MULTICENTRIC CARIES PREVENTION PROGRAM: MECHANICAL CONTROL OF DENTAL PLAQUE THROUGH PERIODIC PROFESSIONAL ORAL PROPHYLAXIS. A 10 YEARS FOLLOW-UP

ABSTRACT

AIM: To verify the incidence of dental caries in a multicentric prevention program applied in pediatric dentistry clinics from different regions of Brazil for 10 years, and compare with results obtained by previous studies. **MATERIAL AND METHODS:** 697 children of both genders, ranging from 30 months to 15 years, were included in a primary preventive strategy program for mechanical control of dental plaque through professional prophylaxis (sodium bicarbonate jet on a monthly schedule). Diagnosis of carious lesions was assessed by monthly clinical examinations and annual radiographs. This procedure aimed to provide a biological equilibrium without producing undesirable side effects. **RESULTS:** The average age of children at beginning of the program was 81.71 months. Before entering the program the children presented an average of 2.66 lesions/surface, while during the program the average was 0.20 lesions/surface; the incidence rate of caries per year before starting the program was on average 0.62 lesions/surface while during the program it was 0.05 lesions/surface; the time of permanence in the program was on average 44.15 months and the absence rate was 0.14 per year. **CONCLUSION:** The results confirm the effectiveness of the program, even when applied by different professionals and in different groups of children, turning it into an indispensible method for the control of dental caries.

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INTRODUCTION

Among the problems of oral health, tooth decay is still one of the biggest challenges in Dentistry[1] and its understanding as a multifactorial process has led researchers to search for the development of several methods of prevention, which mostly aimed to interfere with possible factors involved in the carious process, as well as to increase the resistance of the host.

Several preventive strategies have been established based on criteria such as counting of microorganisms, dietary control, use of fluorides, pit and fissure sealing, among others, without any of them reaching optimum levels of caries prevention. Moreover, the possible side effects caused by the implementation of these measures should be evaluated. The widespread use of fluoride in recent decades, for example, has been associated with an increased number of dental fluorosis, suggesting the development and expansion of other preventive measures[2-4].

Dental plaque plays an important role in the development of carious lesions and some authors consider it the main cause of the appearance of this lesion: "dental caries disease is multifactorial but dental plaque is the only cause"[5]. Thus, plaque control is essential when developing any caries prevention strategy and can be achieved by chemical or mechanical means. The constant use of chemical agents can lead to several changes in the oral environment such as peeling of the mucosa, alteration of the palate, hypersensitivity reactions or modification of the oral microbiota, leading to the emergence of opportunistic infections and perhaps some level of systemic toxicity[6,7]. Therefore, advising against this method as a routine procedure should be given.

Mechanical plaque control, on the other hand, can be implemented without causing any significant side effects and can be performed by the individual itself, through brushing and flossing, or through professional oral prophylaxis. Brushing and flossing are effective, very simple and widely used, but when it comes to children, their effectiveness is diminished because of psychomotor limitations typical to that age, which hinder learning and proper conduct of the technique[1]. On the other hand, oral prophylaxis has proved to be an efficient method for removing plaque[1,8-10] and has gained a great importance in dental caries prevention programs[1,11-14]. Performing constant oral prophylaxis aims to correct the deficiencies of brushing[1] during the period in which psychomotor abilities appear inefficient.

Due to the unsatisfactory results during 10 years of clinical experience with applications of all preventive methods recommended so far and based on the studies of Axelsson and Lindhe (1974)[11] and Axelsson, Lindhe and Waseby (1976)[13], it has been

started in 1982, a program for prevention of dental caries in a private practice which main preventive method was the mechanical plaque control through periodic professional oral prophylaxis.

This preventive strategy promotes a biological balance, avoiding unwanted side effects that compromise health and well-being of the child and family. Based on the success of Lima (2009)[14], some pediatric dentistry professionals have implemented in their clinics, starting in 1996, a preventive program with the same methodology, maintaining as its main method of prevention the mechanical plaque control by means of periodic professional oral prophylaxis.

