Range of Dentocult Tests in Children Treated with Different Preventive Procedures for Plaque Control

Hrvoje Jurić
Ilija Škrinjarić
Domagoj Glavina

Department of Pedodontics
School of Dental Medicine
University of Zagreb

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Summary

Plaque amount and number of bacteria in whole saliva is directly connected with individual caries risk. The aim of this study was to evaluate efficacy of several preventive measures in reduction of Streptococcus mutans *and* Lactobacillus spp. *and plaque control. The study comprised 54 subjects, aged 4-5 and 10-12 years, divided into 3 equal groups with 18 subjects each. Each group was treated with a different preventive agent. The first group with a solution of aminfluoride, the second with professional prophylactic paste and the third with the same paste and additional xylitol-fluoride containing chewing gum on a daily basis. Whole saliva samples and other data were collected 5 times. The first time before the preventive procedure, the second time 30 minutes after, the third time 7 days after, the fourth time 30 days after and the last time 60 days after the preventive procedure. After statistical analysis the following conclusions were made: professional prophylactic paste Proxyt shows high efficacy in a reduction of cariogenic microorganisms and plaque control in contrast to aminfluoride solution. The best results were obtained in the third group, which can be explained by the additional effect of chewing gum in bacteria and plaque reduction during the two months of the investigation.*

Key words: Streptococcus mutans, Lactobacillus spp., *caries prevention.*

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Address for correspondence:

Hrvoje Jurić, D.D.S., M.S.
Department of Pedodontics
School of Dental Medicine
Gundulićeva 5
HR-10000 Zagreb
Croatia

Introduction

In spite of the ever improving state-of-the art and methods available for its efficient prevention, caries remains one of the most widespread diseases worldwide. For example in the USA, 45.7% of children aged 5-17 years have carious teeth (1). In underdeveloped and developing countries, the situation is even worse (2, 3). Loesch made one of the best caries definitions, at the same time providing guidelines for its more efficient reduction: "Dental decay is a chronic, complex bacterial infection that results in milligram losses of mineral from the affected teeth. Despite the multifactorial nature of the infection, the major bacterial and dietary factors that contribute to its expression have been identified" (4). Scientists believe that a multifactorial disease such as caries can only be prevented by multiple inter-

action of a number of preventive procedures. Such a set or "package" of currently known preventive measures lead to the desired goal, i.e. prevention of caries (5). The synergistic action of food, saliva, fluoride, artificial sweeteners (xylitol) and the immune system is a complex and variable system that should be well understood (6, 7) for the preventive measures to be fully efficient. Much effort has been invested in the development of various models for caries prediction (1, 2). An ideal model has not yet been developed, probably due to the above mentioned complexity of the system to be influenced upon. However, qualitative and quantitative analysis of whole saliva has been accepted as one of the widely used clinical procedures that yields relevant data on caries activity (8, 9).

The aim of the study was to assess the efficacy of different preventive procedures in the reduction of the pathogenic flora responsible for the occurrence of caries, i.e. *Streptococcus mutans* and *Lactobacillus*. Data on oral hygiene index, amount of whole saliva, and dmf-s or DMF-S index were only used as complementary information to facilitate individualized caries prevention in the future.

Subjects and methods

The study included 54 subjects, 29 male and 25 female, regularly visiting the Department of Pedodontics, School of Dental Medicine, University of Zagreb, in Zagreb. Study subjects were divided into three groups of 18 subjects each. According to age, the subjects were divided into two groups aged 4-5 and 10-12 years, each group consisting of 27 subjects. The 4-5 age group was predominated by subjects aged 5 (n = 21, 12 male and nine female), whereas the subjects aged 10 were most numerous in the 10-12 age group (n = 10, six male and four female). During the study, the subjects continued with their usual oral hygiene. Subjects receiving any antibiotic during the study were excluded.

In each study subject, salivary content of *Streptococcus mutans* and *Lactobacillus*, salivary buffer capacity, oral hygiene index according to Green and Vermillion (10) and stimulated saliva were determined on five occasions. DMF-S or dmf-s index was recorded at the beginning of the study. Sampling was performed on days 1 (before and 30 min after therapeutic procedure), 7, 30 and 60 of therapy introduction. Subjects were divided into three groups according to the preventive procedure received. Group 1 was treated with Aminfluoride solution (Belupo, Koprivnica, Croatia). Group 2 were treated with Proxyt professional prophylactic paste containing xylitol and cetylamine hydrofluoride (Vivadent, Vivacare, Schaan, Liechtenstein) by use of a synthetic rotating toothbrush on a slow rotating hand piece at a mean rate of 6000 rpm. In addition to the Proxyt paste treatment as in group 2, group 3 used Sensodyne chewing gums with xylitol and fluoride (Block Drug Inc., Ratingen, Germany), according to the predetermined protocol: 5 dragees per day during the first week, 3 dragees per day during the second week, and one dragee after evening meal till the end of the study. The mean time of chewing was 7-10 min.

