

ORIGINAL RESEARCH

Effectiveness of motivational interviewing on oral healthcare in pediatric patients

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Abstract

The study aimed to evaluate the effectiveness of motivational interviewing, compared to using different traditional motivational techniques on early adolescents' knowledge, attitudes, behavior changes, and oral hygiene status about oral healthcare; 156 healthy early adolescents aged between 10–12 years were included in this interventional study. The participants were randomly assigned to four groups. Basic oral hygiene training (BOHT) (n = 39) group, video monitored (VIDEO) (n = 39) group, plaque disclosed method (PDM) (n = 39) group, and motivational interviewing (MI) (n = 39) group. The participants joined all the motivation sessions one-to-one, face-to-face, with the primary researcher. The data collection forms consist of questions measuring the levels of knowledge, attitude and behavior related to oral health. The participants were invited to the reminder sessions in the following 2 weeks and 1 month. The participant's plaque index was recorded and assessed by a blinded examiner at the reminder sessions. Data forms were re-filled after a 3-month end-point to evaluate participants' knowledge, attitude, behavior changes and oral hygiene status. After the follow-up period, while there was a slight increase in knowledge and attitude levels in the PDM and VIDEO groups, there was a higher increase in behavior and attitude levels in the MI group. Compared to the oral hygiene status, the Plaque Index score reduction was greater in the MI group than in the other groups ($p < 0.05$); Although positive changes were observed in all groups, the most significant improvement was observed in the MI group. It was concluded that MI could have a positive effect on improving the oral hygiene habits of pediatric patients.

Keywords

Attitude; Behavior change; Motivational interviewing; Oral healthcare

1. Introduction

Dental caries still has a high prevalence in children despite intensive efforts using preventive strategies worldwide. The majority of adults and 60–90% of school children have dental caries. Dental caries treatment comes with a heavy financial burden for both individuals and society, since preventive dental health is hardly practiced in certain developing countries [1].

The most important risk factors for caries development are related to attitude and behavior change [2]. A study reports the inadequacy of prevalent health education during adolescence in bringing about sustained changes in oral health behavior, although a certain development in knowledge is attained [3]. Particularly, the early adolescence period is socially critical when health behavior is perceived as a reinforced lifestyle habit [4]. This period provides an unparalleled opportunity for oral health interventions to favorably alter negative behavior. The prevalent health education features a sharp focus on raising awareness and giving advice. This often contributes to significant progress in oral health knowledge which is, however,

seldom transformed into sustained changes in behavior [5].

Previous studies have been conducted using oral health care education to develop tooth-brushing habits in different age groups [6–8]. Audiovisual techniques and communication tools (one-to-one intervention, group intervention, follow-up telephone calls) are often used in the studies carried out in schools, and clinics. One approach to behavioral change, motivational interviewing (MI), stands out among school, community, and family-based approaches [9]. MI is a collaborative communication style, person-centered which aims to improve health behaviors. It is more than a set of techniques, it is a form of profession-patient interaction. MI considers individual autonomy and sociocultural context, evoking intrinsic motivation to make long-term behavioral changes [10, 11]. MI can be used when individuals cannot decide due to two-tailed thoughts. Ambivalence originating from these two-tailed thoughts can be distinguished through this technique that enables individuals to deal with their problems with an individual-centered, goal-oriented approach. Thus, the central purpose of the MI is to scrutinize and solve the ambivalence. The motivational

interviewer intentionally addresses this goal [12].

In recent decades, dental studies using MI technique and its effectiveness across different cultures and age groups for early adolescents have been of considerable interest in improving oral hygiene and behavior changes [13, 14]. However, there are limited studies investigating the efficacy of MI on early adolescents with poor oral hygiene. The present study aimed to evaluate the effectiveness of MI, compared to traditional motivation methods in early adolescent patients with poor oral hygiene, on oral hygiene status, knowledge, attitudes and behavior changes in oral healthcare. The null hypothesis of the present study is that there is no difference between the motivational interview (MI) applied for oral hygiene status, knowledge, attitude and behavior change in early adolescents and traditional methods.