The objective of this study is to present the results of caries incidence in children attending six Brazilian clinics over 10 years of follow-up and to compare the results of the obtained data to those found by Lima (2009)[14].

MATERIAL AND METHODS

The prevention program was developed in six pediatric dentistry clinics located in different cities of Brazil: Tupã and Bauru (São Paulo state), Santa Cruz do Sul (Rio Grande do Sul state), Sinope and Cuiabá (Mato Grosso state) and Juiz de Fora (Minas Gerais state). Ethical approval for the study involving human subjects was granted by the local Ethics Committee (CAAE: 14805813.8.1001.5417; Ethics Committee of the Bauru School of Dentistry, University of São Paulo, SP, Brazil).
Six hundred and ninety-seven children of both genders participated in the study, 338 male and 359 female, ranging from 30 months to 15 years of age, regardless their psychomotor and socio-cultural conditions.

Following the exact methodology established by Lima (2009)[14], at the onset of the program, the children were clinically examined and radiographs were taken, detecting and recording carious, missing and previously restored surfaces (dmfs). These data were recorded and caries incidence was determined at the moment the child was included in the program, considering their age at that moment as a parameter and excluding the first year of life (number of caries before the program/per surface/per year). At this time, if necessary, a restorative treatment for the existing carious lesions was carried out, allowing the child's entrance into the program without any lesion being neglected or not treated. The number of new lesions was assessed determining the caries incidence during the program.

The program was undertaken with a single preventive strategy for every child, regardless of their individual conditions as well as their previous experience or risk for caries.

During their permanence in the program, or until 15 years of age, the children

were given monthly a professional oral prophylaxis with sodium bicarbonate jet. The professional prophylaxis was preceded by plaque disclosure and complemented with the use of dental floss, aiming to remove 100% of the plaque. Other methods such as sealing of pits and fissures, dietary and tooth brushing orientation, and patient's motivation were added to the program as supporting techniques, without, however, any sort of efficacy control (that is, without any protocol as to the usage of these methods or any study of possible effects on caries incidence). Therefore, the only prevention method considered indispensable and rigorously executed was the mechanical control of plaque through the use of monthly professional oral prophylaxis with a sodium bicarbonate jet.

Over 10 years of program, the professional prophylaxis sessions were undertaken by pediatric dentists and the motivational sessions by dental technicians.
Caries diagnosis was done through clinical examinations during the sessions and annual interproximal radiographs.

A descriptive statistical analysis was performed and the parameters were the average and standard deviation for each of the observed aspects. To evaluate the correlation between variables, the Spearman Test of Correlation was performed, and to compare data between the 2 studies, the non-parametric Mann-Whitney test was employed. In each of these statistical tests, the significance level was set at 5% ($p<0.05$).

RESULTS

The results are presented in Tables 1 to 7 and Figure 1.

DISCUSSION

The success of this preventive program developed by Lima (2009)[14] over many years, establishing a service protocol that proportioned comfort and safety for the child and related family, quality of life, biological equilibrium and, foremost, success in the control of dental caries, led some pediatric dental professionals to express interest in implementing in their clinics the same methodology. With this intention, it became possible to develop over 10 (ten) years this prevention program in six regions of Brazil and to verify the efficacy of this preventive strategy, when applied by different professionals and on different groups of children.

It is worth adding that the program of Lima (2009)[14] was initiated in 1982 and the multicenters in 1996, 14 years later.

In the same way as in the study of Lima (2009)[14], the targeted population was children ranging from 30 months to 15 years of age, taking into consideration the difficulties reported by parents in following the

professionals' recommendations regarding tooth brushing and dietary orientation, and due to the psychomotor limitations inherent to a child in growth and development, that confers to them immaturity and irresponsibility, making these methods less than effective and turning the child into a high-risk group.

Table 1. Results of average, standard deviation (SD), minimum (Min) and maximum values (Max) for the studied variables.

