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RESEARCH ARTICLE
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EFFECTIVENESS OF PROPER BRUSHING TECHNIQUE BASED ON REPETITION AND REINFORCEMENT ON THE ORAL HEALTH STATUS OF SCHOOL CHILDREN A QUASI-EXPERIMENTAL INTERVENTIONAL DESIGN

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Abstract

Background: Oral health skills (OHS) programs about brushing techniques have been found to have a lasting impact when repetition and reinforcement are used. Existing dental research doesn't apply to school-based surgeon-led oral health skill programs.

Objectives: To determine the effectiveness of Oral Health Skills with regard to proper brushing techniques, based upon repetition and reinforcement on the oral health status of school children through the Community Periodontal Index of Treatment Needs.

Methodology: A quasi-experimental intervention study was conducted in a public school of Rawalpindi with 100 students (ages 13-17) demonstrating proper brushing techniques. These students were given intervention for OHS to demonstrate proper brushing technique. Other forms of awareness such as panaflexes and brochures were also shared. Brushing techniques were

demonstrated and examined on dummies. Students received four OHS sessions at weeks 0, 3, and months 3 and 6, each followed by oral examinations by a dentist.

Results: Proper brushing technique habit at the baseline was 1%. Which rose to 66% at the end of intervention. The CPITN index of participants at baseline was 1.06 and after the 1st, 2nd and 3rd intervention lowered to, 0.94, 0.68, and 0.28 respectively. Paired t-test was conducted with findings of $p < 0.001$. This highly significant result proved that it is advantageous to include OHS based on repetition and reinforcement to improve the oral health status of children.

Conclusion: Programs promoting Oral Health Skills with a focus on repetition and reinforcement have a long-lasting impact on the oral health status of school children.

Keywords: Oral Health skills, Repetition and reinforcement, Oral Health Status

Introduction:

Health is one of the most important assets of human life. Nowadays, it is understood that oral health is highly important for overall physical health. Oral disorders such as dental cariesare among the most important public health problems because of their high prevalence and detrimental effects on quality of life(1). Tooth decay is a common chronic disease in children and is one of the leading causes of student absenteeism.(2). More than 900 million cases of untreated dental caries, severe periodontal diseases, and edentulism were estimated in South East Asia (3). The prevalence of dental caries in Pakistan was found to be 56.62% (4) and school children in Pakistan had a dental caries prevalence of 40.3% (5). WHO declared that in order to improve oral health worldwide, it is essential to boost children's oral health through health-promoting schools (HPS)(6). There have been many different educational interventions utilized, ranging from straightforward dissemination of information to the implementation of sophisticated programs combining psychological and behavior-change techniques. The interventions' objectives were also broad, making it possible to target change in knowledge, attitudes, intentions, beliefs, behaviors, usage of dental services, and oral health status. Hartley found repetition and reinforcement as two of the four main principles of learning, the other two being the clarity of the learning objectives and the learner's active participation. It has also been demonstrated that repetition and reinforcement are essential for the maintenance of healthy behavior and the implementation of oral health skills and that both repetition and reinforcement are mutually beneficial(7). It has also been demonstrated that OHS programs cause participants' knowledge, attitudes, behavior, and skills to change and one of the most important factors for the accomplishment of health promotion is the time of the delivery of the intervention(8). Interventional program by repetition and reinforcement in school children is more effective as compared to puberty because according to reports, puberty presents the greatest challenge for skills development through health education(9). Natural Nashers was able to uphold favorable attitudes and behaviors toward dental health for six months and improved oral health was attributed to the cooperative and enthusiastic style of teachers.(10). In OHS, reinforcement typically takes the form of a material reward and expression of appreciation for newly adopted or modified behavior, a skill reward (11), an acknowledgement of newly acquired or modified skills through repetition and reinforcement (12). Therefore, repetition and reinforcement tools have important role in maintaining the effects of Oral Health skills programs. This study is significant because of its quasi-experimental design, community based intervention and oral health promotion through oral health education and brushing technique skills development which has never been done before. The aim of the present study was to evaluate the effectiveness of the repeated and reinforced oral health skills program on the development of brushing technique skills through a 6-month intervention, and their role in plaque reduction.

Methodology:

A Quasi-Experimental Pre and Post Interventional Design was carried out on 100 children age between 13-17 years of class 6-8, public elementary school of Rawalpindi.

