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EFFECT OF DIFFERENT HEALTH EDUCATION TECHNIQUES ON DENTAL CARIES, ORAL HYGIENE STATUS & ORAL HEALTH RELATED QUALITY OF LIFE AMONG 8-9 YEARS OLD SCHOOL CHILDREN OF UDAIPUR CITY, RAJASTHAN -A BEFORE & AFTER STUDY

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ABSTRACT

Introduction: School dental health education (SDHE) aims to improve the dental caries status, oral hygiene status and Oral Health related quality of life of children. In recent times, there has been a paradigm shift towards edutainment modes, where education and entertainment are integrated. Drama, puppet shows and game-based methods have been used effectively to teach basic oral health and hygiene concepts

Material and methods: The list of schools in Udaipur, Rajasthan were obtained from the concerned Assistant Elementary Education Officer. Three randomly eligible schools were given permission to carry out this study for a period of 6 months. Principle investigator delivered the SDHE to each school using three respective modes : Drama mode, Modified snake and ladder game mode and flashcard mode.

Results: A total of 300 children (drama mode-89, game mode-113, flashcard mode-98) were included in this study. Mean increase in the DMFT score was highest in children belonging to the drama mode. Game and drama modes had a considerable difference in the debris score (p=0.001, 0.001), calculus (p=0.004, 0.01) and OHI-S score (p=0.001, 0.001) respectively, when compared to the flashcards mode. Marked difference between game and flashcards (p=0.001, 0.05, 0.024 respectively) and between drama and flashcards at baseline (p<0.001) and at 6 months (p=0.02).

Conclusion: All the three modes of SDHE were effective in enhancing the oral health status,

and OHRQoLof school children aged 8 to 9 years. Game mode had the highest impact on oral hygiene, and oral health-related quality of life of children, followed by drama and flashcard modes.

Keywords: health education, school programmes, quality of life

Introduction

Oral health is an essential component of general health. Poor oral health can lead to pain, discomfort, reduced self-esteem and impairments in daily life activities[1]. It restricts school activity days, hinders school performances and reduces the quality of life of children[2]. Dental professions globally struggle to improve public oral health through oral health education, which can enhance not only the oral health literacy but also aims to bring out a healthy behavioral change. Promotion of oral health-related practices in childhood can result in a positive impact on the holistic health of an individual for a lifetime. Health promotion is the process of enabling people to improve their health[3]. School is one of the widest channels to reach out to children and their families[4].It provides adequate and appropriate training to children at the prime time of their lives[5]. It also offers a useful platform to raise their health-related behaviours and beliefs[6].School health is a crucial part of community health. Hence, schools have been targeted to enhance the oral health practices of children.

SDHE varies from a simple provision of information to technology-based multimedia programs involving psychological and behavioral change strategies[7] . In recent times, there has been a paradigm shift towards edutainment modes, where education and entertainment are integrated. Drama, puppet shows and game-based methods have been used effectively to teach basic oral health and hygiene concepts[8,9,10]. The success of SDHE depends on the retentiveness of the learned health behavior. To obtain a long-term effect, repetition and reinforcement of the health education are needed[11]. Repetition of information helps in reinforcing healthy practices.

The SDHE interventions aimed at children of school age, govern life in adulthood also. Simple behavioral changes brought about by these interventions can help them to improve their oral health and their oral health related quality of life. ‘Helping people to help themselves’ should be considered more important than rendering direct dental services. This is concerned with the reduction in the behavior- induced diseases and promotes healthier living at young age. Pediatric dentists are always in search of child-friendly modes of dental health education. The frequency, with which oral health education has to be delivered to children, has also remained vague. If the impacts of different dental health education interventions on children are found, the most effective child-friendly intervention can be provided in adequate frequency to educate and motivate children in future. Moreover, long term trials on the effectiveness of school dental health education interventions on the oral health status of children are sparse in India (in general) and in Udaipur, Rajasthan (to be more specific). The aim of the study is to evaluate and compare the effectiveness of three different modes of School dental health education (SDHE) interventions on dental caries, oral hygiene status and oral health related quality of life among 8-9 year old school children of Udaipur city.