2. Materials and methods

2.1 Sample Selection and randomization

The present interventional study was conducted on early adolescents aged 10–12 years who applied to Cukurova University Faculty of Dentistry Pediatric Dentistry Clinics between March and June in 2017. An internet-based randomization program (researchrandomizer.org) was used in the selection of participants to avoid bias and to show that there was no difference between the groups in terms of gender and age. Patients were randomly assigned using a table of random numbers. Power analysis was performed using the G*Power 3.1.9.7 (Heinrich-Heine-University, Dusseldorf, Germany) program. 156 participants in total were calculated for a sample size of 39 per group with 95% power, and a 5% significance level. Participants were recruited from the Pediatric Dentistry Clinics in March and June 2017 under the following inclusion criteria: (1) to volunteer to participate in the survey with parental consent, (2) to have the ability to read, understand and fill in the data forms, (3) the absence of a systemic problem that may affect oral health (diabetes mellitus, hemophilia, cardiovascular diseases, *etc.*), (4) the absence of a condition that prevents communication (mental retardation, visual and hearing impairment, *etc.*), (5) non-use of medication that may affect oral health, (6) to have plaque index (PI) >2 and to have pain or trouble with teeth in the last 1 year as a sign of lack of knowledge, attitude and behavior related to oral hygiene.

2.2 Interventions

All the participants were given a Turkish data form (**Supplementary material**) consisting of 22 questions. The data forms which were filled out through one-to-one face-to-face contact were developed based on previous studies related to pediatric patients' knowledge, behavior, and attitude toward their oral hygiene before the study [15–17]. Prior to the study, the questions in the data form measuring the level of knowledge, attitude and behavior used in the study were tested on 30 early adolescents to measure the intelligibility of the questions. As a result of the measurements, it was found that the question patterns were understandable and the data form was used in the study accordingly. The data forms which were filled out through one-to-one face-to-face contact

in a room isolated in terms of sound and visual stimuli in the pediatric dentistry clinic were created based on previous studies related to pediatric patients' knowledge, behavior and attitude toward their oral hygiene before the study. The behavior level is composed of 7 questions designated as Q 1–7; the Attitude level is composed of 6 questions designated as Q 8–10, Q 15 and Q 21–22; and the Knowledge level is composed of 9 questions designated as Q 11–14 and Q 16–20 in the data form.

The data of the participants were collected using this form, which was prepared with 4 options to evaluate the level of knowledge, attitude and behavior of the child regarding oral and dental health, in which only one option was marked. When the correct option was selected, it was evaluated as 1 point and when the wrong option was selected, it was evaluated as 0 points, and thus the result scores were created. Knowledge, attitude and behavior scores were evaluated separately and the total score was not evaluated. The oral health knowledge of the participants was evaluated over 9 points, their attitude 6 points, and their behavior 7 points. The increase in knowledge, attitude and behavior scores means that the level of knowledge, attitude and behavior about oral health increases. The participants were randomly divided into four groups as follows:

1. Basic Oral Hygiene Training (BOHT): Basic oral hygiene instruction was given to this group on a model of the mouth. The participants were then given basic knowledge of the surfaces of the teeth on the model. Brushing of the buccal, lingual/palatal and occlusal surfaces was demonstrated. Participants were also shown how to clean the interface with dental floss. The participants were then asked to imitate the processes on the model. Recommendations for regularly visiting a dentist and reduction in sugary snack consumption were also given. At the end of the instruction, the participants were provided with appropriate toothbrushes, toothpaste, and dental floss.

2. Video Monitored (VIDEO): Audio-visual stimuli prepared specifically for this training were displayed on the tablet screen by the researcher for the patient in an isolated room in addition to basic oral hygiene instruction. Any issues not clearly understood were verbally explained following the screening.