This quasi-experimental study followed a pre and post interventional design and was conducted in a public elementary school in Rawalpindi, Pakistan. 100 children, from class 6th to class 8th, between the ages of 13 to 17 were chosen as study participants through simple random sampling. This study included elementary school students who had completed their permanent dentition and did not have any deciduous (baby) teeth present. Students with a history of tooth loss due to trauma, previous orthodontic treatment, family dental history, psychological issues, or any previous trauma were excluded from the study.At the outset of the study, the researchers formulated the null hypothesis that oral health skills regarding proper brushing based upon repetition and reinforcement have no effect on the oral health status of school children. Conversely, the alternative hypothesis stated that oral health skills regarding proper brushing based upon repetition and reinforcement have a positive effect on the oral health status of school children. Ethical permission was taken from AFPGMI, Rawalpindi, and each participant had to give informed consent to be included in the study. Participants were divided into 5 groups with 20 children each and were given OHS interventions**.** Knowledge, attitude behavior, DMFT and CPITN index value of elementary school children of Rawalpindi and Islamabad have been published earlier by author of present study (5). The participants for the present research were chosen from the published research by simple random sampling provided that they met the inclusion criteria.

Intervention:

The OHS program had many forms of interventions aimed to generate awareness and develop oral health skills among the students. The program included informative booklets detailing information about oral health, education regarding dental and oral hygiene with a focus on brushing for 2 minutes, twice a day, before going to bed and after breakfast. To develop proper brushing skills, students were given pamphlets and brochures, and were exposed to panaflexes and YouTube videos that demonstrated the Modified Bass Technique of brushing. Physical demonstration about proper brushing technique was performed on dummies and model casts. Every participant was encouraged to test their brushing technique on the models and was assessed and examined based on their skills. Class teachers were also trained to repeat and reinforce the oral health skills by giving reminders in daily morning assembly and monitoring the students. The groupswere exposed to 4sessions, week 0, week 3, month 3, and month 6, to repeat and reinforce the oral health skills they developed. Each session was conducted for 30 minutes per group and included demonstration on dummies and YouTube videos, followed by 2 minutes of monitoring of brushing technique on model casts for each participant individually.

The oral examination was conducted under daylight and using tactile and visual sensation. The patient was seated in a regular household chair. WHO probe Community Periodontal Index probe and instruments were used to determine the periodontal status of the participant and were twice sterilized before and after examination. Participants were examined for presence of dental plaque, gingival bleeding on probing and calculus at baseline by fresh dentist from AFID Rawalpindi. According to WHO standards for CPITN index, the buccal/labial and lingual/palatal surfaces of two central incisors in the anterior sextants, two most posterior teeth in the right and left sextants of the upper and lower dental arches, and their surfaces were all evaluated. Intervention sessions were performed at baseline of study, 3rd week, 3rd month, and 6thmonth and examination was performed respectively as explained in table 1.

Table 1: Repeated and Reinforced Intervention and Evaluation

S. No	Interventional Skills Programs	Evaluation
1.	Baseline 1st Intervention	0 Week
2.	2nd Intervention	3 Weeks
3.	3rd Intervention	3 Months
4.	4th Intervention	6 Months

Data was entered and analyzed in SPSS version 26.0. Mean and standard deviation were calculated and a paired T-Test was applied to evaluate significance of results.

Results:

Quasi experimental pre and post interventional study design include total 100 students. 51 (51%) were male and 49 (49%) were females. Gender distribution can be seen in table 2.

Table 2: Gender distribution of respondents

Serial No	Variable	Percentage
1	Male	51%
2	Female	49%
3	Total	100%

Figure 1 shows the age distribution of the students. Ages of the participants were 13 years (52%), 14 years (44%), 15 years (3%), and 16 years (1%)