Variable	Nº of children	Average	SD	Min	Max
Age of child upon initiation of program (in months)	697	81.71	38.77	30	168
Nº carious lesions surfaces upon entering the program (per patient)	697	2.66	5.00	0	53
Nº. carious lesions surfaces detected during program (per patient)	697	0.20	0.69	0	6
Incidence of carious lesion surfaces before program (per year)	697	0.62	1.60	0	18.2
Incidence of carious lesion surfaces during program (per year)	697	0.05	0.18	0	1,8
Time remaining in program (in months)	697	44.15	24.00	12	103
Nº. of absences (per year)	697	0.14	0,36	0	3.7

Table 2. Distribution of children by service centers.

Service Center	Nº. of children assisted
1	103
2	71
3	236
4	110
5	116
6	61
Total	697

Table 3. Distribution of children by carious surfaces during the program at multicenters.

Nº. of children	Nº. carious surfaces	Percentage
623	0	**89.3%**
39	1	**5.5%**
21	2	**3%**
5	3	**0.7%**
6	4	**0.8%**
1	5	**0.14%**
2	6	**0.2%**
697	137	**100%**

Therefore, it is of most importance to implement a better and long term strategy of prevention. On the other hand, after 15 years of age, due to their maturity, the child that was educated, motivated, and trained has conditions to perform plaque control by means of an efficient brushing. Besides that, at this phase, in general, all the permanent teeth are in occlusion, which eases cleaning.

Similar to the study of Lima (2009)[14], the distribution of the children in the sample was done in a random order, representing what occurs in the population, and proved that there was no difference in caries incidence between genders.

Professional cleaning is made through the use of different instruments, although the sodium bicarbonate jet has been shown to be more effective in plaque removal, especially in regions of the teeth like pits and fissures[15-19].

The efficacy of the mechanical plaque control through the use of professional oral prophylaxis is already recognized, when performed periodically, for reducing the incidence and progression of caries[11-14].

However, there is still concern among professionals with respect to possible tooth structure damage when performing this procedure. The application of the sodium bicarbonate jet on healthy dental enamel apparently does not lead to major problems[10,20-22]. On the other hand, when applied on enamel that has an initial carious lesion, it can promote some superficial wear.

According to the study of Honorio et al. (2006)[22], the variability of wear of prophylaxis performed with sodium bicarbonate jet was always lower than the variation promoted when using pumice slurry and brush. The wear caused by prophylaxis with pumice and brush was nearly twice larger than that of prophylaxis performed with sodium bicarbonate jet; besides, clinically, this difference may be even greater, since the wear caused by prophylaxis with pumice and brush is more sensitive to personal variations when compared to sodium bicarbonate jet. Thus, it is believed that the benefit attained by the efficient control of plaque through the use of professional prophylaxis with sodium bicarbonate jet justifies its application.

As this program was developed in private clinics, where the commitment to the patient is to provide the greatest benefits possible in terms of caries prevention, other methods were employed, although as supporting techniques. They were: orientation about the effects of diet, tooth brushing, dental floss, awareness-building and motivation.

However, due to the immaturity and irresponsibility of the child as well as the disinterest of the parents, these methods became inefficient and impossible to be controlled for an extended period of time, making their participation of little significance to the results. Regarding fluoride therapy, even

not being part of the preventive strategies of the program, it could have had a positive effect related to the presence of fluoride in toothpastes and fluoridated public water.

Table 4. Results of average (x), standard deviation (SD), minimum (Min) and maximum values (Max) for the studied values exclusively in children with caries experience.

Variable	Nº of children	Average	SD	Min v.	Max v.
Age of child upon initiation of program (in months)	293	89.56	37.25	30	167
Nº carious surfaces upon entering the program (per patient)	293	6.33	6.02	1	53
Nº. carious surfaces detected during program (per patient)	293	0.32	0.86	0	6
Incidence of carious surfaces before program (per year)	293	1.48	2.19	0,08	18.17
Incidence of carious surfaces during program (per year)	293	0.09	0.23	0	1.8
Time remaining in program (in months)	293	42.89	0.24	12	103
Nº. of absences (per year)	293	0.17	0.42	0	3.69

Table 5. Distribution of children with caries experience by carious surfaces during the program at multi-centers.