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Material and methods:

An interventional study was planned and its protocol was approved by the Institutional Review Board. The study was carried out between School children aged 8-9 years old of Udaipur City. The present study was approved by the Institutional Ethics Committees. The sample size was calculated based on the results obtained from pilot study (n=30) using G Power Software. The significance level was set at 5%, and the power of the test was 80%. The estimated sample size is 300 children. The List of all Government primary schools will be obtained from District Education officer of Udaipur city. English- medium private schools with similar fees structure following the same syllabus and with no ongoing oral health education programmes were shortlisted. Three, out of the seven eligible schools gave permission to carry out this study for a period of 6 months.

In this study, single mode of SDHE was randomly allocated to each school to prevent contamination of information. Assignment of intervention to the schools was done using sequentially numbered opaque sealed envelopes by a postgraduate student who was not aware of the sequence generation. The study population included third-grade children, aged eight to nine years from the 3 schools in Udaipur. All third-grade children were screened in the 3 schools. Children undergoing fixed orthodontic treatment or with systemic illness, intake of medications affecting oral health (antibiotics, mouth washes) in previous two weeks were excluded from the study. The protocol of the study was explained to the authorities of the 3 schools and written consent was obtained. Written informed consent was obtained from the parents of those children who accepted to participate in this study. In each school, based on the frequency of reinforcement, children were randomly sub-grouped into subgroup A (reinforcement every three months) and subgroup B (reinforcement every six months) by another postgraduate student using a table of random numbers. All the children were examined in their school premises under natural sunlight (American Dental Association type III examination). A dental hygienist recorded the findings. The intra-examiner reliability was checked by re-examining ten children from each subgroup in all the three schools (kappa 0.85 to 0.90).

The oral health status assessment included: Dental caries status for primary teeth using decayed filled teeth index (dft), Dental caries status for permanent dentition using Decayed - Missing - Filled Teeth Index (DMFT), **Oral hygiene status using Simplified Oral Hygiene Index (OHI-S) and questionnaire survey in form of** Child Oral Health Impact Profile - Short form (COHIP-SF) scale to assess Oral Health -Related Quality of Life was recorded. School Dental Health Education (SDHE) interventions delivered information about oral health, oral hygiene, causes and consequences of dental caries, gingival problems, healthy eating habits, the importance of regular dental visits and the relationship between general health and oral health. Care was taken to deliver the same content of information in all the three modes of SDHE. The 3 modes of SDHE were used in this study after validating the information to be provided. The S-CVI score obtained was 1, which indicated that contents of information judged were valid and congruent. After the baseline data collection, the principal investigator (GP) delivered the SDHE to each

school using the respective modes: 1)Drama mode , 2) Modified snake and ladder game mode and 3) Flashcard mode.All children received regular reinforcements of SDHE throughout the six months study period at 2 different frequencies. Children in subgroup A received their reinforcement every 1 month in their respective modes. Children in subgroup B received their reinforcements every 2 months in their respective modes.

Data from the clinical examinations and questionnaires of the children who participated in the entire study period only were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS, Version 19, Chicago, IL, USA).The statistician was blinded of the mode of intervention received by the children. The data obtained was assessed for its normality using the Shapiro Wilk test. Non- parametric tests of significance were used to analyze the data, as the data were non- normally distributed. 'p' value ≤ 0.05 was considered statistically significant. Intragroup differences in the variables used to assess the oral health status and the OHRQoL between baseline and six months, was assessed by Wilcoxon Sign Rank test. Mann Whitney test was used to evaluate the differences in the effectiveness of the 2 frequencies of reinforcements. Friedmann test was used to evaluate the intragroup comparison of all the variables of 3 modes between baseline, one month and six months. Intergroup comparisons of oral health status, OHRQoL were done using Kruskal Wallis test. Post-hoc analysis were performed using Mann Whitney test.

Results:

A total of 300 children (drama mode-89, game mode-113, flashcard mode-98) were included in this study. At baseline, subgroup A included 42 (47.2%), 57 (50.4%) and 50 (51.0%) children and subgroup B included 47 (52.8%), 56 (49.6%) and 48 (49.0%) in drama, game and flashcards mode respectively. At the end of six months, 6.3% attrition (n=19) was seen in the total sample. Attrition rate in individual group was as follows: drama mode 5.62% (n=5), game mode 2.65% (n=3) and flashcard mode 11.22% (n= 11).