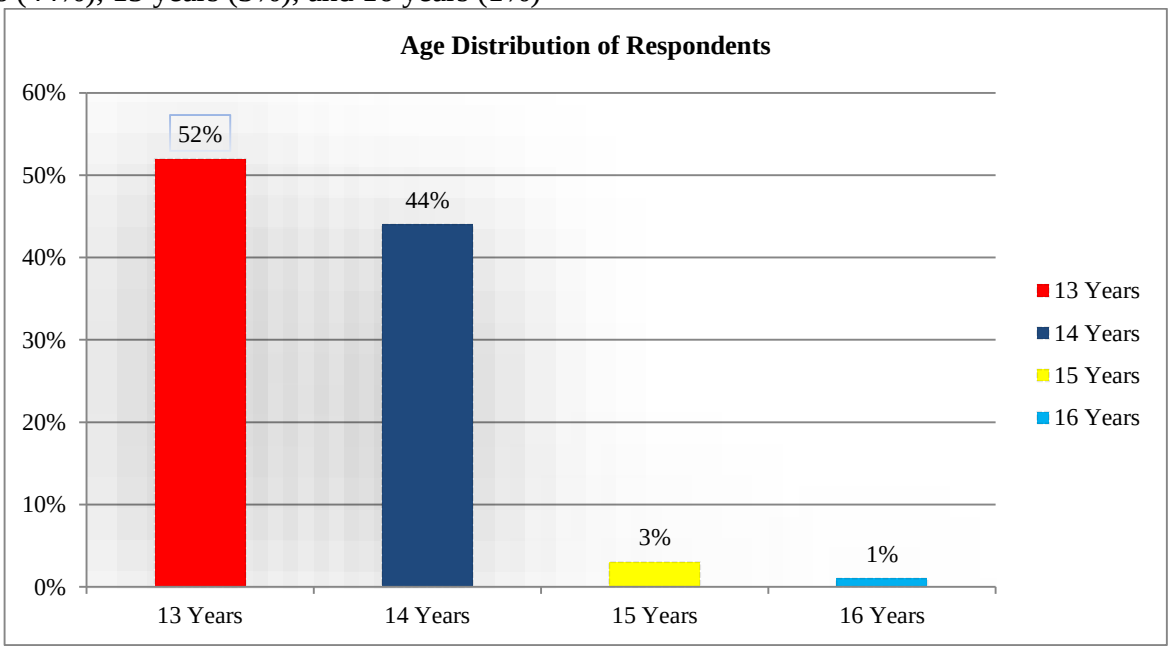

Figure 1: Age distribution of respondents

Figure 2 explains the class distribution of respondents. Class 6 had 0% of respondents as no student met the inclusion criteria, Class 7th (42%) and Class 8th (58%).

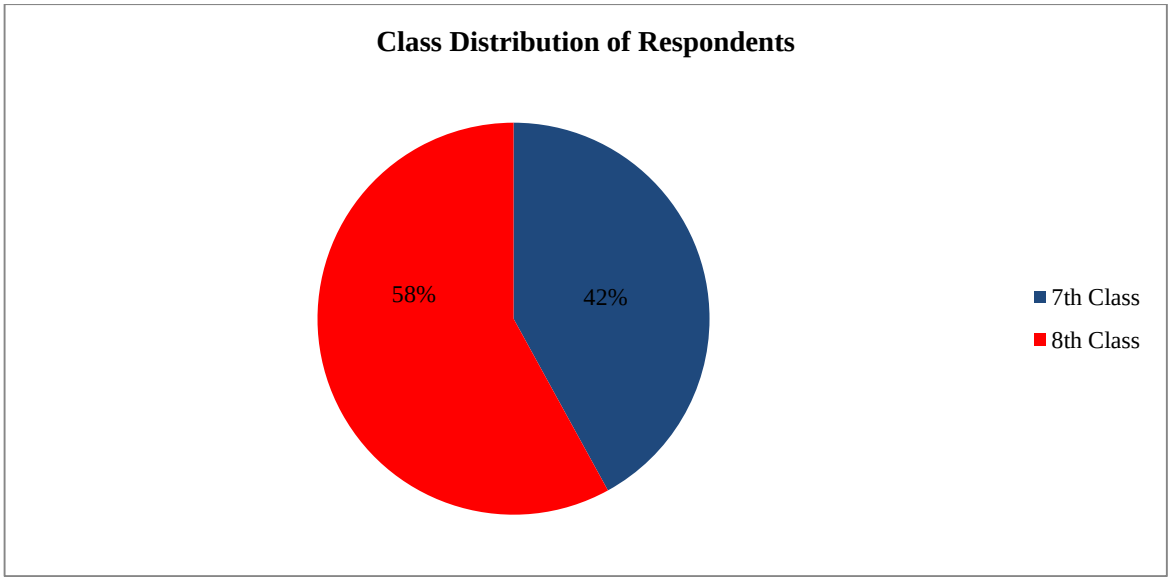

Figure 2: Class distribution of respondents

Respondents were first examined at baseline to determine their brushing habits and only1%had proper brushing technique pattern. After the 1st, 2nd 3rd and 4th intervention we were able to maintain Modified Bass Technique brushing habits for 5%, 16%, 34% and 66% of respondents respectively as explained in Table 3.

Table 3: Skills development of Brushing technique of respondents before and after intervention

S. No	Intervention	Skills Development
1.	Baseline Evaluation	1%
2.	After1st Intervention	5%
3.	After 2nd Intervention	16%
4.	After 3rd Intervention	34%
5.	After 4th Intervention	66%

The results of the study prove that a 6-month short-term interventional plan is effective for skills development.

Respondents were assessed for the presence or absence of gingival bleeding on probing, supra or subgingival calculus and periodontal pockets by using a 0.5 mm ball tip WHO probe, at baseline and followed by repeated and reinforced intervention at 3rd week, 3rd month and 6thmonths to measure the plaque index CPITN. Mean value of plaque index is explained below in table 4.