Nº. of children	Nº. carious surfaces	Percentage
243	0	82.93%
29	1	9.89%
11	2	3.75%
4	3	1.36%
4	4	1.36%
1	5	0.34%
1	6	0.34%
293	90	100%

Table 6. Distribution of children without caries experience by carious surfaces during the program at multi-centers.

Nº. of children	Nº. carious surfaces	Percentage
380	0	94.05%
10	1	2.47%
10	2	2.47%
1	3	0.24%
2	4	0.49%
1	6	0.24%
404	47	100%

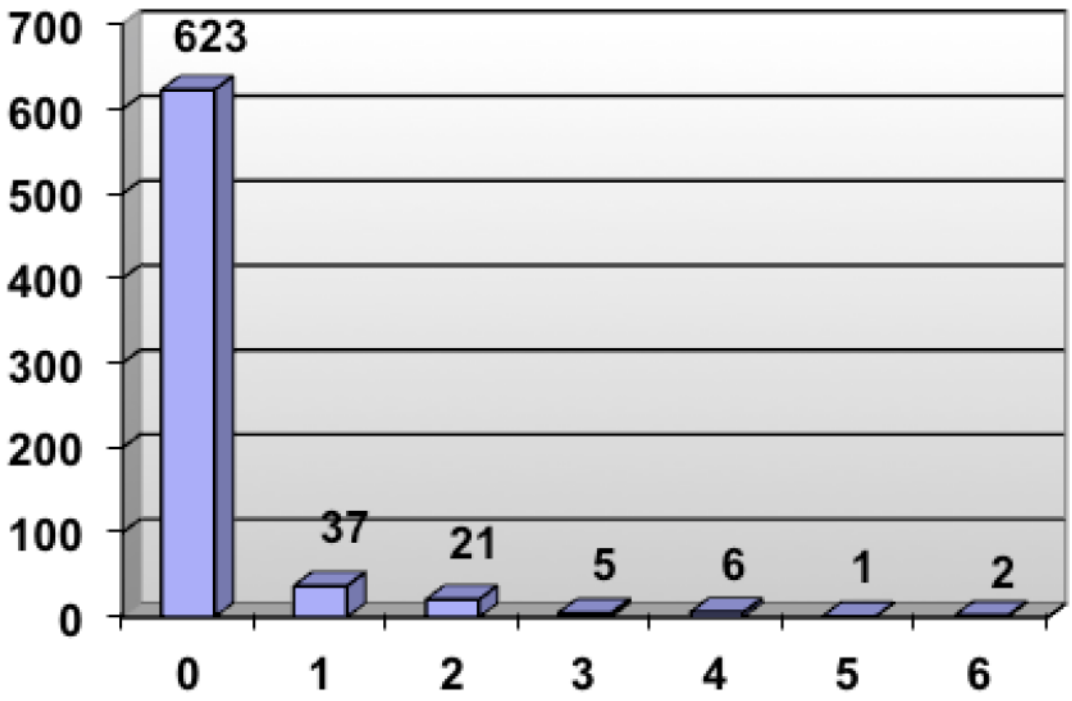
However, this occurred in both groups of children, that is, before and after the program, and therefore cannot be considered responsible for the obtained results.

The sealing of pits and fissures with ionomer cements was especially indicated for teeth in eruption process, but not systematically, so it is impossible to conclude anything regarding its contribution to the results. Focusing on long-term results and summarizing all the relevant aspects to prevention, the awareness-building and motivational sessions, combined with monthly professional oral prophylaxis were the only methods considered indispensable, applied and controlled.

Table 7. Spearman´s coefficient of correlation (R) between incidence of caries in program (ICP), number of caries before program, age of child and number of absences.

Variable pairs	Nº of Children	Value of r	P
Caries during X Age	697	0.003	0.374
Caries during X Caries before	697	0.21	< 0.001*
Caries during X Absences	697	0.11	< 0.001*

Figure 1. Number of patients X Number of carious surfaces.



Analysis of the results of the study of Lima (2009)[14] shows that the average age of the children that entered the program was lower in the multicenters, possibly because these programs began at a more recent scenario where the level of information and interest in prevention is greater. This trend is positive and it may translate into better results in the future.

