

Original Article

Evaluation of knowledge and plaque scores in school children before and after health education

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ABSTRACT

Background: Health education is a process of transmission of knowledge and skills necessary for improvement in quality of life. The purpose of the present study was to evaluate the oral hygiene related knowledge and plaque scores of 12-year-old school children in Belgaum city before and after health education.

Methods: Three schools of Belgaum city were randomly selected and assigned into one of three health educational groups – group I (audiovisual aids), group II (chalk and blackboard) and group III (no health education). Oral health related knowledge and plaque scores were assessed in all the groups before and after health education.

Results: The mean knowledge score before intervention in group I was 7.94, in group II was 7.86 and in group III was 7.74 ($P=0.86$). After intervention, the mean knowledge score was 14.42 in group I, 12.7 in group II and 9.58 in group III ($P<0.001$). Plaque scores in the three groups were similar and statistically nonsignificant at baseline. After the oral health education, the mean plaque scores were 0.627 in group I, 0.8826 in group II and 1.0156 in group III. Within the group comparisons revealed a statistically improved oral hygiene with decreased plaque scores in all the three groups.

Conclusion: Health education by audiovisual aids could be an effective preventive measure against plaque-related oral diseases.

Key Words: Caries, dental hygiene education, educational systems, knowledge, gingival scores

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INTRODUCTION

Major improvements in oral health have occurred in many developed countries over the last 30 years. However, oral diseases are still prevalent in the developing countries and their impacts on both society and the individual are significant. Pain, discomfort, sleepless nights and time off school or work are the common problems for many children and adults. The costs of treatment are high, although the causes of the diseases are known and largely preventable.^[1]

Globally, most children show signs of gingivitis, and among adults, the initial stages of periodontal diseases are prevalent. Severe periodontitis which may result in tooth loss is found in 5–15% of the population.^[2]

Evidence exists to show that growth of dental plaque and inflammation of gingival tissue leading to periodontitis are ubiquitous and strongly linked irrespective of age, gender or racial/ethnic identification.^[3] Regular removal of dento-gingival plaque is crucial for the maintenance of periodontal health. Though mechanical cleaning is recognized to be potentially useful in controlling supragingival plaque, the expectation that each individual will maintain a good standard seems to be beyond most people's capabilities. A number of factors have been suggested as playing a role in motivation of patients in performing oral hygiene procedures. Most important amongst these factors are patient's recognition of

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the disease and the knowledge of various preventive measures.^[3]

Health education, a widely accepted approach in prevention of oral diseases, is a process of transmission of knowledge and skills necessary for improvement in quality of life. The goal of planned health education program is not only to bring about new behaviors but also to reinforce and maintain healthy behaviors that will promote and improve individual, group or community health.

Schools are thought to be the most suitable environment to provide health information to children in order to achieve the goal of health education program. As children in school are relatively accessible and already in a learning environment, dental health education programs in such settings are the most effective.^[4-6]

Even though the assumption that oral health education may modify children's oral health knowledge and consequently change children's oral health behavior is still controversial, children must be aware of not only the causes of oral diseases but also the current preventive measures to avoid them. School education programs will enable children to make decisions about oral health regarding their own children in future or even their community.^[7]

A common mode of delivery of oral hygiene messages is the personal instruction approach on one-to-one basis. Although this approach has been shown to be effective in improving oral hygiene and gingival health, it is time consuming and may not be practical from a community perspective. Substitution of personal instruction by other means of communication has been investigated, such as the use of self-educational manuals and audiovisual aids. Few studies have actually compared the relative effectiveness of these various modes of delivery of oral hygiene messages. Furthermore, most of the programs reported included scaling as a part of the therapeutic program, so only a limited number of studies have explored the effectiveness of self-performed oral hygiene alone in improving gingival health. In a country like India with generally low dental awareness and the widespread presence of calculus and less availability of oral health manpower, complete scaling for the entire community would not appear a practical proposition. There is an obvious need to investigate the effectiveness of promotion of dental health through oral health education.^[8]

Hence, the present study was planned to evaluate the oral hygiene related knowledge and plaque scores of 12-year-old school children in Belgaum city before and after health education.

