presented information through a playful method.

The **second module** focused on education. Audiovisual original videos were shown to the children, presenting various oral hygiene tools and specific techniques for their proper use. Afterward, using plastic models of dental jaws, the Stillman method for tooth cleaning was demonstrated. At the end of this module, another game called "How is it done?" was held, with the goal of having the children try to replicate what they had learned under the supervision of the program leader, who made necessary corrections if needed (Fig. 3).



Statistics:

The data obtained from the study were processed using the IBM SPSS software, version 19.0. The adopted critical significance level for testing the null hypothesis (H0) was $\alpha = 0.05$.

To objectively evaluate the results from the conducted analyses, the following methods were used:

- Descriptive analysis;
- Analysis of variance (ANOVA);
- Paired samples T test for comparing related groups;
- Independent T test for comparing independent groups;
- Pearson Chi-Square test (χ^2);

RESULTS:

1. Caries prevalence in the studied children

The following diagram presents the data on caries prevalence in the studied children, categorized by age groups (Fig. 1).

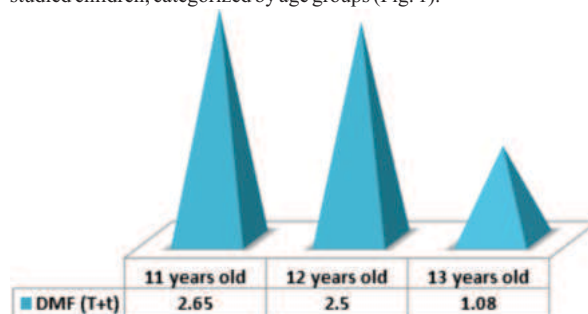
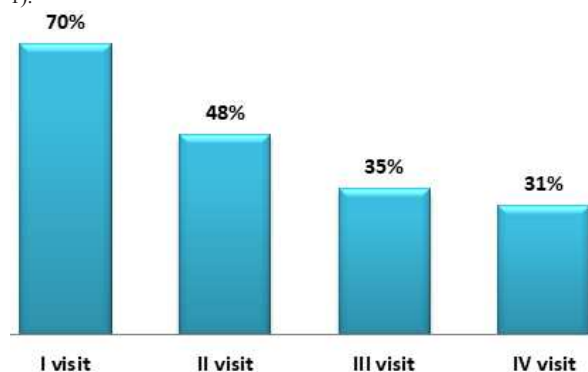


Fig. 1 Caries prevalence in the studied children by age

From the diagram, it can be seen that the DMF (T+t) is the lowest in 13-year-old children, where, on average, 1 tooth per child is affected by carious processes. Twice as many teeth affected by caries are found in 11 and 12-year-old children, which is statistically significant ($t = 1.57$, $p < 0.05$).

2. Oral hygiene status of the children during the study

The following graph shows the values of the plaque accumulation index over the course of the study for all the children examined (Graph 1).



Graph 1 Dynamics of FMPS during the study.

From the graph, it can be seen that during the program, the values of the plaque accumulation index gradually decrease. The initial oral hygiene status shows that approximately 70% of the tooth surfaces are covered with dental biofilm, while by the end of the program, plaque accumulation decreases significantly by about 40% ($t = 20.81$, $p < 0.05$).

The following table shows the dynamics in the values of oral hygiene status during the program in different age groups (Table 2).

Table 2 Oral Hygiene Status During The Program By Age.

Age	N	FMPS				Paired sample test
		I visit ¹ Mean±SD	II visit ² Mean±SD	III visit ³ Mean±SD	IV visit ⁴ Mean±SD	
11 years old	52	74,42±10,15	51,19±4,18	34,85±14,47	30,31±15,00	$p < 0,05^*$

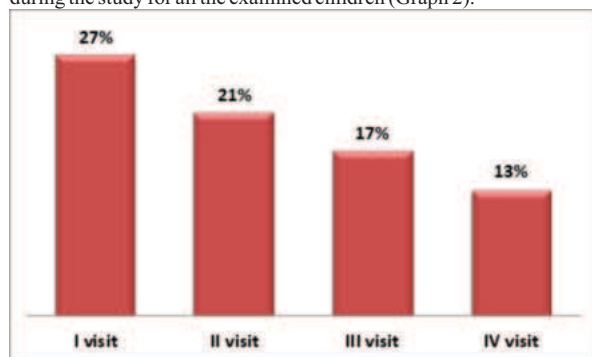
12 years old	28	72,14±11,57	53,00±2,69	30,21±11,54	25,43±14,47	p<0,05* p _{3,4} >0,05
13 years old	26	57,96±12,21	36,88±11,07	39,00±8,83	39,12±12,75	p _{2,3} >0,05 p _{2,4} >0,05 p _{3,4} >0,05
ANOVA		t _{11,12} = 2.28 p >0.05 t _{11,13} = 16.46 p <0.05* t _{12,13} = 14.18 p <0.05*	t _{11,12} = -1.80 p >0.05 t _{11,13} = 4.15 p >0.05 t _{12,13} = -8.78 p <0.05*	t _{11,12} = 4.63 p >0.05 t _{11,13} = -4.15 p >0.05 t _{12,13} = -8.78 p <0.05*	t _{11,12} = 4.87 p >0.05 t _{11,13} = -8.80 p <0.05* t _{12,13} = -13.68 p <0.05*	

From the table, it can be seen that the initial plaque accumulation in 11 and 12-year-old children is significantly higher compared to 13-year-olds ($p < 0.05$). During the study, plaque accumulation in 11 and 12-year-old children gradually decreased with each subsequent visit, and by the end of the follow-up period, plaque accumulation in these children affected about 25-30% of the tooth surfaces.

