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Original Article

Impact of Educational Interventions Based on the Implementation Intentions Strategy on the Oral Health of Schoolchildren

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Abstract

Objective: To compare the effectiveness of a traditional educational intervention with other two based on the implementation intentions psychological model on clinical and cognitive aspects related to the oral health of schoolchildren. **Material and Methods:** A sample of 160 children aged 7-10 years was divided into three groups: control (CG), Intervention 1 (IG1) and Intervention 2 (IG2). Plaque index (PI), gingival bleeding index (GBI) and knowledge on the oral health of schoolchildren were collected at baseline, 30, 60 and 120 days. All groups participated in educational lectures and had individual tooth brushing supervision and children from IG1 and IG2 participated in a self-regulatory strategy called implementation intentions aimed at facilitating behavior of brushing teeth at least three times a day. In addition, children from IG2 participated in a collaborative implementation intentions strategy with their parents in order motivate them to develop the behavior with their children. **Results:** All groups showed reductions in PI and GBI values and improvements in oral health knowledge, but IG1 and IG2 showed statistically significant differences in these variables compared to CG. **Conclusion:** The use of the Implementation Intentions psychological model in oral health educational programs showed a greater impact on the knowledge about oral health and plaque index of schoolchildren compared to traditional educational programs.

Keywords: Psychological Theory; Oral Health Education; Experimental Psychology.

Introduction

Interventions aimed to educate and motivate children may help them to cope with difficulties in achieving and maintain their oral health [1]. Schools are considered important settings for health promotion activities and children on early school years are considered more receptive to learning oral health contents [2].

Several psychological models and theories have been developed to better understand which underlying variables are related to health motivation, and one of the most used is the Theory of Planned Behavior (TPB) [3-5].

According to TPB, behavior implementation depends on the individual intention to act. The individual intention to act (behavior) is determined by three variables: 1) Attitude related to behavior; 2) Subjective norm (refers to the belief about whether most people approve or disapprove the behavior, the social pressure on behavior) and 3) Perceived behavioral control (refers to a person's perception of ease or difficulty of performing the behavior of interest, but limited by difficulties in executing this behavior). Therefore, in TPB, intention is considered an important predictor of health-related behavior [6].

However, recent researches have confirmed that even after people set a goal to change their behavior and are motivated to fulfill it, they need to overcome difficulties inherent to behavior initiation to, in fact, execute the behavior. To achieve this objective, a psychological theory was elaborated, which presents the presupposition that an anticipated mental behavior planning that the person wishes to implement to reach goals and the choice of situations more favorable to perform them ("when", "where" and "how"), may help them overcome problems associated with the implementation of the desired behavioral objectives. This anticipated planning was called "Implementation Intentions", in which an individual creates a previous metallization of intentional behavior, which can be later transformed into real behavior [7].

"Implementation Intentions" is considered a suitable self-regulatory strategy when dealing to overcoming problems related to the initiation of behavior directed to a specific objective, increasing probabilities of automation in these situations [8]. This strategy also includes 'obstacle-overcome planning', in which the individual identifies risk situations or barriers that may obstruct or negatively interfere in behavior performance [9] and elaborates a response to cope with this situation [10].

There are many studies in scientific literature using traditional educational methodologies for oral health education but a limited number of investigations about the effectiveness of TPB and Implementation Intentions theory with schoolchildren and their caregivers [11,12]. Thus, there is a need for more studies in the field of oral health using these theories in order to produce more effective actions in health planning.

The objective of this study was to compare the effectiveness of a traditional oral health education intervention with two others based on the Implementation Intentions theory on clinical and cognitive aspects of oral health among schoolchildren.

Material and Methods

Ethical Aspects

Before the beginning of interventions, the project was approved by the Ethics Research Committee of the Piracicaba Dental School - FOP/Unicamp (Protocol number 026/2013). Parents signed an informed consent form with information regarding the study methodology and consent for their children to participate in the research. The consent from was also applied to children.

Study Design

This is a randomized clinical trial carried out in two of nine public elementary schools of the city of Agudos, São Paulo, Brazil, with a population of approximately 35,872 inhabitants. Schools were selected taking into account that students had similar socioeconomic conditions and clinical characteristics. These aspects were identified by a pilot test aimed to verify the homogeneity of the selected population. Schools had no oral health educational programs. The total sample was composed of 178 students aged 7-10 years of both sexes from 11 classes.