Table 4: Oral Health of respondents using CPITN after Interventional Skills Programs

S. No	Intervention	Mean Value of CPITN	CPITN values
6.	Baseline Evaluation and 1st Intervention 0 week	1.06	0.908
7.	2nd Intervention 3rd week	0.94	0.930
8.	3rd Intervention 3rd month	0.68	0.886
9.	4th Intervention 6th month	0.28	0.604

The satisfactory results of this intervention study proved that Modified Bass brushing technique skills development programs are effective in plaque reduction. Paired T test was applied, and the results showed that $p < 0.001$. This highly significant result proved that it is advantageous to include OHS based on repetition and reinforcement to improve the oral health status of children.

Discussion:

This research targeted 100 school children age between 13-17 years. We decided to choose school children of this age as this age range is covered by the concrete operating phase of Piaget's theory. Children learn how to use cognitive functions like logical thought processes in their daily lives(13).In order to lessen the impact of short-term learning, this evaluation included repeated and reinforced trials with a minimum of six-month follow-up as Esfahani zadeh had the fewest follow-ups during a period of 6 months for intervention (14). This study proved highly significant result of $p< 0.0001$ proving that a6 month intervention is enough to change skills of school children. However, our results were not in accordance to a study carried out by Abdul Aleem in Karachi where he was unable to change oral health status of children significantly after 6 months intervention. In health education, repetition refers to rehearsing the same messages repeatedly. When it occurs during a single educational event, it is referred to as "mass repetition," and when it occurs during various health education sessions, it is referred to as "spaced repetition (15). The present study practiced spaced repetition as suggested by Rachel Seabrook in improving oral health skills by repetition and reinforcement (16).In this study, direct communication by dentists was effective in developing oral health skills. This is in accordance to Chachra et al. research conducted in India in which the researchers found that dentists were the most successful as compared to the

other educators for oral health education(17).Our results of improving oral health status of 35 % children by repetition and reinforcement are in favor of Emler et al. study conducted in Kentucky, as they found repetition and reinforcement to be an important tool in improving health status of children by 31.53% (18). The present study used the Modified Bass Technique for skill development in accordance with M Poyato-Ferrera et al. who concluded that Modified Bass Technique was significantly more effective in plaque control as compared to normal tooth brushing practices(19). The present study disseminated tooth brushing instructions through pamphlets and videos as well as physical demonstrations and examinations on dummies. This was in accordance with Anaise and Zilkah who proved that maintenance of satisfactory oral hygiene was dependent upon the form of the educational programs as well as toothbrushing instructions(20).The present study demonstrated and examined the participants' brushing technique on dummies as Kashmira M Gurav et al. proved that interventional material like lectures, drawings, and brochures were not effective in reduction of plaque level (21). This study had highly significant results ($p < 0.001$) which favors a similar study in Bangladesh which proved that when compared to pre OHE levels, practically all knowledge and behavior markers showed a considerable improvement ($p<0.001$) (22). An oral health skills program was considered as a practical strategy to reach out to all children, regardless of their socioeconomic status, location, or level of development. This was in accordance with a study conducted in India where researchers Rekha P Shenoy and Peter S Sequeira concluded that plaque reduction is highly significant in interventional groups regardless of socioeconomic status (23). Our study was also in favor of a research in Brazil by Frietas et al. which found a 35% reduction of plaque scores over a period of 6 month intervention (24). This study observed a 69.9% reduction in bleeding upon probing and was in favor of an earlier study conducted by Zimmerman et al. on 87 Chilean refugees which observed a 50% reduction on bleeding upon probing over a 6-month intervention period(25).Oral health skills program were more effective when oral health education were targeted towards children and studies by Rong et al. (26),Alsada et al.(27), and Ko wash et al.(28), demonstrated a considerable improvement in oral health status and practices through effective oral health education interventional programs.

Small sample size, lack of randomization and control group, and selection bias were the main limitations of study. To enhance the generalizability of the results and address the limitations of the present study, it is recommended to conduct additional research in the form of randomized controlled trials (RCTs) or quasi-experimental trials.

Conclusion:

Oral Health Skills interventional programs based upon repetition and reinforcement have a long-lasting positive impact on oral health status of school children when implemented for 6 months. These short-term brushing technique skills development programs must be implemented in schools by dentists, teachers, students, and parents with regular reinforcement to make them more effective. Children must also pass on these acquired brushing skills to others in need.

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Authors contribution: 1 and 2 conceived the study, designed the experiments and wrote manuscript. 3,4, and 5 performed the experiments and collected the data. 6, 7, 8 reviewed and analysed the manuscript and also helped in statistical analysis. All authors read and approved the final manuscript.

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