MATERIALS AND METHODS

Study population

The study was conducted in three schools (similar in socioeconomic status and standard of teaching) of Belgaum city (Karnataka, India). Participants of this study comprised 150 children of 12 years of age. At the outset, a pilot study was performed on 50 children aged 12 years to check the comprehension of the questionnaire. In a two-stage random sampling, Belgaum city was first divided into three zones. Three schools (one from each zone) were chosen randomly using table of random numbers. In the second stage, all the children aged 12 years from the selected schools were screened for inclusion and exclusion criteria. Children visiting a dentist regularly or receiving dental health education through another source and/or physically or mentally or medically compromised children were excluded from the study.

Permission to conduct the study was obtained from the ethical committee of the institution and the headmasters of the respective schools. A parents' meeting was called wherein the study was explained in full detail to them and then a written consent was sought depending on their willingness to participate in the study. A total of 300 children aged 12 years were present in the three schools. From these, 73 children from school 1, 76 children from school 2 and 77 children from school 3 fulfilled the inclusion and exclusion criteria. Amongst these, 50 children from each school were selected randomly to form individual groups, amounting to a total of 150 participants in the study.

Study procedure

The present study was a double-blind, controlled field trial. The three schools were divided randomly into three groups: group I, group II and group III. The first and the second groups received oral health education (experimental groups), while the third group served as the control. The whole study was divided into three phases [Figure 1] and was carried out for a period of 2 months (September 2008–October 2008).

Personnel involved in the research

Investigator – Selected the schools, obtained permission from schools, performed primary screening

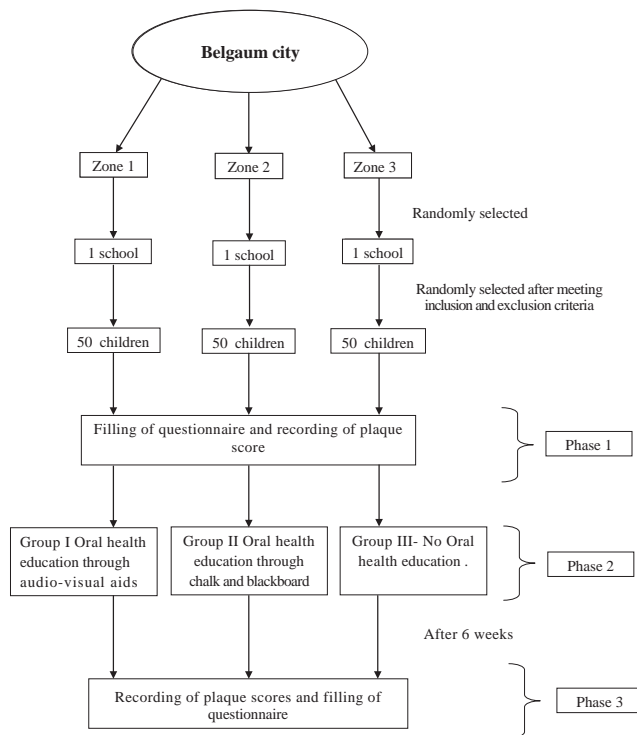


Figure 1: Schematic representation of study procedure

and selection, distribution and collection of data and provision of health education.

Examiner – Carried out pre- and post-recording of plaque scores and collection and tabulation of the data for statistical analysis.

Recording clerk – Assisted the examiner in recording plaque scores.

Phase 1

On the predetermined dates for each school, all the enrolled participants of the respective schools were requested to assemble in their classroom. Children's oral health related knowledge was assessed by the investigator using a questionnaire in English language (as it was the medium of instruction in the schools) (Annexure I). The questionnaire was divided into two parts: the first part comprised the general information of the child and the second part consisted of 16 closed-ended questions regarding oral health knowledge and practices. All the children were briefed regarding the questionnaires and were instructed not to leave any answers blank. Sufficient time was given to think and mark the answers and it was made sure that no cross copying was done. The next day, plaque score for all the children was recorded using Silness and Loe plaque index.^[9] A total of 25 children were examined per day. The examiner was blinded to the

type of health education given to the children. Clinical examination was carried out by a single trained and calibrated examiner (intraexaminer reliability=0.78) in the school premises. The children were made to sit comfortably on a chair and plaque scores were recorded under natural lighting conditions. A recording clerk who was trained to assist in the recording procedure helped the investigators in recording the findings.

Phase 2

Group I

This group received a comprehensive program consisting of a single information session pertaining to the etiology and prevention of dental diseases and oral hygiene procedures. The mode of delivery of oral health education was audiovisual aids. The oral health education encompassed topics like importance of teeth, type of dentition, brushing techniques and the importance of brushing, dental caries – its etiology, signs and symptoms, preventive methods, the role of fluorides and golden rules for having a healthy mouth.

