# The Influence of an Oral Health Education Program Provided in a Community Dental Clinic on the Prevalence of Caries Among 12-14 Year-Old Children

Moti Moskovitz* / Wassim Abud** / Diana Ram ***

***Objectives:*** *To evaluate the effectiveness of an oral health education program when given in a public dental clinic, by assessing caries and restorations.*

***Methods:*** *This was done by assessing changes in caries prevalence in the mouth of children aged 12 to 14 year- old. Data was obtained from files of patients treated in the Dental Volunteers for Israel (DVI) clinic in Jerusalem. Children must prove understanding and also application of what they learned in the educational program in order to receive restorative dental treatment.*

***Results:*** *280 children were included in the intervention group. The control group constituted 173 children who had never had any restorative treatment in the DVI clinic. The extent of caries surfaces differed greatly between the intervention and the control groups. 35.2% of the control group, and as many as 64% of the intervention group had low caries (DMFS< 3). The situation is reversed when comparing the difference in the restored teeth surfaces between the two groups- 56.6% of the control group had no restorations and 66.2% of the children in the intervention group had treated teeth. DMFS scores reveal fewer differences between the two groups. The mean carious surface was 1.8 times greater in the control group, and the restored surfaces were 2.1 times greater for the intervention children. Nevertheless when comparing DMFS means between control and intervention groups t-test result shows no statistical significant difference for the slightly lower DMFS levels in the intervention group.*

***Conclusions:*** *This study shows that even a comprehensive preventive program given by professional personnel, followed by free dental treatment, is not enough to improve dental health status for children from a lower socioeconomic class. Still, a consideration of the ethical responsibility of the profession to educate children about oral diseases and their prevention should be carried out, irrespective of the implementation of the knowledge.*

***Keywords:*** *oral health, tooth decay, community dental clinic*
J Clin Pediatr Dent 33(3): 259–264, 2009

## INTRODUCTION:

Providing knowledge of oral health topics to healthy individuals in order to maintain a healthy status is primary prevention in dentistry in the pre-pathogenic phase. This includes tooth brushing, fissure sealants, fluorides supplements, etc. Dental caries is the single most common chronic childhood disease. Caries is considered a preventable disease. Although effective methods are known for prevention and management of the disease, the unmet need for treatment, especially in children, does not seem to be diminishing. Still, since the early 1970s extensive reports on caries decline in industrialized countries were published.[1] Caries is distributed disproportionately so that most of the disease occurs in only a small percentage of the children.[2,3] Children who have had dental caries will most likely continue to develop them in the future. Since children's teeth provide a ready profile of past experiences, the best way to assess the child for future caries risk is to determine the extent of a child's past and current caries state through an oral examination. Other factors such as fluoride intake, oral hygiene, dietary habits, medical history and status, and socioeconomic status are also considered.[4]

Children from families with low income levels are considered at a higher risk than those from more prosperous

* Moti Moskovitz, DMD, PhD Clinical Lecturer, Department of Pediatric Dentistry, The Hebrew University–Hadassah School of Dental Medicine, Jerusalem, Israel.
** Wassim Abud, DMD** Graduate student, Department of Pediatric Dentistry, The Hebrew University–Hadassah School of Dental Medicine, Jerusalem, Israel.
*** Diana Ram, Dr. Odont. Senior Clinical Lecturer, Department of Pediatric Dentistry, The Hebrew University–Hadassah School of Dental Medicine, Jerusalem, Israel.

Send all correspondence to: Dr. Moskovitz Moti, Department of Pediatric Dentistry, Hadassah School of Dental Medicine, P.O.Box 12272, Jerusalem 91120, Israel.

Tel: 972-2-776122
Fax: 972-2-6431747,

E-mail:motimo@ekmd.huji.ac.il

backgrounds, and the answer for them should be access to free dental care.[5] Teeth with anatomical variations or deep pits and fissures should be identified and receive sealants. Children used to frequent snacking habits should be educated to have a more healthy diet.

As in most industrialized countries, the prevalence of dental caries in Israel has declined significantly over the past decades. In the last epidemiological survey on Israeli 12-year-olds conducted in 2005, the decrease in caries indices compared to the previous survey in 1989 was evident (DMFT- 40% decline), but it was also observed that a wide dental health disparity existed among children. Caries prevalence was significantly higher in Arabs, immigrants from the former Soviet Union, and children living in non-fluoridated areas.[6] The polarization was very strongly related to deprivation and oral health was affected by social norms.[2,3] Because the environment played an important role in oral health status, any effectiveness study of oral health education for children applied a program to one specific environmental setting. Many studies chose the school to be the environmental setting; some others chose a community center to be the place of intervention.[7] Fewer studies focused on the role of the dental clinic in oral health education for children. Little is known about the effectiveness of the education programs given by professional hygienists and dentists in the dental office on improving knowledge and beliefs, healthy behavior and attitudes, and dental status for children.