The number of carious surfaces upon entrance into the program per child, as well as per year, was also significantly lower in the multicenters when compared to the study of Lima (2009)[14]. This can be explained by the lower average age of these children when entering the program, therefore having been exposed for a shorter period of time to an uncontrolled carious challenge. These data shows the need to start the program as soon as possible, at around 3 years of age.

It can be observed that both the incidence of carious surfaces per child (0.20) and per year (0.05) display a result with an insignificant difference when compared to the results obtained by Lima (2009)[14], which were 0.19 and 0.03 respectively. This demonstrates the effectiveness of the program, even when applied by different professionals and in different groups of children and claims for the possible caries eradication in the future.

The distribution of the children per carious surface during the program (Table 3) is displayed in the same pattern as in the study of Lima (2009)[14], where the overwhelming majority of children did not present carious lesions, reaching 89.3% at the multicenters, while in the study of Lima (2009)[14] it reached 89.7%. It can also be observed in Table 3 that during the ten-year period of the program, there was an occurrence of 137 carious surfaces among 697 children participating in the program. Considering that these children, at this age group, have an average of 24 teeth, 12 being posterior with 5 surfaces each and 12 being anterior with 4 surfaces, totalizing 216 surfaces subject to decay, it can be affirmed that each child that participates in the program has 99.8% chance of not having a carious surface. In the study of Lima (2009)[14], among 640 children, 116 carious surfaces occurred during 25 years of program, and, following the same reasoning, it can also be stated that there is 99.8% chance of prevention of tooth surface decay per child.

It is also important to consider the incidence of caries during the program among children with previous caries experience. It can be verified in Table 4 that there was a significant reduction in carious surfaces, both per child as well as per year, from 6.33 to 0.32 and 1.48 to 0.09, respectively. The distribution of children with caries experience per carious surface during the program (Table 5) shows that the overwhelming majority (82.9%), or 243 children, had no caries, while (17.1%), or 50 children, presented a lesion. If it is considered that among 293 children there was an incidence of 90 carious surfaces during the program, and, following the same reasoning described earlier, it can be stated that the probability of a child with caries experience that participated in the program not having caries is 99.7%, while for children without previous caries experience (Table 6) the probability is 99.9%. The analysis of the data

suggests that there is an association between caries experience and the occurrence of caries during the program ($p<0.001$).

The difference in caries incidence during the program between Tables 1 and 4 may be explained by the difference that exists among these children before their ingression into the program, due to the carious challenge determined by their eating habits which may have been maintained during the program; or also the possibility of consequences of the uncontrolled carious challenge that may have occurred before the program and is manifested in the form of carious lesions later on during the program. These presumptions may justify the association between caries experience and caries incidence during the program (Table 7), which can also be noted in the study of Lima (2009)[14]. However, the rate of tooth decay of these children with caries experience became significantly lower during the program.

The results of the correlation between caries incidence during the program and the number of absences at the multicenters (Table 7) was positive, while in the study of Lima (2009)[14], even though maintained for a much longer period, the correlation was negative. This conflict leads to the belief that a minimum possible periodicity in plaque control should be established, and a monthly schedule seems to be the most adequate period.

It can be observed at the multicenters (Table 7) that there was no correlation between the age of the child and caries incidence in the program which is in accordance with Lima's results (2009)[14], indicating that the age of the child should not be considered as a factor in the etiology of caries, thus facilitating the implementation of the preventive program.

Both in the study of Lima (2009)[14] and at the multicenters the average period of permanence of the children in the program translates, with a great deal of clarity, the pediatric dentistry of accompaniment, for both the child and the family, which, besides prevention, aggregates values, providing monitoring of the development of the teeth, early diagnosis and treatment of dental caries. This new proposal, that is, the Dentistry of accompaniment, provides an improved cost-benefit relation in order to obtain quality of life that starts with oral health.

CONCLUSION

The results of this study provide consistent data and confirm the effectiveness of a preventive program based on the mechanical control of dental plaque through the use of periodic professional oral prophylaxis, even when applied by different professionals and in different groups of children, turning it into an indispensible method for the control of dental caries at the age range from 0 to 15 years old.

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