Group II

This group received a comprehensive program similar to group I but audiovisual aids were not used. Oral health education was provided using chalk, blackboard, charts and pictures.

Group III

The children in this group received no informational session or oral hygiene instructions and served as the control.

Phase 3

Children's oral health related knowledge was assessed by the investigator using the same closed-ended questionnaire, 6 weeks after provision of oral health education. Plaque scores for all the children were then re-recorded by the same examiner using Silness and Loe plaque index. As it would be unethical to leave any group without receiving benefits, the control group also received a similar type of health education after the completion of phase III.

Data analysis

Data were analyzed and the mean knowledge and plaque scores in the three groups were calculated. Within the group comparisons for knowledge scores were studied using paired *t*-test. For intergroup comparisons of knowledge scores, analysis of variance (ANOVA) followed by Newman-Keuls multiple

comparisons test were used. Plaque scores were analyzed using Kruskal–Wallis and Wilcoxon Matched Pair Signed test. Intergroup comparisons for plaque scores were performed using Mann–Whitney U test.

RESULTS

Knowledge scores

At the start of the study, the mean knowledge scores of children in the two experimental groups (group I: 7.94 and group II: 7.86) were slightly higher than that of the control group (group III: 7.74) though this difference was not statistically significant ($P=0.86$). After the intervention, the mean knowledge score was 14.42 in group I, 12.7 in group II and 9.58 in group III [Table 1]. Comparison of the baseline values with their respective post-intervention knowledge scores illustrated a statistically significant ($P<0.001$) increase in knowledge in group I, group II and group III [Table 2]. Further analysis using Newman–Keuls Multiple Comparison test (*post hoc* test) revealed that the differences in knowledge gain were statistically significant between the three groups and the increase was highest in group I followed by Group II and the lowest was in Group III (control group) [Table 3].

Table 1: Summary statistics of knowledge scores and plaque scores pre- and post-intervention

Intervention	Summary	Group I	Group II	Group III	P-value
Knowledge scores					
Pre	Means	7.94	7.86	7.74	0.86
	Std. Dev.	1.44	2.05	2.08	
Post	Means	14.42	12.70	9.58	<0.001
	Std. Dev.	1.48	2.40	2.02	
Plaque scores					
Pre	Means	1.33	1.35	1.47	0.42
	Std. Dev.	0.70	0.64	0.67	
Post	Means	0.62	0.88	1.01	<0.001
	Std. Dev.	0.33	0.48	0.52	

ANOVA was used for knowledge scores while Kruskal–Wallis test was used for plaque scores

Table 2: Comparison of pre- and post-intervention knowledge scores in group I, group II and group III

Group	Knowledge	Mean	Std. dev.	Paired t-test	P-value
Group I	Pre	7.94	1.44	23.11	<0.001
	Post	14.42	1.48		
Group II	Pre	7.86	2.05	10.62	<0.001
	Post	12.70	2.40		
Group III	Pre	7.74	2.08	4.91	<0.001
	Post	9.58	2.02		

Plaque scores

Plaque scores in the three groups were similar and statistically nonsignificant at baseline. After the oral health education, the mean plaque score was 0.627 in group I, 0.8826 in group II and 1.0156 in group III [Table 1]. Within the group comparisons revealed a statistically improved oral hygiene with decreased plaque scores in all the three groups [Table 4]. Group I had the least plaque score ($P<0.001$) followed by group II and group III though the difference between the latter groups was statistically nonsignificant [Table 5].

Table 3: Pair wise comparison of knowledge scores of three groups by Newman–Keuls multiple comparison tests procedure

Intervention	Group	P-value
Pre	Group I	0.90
	Group II	
	Group III	
	Group I	0.56
	Group II	
	Group III	
Post	Group I	0.004
	Group II	
	Group III	
	Group I	0.0001
	Group II	
	Group III	

Table 4: Comparison of pre- and post-intervention with respect to plaque scores by Wilcoxon matched pairs signed test

Groups	Intervention	Z-value	P-value
Group I	Pre–Post	5.65	<0.001
Group II	Pre–Post	3.16	<0.0016
Group III	Pre–Post	2.94	0.0032

Table 5: Pair wise comparison of plaque scores of three groups by Mann–Whitney U test procedure