The aim of the present study is to evaluate the effectiveness of an oral health education program when given in a public dental clinic by professional hygienists.

## MATERIALS AND METHODS

This is a longitudinal, retrospective survey. Data was obtained from the Dental Volunteers for Israel (DVI) clinic in Jerusalem. This clinic offers free dental treatment for poor children from the city.

In order to receive free restorative dental treatment in the clinic, following a dentist check up each child must attend an educational session presented by a hygienist. Implementation of the instructions is then checked two weeks later and only children who have a low plaque score can be treated. If not, another hygienist appointment is made. In addition, any child who has not attended the clinic for more than six month must go through an educational session again and then prove one more time to have a low plaque score. In this way, no child can receive a restorative treatment unless achieving good plaque control.

All the active files in the clinic were checked, no sampling was conducted. Two groups were created. A control group consisted of children who had had their first dental examination in the clinic when they were aged 12-14 years. They did not receive the clinic's educational session until that time (although they might have received treatment or education in other places). A second group, the intervention group, consisted of children who had also had a full dental examination between the ages of 12 and 14 years old, and in addition, at least 3 further visits to the clinic in the past that included an educational session. Thus, in each group were children who had a full clinical and radiographic examination and a treatment plan at the age of 12-14. Children in the control group differed from those in the intervention group by the number of educational sessions they had.

Of 3343 active files in the clinic, only 173 met the criteria for inclusion in the control category, and 280 in the intervention group. The dental status of each child was evaluated by a single specialist in pediatric dentistry during September-October 2005. The number of carious and restored surfaces and missing teeth of a child was determined based upon the clinical and radiographic diagnosis filled by the dentist in the file. The dental status evaluation in this study differed from the more widely accepted criteria for dental examinations recommended by the WHO report on oral health surveys in that it used radiography and more precise clinical examinations. The index used in the present study is very similar in kernel to the normal DMFS index except:

- The information was obtained retrospectively from dental files.
- Every file contained a full clinical and radiographic diagnosis of the whole mouth, and this was the only source of information.
- A missing permanent tooth was considered extracted because of caries only when documented.

The educational program carried out by the hygienist consisted of two parts. The first was the theoretical part which included instruction on oral hygiene, counseling on healthy nutrition, education on fluorides and dental attendance. Diet counseling focused on the danger of frequent intake between meals of sugar-rich food and beverages. The importance of topical fluorides as a protective agent was emphasized, advising toothpaste as the preferred carrier. The practical part included actual teaching and guidance of tooth brushing and also applying sealants on permanent molar teeth.

### Statistical analysis

To evaluate the effectiveness of the preventive program the prevalence of the carious and/or filled surfaces was compared between the intervention and control groups. The hypothesis of no difference between the groups was tested. The data analysis used Chi square test for comparison of the two groups for: (i) caries (active caries and missing permanent teeth because of caries), (ii) restorations and (iii) both of them. Tests resulting in P-values $<0.05$ were considered significant. T-test was calculated for equality of means.

## RESULTS

Out of 453 children aged 12 to 14 years who were treated in the clinic at the time of the study, 280 met the criteria to be included in the intervention group. Those children were further divided according to the number of intervention sessions in which they participated in the clinic prior to the last check-up. Of the 280 children in the intervention group, 95

went through 4 educational sessions by the hygienist, 76 went through 5 such interventions, 53 went through 6, 31 had 7 interventions, and the remaining 25 children had 8-11 sessions. The control group constituted 173 children who never had any intervention in the DVI clinic.

Two hundred thirty five children (51.8%) were girls and 218 (48.2%) were boys with no statistically significant difference. The female/male ratio was very similar in the control and intervention groups. (Table1).

The mean age of the intervention group was 12.9 years, and of the control group 13.2 years with no statistically significant difference.