Streptococcus mutans and *Lactobacillus spp*. were determined by the commercial systems Dentocult SM and Dentocult LB (Vivadent, Vivacare, Schaan, Liechtenstein), respectively, belonging to the category of dip-slide tests. Salivary buffer capacity was measured by Dentobuff system (Vivadent, Vivacare, Schaan, Liechtenstein). All bacterial cultures were cultivated in the manufacturer's thermostat at standard temperature of 36.5°C. Culture media were stored and prepared according to the manufacturer's instructions. These instructions were followed on the sampling procedure. The results obtained by culture in the thermostat were read by use of the Model Chart supplied by the manufacturer. Oral hygiene index was determined according to Green and Vermillion10 (simplified), and dental plaques were stained by a plaque indicator (Vivadent, Vivacare, Schaan, Liechtenstein). Stimulated saliva was collected over 5 min, and its amount in milliliters was measured by the graded tube for saliva collection. DMF-S or dmf-s index was recorded by clinical examination performed by one investigator with the use of a dental mirror and a probe with an appropriate independent light source.

Besides variable description, standard methods for testing hypotheses on possible associations between particular pairs of variables (X^2-test, rank based tests) were employed. STATISTICA for Windows, Release 5.5 H ('99 Edition) and SPSS for Windows,

Release 6.1 statistical packages were used for statistical analysis and data presentation.

Results

Distribution of *Lactobacillus spp*. before and after caries preventive measures in all the three study groups is presented in Fig. 1, showing pronounced microorganism reduction in group 3 treated by Proxyt and chewing gums. Aminfluoride solution shows minimal influence on number of *Lactobacillus* spp. Figure 2. presents the results of *Streptococcus mutans* reduction per milliliter of saliva. This figure shows a very low efficacy of aminfluoride and a relatively limited effect on this microorganism in general. Despite this Proxyt paste suported by chewing gums achieved the best results of all studied preventive agents.

Changes in the oral hygiene index are illustrated in Fig. 3, showing an almost instantaneous effect of Proxyt paste. A prophylactic paste such as Proxyt, supported by chewing gum ensure very good efficacy, especially in cariogenic bacteria reduction and plaque control.

For obvious reasons, the amount of stimulated saliva was analyzed separately for particular age groups (younger and older) (Fig. 4). However, it should be noted that the amount of stimulated saliva is considerably increased by the use of chewing gum.

Discussion

The amount of plaque formation and bacterial count in the saliva are directly associated with the individual risk of caries development (11, 12). The number of *Streptococcus mutans* is strongly indicative of caries, and its finding in the patient's saliva, plaque or fissures of the tooth point to a high risk of caries development (13, 14). A problem encountered in daily dental clinical practice is how to objectively identify such patients, assess the real risk level, and introduce appropriate treatment to reduce the risk of caries. One of the simple and clinically acceptable criteria that may facilitate the procedure is determination of the relative salivary amount of bacteria mobilized from dental plaque. This can be quite easily performed by use of diagnostic tools such as Dentocult tests, employed in the present study, for determination of pathogenic bacteria, e.g., *Streptococcus mutans* and *Lactobacillus*, the major cariogenic agents (15, 16). The third tool in the system is Dentobuff, able to determine salivary buffer capacity rapidly and in a very small sample, thus providing complementary data on a particular patient's risk for caries development. Such an approach can provide good results and useful orientation for appropriate choice of therapy in such a patient.

Each of the preventive agents used in the study has a specific mechanism of action. Favorable effects of each of them and data obtained in the study are presented below. Aminfluoride, an organic fluoride compound in the form of mono- and dihydrofluoride, increases local concentration of fluoride and, which is equally important, stimulates salivation better than inorganic fluorine compounds (monofluorophosphate, APF, NaF, SnF) (17), as also confirmed in the present study. During the study, the existing protocol for the use of aminfluoride was validated, promoting its weekly use as an optimal preparation dose for efficient caries prevention.

The action of the professional prophylactic paste Proxyt, used in groups 2 and 3, is based on its caries preventive effect. The paste contains three active substances, an organic compound of fluoride acetylamine hydrofluoride (total fluorides content, 0.05%) and xylitol, which comprise the basis of its caries protective action. However, the abrasive and polishing properties of Proxyt in preventive procedures should by no means be neglected either (18, 19). Thirty minutes after the paste application, the very high mean values of 2.5 for *Streptococcus m.* and 10^5 colonies for *Lactobacillus* fell to the respective mean values of 1.22 and slightly above 10*3*, ensuring quite a safe setting in terms of caries development (20). Thus, the paste showed its caries preventive value with a prolonged action for about two months, suggesting a standard three-month recall.

The effect of xylitol on plaque formation and metabolism has also been thoroughly studied, and its effects on these segments of the cariogenic process are well known. The effects of xylitol in plaque control and its metabolism modification have been

definitely proved, pointing to it as an indispensable participant and mediator in caries prevention (21, 22).

The results obtained in group 3 treated with Proxyt and chewing gum containing xylitol and fluoride confirmed the facts presented above. The values of all variables relevant for the assessment of the risk of caries and plaque control efficiency were lower than those recorded in the other two subject groups during the study and, which is of utmost importance, at the end of the study. This could be explained by the additional intake of active substances such as xylitol and fluorides into the oral cavity via chewing gum, one of the most efficient vehicles today (23, 24).

In conclusion, bacterial count in the saliva and plaque can be relatively successfully controlled, which should be used for efficient individual caries preventive therapy. Only individual therapy will ensure highly successful caries prevention, which is very difficult to prevent due to its multifactorial causality.