Classes were randomized into three groups according to methodology proposed by Pine [13]: Control Group (CG) = 73 children; Intervention Group 1 (IG_1) = 58 children and Intervention Group 2 (IG_2) = 47 children. The sample size was considered appropriate to test a strong effect with 5% significance and 80% power in the ANOVA model with 3 comparison groups. The distinct number of participants in each group was due to the fact that the selected classes did not present an equal number of children and also because some parents did not sign the informed consent form.

Baseline Data Collection

At baseline, all children were clinically examined in schools, before meal, under artificial lighting, and with the use of mouth mirror and periodontal OMS probe. The Gingival Bleeding Index (GBI) and the Plaque Index (PI) were analyzed [14]. Data were collected by a trained and experienced researcher.

In addition, children from all groups answered a questionnaire about basic oral health knowledge with 9 multiple choice questions developed from previous studies [13,15], including topics such as oral self-care, tooth brushing frequency, use and importance of dental floss and eating habits, assigning score 1 for right answers and 0 for wrong answers. To investigate the comprehension of instrument questions by children, a pilot test was carried out with a sample of 15 schoolchildren of the same schools. The socioeconomic level of parents was investigated by a previously elaborated questionnaire [16].

After initial clinical data collection and questionnaires, classes were drawn per school to compose the three study groups.

Development of Collective Educational Activities

Collective educational activities were developed by a dentist, every 10 days, over a 30-day period with classes of each study group, since according to Bastable [17], the distribution of learning in several learning sessions leads to a better memorization of information than in a single session.

The learning process was based on activities about mouth parts and their importance to daily activities; oral health care and importance; tooth brushing techniques and the use of dental floss; eating habits and its connection with dental caries. Subjects were addressed by orientations and lectures using educational resources, such as dental macromodels, movies and electronic devices (tablet) to explain the importance of oral hygiene and health of teeth and gum, interactively showing the growth of dental plaque and the difference between healthy tooth and dental caries; drawings about the connection between diet and dental caries, recognizing cariogenic and non-cariogenic foods. The cariogenecity of some foods was also emphasized by offering a cookie and observing, through an individual mirror, where food adhered to teeth. Still in this session, children were shown photographic images of children's characters significant to them attached to a poster and with their intact and decayed teeth (made in an image editing program) in order to fix the importance of healthy eating and good oral health hygiene. Children also performed a sensitization exercise about oral health related to the rest of the body, using different types of mouth made of cardboard and looking at themselves in the mirror [18]. In the last session of educational activities, children learned the importance, techniques and the main occasions to brush their teeth and use dental floss, initially with the aid of an oral micromodel, and, after, they brushed their teeth with supervision of Fone's technique [19].

After the end of educational activities with children from the three groups, the 'implementation intentions strategy' was applied to schoolchildren from groups GI_1 and GI_2 [6-8], in which the individual mentally formulates a proposition of when, where and how he will perform the behavior desired. In the case of this study, the behavior proposed to groups GI_1 and GI_2 was brushing their teeth daily, three times a day. For that, the researcher initially delivered to children a leaflet with the following description: *"I will brush my teeth every day, at least three times a day. Let's think of when, where and how I will brush my teeth."* The leaflet presented child illustrations (of when, where and how to brush teeth) and blank spaces for them to fill out showing how they would implement that intention (brush their teeth three times a day).

In addition, the researcher applied the 'obstacle overcoming strategy' [6-8], in which the individual exposes ways to overcome obstacles to perform the behavior through a leaflet with the following statement with blank spaces to be filled out: *"There may be situations and obstacles that will prevent you from brushing your teeth at some time of the day. Let's think about these difficulties and try to overcome them"* [7,8,20]. *The child was oriented to think of situations that would prevent them from performing the behavior mentioned above and answer what would be the best way to overcome that intercurrence.*

To achieve success in the implementation intentions strategy, it is important for the individual to formulate attainable goals, making it easier for behavioral change [10]. For both strategies, the researcher read and explained the leaflet information for the children and, for those that presented difficulties in describing what they were thinking, the researcher helped them to write down their thoughts.

Moreover, for children from group GI_2, a collaborative strategy was elaborated with their parents so they can participate in the planned objective. For that, parents of children form GI_2 group attended a lecture about theory and information proposed to children and they were recommended to monitor or observe at least the last brushing of the day, at night, before children go to sleep [12,13].