Data were expressed in mean ± SD for better understanding, as median values are close to zero. At baseline, there was no significant difference between the 3 modes of intervention with respect to the following parameters: age, sex, socio-economic status, school syllabus, clinical parameters and the OHRQoL questionnaire (Table 8.26: oral health well-being and functional well-being scores). There was a significant difference in the debris and OHI-S scores and in social well-being, school environment, self-image and total COHIP components of OHRQoL. Intragroup comparison of the dental caries status in primary dentition between baseline and six months. There was a significant reduction in the decay component (d) of primary teeth and the dft status of children in drama ($p= 0.017$, 0.02 respectively), game ($p< 0.001$) and flashcard mode ($p=0.001$) after six months of SDHE. The CTN of primary teeth significantly reduced in children of drama ($p=0.020$), game ($p=0.001$) and the flashcard mode ($p=0.001$).The decay component 'D' of permanent teeth significantly increased in the children belonging to drama ($p =0.002$) and flashcard mode ($p = 0.04$) as shown in table 8.3. The DMFT index score significantly increased in drama ($p = 0.001$) and flashcard ($p=0.003$) mode. There was a statistically significant

difference in the CTN of permanent teeth in drama (p=0.01) and flashcard mode (p = 0.04). There were no significant differences in the missing component (M) and filled components (f and F) in all the three groups.

Intragroup comparison of the dental caries status in the permanent dentition between baseline, one month and six months. Drama and flashcards showed a significant difference in the 'D' component (p=0.002, 0.038)respectively) Post hoc analysis for 'D' component showed significant difference between the baseline and one month in game mode (p=0.03) and between the baseline and six months in the drama mode (p=0.002) and flashcards mode (p=0.04). All the 3 groups showed a significant difference in the DMFT component (p<0.001, 0.038 and 0.003 respectively) between the 3 time periods. Post hoc analysis showed significant difference between the baseline and one month in the game mode (p=0.008) and between the baseline and six months in the drama mode (p=0.001) and flashcards mode (p=0.003).(Table1)

Intergroup comparison of dental caries status in primary dentition at the three time periods (baseline, one month and six months) showed no significant difference as seen in table 8.23. Intergroup comparison of dental caries status in permanent dentition at the three time periods showed a significant difference in the D2 ('D' component at six months; p=0.006) and D-D2 (difference in 'D' between baseline and six months; p=0.043). Post hoc analysis showed a significant difference between drama and game mode [D2 (p=0.002) and D-D2 (p=0.013)]. Significant difference was seen in the DMFT2 (DMFT score at six months; p=0.006) and DMFT-DMFT2 (difference in the DMFT between baseline and six months; p=0.045). Post hoc analysis showed a significant difference between drama and game mode [DMFT2 (p=0.001) and DMFT- DMFT2 (p=0.016)].(Table 2)

After six months of SDHE, there was a significant reduction in the debris score of children belonging to all the three modes (p= <0.001). An increase in the calculus score was found in children of game (p=0.03) and flashcard modes (p<0.001). There was a significant reduction in the OHI-S score of children in the all the 3 modes (p<0.001) of SDHE. Intragroup comparison of the oral hygiene status between baseline, one month and six months. All the 3 modes showed a significant difference in the debris score (p<0.001), calculus score (p=0.01, 0.005 and <0.001 respectively) and OHI-S score (p<0.001, <0.001, 0.01 respectively) between the 3 time periods studied. Post hoc analysis of debris component showed significant difference between baseline and one month in all the 3 modes (p<0.001) and significant difference between baseline and six months in all the 3 modes (p<0.001). Post hoc analysis for calculus score showed significant difference between baseline and one month in all the 3 modes (p=0.018, 0.013, <0.001 respectively). Post hoc analysis for OHI-S score showed significant difference between baseline and one month in drama and game modes (p<0.001) and significant difference between baseline and six months in all the 3 modes (p<0.001).Intergroup comparison of the mean differences in debris, calculus and OHI-S scores (table 8.8) showed statistically significant changes (p<0.001, 0.006 and <0.001 respectively). Post hoc analysis revealed that game and drama modes had a considerable difference in the debris score (p=0.001, 0.001), calculus (p=0.004, 0.01) and OHI-S score (p=0.001, 0.001) respectively, when compared to the flashcards mode.(Table 3)