The extent of caries surfaces differed greatly between the intervention and the control groups (Table 2). Six point nine percent of the children in the control group and 18.6% of the intervention group were caries free. Only 35.2% of the control group and as much as 64% of the intervention group had low caries (DMS< 3). On the other hand, as much as 12.1% of the control children had 12 decay/missing surfaces and more, while the same was true of only 1.1% of the intervention children. The difference was statistically significant (P-value< 0.05). The situation is reversed when comparing the difference in the restored teeth surfaces between the two groups (Table 3). Fifty six point six percent of the control group has no restorations. At the same time, 66.2% of the children in the intervention group have treated teeth. The difference is statistically significant (P-value< 0.05).

**Table 1:** Female to male ratio in the control group and in each intervention subgroup.

| | Control | intervention subgroups (according to number of interventions) | | | | |
|---|---|---|---|---|---|---|
| Number of interventions | 0 | 4 | 5 | 6 | 7 | 8—11 |
| Number of children (F—M) | 88-85 | 47-48 | 39-37 | 25-28 | 21-10 | 15-10 |
| Female to male ratio | 50.8%-49.2% | 49.5%-50.5% | 51.3%-48.7% | 47.2%-52.8% | 67.7%-32.3% | 60%-40% |

* F for female, M for male.

**Table 2.** The distribution of children in the control and intervention groups according to the levels of carious surfaces categories.

| Number of surfaces with caries | | control | intervention | Total |
|---|---|---|---|---|
| **none** | Count | 12 | 52 | 64 |
| | % within study group | **6.9%** | **18.6%** | **14.1%** |
| **1-3** | Count | 49 | 127 | 176 |
| | % within study group | **28.3%** | **45.4%** | **38.9%** |
| **4-11** | Count | 91 | 98 | 189 |
| | % within study group | **52.6%** | **35%** | **41.7%** |
| **12 or more** | Count | 21 | 3 | 24 |
| | % within study group | **12.1%** | **1.1%** | **5.3%** |
| Total | Count | 173 | 280 | 453 |
| | % within study group | 100% | 100% | 100% |

Fewer differences between the two groups were demonstrated with reference to DMFS scores (Table 4). The control and intervention groups constituted a small proportion of 4% and 5.7% children with DMFS=0, respectively. Children with low DMFS (fewer than 3) constituted 23.7% of the control category, and 29.3% of the intervention. The slightly higher DMFS for the control children are not significant statistically (P-value= 0.46). Children with very high DMFS (25 and more) constituted 1.7% and 2.9% of the control and intervention groups, respectively. This relation is somewhat inverted, but with no statistical significant difference (P-value= 0.46) because of the small number of subjects in the subgroups (3 and 8 children only).

T-test was calculated for equality of means (Table 5). The mean carious surfaces was 1.8 times greater in the control group (5.91 vs. 3.35), and the restored surfaces was 2.1 times greater for the intervention children (3.55 vs. 1.64). Those differences are of statistical significance (t-test, 2-tailed< 0.0001), yet when comparing DMFS means between control and intervention groups (7.6 vs. 6.8 respectively), t-test result (0.194) shows no statistical significant difference for the slightly lower DMFS levels in the intervention group.

**Table 3.** The distribution of children in the control and intervention groups according to the levels of filled surfaces categories.

| Number of surfaces with caries | | control | intervention | Total |
|---|---|---|---|---|
| **none** | Count | 98 | 55 | 153 |
| | % within study group | **56.6%** | **19.6%** | **33.8%** |
| **1-3** | Count | 42 | 116 | 158 |
| | % within study group | **24.3%** | **41.4%** | **34.9%** |
| **4 or more** | Count | 33 | 109 | 142 |
| | % within study group | **19.1%** | **38.9%** | **31.3%** |
| Total | Count | 173 | 280 | 453 |
| | % within study group | 100% | 100% | 100% |

**Table 4.** The distribution of the control and intervention groups according to the proportion of children found in the various DMFS categories.

| modified DMFS index | | control | intervention | Total |
|---|---|---|---|---|
| **none** | Count | 7 | 16 | 23 |
| | % within study group | **4%** | **5.7%** | **5.1%** |
| **1-3** | Count | 34 | 66 | 100 |
| | % within study group | **19.7%** | **23.6%** | **22.1%** |
| **4-24** | Count | 129 | 190 | 319 |
| | % within study group | **74.6%** | **67.9%** | **70.4%** |
| **25 or more** | Count | 3 | 8 | 11 |
| | % within study group | **1.7%** | **2.9%** | **2.4%** |
| Total | Count | 173 | 280 | 453 |
| | % within study group | 100% | 100% | 100% |

**Table 5.** The mean values of DMS , FS, and DMFS indices in each of the control and intervention groups.

| | Study group | N | mean | Std. Err. mean |
|---|---|---|---|---|
| DMS | control | 173 | 5.91 | 0.376 |
| | intervention | 280 | 3.25 | 0.183 |
| FS | control | 173 | 1.64 | 0.211 |
| | intervention | 280 | 3.55 | .0.243 |
| Modified DMFS | control | 173 | 7.55 | 0.469 |
| | intervention | 280 | 6.8 | 0.348 |

* DMS: number of surfaces with caries or extracted because of caries. FS: number of surfaces with fillings.