Children from all groups were evaluated at the beginning / baseline (T_1), 30 days (T_2), 60 days (T_3), and 120 days (T_4) after the first evaluation.

Development of Educational Activities at T_2, T_3 and T_4

At T_2 and T_3, new clinical exams were carried out (PI and GBI) and the same questionnaire applied in T_1 on oral health knowledge was applied to children to assess if the information given was learned. After school vacation from December to January, a period of approximately 8 weeks (T_4), the last clinical test was carried out and children answered again the questionnaire about oral health knowledge.

Statistical Analysis

Initially, an exploratory data analysis was carried out by absolute, relative and average frequency and standard deviation. Subsequently, analysis of variance (ANOVA) with repeated measures was carried out, followed by Tukey's test when a statistically significant factor effect was identified. All models developed in this analysis had satisfactory assumption about residuals. Four ANOVA models were developed, i.e., one for GBI, one for PI, one for Correct Answers in the Oral Health Questionnaire (OHQ-Correct), and one for Wrong Answers in the Oral Health Questionnaire (OHQ-Wrong), the dependent variables considered were clinical parameters (PI, GBI) and correct and wrong answers in the oral health questionnaire (OHQ-Correct and OHQ-Wrong), and as independent variables (factors), group, period (with repeated measures) and group x time interaction. Only when a statistically significant effect of groups (CG, IG_1 and IG_2) was detected, the Tukey's test was applied, aiming to identify which groups differed among each other. Concerning the evaluation of the Oral Health Questionnaire, as previously described, score 1 was attributed to right answers and 0 to wrong answers. The final score was the sum of correct and wrong answers for each individual. Moreover, by an exploratory analysis of data, the average of total points for each group (CG, IG_1 and IG_2) was calculated. The hypothesis test developed in this study considered a significance of 5%, i.e., the null hypothesis was rejected when p-value was lower or equal to 0.05.

Results

At the end of the study, there was sample loss especially after the period of school vacation, 70 children remained in CG, 55 children in IG_1 and 35 children in IG_2. The highest sample loss was observed in IG_2, because some parents did not attend the lecture about oral health, which was part of the implementation intentions strategy.

However, even with sample loss, according to Table 1, groups at baseline were statistically similar regarding variables PI, GBI, number of correct and wrong answers of the oral health questionnaire (OHQ-Correct and OHQ-Wrong), income, parental schooling at baseline ($p>0.05$), therefore presenting a certain homogeneity of characteristics assessed in that moment. At baseline, of the total of 160 children, 44% were from CG (70 children), 34% from IG_1 (55 children) and 22% from IG_2 (35 children). About 42% of families had income between US$ 251 and US$ 502 and 39% of fathers and 53% of mothers had completed high school.

Table 1. Average and Standard deviation of variables PI, GBI, OHQ-Correct and OHQ-Wrong at baseline, followed by p-value of Kruskal-Wallis test, and absolute and relative frequency of income and maternal schooling, by group, followed by p-value of chi-squared test for independence.

Variable	Category	Group			p-value
		Intervention 1	Intervention 2	Control	
PI		0.84 (0.31)	0.86 (0.34)	0.96 (0.33)	0.0702
GBI		0.66 (0.29)	0.71 (0.35)	0.67 (0.32)	0.6603
OHQ-Correct		6.27 (1.87)	6.2 (1.75)	5.51 (1.78)	0.0546
OHQ-Wrong		2.73 (1.87)	2.8 (1.75)	3.49 (1.78)	0.0546
Income	Lower/equal 2 MW*	29 (18.12)	20 (12.5)	37 (23.12)	0.9014
	Higher than 2 MW	26 (16.25)	15 (9.37)	33 (20.62)	
Maternal schooling	until 8 years of study	12 (7.50)	3 (1.87)	18 (11.25)	0.1188
	> 8 years of study	43 (26.87)	32 (20.00)	52 (32.5)	
Paternal schooling	until 8 years of study	20 (12.5)	11 (6.87)	32 (20.00)	0.3146
	> 8 years of study	35 (21.87)	24 (15.00)	38 (23.75)	

*MW -Minimum wage at the time of data collection ≈ US$ 251.