Children in the drama mode showed a significant increase (p=0.005) in the oral health well-being component of COHIP. Drama, game and flashcard modes showed a significant increase in the functional wellbeing (p=0.001, <0.001 and 0.004 respectively), school environment (p=0.033, <0.001 and 0.002 respectively) and the total COHIP score (p<0.001, 0.021 and 0.002 respectively). Children in the drama and flashcard modes showed a significant increase in social well-being (p=0.043 and 0.016 respectively) and self-image (p=0.002 and 0.04 respectively).(Table 4)

Discussion

In the present study, widely accepted entertainment modes were modified and used to educate children about oral health. The drama has been used as an educative tool for a long time, and its characteristic feature is the teaching through dialogues. They help the observer to visualize and learn, when a health promoting situation is taught by acting out in real. John B et al in a 3 month trial reported that drama mode had a better impact on the oral health of preschool children[8]. Games have been used as a teaching strategy as it promotes active participation and self-learning. They are often a conscious and voluntary activity that keeps the child engaged during the learning process[12]. Kumar et al showed a significant increase in the oral health related knowledge score of children educated with a play-way (connect the dots game) method compared to the flashcard mode at the end of 3 months[13]. Flashcards still act as a conventional and most economical tool in health education. Using these edutainment modes, the current two-year trial, was planned to evaluate the effectiveness of the drama, game and conventional flashcard modes on enhancing the oral health status of school children.

A reduction in the caries status of primary teeth was observed in all the three modes at the end of 6 months. The reduction was consistent in the game and the flashcards modes; i.e both at the end of 1 and 6 months of SDHE. But in the drama mode, there was a slight increase in the decay status at the end of the first year and then a reduction was seen at the end of 6 months. This step down could have occurred either because children received dental treatments or their carious primary teeth exfoliated/ extracted in the mixed dentition transition period. Children belonging to the game mode showed the highest reduction in caries status with a considerable increase in restorative care. Tai et al (2009) found a significant increase in the number of restored surfaces and sealants placement and decrease in the score of untreated dental caries at the end of three years in children who received health education than those controls, who did not receive any intervention[14]. Al-Jundi et al reported from their study that the control group children were 3.1 and 6.4 times at higher risk for having dental caries than those children in the study group who received intensive oral hygiene instructions and supervised daily tooth brushing, for age groups 12 and 6 years respectively[15].

Frencken et al (2001) and Petersen et al (2004) showed that the oral health education interventions did not improve the caries status of children[16,17]. Lai et al showed a reduction in mean DMFT score in children whose tooth-brushing was supervised for a period of 10 years. In this study, the caries status of permanent teeth and their treatment needs were found to consistently increase in drama and flashcards modes. In the game mode, there was an increase in the caries from baseline to one month. But there was a considerable reduction in the caries status

from one month to 6 months. The reduction in caries in the second year could be attributed to the increase in the number of filled teeth. All newly erupted permanent teeth are vulnerable to caries in the post-eruption maturation phase[18]. Stained fissures on permanent first molars advised for sealants at baseline, left untreated, could have become carious in 6 months could have been the prime reason for an increase in the caries status of all the children involved in the study. Game mode was better than the other two methods as the caries increment and the need for treatment was least in this group of children.

Redmond et al (1999), Valle et al (2004), Vannobbergen et al (2004), Tai et al (2009) and Lai et al (2016) have shown a reduction in the plaque scores after dental health education[19,20,21,22,23]. Zanin et al (2007) and Esfahanizadeh et al (2011) have shown an improvement in the gingival health status of children receiving oral health education[9,24]. In the present study, all the three modes were effective in reducing the debris and OHI-S scores consistently over the 6 month study period. The results were consistent with the short-term trials conducted by Kumar et al[38] and Maheswari et al[25]. Connect the dots game, and snake and ladder game combined with flashcards were more effective than the flashcards alone, in reducing the debris scores in their study population. John et al showed a significant reduction in the debris score using drama mode of health education[8]. The health education provided to children positively influenced their attitude towards oral hygiene maintenance. It is reasonable to assume that this change in their attitude caused a significant improvement in their oral hygiene status. The authors found that the proportion of twice brushing had considerably increased at the end of 6 months. Routine tooth brushing can remove the loosely bound debris and not the firmly attached calculus. The significant increase in calculus score, especially on the lingual surfaces of permanent lower incisors was seen in children of all the 3 modes of SDHE, which could be due to the lower anterior crowding, as it is common in this age group of children[26]. Since these young children are in the process of shift in their oral hygiene maintenance from parental care to self-care, there is always a possibility of lack of efficient oral health care. This transition could also be difficult or complicated for children to maintain good oral hygiene. Children in the game mode showed the maximum reduction in debris score and minimal increase in the calculus score compared to the children belonging to the other methods.