3. Plaque Disclosure Method (PDM): Basic oral hygiene instruction was also given to this group. Participants' teeth were then dyed with a plaque-disclosing agent and photographed using a tablet camera. Images were displayed to the participants so that they visualize tooth plaque in the mouth in a concrete way. The participants were asked to brush their teeth with toothpaste and toothbrush and use dental floss, in the same way as instructed during basic oral hygiene training, to remove plaque. After the teeth were brushed, they were dyed again with the plaque-disclosing agent and photographed. The images were compared to describe the role of tooth brushing in preventing plaque accumulation.

4. Motivational Interview (MI): The participants were asked to talk about their experiences concerning knowledge, attitude, and behavior concerning dental care after the basic oral hygiene instruction was presented. It was conducted by the primary researcher trained in MI, Miller, and Rollnick style [12]. The MI intervention lasted for, on average, 20 min. and was carried out in a quiet room. The central foci for

the MI were the participants' opinions of their current oral health status and how their oral health status is relevant to their behaviors encompassing past, present and future. The interview commenced with an open-ended question asking how the participants commented on their current oral health status. Certain strategies for behavioral changes regarding oral health and periodontal treatment were unearthed and strengthened. Participants with low motivation and readiness for a change were motivated to expose ambivalence. Self-efficacy was enhanced by involving the participants as active agents that could search for information and make plans regarding behavior in the research.

2.3 Outcome measures

The effectiveness of the interventions was evaluated using psychological, behavioral, and clinical outcomes. All the participants were invited on the 2-week, 1-month and 3-month post-intervention for data collection. In the 2-week and 1-month post-intervention, the methods were repeated and proper brushing and dental flossing were reminded. Intraoral examinations were performed and PI levels were taken to identify the oral hygiene status of all participants. Data forms were re-filled after a 3-month end-point to evaluate participants' knowledge, attitude, behavior changes, and oral hygiene status.

The oral hygiene status was evaluated using The Silness & Løe Plaque index (PI) [18]. Four surfaces (mesial, distal, buccal and lingual) of six permanent teeth were examined. The cleanliness of each surface was rated from a score of 0 to 3. The measurements of all plaque index scores were carried out by a single blinded examiner. Measurements of plaque index scores were repeated three times by the examiners for a total of three patients who were not included in the study and demonstrated an intra-agreement coefficient K of 0.86. All participant flow-up analysis diagram is summarized in Fig. 1.

2.4 Statistical analyses

SPSS software (version 25.0; IBM, Armonk, NY, USA) for Windows program was used for statistical analysis of the data. Categorical measurements were summarized as numbers and percentages, and continuous measurements as mean and standard deviation (median and minimum-maximum where appropriate). The chi-square test was used to compare categorical expressions. The Shapiro-Wilk test was used to find out whether the parameters in the study showed normal distribution. Repeated measures test was used to examine the changes in Initial, 2nd week, 1st month and 3rd Month. Kruskal Wallis test was used for the parameters that did not show a normal distribution. *Post Hoc* Tamhane's T2 test was used to examine the source of the difference between the groups. The statistical significance level was taken as 0.05 in all tests.

3. Results

156 early adolescents ranging in age from 10 to 12 years old took part in the study. 86 were males (55.1%) and 70 were females (44.9%). The average age of participants was 10.9 ± 0.8 years old. Participants were referred for a variety of

reasons, including dental caries (96.2%), orthodontic problems (1.3%), routine dental caries control (1.9%), and dental trauma (0.6%). Table 1 shows that the gender and age distributions of the participants were similar in the groups. Additionally, Table 1 shows that the distribution of mothers' and fathers' educational status of the participants was similar across the groups (respectively $p = 0.641$, $p = 0.121$).

The change in the level of knowledge, behavior and attitude of the participants within and between groups over time is shown in Table 2. Considering the knowledge level of the participants, there was a statistically significant difference between the groups at the start of the study ($p = 0.047$). Considering the 3rd month and Δ knowledge level, there was a significant difference between the groups ($p < 0.001$) (Table 2).