## DISCUSSION

Experts on dental caries generally agree that it is an infectious and communicable disease with multiple factors influencing its initiation and progression. The nature of the disease is highly dynamic, with periods of progression alternating with periods of arrest or even of partial repair. Periods of disease activity vary in duration and intensity between different population groups, between different individuals, and within a single patient at different ages and even throughout the day.[8] The interaction is influenced by many anatomic, behavioral, dietary, genetic, social, cultural, socioeconomic, and therapeutic variables that can significantly influence the level of caries activity favorably or unfavorably.[9]

Reviews published in the last decennium concluded that oral health education can result in a small positive, but temporary effect on plaque accumulation (improvements in oral health behaviors), a consistent gain in knowledge, and, when additional health-promoting measures involving widespread multiple fluoride exposure were included, a positive effect on oral health status.[2,7,10]

Dental public health programs must satisfy the criteria of practicality, feasibility, acceptability, safety, effectiveness, and relatively low cost.[11] The following are publications, examining various programs from different countries, trying to evaluate the preventive effectiveness of the oral hygiene education; Kay and Locker[7] reviewed 143 studies relating to dental health education interventions, which were published between 1982 and 1994. Dental health interventions have a small positive, but temporary effect on plaque accumulation, no discernable effect on caries increment and a consistent positive effect on knowledge levels.[7] Rozier[12] reviewed articles published between the years 1980-2000 on the subject of primary prevention for children by operator-applied methods. He found that the application of topical fluoride gel, fluoride varnish, chlorhexidine mouth rinses, and sealants proved effectiveness in lowering caries prevalence in permanent teeth. The author found that the effectiveness of patient counseling is not conclusive, and apparently it does change knowledge levels, but the relationship between knowledge and behavior is rather weak.[12] Frencken *et al*[10] performed a longitudinal study in a district in Zimbabwe on the effectiveness of 3.5 years preventive educational program in schools for 8-10 years olds carried out by trained teachers. The dependant variables over the study period were plaque accumulation and caries increment. At the end of the study no significant difference was observed in the intervention schools compared to schools who did not participate in the program. The authors concluded that the training of teachers to carry out such programs was ineffective in changing caries prevalence.[10] In our study, the results show that the prevention program was not significantly effective in caries prevention, since the DMFT was similar in both groups. It can be assumed that education and be annually fluoride application is not enough to make a change in the rate of the appearance of new cavities in this high risk population. Children of a low socioeconomic level need more active prevention measures. The program should include multiple fluoride exposures on prescheduled appointments in order to actively intervene in the efforts to reduce the appearance of new cavities. Vanobbergen *et al*[2] examined the effectiveness of a program constituting a yearly educational session for school children over a period of 6 years in Flanders, Belgium. At the end of the study there was no significant difference in the DMF values and in the reported frequency of brushing. Significant difference in favor of the intervention children was found in the number of between-meal snacks and the proper use of topical fluorides. In addition, children in the control group showed a significantly lower proportion in restored tooth.[2] Hartono *et al*[13] conducted a study in West Java, Indonesia, on the effectiveness of a school-based educational program given to 8-12 years old children. The results of the study showed no difference in active caries prevalence. On the other hand, plaque scores were higher in the control groups, and the brushing frequency had significantly improved among experimental children.[13] Petersen *et al*[14] evaluated the effectiveness of a primary school-based oral health education program in Wuhan City- China, for children and their mothers as well as their schoolteachers. The authors concluded that the program had positive effects on gingival bleeding score and oral health behavior of children. No difference in caries prevalence was observed, but more fillings were found in the intervention children. The program had positive effects on the knowledge and attitudes of mothers and teachers.[14] Milsom *et al*[15] conducted a controlled trial in which several models of dental education in 169 schools in the northwest of England were compared to control schools that did not have any educational program. The educational programs in the intervention schools varied from a dentist's examination plus preventive education for all pupils in the schools with the "strict" programs, to only disseminating leaflets for the parents via their children in the more "loose" educational regimens. The control and intervention children were checked for caries prevalence and dental attendance. The results concluded that there was no significant difference between the various intervention schools, and between the intervention and control.[15]

In conclusion oral health education programs can result in:

1. Small positive, apparently temporary effect on plaque accumulation (improvements in oral health behaviors).

2. Consistent gain in knowledge.
3. Probably higher levels of dental attendance and treatment.
4. When additional health-promoting measures involving widespread multiple fluoride exposure were included, there was a positive effect on oral health status (decrease in caries prevalence).