Most of the studies restrict in assessing the objective parameters of a diseased condition following an intervention. The true outcome of the treatment or any intervention depends mainly on the symptom reduction, patient's satisfaction, and increased functional and emotional well‐being. To determine these subjective criteria various scales have been used, which assess the oral health related quality of life. Oral health‐related quality of life (OHRQoL) characterizes a person's perception of how oral health influences an individual's life quality and overall well‐being. Therefore, incorporating OHRQoL component in assessing oral health creates a shift from traditional assessment to the care that focuses on a person's functioning and well‐being[27]. Alsumait et al reported better OHRQoL in those children who attended school-based oral health programmes[28].

The (OHRQoL) was commonly assessed in adults and adolescents. It has not been studied extensively in children due to the lack of validated scales for children. Very few scales were available to assess the OHRQoL in children. In the present study, OHRQoL was assessed using the Child Oral Health Impact Profile - Short form (COHIP-SF) scale. This is a simple scale which can be used in a self-report format for children aged 8 to 16 years. This helps to examine the relationships between children's perceived impact of their oral health on different aspects of their lives and their perception of their dentofacial attractiveness, social anxiety and self-concept. The unusual character of this scale is that, it includes positive as well as negative aspects of OHRQoL[29.30].

In this study, children in all the three modes showed a substantial improvement in their OHRQoL. Among the six components, functional wellbeing, school environment and total COHIP scores showed a consistent improvement from baseline to 6 months in all the three modes. The other components increased from baseline to 6 months in all the modes. But there was no consistent increase from baseline to one month to 6 months. In the intergroup comparison, among the six components of the OHRQoL scale, there was a significant improvement only in the school environment component. This difference was seen only in the game mode, making it better than the other modes in improving the OHRQoL of children. School environment component deals with missing school days due to dental problems and not to speak or read loud in the classroom. So it can be inferred that children belonging to game mode had reduced missing school days due to reduced dental problems and improved in feeling confident to speak or read loud in classroom.

Conrado et al (2004)[31] highlighted the importance of the continuous implementation of school-based programs to promote the oral health. Repetition of information in health education helps in reinforcing healthy practices. It can be done either as mass or spaced repetitions. In the former, repetitions happen in the same learning experience. In spaced repetition, messages are repeated in different learning classes or sessions[32]. Spaced repetitions are successful in improving memory[33]. In the present study, spaced repetitions were done at 1 month or 2 months intervals. There was no difference in the effectiveness of the two frequencies of reinforcement in the flashcard mode. In the drama mode, reinforcements given every 2 months were found to be more effective in improving few components of OHRQoL scale. But they made no significant impact on caries and oral hygiene status of those children. Reinforcements given every one month using the game mode had a significant effect on both the OHRQoL and also in improving the restorative level of primary teeth. It was vivid that the children in game mode had periodic dental visits and got their decayed teeth filled. Duke (2006) believed that games can be used as a challenging educational tool and by involving repetition and allowing important points to be reiterated, games appear to increase retention[34]. Laiho M et al (1993) reported that any topic when repeated too frequently may cause more negative attitudes towards oral health education and practices[35]. Brown (1994), in his review stressed that repeated contacts, one to one instruction and involvement of participant are the main elements of the health education interventions[36]. Shenoy et al (2010) showed highly significant changes in children who received

SDHE, more significantly in schools receiving more frequent (3 weeks) interventions[37]. Children are ready for the change at different times. Hence, oral health education should be a continuous activity with repetition and reinforcement because it can make an impact at any time point[38].