Table 2 presents variable PI for groups over time. A difference between averages of groups was verified. A decrease was observed for all groups at the end of the 120 days compared to baseline ($p<0.0001$) and also between IG_1 and IG_2 in relation to CG for all periods evaluated ($p<0.0001$).

Table 2. Plaque index (PI) for groups in relation to period (with repeated measures) and interaction of groups in relation to period.

Group	Period (Days)							
	T_1 (Baseline)		T_2 (30)		T_3 (60)		T_4 (120)	
	Average	SD	Average	SD	Average	SD	Average	SD
Control (B)	0.96	0.33	0.28	0.25	0.42	0.26	0.69	0.28
Intervention 1 (A)	0.84	0.31	0.23	0.15	0.36	0.26	0.59	0.29
Intervention 2 (A)	0.86	0.34	0.16	0.09	0.31	0.21	0.62	0.36
Total	0.90	0.33	0.24	0.19	0.37	0.25	0.64	0.30
p-value - group								0.0001
p-value - period								<0.0001
p-value - group*period								0.8414

SD: Standard Deviation. *Different letters in parentheses represent statistically significant differences among groups by the Tukey's test ($p<0.05$).

With regard to GBI, a statistically significant decrease was observed between baseline and the period of 120 days for all groups (p<0.0001); however, no differences among groups were observed (p=0.3844), as shown in Table 3.

Table 3. Gingival bleeding index (GBI) for groups in relation to period (with repeated measures) and interaction of groups in relation to period.

Group	Period (Days)							
	T_1 (Baseline)		T_2 (30)		T_3 (60)		T_4 (120)	
	Average	SD	Average	SD	Average	SD	Average	SD
Control (B)	0.67	0.32	0.16	0.10	0.24	0.17	0.49	0.27
Intervention 1 (A)	0.66	0.29	0.15	0.08	0.20	0.13	0.45	0.28
Intervention 2 (A)	0.71	0.35	0.11	0.07	0.21	0.13	0.47	0.33
Total	0.68	0.32	0.15	0.09	0.22	0.15	0.47	0.28
p-value - group								0.3844
p-value - period								<0.0001
p-value - group*period								0.8033

SD: Standard Deviation. *Different letters in parentheses represent statistically significant differences among groups by the Tukey's test (p<0.05).

With respect to correct and wrong answers in the oral health questionnaire (OHQ-Correct and OHQ-Wrong), there was a difference in the averages of groups, and according to Tables 4 and 5, the average of correct answers increased over time, as the average of wrong answers decreased among groups evaluated. According to the averages of each group, CG presented, in general, lower averages of correct answers and higher averages of wrong answers in all periods (p<0.0001) in comparison with groups IG_1 and IG_2. Groups IG_1 and IG_2 presented similar values, regardless of period, and slightly higher average of correct answers and lower average of wrong answers compared to CG (p<0.0001).

Table 4. Results of OHQ-Correct, with factors group, period (with repeated measures) and interaction of groups in relation to period.

Group	Period (Days)							
	T_1 (Baseline)		T_2 (30)		T_3 (60)		T_4 (120)	
	Average	SD	Average	SD	Average	SD	Average	SD
Control (B)	5.51	1.78	7.19	1.56	7.21	1.50	7.19	1.64
Intervention 1 (A)	6.27	1.87	7.87	1.41	7.62	1.62	7.75	1.46
Intervention 2 (A)	6.20	1.75	7.94	1.08	7.91	1.07	7.89	1.16
Total	5.93	1.83	7.59	1.46	7.51	1.48	7.53	1.51
p-value - group								<0.0001
p-value - period								<0.0001
p-value - group*period								0.9889

SD: Standard Deviation. *Different letters in parentheses represent statistically significant differences among groups by the Tukey's test (p<0.05).

Table 5. Results of OHQ-Wrong, with factors group, period (with repeated measures) and interaction of groups in relation to period.

Group	Period (Days)							
	T_1 (Baseline)		T_2 (30)		T_3 (60)		T_4 (120)	
	Average	SD	Average	SD	Average	SD	Average	SD
Control (B)	3.49	1.78	1.81	1.56	1.79	1.50	1.81	1.64
Intervention 1 (A)	2.73	1.87	1.13	1.41	1.38	1.62	1.27	1.45
Intervention 2 (A)	2.80	1.75	1.06	1.08	1.09	1.07	1.14	1.14
Total	3.08	1.83	1.41	1.46	1.49	1.48	1.48	1.50
p-value - group								<0.0001
p-value - period								<0.0001
p-value - group*period								0.9803

SD: Standard Deviation. *Different letters in parentheses represent statistically significant differences among groups by the Tukey's test (p<0.05).