The overall aim of this retrospective study is to evaluate the outcome of the preventive program given in the community clinic on tooth decay prevalence among the patients treated at the clinic. The significance of such a study lies in assessing the extent to which education alone (even when conducted thoroughly in a dental clinic by professional personnel) as the preventive measure for children at school age is, in fact, effective in improving dental status. Though it seems that practically, the children in the control group differed from those in the intervention group merely by the number of visits, when checked plaque control and/or educational sessions, the difference is far more profound. The intervention children participated in an active and comprehensive program which consisted of treating and educating the children who attended the clinic several times through out, at least, six years during childhood. While on the other hand, the control group, lack this kind of experience through crucial childhood years. The clinic in reality provides a health environment for those children attending it regularly. Most recent literature agrees that preventive programs providing education alone did not have a significant effect on dental status, whether it is a program given in an already healthy dental climate,[2,10,15] or a program serving a poor population with high caries prevalence.[3,14] When comparing the DMFS results in this study, the same conclusion is clear; those attending the clinic regularly are simply treated more often, not actually apply the information they were given. It is agreed in the literature that children from lower socioeconomic classes benefit from preventive programs the best, and their dental status improves more than the average population when additional preventive measures such as the supplement of fluoride containing toothpaste is included.[3,7] However, the present study measured only the effect of the educational program.

By assessing caries prevalence alone, the preventive program seems to have achieved good results. But when considering DMFS these results are misleading and the true reason for this is the significant difference between intervention and control groups in the amount of restorative care which had been provided.

The most widely used index of caries is the DMF which has undergone considerable refinements since it was first described by Klein and Palmer (1937). Differences in opinion amongst epidemiologists still exist regarding this index. For safety and ethical reasons, caries epidemiologists do not use radiographs to quantify interproximal cavities. However a more complete estimate of caries incidence is obtained if radiographs are used. Hence, where local circumstances permit, it is desirable especially in longitudinal cohort studies, to take radiographs at the baseline and final examinations.[1]

The mean carious level of a control child is almost two times greater than an intervention child, and the mean restoration level of the intervention is about two times greater than the control. The summation of the latter results into DMFS means account for their near equivalence.

As many other evaluation studies of educational programs concluded, the limitation of such studies may be a crucial factor in the apparent inefficacy of the intervention.[2,10] Not knowing whether the control children went through similar dental education in their schools, or the extent to which control group children had dental treatments outside the clinic, or even maybe the possibility of fluoride application, are such limitations.

All attempts to identify the principal factors influencing caries decline in industrialized countries have met with difficulties,[16] and so it is impossible to determine with certainty which factors have been the most influential for the majority of the population. Whether these were fluorides, fissure sealants, health education, or the overall improvement of the socioeconomic level of the population and the development of prosperous societies, remains unclear.

The present study did not examine behavioral changes in addition to the clinical outcomes. In the literature, studies examining such outcomes reported only temporary improvements.[2,7,10,15,17-19]There is no evidence in the literature for any dietary change as a result of an oral health education and studies examining dietary changes are hard to compare.[2]

One misleading feature in the present study is the use of surfaces as the measure for calculating differences between the control and the intervention group. When a restoration is performed on two surfaces it does not necessarily imply that there was decay in both surfaces. In that case the DMFS of the treated children is high because of the treatments and they actually have less decayed surfaces than the control group.

## CONCLUSION

This study demonstrates that even a comprehensive preventive plan by professional personnel, followed by free dental treatment is not enough to improve dental health status for children. Thus it must be questioned whether the provision of health education is cost-effective, and if it does produce certain positive results, some estimate of the clinical significance of the changes observed should be made. Oral health education sessions must be reevaluated and it must be decided either to expand them to include more active prevention measures. Still, a consideration of the ethical responsibility of the profession to inform people about oral diseases and their prevention is mandatory, irrespective of its implementation.[7] A more active prevention program as described by Maltz *et al*,[20] based on more frequent prescheduled fluoride applications is needed for this high caries risk population.