The following interesting observations were noted during the study period. Drama mode was found to be attractive to the children in the earlier visits of the study period. But the children seemed to lack the same enthusiasm in the subsequent reinforcement sessions as they were familiar with the scenes and dialogues of the drama. Children in flashcard mode received SDHE similar to their regular teacher- centric classroom sessions. These children were never excited about seeing the dental team. But they were very attentive in listening to the instructions given. Children in the game mode were interested and ready to play the snake and ladder game in all the visits throughout the entire study period. This game mode was child-friendly, interactive, entertaining and augmented the learning process. The content of health information was stickier when delivered through the game mode, making it better than the other two methods of intervention. The only drawback seen in this mode was that children were more eager to get their turn to play rather than listening to the instructions of the supervisor. Within the limitations of this 6 month trial and from the observations mentioned above, it can be concluded that this study has ascertained the need for SDHE in schools to improve the oral health status of school children. Use of edutainment modes can make the information more interesting and adhesive. Health educators are always in search of newer and interesting modes of health education. They are recommended to use traditional games modified based on the age, race, cultural background and geographical location to gain the interest of children and to actively involve them in educational activities. They can capitalize on the advantages of these games against the odds of the newer technology-based modes of health education interventions. It is recommend the use of structured SDHE programmes using the game modes in different parts of the country to practically visualize its impact on the oral health of school children.

Conclusion

All the three modes of SDHE were effective in enhancing the oral health status, OHRQoL of school children aged 8 to 9 years. Game mode had the highest impact on oral hygiene, oral health-related quality of life of children, followed by drama and flashcard modes. The effectiveness of the frequencies of reinforcements was not coherent in all three modes. But, one month reinforcement in the game mode seemed to have a meaningful impact on the oral health of children.

References:

1. Jurgensen N, Petersen PE. Oral health and the impact of socio- behavioural factors in a cross sectional survey of 12-year old school children in Laos. BMC Oral Health 2009; 9:29.
2. World Health Organization information series on school health. Oral health promotion: An essential element of a health-promoting school. Geneva: WHO, 2003.
3. Peter S. Essentials of preventive and community dentistry.2nd edition.Arya (Medi) Publishing House, New Delhi; September 2003.

4. Kazemian R, Ghasem H, Movahhed T, Kazemian A. Health education in primary school textbooks in Iran in school year 2010 - 2011. J Dent (Tehran) 2014;11(5):536-44.
5. WHO global school health initiative & World Health Organization. Health education and promotion unit. Promoting health through schools: Geneva: WHO, 1996.
6. Geetha Priya PR, Asokan S, Kandaswamy D, Malliga S, Arthi G. Health camps in schools and content analysis of the school textbooks: A cross- sectional study in Tamil Nadu. J Ind Soc Pedod Prev Dent 2016;34:223- 26.
7. Kay EJ, Locker D. Is dental health education effective? A systematic review of current evidence. Community Dent Oral Epidemiol 1996;24(4):231-5.
8. John BJ, Asokan S, Shankar S. Evaluation of different health education interventions among preschoolers: a randomized controlled pilot trial. J Ind Soc Pedod Prev Dent 2013;31(2): 96-9.
9. Zanin L, Meneghim MC, Assaf AV, Cortellazzi KL, Pereira AC. Evaluation of an educational program for children with high risk of caries. J Clin Pediatr Dent 2007;31(4):246-50.
10. Castillo Lizardo JM, Rodriguez-Moran M, Guerrero-Romero F. Games as an alternative or teaching basic health concepts. Am J Public Health 2001; 9: 311-4.
11. Haleem A, Khan MK, Sufia S, Chaudhry S, Siddiqui MI, Khan AA. The role of repetition and reinforcement in school-based oral health education-a cluster randomized controlled trial. BMC Public Health 2016;16:2.
12. Lloyd RP. Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations and games. Educ Technol Res Dev 1996;44(2):43-58.
13. Kumar Y, Asokan S, John B, Gopalan T. Effect of conventional and game-based teaching on oral health status of children: A randomized controlled trial. Int J Clin Pediatr Dent 2015;8(2):123-6
14. Tai BJ, Jiang H, Du MQ, Peng B. Assessing the effectiveness of a school-based oral health promotion programme in Yichang City, China. Community Dent Oral Epidemiol 2009;37:391-98.
15. Al-Jundi SH, Hammad M, Alwaeli H. The efficacy of a school-based caries preventive program: a 4-year study. Int J Dent Hyg 2006;4(1):30- 34.
16. Frencken JE, Borsum-Andersson K, Makoni F et al. Effectiveness of an oral health education programme in primary schools in Zimbabwe after 3.5 years. Community Dent Oral Epidemiol 2001;29:253-59.
17. Petersen PE, Peng B, Tai B et al. Effect of a school-based oral health education programme in Wuhan City, Peoples Republic of China. Int Dent Journal 2004;54:33-41
18. Carlos JP, GittelsohnAM. Longitudinal studies of natural history of caries - II. A life-table study of caries incidence in the permanent teeth. Arch Oral Biol 1965;10:739-51.
19. Redmond CA, Blinkhorn FA, Kay EJ, Davies RM, Worthington HV, Blinkhorn AS. A cluster randomized controlled trial testing the effectiveness of a school-based dental health education program for adolescents. J Public Health Dent 1999;59:12-17.
20. Valle DD, Vianna RBC, Quintanilha LE, Abreu FV. Evaluation of an oral health promotion