Discussion

Educational oral health programs based on psychological models of behavior change usually present higher impact on the individual's knowledge and attitude [1], and schools represent an important scenario to stimulate these interventions [2]. However, for any educational intervention in health to be effective, a careful planning should consider psychosocial factors that may negatively influence results, such as lack of motivation, opportunities and support to maintain healthy lifestyle.

Regarding children's oral health, it is known that dental caries and gingivitis frequently occur in this population [22,23]. So, effective interventions directed to reduce oral biofilm are necessary to promote oral health, and the findings of this study contribute to this condition because they show positive changes in children's oral hygiene status throughout the research, clinically detected by decreases in the averages PI and GBI values for all three groups, especially at the end of educational activities.

With regard to the answers of questionnaire about oral health knowledge, it was observed that IG_1 and IG_2 presented levels of correct and wrong answers statistically higher compared to CG over time, indicating the same tendency found in reference, because, in general, studies on oral health education directed to children, considering this age group, have found improvements regarding knowledge and oral health practices compared to control group [24]. This result also reveals that educational intervention with the aid of the implementation intentions strategy helped children to better keep knowledge over time compared to CG, which remained unchanged after vacation period, a fact that confirms other findings that demonstrated that this is a successful psychological strategy to change knowledge and oral health behavior after following for a period longer than 30 days [25,26], but, in adults. Therefore, data of this study helped to find more evidence about the impact of this strategy on children and in a longer follow-up period (120 days).

With regard to clinical and cognitive variables, there were no statistically significant differences between IG_1 and IG_2, showing that there was no high impact of intervention of collaborative implementation intentions with parents in comparison to that carried out only with children. This finding is not in agreement with results of observational studies presented in reference, which observed that the effective involvement of parents or other members of the family in educational intervention, may positively impact schoolchildren regarding oral health [15,27]. A hypothesis for this result may be due to the fact that parents did not support the proposal of researchers due to socioeconomic and cultural contexts that determine the oral health lifestyle and values for each family [27,28].

After vacation period (120 days of baseline), no statistically significant difference between clinical results found in IG_2 and other groups was observed, a fact that may have occurred because parents of all groups have been less vigilant regarding hygiene, diet control of children during this period [29]. The school vacation period is considered critical regarding the consumption of cariogenic foods encouraged by media, which advertising directed to this target is intensified by the advertisement of foods with high levels of sugar, fat and sodium [30].

Other hypothesis for the lack of statistically significant difference in GBI and a not very evident difference in PI, as well as 2 in correct and wrong answers of groups IG_1, IG_2 and CG, may have been the impact of the educational methodology initially used in the three groups, which has been based on exercise of participation of children and use of educational resources that stimulate empathy of children to the subjects proposed, with the use of characters considered relevant to them and, therefore, different from interventions proposed in literature, which are primarily focused on cognitive contents of oral health, using illustrations and models meaningless to children and use of passive learning methodologies [2,13,15].

The not so different intragroup values found in the final assessment and baseline regarding average PI and GBI values, may have occurred due to the fact that they were already low at baseline. Maybe, if these interventions were applied to a sample of schoolchildren with higher index at baseline, the results could have been different.

Another factor that may have limited obtaining a higher impact of intervention using implementation intentions in comparison with traditional approaches may have been the mean sample age. The majority of participants was 7 years old and did not have yet cognitive skills necessary to read and write with competence, fact that may have compromised the exercise of children thinking and writing about how they would implement their intention.

Although this research demonstrated superiority of the implementation intentions strategy over traditional educational strategy regarding variables PI, GBI and oral health knowledge, future studies should be carried out with children of other age groups and also in other social contexts in order to confirm or not the effectiveness of interventions evaluated in this study.

Conclusion

The three interventions under study were effective to improve variables PI, GBI and oral health knowledge. However, interventions based on the implementation intentions theory combined with traditional educational activities present better results regarding clinical aspects as well as cognitive aspects compared to traditional programs that do not apply the referred psychological strategy.

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