Considering the behavior level of the participants, there was no statistically significant difference between the groups at the start of the study ($p = 0.773$). Considering the 3rd month and Δ behavior level, there was a significant difference between the groups ($p < 0.001$) (Table 2).

Considering the attitude level of the participants, there was no statistically significant difference between the groups at the start of the study ($p = 0.187$). There was a significant difference between the groups when the 3rd-month attitude level was examined ($p < 0.001$). Considering the Δ attitude level, there was a significant difference between the groups ($p < 0.001$) (Table 2).

The variation of the plaque index scores of the participants within and between groups over time is shown in Table 3. When the initial plaque index (PI) scores were also compared, the groups had no statistically significant difference. PI scores at 2 weeks and the 1 month, as well as the 3-month post-intervention, were compared, there was a statistically significant difference among the groups ($p < 0.001$). When the Δ PI scores were examined, there was a significant difference between the groups ($p < 0.001$) (Table 3).

4. Discussion

Oral health education has been accepted as a substantial and integral part of dental health services. The educational interventions used have varied considerably, from the provision of simple information to the use of complex programs that include psychological and behavior modification strategies. The objectives of the interventions have also been broad and therefore knowledge, attitudes, intentions, beliefs, behaviors, use of dental services, and oral health status are all targeted for change [19, 20].

Oral health behaviors are determined by the attitudes of individuals. For behavior change, attitude changes are needed. Otherwise, behavior change without attitude change may not become a habit [21]. When the intervention groups were evaluated in terms of attitude change in the present study, there was no statistically significant difference in attitude change in the BOHT group. However, statistical changes were found in behavior change for all groups in this study. The behavior changes in the VIDEO and BOHT groups without a significant attitude change suggest that the early adolescents did not lose their motivation yet, since this study took place in a short