program using different indicators. J Clin Pediatr Dent 2004;29(1):87-92.

21. Vanobbergen J, Declerck D, Mwalili S, Martens L. The effectiveness of a 6-year oral health education programme for primary school children. Community Dent Oral Epidemiol 2004;32:173-82.
22. Tai BJ, Jiang H, Du MQ, Peng B. Assessing the effectiveness of a school-based oral health promotion programme in Yichang City, China. Community Dent Oral Epidemiol 2009;37:391-98.
23. Lai H, Fann JC-Y, Yen AM-F et al. Long-term effectiveness of school- based children oral hygiene program on oral health after 10-year follow- up. Community Dent Oral Epidemiol 2016;44(3):209-15.
24. Esfahanizadeh N. Dental health education programme for 6-year-olds: a cluster randomized controlled trial. Eur J Paed Dent 2011;12(3):167-70.
25. Maheswari UN, Asokan S, Asokan S, Kumaran ST. Effect of conventional vs game-based oral health education on children's oral health-related knowledge and oral hygiene status - a prospective study. Oral Health Prev Dent 2014;12(4):331-6.
26. Sehaibany FA. Assessment of incisor crowding in mixed dentition among Saudi school children attending college of Dentistry Clinics at King Saud University. Pakistan Oral Dent J 2011; 31(1):122-27.
27. Okunseri C, Chattopadhyay A, Lugo RI, McGrath C. Pilot survey of oral health‐related quality of life: A cross‐sectional study of adults in Benin City, Edo State, Nigeria. BMC Oral Health 2005;25;5:7.
28. Alsumait A, Elsalhy M, Amin M. Long-term effects of school based oral health program on oral health knowledge and practices and oral health- related quality of life. Med Princ Prac 2015;24:362-68.
29. Broder HL, Wilson-Genderson M. Reliability and convergent and discriminant validity of the Child Oral Health Impact Profile (COHIP Child's version). Community Dent Oral Epidemiol 2007;35:20-31.
30. Broder HL, Wilson-Genderson M, Sischo L. Reliability and validity testing for the child oral health impact profile-reduced (COHIP-SF19). J Public Health Dent 2012;72:302-12.
31. Conrado CA, Maciel SM, Oliveira MR. A school-based oral health educational program: the experience of Maringa- PR, Brazil. J Appl Oral Sci 2004;12(1):27-33.
32. Lowenstein AJ, Foord L, Romano JC. Teaching strategies for health education and health promotion. Working with patients, families and communities,1st edn. Ontario: Jones and Barlett Publishers, 2009.
33. Seabrook R, Brown GD, Solity JE. Distributed and massed practice: from laboratory to classroom. Appl Cogn Psychol 2005;19(1):107-22.
34. Duke ES.A Taxonomy of games and simulations for nursing education. J Nurs Educ 2006;25:197-206.
35. Laiho M, Honkala E, Nyyssonen V, Milen A. Three methods of oral health education in secondary schools. Scand J Dent Res 1993;101;422- 27.
36. Brown LF. Research in dental health education and health promotion: A review of the literature. Health Education 1994; 21(1): 83-102.

37. Shenoy RP, Sequeira PS. Effectiveness of a school dental education program in improving oral health knowledge and oral hygiene practices and status of 12 to 13 year old school children. Indian J Dent Res 2010;21(2):253-59.
38. Haleem A, Siddiqui MI, Khan AA. School based strategies for oral health education of adolescents-a cluster randomized controlled trial. BMC Oral Health 2012;54(12);1-12.