In 13-year-old children, a decrease in plaque accumulation was observed during the second visit ($p < 0.05$), and these values remained unchanged until the end of the follow-up period, showing around 37-39% involvement of the tooth surfaces with plaque accumulation ($t = -1.51, p > 0.05$).

3. Gingival status of the children during the study

The following graph presents the values of the gingival bleeding index during the study for all the examined children (Graph 2).



Graph 2 Dynamics of FMBS during the study.

Table 3 Gingival Status During The Program By Age

Age	N	FMBS				Paired sample test
		I visit ¹ Mean±S D	II visit ² Mean±S D	III visit ³ Mean±S D	IV visit ⁴ Mean±S D	
11 years old	52	27,62±16,91	21,73±12,55	16,92±11,05	13,42±7,60	p<0,05*
12 years old	28	33,43±19,61	25,93±11,06	18,93±11,38	13,14±5,84	p<0,05*
13 years old	26	17,15±6,57	14,81±5,67	14,73±4,95	13,58±3,87	p _{2,3} >0,05 p _{2,4} >0,05 p _{3,4} >0,05
ANOVA		t _{11,12} = -5.81 p >0.05 t _{11,13} = 10.46 p <0.05* t _{12,13} = 16.27 p <0.05*	t _{11,12} = -4.19 p >0.05 t _{11,13} = 6.92 p <0.05* t _{12,13} = 11.12 p <0.05*	t _{11,12} = -2.00 p >0.05 t _{11,13} = 2.19 p >0.05 t _{12,13} = 4.19 p >0.05	t _{11,12} = 0.28 p >0.05 t _{11,13} = -0.15 p >0.05 t _{12,13} = -0.43 p >0.05	

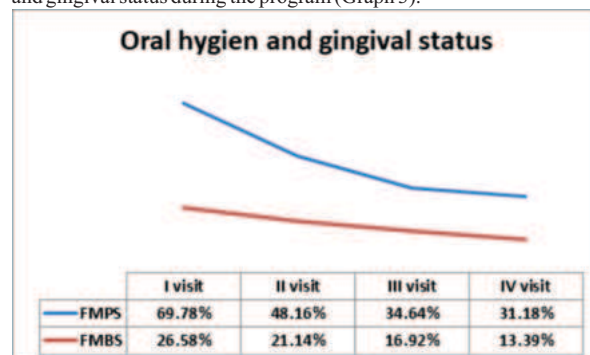
From the graph, it can be seen that the values of the gingival bleeding index gradually decrease during the study. The initial gingival status of the children shows the presence of bleeding on probing affecting 27% of the gingival units, indicating that the children had initially localized gingival inflammation. At the end of the follow-up period, the values of the index show a prevalence of around 13%, which is at the threshold of periodontal health ($t = 11.62, p < 0.05$).

The following table shows the dynamics in the values of bleeding on probing index during the study in different age groups (Table 3).

From the table, it can be seen that in 11-year-old children, the values of bleeding on probing decrease by 15%, and in 12-year-old children by 20% by the end of the follow-up period. It is noteworthy that, during the first and second visits, the values of FMBS in 11 and 12-year-old children are significantly higher than in 13-year-olds ($p < 0.05$). This is likely due to the fact that the initial bleeding on probing in 13-year-olds was low. In the third and fourth visits, the values of the index are approximately the same for all three age groups ($p > 0.05$).

4. Comparative data between oral hygiene and gingival status during the program

The following graph presents comparative data between oral hygiene and gingival status during the program (Graph 3).



Graph 3 Dynamics of plaque accumulation and gingival status during the program

From the graph, it can be seen that both the oral hygiene and gingival status of the children studied improved gradually during the program. One month after the beginning, plaque accumulation was minimal and covered approximately 30% of the tooth surfaces. The gingival status in all the examined children showed the presence of provoked gingival bleeding affecting approximately 13% of the gingival units, which is considered as gingival health.

DISCUSSION:

The goal of our developed comprehensive group preventive program was to create lasting motivation and conscious behavior in children related to maintaining oral health. The multifactorial etiology of oral diseases necessitates a comprehensive approach in preventive strategies, targeting all factors that contribute to maintaining balance in the oral environment [10].

In this study, we found that both the oral hygiene and gingival status of the participants in the program gradually improved over the follow-up period. At the end of the period, the plaque accumulation levels in the children were around 30%, which we consider minimal, and the values of their gingival status reached levels characteristic of periodontal health. We believe that the comprehensive approach of our program, as well as its application in a group environment, positively influenced both the children's motivation and the development of better habits for maintaining oral health.

The development and application of individual preventive programs show high effectiveness on an individual level. However, building long-term habits and maintaining them over time requires continuous control and re-motivation, which requires additional efforts from both pediatric dental specialists and the families of adolescents [11,12,13,14].

Group oral health prevention programs, on the other hand, show high effectiveness and long-term results when applied according to a specific methodology that guarantees awareness and motivation through group dynamics [15]. Such programs save resources for the facilitator, as the same amount of time is dedicated but impacts more children, and at the same time, they do not engage parents, as these programs are typically held in a school setting. The principles of group dynamics, which emerge during such programs, create a competitive environment that further engages children and influences the results. Furthermore, when children are placed in a shared environment and share what they have learned, conditions are created for further

discussions even after the session has ended.

Whether individual or group-based, preventive oral health programs must address all risk factors related to oral pathology. This is achieved through motivation based on the individual or group characteristics of the participants, a preliminary assessment of the children's knowledge on oral health topics, and subsequent education on avoiding the main risk factors for oral pathology, as well as specific oral hygiene programs [10,16].

CONCLUSION:

The application of a comprehensive group preventive oral health program for children aged 11-13 years shows high effectiveness, leading to improvements in oral hygiene status and the recovery of gingival health.

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