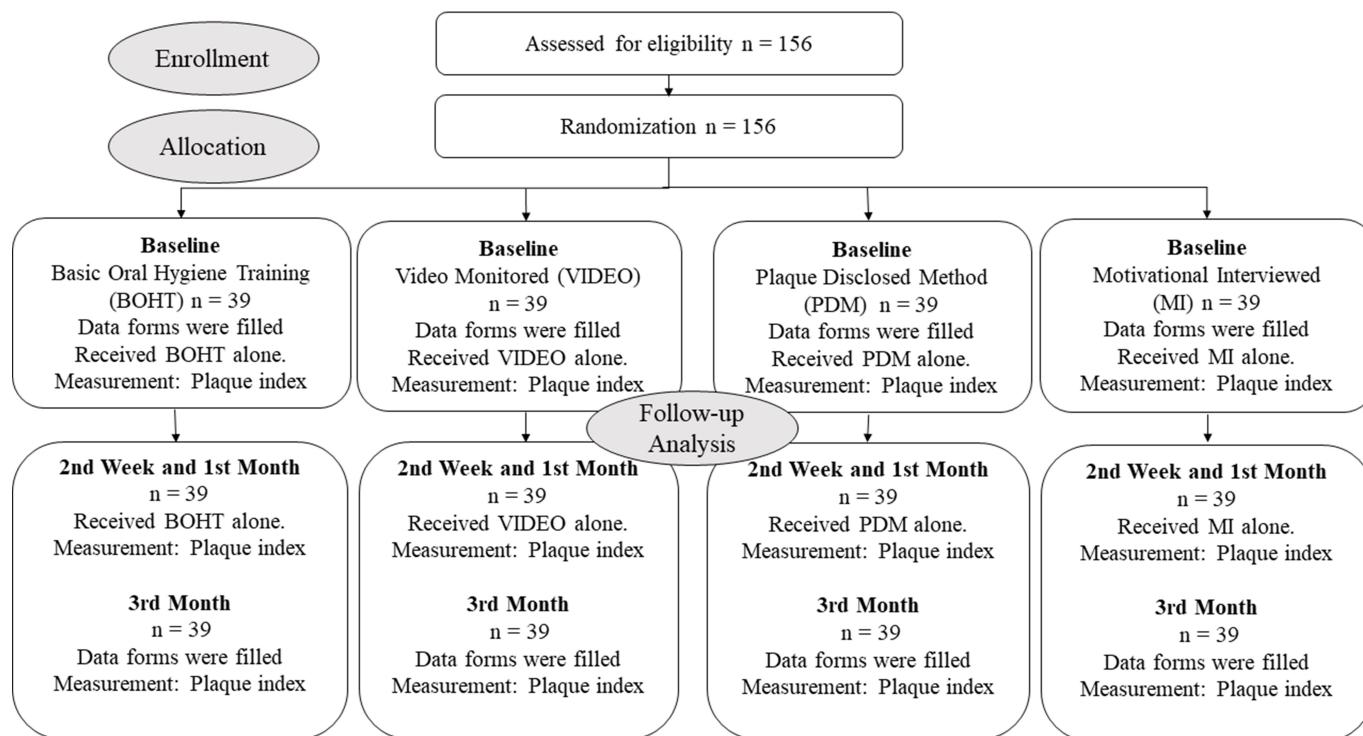


FIGURE 1. Participant flow diagram.

TABLE 1. Distribution of gender, age and parents' educational status among groups.

	MI	PDM	VIDEO	BOHT	<i>p</i>
Gender (n (%))					
Female	16 (41)	21 (53.8)	12 (30.8)	21 (53.8)	0.116 ^a
Male	23 (59)	18 (46.2)	27 (69.2)	18 (46.2)	
Mother Educational Status					
Primary school	19 (48.7)	17 (43.6)	25 (64.1)	20 (51.3)	0.641 ^a
Middle school	13 (33.3)	12 (30.8)	7 (17.9)	9 (23.1)	
High school	2 (5.1)	3 (7.7)	4 (10.3)	5 (12.8)	
University	5 (12.8)	7 (17.9)	3 (7.7)	5 (12.8)	
Father Educational Status					
Primary school	11 (28.2)	10 (25.6)	20 (51.3)	12 (30.8)	0.121 ^a
Middle school	12 (30.8)	10 (25.6)	4 (10.3)	10 (25.6)	
High school	5 (12.8)	5 (12.9)	9 (23.1)	8 (20.5)	
University	11 (28.2)	14 (35.9)	6 (15.3)	9 (23.1)	
Age (Med (Min–Max))	11 (10–12)	11 (10–12)	11 (10–12)	11 (10–12)	0.535 ^b

p < 0.05, ^a: Chi-Square, ^b: Kruskal Wallis. MI: Motivational Interview; PDM: Plaque Disclosed Method; VIDEO: Video Monitored; BOHT: Basic Oral Hygiene Training.

TABLE 2. Change of knowledge, behavior and attitude level over time across groups.

	MI (1)	PDM (2)	VIDEO (3)	BOHT (4)	p^a	p^b
	Med (Min–Max)	Med (Min–Max)	Med (Min–Max)	Med (Min–Max)		
Initial knowledge level	4 (1–5)	3 (0–6)	2 (1–5)	3 (1–6)	0.047*	1–3; $p = 0.039$ 1–3; $p < 0.001$
3rd month knowledge level	5 (3–7)	5 (3–8)	3 (2–6)	4 (1–6)	<0.001**	1–4; $p < 0.001$ 2–3; $p < 0.001$ 2–4; $p < 0.001$
Δ Knowledge level	2 (–1–3)	1 (–2–4)	0 (–2–2)	0 (–2–3)	<0.001**	1–3; $p < 0.001$ 1–4; $p < 0.001$ 2–3; $p < 0.001$ 2–4; $p = 0.001$
Initial behavior level	2 (0–3)	2 (0–4)	1 (0–3)	1 (0–3)	0.773	
3rd month behavior level	7 (5–7)	4 (1–7)	4 (0–7)	3 (0–7)	<0.001**	1–2; $p < 0.001$ 1–3; $p < 0.001$ 1–4; $p < 0.001$ 2–4; $p = 0.001$ 1–2; $p < 0.001$
Δ Behavior level	5 (4–7)	3 (0–7)	2 (–1–7)	2 (0–5)	<0.001**	1–3; $p < 0.001$ 1–4; $p < 0.001$ 2–4; $p = 0.005$
Initial attitude level	3 (0–6)	3 (1–6)	2 (0–6)	3 (0–6)	0.187	
3rd month attitude level	6 (4–6)	5 (2–6)	3 (2–6)	3 (1–6)	<0.001**	1–2; $p < 0.001$ 1–3; $p < 0.001$ 1–4; $p < 0.001$ 2–3; $p = 0.010$ 1–2; $p < 0.001$
Δ Attitude level	3 (0–6)	1 (–1–4)	1 (–1–5)	0 (–3–3)	<0.001**	1–3; $p < 0.001$ 1–4; $p < 0.001$ 2–4; $p = 0.009$