Table 1: Intergroup comparison of dental caries status in permanent dentition between baseline and 6 months

Difference in the variables	**Drama** Mean±SD	**Game** Mean±SD	**Flash cards** Mean±SD	**p value***	**Post Hoc Analysis†**		
					Drama vs Game	**Game vs Flash Card**	**Drama vs Flash Card**
D	-0.27 ±0.80	-0.04 ±0.33	-0.13±0.55	**0.043**	**0.013**		
M	-0.04 ±0.33	0.00 ±0.00	0.00±0.00	0.310			
F	0.01 ±0.11	-0.03 ±0.21	-0.08±0.53	0.174			
DMFT	-0.32 ±0.84	-0.08 ±0.45	-0.21±0.65	**0.045**	**0.016**		

Table 2: Intergroup comparison of dental caries status in primary dentition between baseline and 6 months

Difference in the variables	**Drama** Mean±SD	**Game** Mean±SD	**Flash cards** Mean±SD	**p value***	**Post Hoc Analysis†**

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				Drama vs Game	**Game vs Flash Card**	**Drama vs Flash Card**
d	0.43±1.59	0.55 ±1.41	0.43 ±1.24	0.388	p>0.05	p>0.05
f	0.01 ±0.36	-0.05 ±0.35	0.02±0.40	0.298	p>0.05	p>0.05
dft	0.44 ±1.64	0.52 ±1.46	0.45±1.34	0.643	p>0.05	p>0.05

*Kruskall Wallis test
†Mann Whitney test

Table 3: Intragroup comparison of the oral hygiene status between baseline and 6 months

Variables	**Drama Mode** (Mean±SD)				**Game Mode** (Mean±SD)			**Flashcard Mode** (Mean±SD)	
	Baseline (n=89)	**6 months (n=84)**	**p* value**	**Baseline (n=113)**	**6 months (n=110)**	**p* value**	**Baseline (n=98)**	**6 months (n=87)**	**p* value**
Debris Index	0.92 ±0.52	0.33 ±0.43	**<0.001**	0.92 ±0.46	0.17 ±0.19	**<0.001**	0.53 ±0.47	0.23 ±0.20	**<0.001**
Calculus Index	0.11 ±0.23	0.14 ±0.21	0.248	0.08 ±0.19	0.11 ±0.18	**0.03**	0.05 ±0.14	0.17 ±0.31	**<0.001**
OHI-S index	1.04±0.66	0.86 ±3.59	**<0.001**	1.00 ±0.53	0.28 ±0.31	**<0.001**	0.57 ±0.55	0.39 ±0.41	**<0.001**

*Wilcoxon signed rank test
OHI-S indicates oral hygiene index simplified

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Table 4: Intragroup comparison of oral health related quality of life (COHIP) and overall knowledge between baseline and 6 months

Variables	**Drama Mode** (Mean±SD)			**Game Mode** (Mean±SD)			**Flashcard Mode** (Mean±S D)		
	Baseline	**6 months**	**p* value**	**Baseline**	**6 months**	**p* value**	**Baseline**	**6 months**	**p* value**
Oral health	14.71±3.58	16.02±3.54	**0.005**	15.44±3.17	15.53±3.44	0.25	14.63±3.74	14.93 ±3.83	0.60
well-being									
Functional well-being	13.52±2.85	14.84±1.91	**0.001**	13.5 ±2.88	14.7 ±2.01	**<0.001**	13.35±2.57	14.21 ±2.19	**0.004**
Social well-being	19.46±4.09	20.64±4.13	**0.043**	20.04 ±4.0	20.15±4.55	0.603	17.96±4.27	19.24 ±5.49	**0.016**
School environment	7.25±1.21	7.57 ±1.17	**0.033**	6.42 ±1.64	7.50 ±1.07	**<0.001**	6.39 ±1.76	7.22 ±1.59	**0.002**
Self-image	4.95±2.14	5.82 ±1.77	**0.002**	5.44 ±2.29	5.69 ±1.76	0.34	4.48 ±2.25	5.04 ±1.93	**0.04**
Total	59.8±9.24	64.55±9.03	**<0.001**	60.9±10.04	63.44±9.91	**0.021**	56.8±9.8	60.63 ±11.8	**0.002**
Overall Knowledge	5.19±1.43	6.58±1.65	**<0.01**	5.38±1.34	7.19±1.08	**<0.01**	5.34±1.33	7.04±1.25	**<0.001**