Intervention	Group	U-value	P-value
Pre	Group I	1206.50	0.76
	Group II		
	Group III		
	Group I	1068.00	0.20
	Group II		
	Group III		
Post	Group I	859.50	<0.0071
	Group II		
	Group III		
	Group I	666.50	<0.0001
	Group II		
	Group III		

DISCUSSION

The role of prevention in dental health in India is a challenge to all dental health professionals. Although the literature is saturated with recent advances in materials and technology to treat dental disease, there is relatively very little being accomplished in the arena of health promotion. This area needs to gain attention all the more due to the overwhelming rise in the incidence of dental diseases, where attempts by secondary and tertiary prevention are like building a roof on a house without foundation. The only practical solution that is worth heading for would be primary prevention wherein the problem is struck at the root, that is, even before its inception. Primary prevention includes health promotion by way of health education.

Health education can be delivered by either personal instruction or by the use of self-instruction manuals and audiovisual aids. Several other methods can also be employed to deliver effective health education. The present study aimed to evaluate the oral hygiene related knowledge and plaque scores of 12-year-old school children in Belgaum city before and after health education.

Pre and post questionnaire comparison

Three schools, similar in socioeconomic status and the standard of teaching, were randomly selected from three different zones of Belgaum city. Socioeconomic status was not assessed separately because public/private school attendance may be considered a surrogate measure for socioeconomic status, with private school attendance likely to represent higher socioeconomic status relative to public school attendance.^[10] Private schools are attended by children whose parents can afford the high school fees. Thus, the private school children are from the higher socioeconomic strata of the community. The government or public schools do not charge fees and are run by the state governments. The children in the government or public schools are therefore predominantly from the lower socioeconomic group in the community since their parents cannot afford to pay the fees charged by the private schools.^[11]

The children's knowledge was evaluated using a self-designed questionnaire and plaque scores were assessed using Silness and Loe plaque index (1964). Health education was then provided to the experimental groups by a professionally trained investigator who was proficient in educating the children. It was done

keeping in mind that the school teachers are not professionally trained to provide health education, therefore their method of delivering the talk may not be effective and may not include all the relevant areas to create an impact on the school children.

Since the questionnaire was self-designed, exact comparisons with other studies could not be made.

Initially, the children perceived oral and general health to be two different aspects, but after the health education, most children in group I and group II (experimental groups) understood that both of them are inter-related and hence an improvement in knowledge with regard to this question may have been noted in the two groups.

Questions on number, types and sets of teeth got correct responses at baseline itself from children of all the three groups. This may be attributed to the school curriculum wherein some general information about the teeth is taught to the children in the primary classes. Reinforcement of this knowledge was done in the health education.

Television, categorized only as an entertainment media few decades earlier, has started expanding its horizons and is now playing an important role in educating children through its various educational programs designed specially for children. Children may also gain knowledge from the various advertisements shown about different oral health products. These advertisements and some other educational programs on television may have helped children to gain knowledge and give correct responses to questions on frequency of cleaning teeth, method of cleaning teeth, importance of rinsing or about visiting a dentist every 6 months.

Oral health education that was provided to the children covered topics like dental caries formation, its etiology, signs and symptoms and modes of prevention including the role of fluorides. The beneficial effect of this education was observed in the increased number of correct responses by the children of experimental groups (group I and group II).

After health education, children understood that dental decay can present itself as a blackish discoloration and/or a hole in the tooth. They even realized that their favorite food items like chocolates, toffees and sweets should preferably be eaten along with meals rather than at anytime of the day. The fact that oral health education increased awareness of the importance and role of fluoride in preventing dental

caries was visualized in the higher number of correct answers from children in the experimental groups as compared to the control group.

Pre- and post-intervention knowledge scores

In the present study, baseline knowledge scores of children in the three groups were almost similar. But a statistically significant increase in knowledge was seen in the experimental groups (group I and group II) as compared to group III after the health education. Better results in knowledge scores were found in group I as compared to group II which can be ascribed to the mode of health education. The audiovisual aids may have had a greater impact on the children and probably could have aroused interest in the subject, leading to better gain in knowledge. The results of the present study were in accordance with other studies aiming at improved knowledge and health behavior.^[12-14] The results were also in accordance with the study conducted by Buischi *et al*, wherein the effect upon dental health knowledge and dental health behavior of a comprehensive and a less comprehensive preventive program was compared in a 3-year follow-up study. In the above study, gender comparison was also done and the difference in knowledge gained was found to be statistically nonsignificant.^[15] As the primary objective of the present study was to assess the effectiveness of oral health education and the best method of imparting it, gender comparison was not done.