* $p < 0.05$; ** $p < 0.001$; a : Kruskal Wallis; b : Post Hoc Tamhane's T2; Δ : Change between 3rd month—Initial knowledge or behavior or attitude level. MI: Motivational Interview; PDM: Plaque Disclosed Method; VIDEO: Video Monitored; BOHT: Basic Oral Hygiene Training.

TABLE 3. Change of plaque index (PI) over time across groups.

Plaque index score	MI (1)	PDM (2)	VIDEO (3)	BOHT (4)	p^1	p^2
	Med (Min–Max)	Med (Min–Max)	Med (Min–Max)	Med (Min–Max)		
Initial	3 (2.62–3)	3 (2–3)	3 (2–3)	3 (2–3)		0.242
2nd week	1 (0–3)	1.65 (0–3)	1.80 (1–3)	2 (1–3)	<0.001**	<0.001**
1st month	0.33 (0–2)	1.13 (0–3)	1.65 (1–3)	2 (1–3)		<0.001**
3rd month	0.26 (0–1)	1.33 (0–3)	2.20 (0–3)	2 (1–3)		<0.001**
Δ PI	–2.71 (–3–1.83)	–1.64 (–2.91–0)	–0.70 (–3.0–0)	–1 (–2.0–0)	p^3 : <0.001**	1–2; $p < 0.001^a$ 1–3; $p < 0.001^a$ 1–4; $p < 0.001^a$ 2–3; $p < 0.001^a$ 2–4; $p < 0.001^a$

$p < 0.05$; $p^{**} < 0.001$; p^1 : Repeated measures; p^2 – p^3 : Kruskal Wallis; Δ PI: Change between 3rd month—Initial; a : Post Hoc Tamhane's T2. MI: Motivational Interview; PDM: Plaque Disclosed Method; VIDEO: Video Monitored; BOHT: Basic Oral Hygiene Training.

period of 3 months. The slight decreases in PI between the 2 weeks and 3 months in the control sessions are other findings showing that the behavior change is temporary without a change for VIDEO and BOHT groups in attitude levels.

The adolescence period is a life stage in which many health behaviors are perpetuated [1, 19]. Health interventions during early adolescence are likely to produce a long-term impact on one's health outcomes [4]. The results of this study analysis showed that early adolescents experienced an increase in knowledge, attitudes, and behavior level in their oral health-care and decreased plaque index scores after 3 months of observation after four interventions. However there was a slight increase in knowledge and attitude levels in the BOHT and VIDEO groups, and there was a greater increase in behavior and attitude levels in the MI group.