## ACKNOWLEDGEMENTS

This article is based on a DMD thesis submitted to the Hebrew University–Hadassah School of Dental Medicine, Jerusalem, Israel. The authors would like to thank Dental Volunteers for Israel (www.dental-DVI.co.il) clinic for the use of the database.

## REFERENCES

1. Bowen HW, Tabak AL. Cariology for the Ninetees. University of Rochester Press, 1993; 37–59.
2. Vanobbergen J, Declerck D, Mwalili S, Martens L. The effectiveness of a 6-year oral health education program for primary schoolchildren. Community Dent Oral Epidemiol, 32: 173–82, 2004.
3. Ellwood RP, Davies GM, Worthington HV, Blinkhorn AS, Taylor GO, and Davies RM. Relationship between are deprivation and the anti-caries benefit of an oral health program providing free fluoride toothpaste to young children. Community Dent Oral Epidemiol, 32: 159–65, 2004.
4. Graves RC, Abernathy JR, Disney JA, Stamm JW, Bohannan HM. The University of North Carolina Caries Risk Assessment Study 3: Multiple Factors in Caries Prevalence. J Public Health Dent, 51: 134–43, 1991.
5. US Department of Health and Human Services: Oral health in America: a report of the Surgeon General, Rockville, Md, 2000, US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National institutes of Health.
6. Zusman SP, Ramon T, Natapov L, Kooby E. Dental health of 12-year-olds in Israel-2002. Community Dent Health, 22: 175–9, 2002.
7. Kay EJ, Locker D. Is dental health education effective? A systematic review of current evidence. Community Dent Oral Epidemiol, 24: 231–5, 1996.
8. Johnson, N.W. Risk Markers for Oral Diseases. Vol. 1. Dental caries. Cambridge University Press, 111, 1991.
9. Mcdonald, RE. Avery, DR. and Stookey, GK. Dental caries in the child and adolescent. In:Dentistry for the child and adolescent. Ed: Mcdonald, RE. Avery, DR. and Dean JA.. Mosby, Inc. Missouri, USA, 203–235, 2004.
10. Frencken JE, Borsum-Andersson K, Makoni F, Moyana F, Mwashaenyi S, Mulder J. Effectiveness of an oral health education program in primary schools in Zimbabwe after 3.5 years. Community Dent Oral Epidemiol, 29: 253–9, 2001.
11. Harris, O.N., Christen, G.A. Primary Preventive Dentistry. 4th ed. Appleton & Lange, 1–15, 157–184, 1995.
12. Rozier RG, Effectiveness of methods used by dental professionals for the primary prevention of dental caries. J Dent Educ, 65: 1063–72, 2001.
13. Hartono SW, Lambri SE, van-Palenstein-Helderman WH. Effectiveness of primary school-based oral health education in west java, Indonesia. Int Dent J, 52: 137–43, 2002.
14. Petersen PE, Peng B, Tai B, Bian Z, Fan M. Effect of a school-based oral health education program in Wuhan city, People's Republic of China. Int Dent J, 54: 33–41, 2004.
15. Milsom K, Blinkhorn A, Worthington H, Threlfall A, Buchanan K, Kearney-Mitchell P, et.al. The effectiveness of School dental screening: a cluster-randomized control trial. J Dent Res, 8: 924–8, 2006.
16. Vrbic V. Reasons for the caries decline in slovenia. Community Dent Oral Epidemiol, 28: 126–32, 2000.
17. Buischi Y, Axelsson P, Oliveira LB, Mayer M, Gjrmo P. Effect of two preventive programs on oral health knowledge and habits among Brazilian schoolchildren. Community Dent Oral Epidemiol, 22: 41–6, 1994.
18. Mazzocchi AR, Moretti R. Effectiveness of a dental preventive program on plaque index results in 8-year-old children of Bergamo, Italy. Community Dent Oral Epidemiol, 25: 332–3, 1997.
19. Van-Palenstein-Helderman WH, Munck L, Mushendwa S, van't-Hof MA, Mrema FG. Effect evaluation of an oral health education program in primary schools in Tanzania. Community Dent Oral Epidemiol, 25: 296–300, 1997.
20. Maltz M, Barbachan e Silva B, Carvalho DQ, Volkweis A. Results after two years of non-operative treatment of occlusal surface in children with high caries prevalence. Braz Dent J, 14: 48–54, 2003.