A statistically significant improvement in knowledge was seen in group III after 6 weeks though the improvement was less when compared to groups I and II. This may be attributed to Hawthorne effect. (Hawthorne effect is a form of reactivity whereby subjects improve an aspect of their behavior being experimentally measured simply in response to the fact that they are being studied, and not in response to any particular experimental manipulation.) It may be possible that even in the absence of health education, some children might have tried to search and get correct answers and gain knowledge about oral health through various sources.

Pre- and post-intervention plaque score comparison

The present study also aimed to assess the change in plaque scores in the test and control groups after 6 weeks of health education. The mean plaque scores of the three groups at baseline were similar and statistically nonsignificant.

When assessed after health education, it was noted that the mean plaque scores had lowered in all the

three groups and this decrease was statistically significant. This decrease cannot be ascribed to the last minute brushing since the children were not forewarned about the examination.

Children in group I showed considerable improvement in their oral hygiene, as demonstrated by decrease in the plaque scores. Use of three-dimensional animated pictures and colorful diagrams, and stepwise representation of concepts may have helped the children to understand the topics better and may have created an interest to bring about behavioral change.

Children in group II also showed considerable improvement in their oral hygiene 6 weeks after health education was delivered using blackboard and chalk. The use of pictorial diagrams and sketches may have helped the children to clear the concepts of oral health.

Although children in the control group (group III) did not receive any oral health education program during this study, they showed some improvement in their plaque scores. This may have occurred because of the interest of some children to gain knowledge about various aspects of oral health through varied sources.

On comparison of the three groups, highest improvement was seen in group I, followed by group II and group III. The plaque scores of group II and group III were not statistically significant. A reason for notable lack of improvement of oral hygiene in group II may be that these children did not put into practice what they had learnt through health education.

It is believed that the reduction in plaque scores and improvement of oral hygiene seen in the test groups compared to control group was most likely due to the information children received at the educational session and that this information contributed to their improved oral hygiene measures. Increase of knowledge and improvement of oral hygiene noted in control group can be ascribed to Hawthorne effect. Howat *et al*^[16] and Dahlen *et al*,^[17] have also emphasized the impact of dental examinations alone on reduction of oral hygiene scores and plaque removal.

The results of the study were in accordance with a study conducted by Albandar *et al*,^[5] wherein two different preventive programs were provided to 13-year-old children. The effectiveness of the program was evaluated by examining the plaque scores and gingival bleeding. It was found that the plaque scores were least in the group wherein

the preventive program was most comprehensive followed by the less comprehensive program and the least improvement was noted in the control group. The results of the present study were comparable with another study done by Ivanovik and Lekic.^[18] They conducted a randomized controlled trial to examine the short-term effect of an intensive instructional program without professional prophylaxis on gingival health of 240 children of age 11–14 years. They found a significant improvement in oral hygiene of children in experimental group as noted by a significant decrease in plaque scores and gingival bleeding as compared to the control group which showed slight but not significant reductions in plaque scores. It was concluded that though improvement was observed, it was transient and only during the experimental period. The maintenance of improved gingival health over longer periods requires prolonged, repeated instruction by professionals. The findings from this study were consistent with the results reported in other studies carried out in western communities by Glavind *et al.*,^[19] Hetland *et al.*,^[20] Soderholm *et al.*^[21]

However, a shortcoming of the present study was its short duration. Nevertheless, the results of this study confirm the findings of Gaare *et al.*^[22] and Hetland *et al.*^[23] that improved dental health can be brought about by oral health education alone, aimed simply at improving oral cleanliness. It should be remembered that once cognitive and affective gains pertaining to oral health have been established at a young age, they could later, when the present children become parents, be a factor in improving the health-related behavior of the next generation.^[23]

The present study concluded that the mean knowledge scores of children improved 6 weeks after provision of health education. The mean plaque scores of children decreased in the test group after health education. Health education was most effective when used with audiovisual aids, and the same method of health education was employed to educate children of group II and group III after completion of the study. However, further longitudinal studies involving multiple health education sessions engaging children, teachers and parents with follow-up at different intervals to study the retention of knowledge after discontinuation of health education are needed.

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