MI has come to the fore among behavioral interventions used to improve oral health status of children, adolescents, and adults in recent years. There are numerous studies evaluating the effectiveness of MI in maintaining and improving periodontal health, smoking cessation, and weight reduction in adults. The results of these studies were found to be contradictory. Some studies have shown that MI is superior to traditional training and motivation techniques [22, 23], while others have concluded that there is no difference in their effectiveness [24, 25]. There are only a few studies evaluating the effectiveness of MI in protecting or improving oral health in adolescents. In a study evaluating the dental plaque-reducing effect of a single session MI in adolescents with fixed orthodontic appliances over 6 months, it was shown that there was no superior effect compared to traditional methods [26]. However, according to Miller and Rollnick, the authors did not report to have employed the MI style. Furthermore, the appropriate counsellor training and the assessment of MI fidelity by a professional researcher were hardly addressed. This absence of standardization could explain why they found no difference in plaque reduction between the groups.

Performing a study with young adults and adolescents was a difficult and demanding process that required careful consideration of numerous developmental and contextual elements as well as the exploration and respect of individual agendas. A balance between these elements is tipped by interventions based on MI, which is an effective strategy in this age group. In a study with a short follow-up of 4 weeks, knowledge, attitude, tooth brushing practice, and plaque index were evaluated, and the superiority of MI over conventional methods was demonstrated in adolescents [27]. Rigau-Gay *et al.* [28] concluded that a single MI session combined with traditional training might improve oral hygiene in adolescents and young adults using fixed appliances. In this study, it was concluded that MI is superior to traditional methods in improving attitudes, and behaviors related to oral health, by reducing the plaque index, similar to previous dental MI studies [27, 28]. In this study, it was concluded that MI is superior to traditional methods except for PDM in improving knowledge related to oral health.

Behavior change techniques have been described as observable, replicable, and fundamental components of an intervention designed to alter causally processed information that regulate behavior, and these techniques, including face-to-face counselling, could be effective in almost all dental healthcare

strategies [29, 30]. Wu L *et al.* [3] assessed the efficacy of oral health education and motivational advice on the incidence of plaque removal in a one-year follow-up study with children aged between 12 and 13 years. At the end of their study, MI was shown to effectively reduce early caries lesions in this age group. A meta-analysis study confirmed that multiple MI sessions with the patient increased the effectiveness of MI [31]. A new study by Wu *et al.* [32], showed that one-to-one face-to-face MI sessions outperformed prevailing education in improving adolescents' oral health self-efficacy and behaviors and preventing dental caries, as determined through The International Caries Detection and Assessment System (ICDAS) [32]. A recent report concluded that there were positive findings of MI and this motivational technique can have a beneficial effect on oral health behaviors and self-efficacy [33].

At the end of 3 months, even short-term effects in our MI group, a significantly positive change was observed in both knowledge, attitude, and behavior related to oral hygiene, and the PI also decreased significantly more than the other intervention groups. In this study, which evaluated the effectiveness of MI with traditional methods, more than one MI session was performed and the results were also found to be similar to other studies with multiple MI sessions.

In interpreting the findings of this study, a number of limitations should be considered. Although the study was initiated by the results based on prior research, the relatively small sample size may not have been sufficient to detect treatment effects. It has been studied on a limited population of early adolescents with poor oral hygiene and who were followed for a relatively short 3-month period, so it does not give an idea about possible long-term results. Additionally, the lack of caries detection and the Hawthorne effect are other limitations of the study.

5. Conclusions

Although the level of knowledge about oral hygiene was similar in the PDM and MI groups, the levels of attitude and behavior were significantly higher in the MI group than in the other groups. Furthermore, PI scores were also found to be significantly lower than those of the other groups. Based on our study, it was concluded that the behavioral strategy of MI with multiple sessions, which is compared to traditional health education techniques, can improve oral health self-efficacy in maintaining early adolescents' dental hygiene habits over time. Future studies are needed to evaluate the MI's long-term effects in promoting oral healthcare and reducing dental caries across different cultures and age groups.

ABBREVIATIONS

BOHT, Basic oral hygiene training; VIDEO, Video monitored; PDM, Plaque disclosed method; MI, Motivational interviewing; PI, Plaque index; Q, Question.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

HNU and MCD—designed the research study. HNU and VC—performed the research. HNU, VC and MCD—analyzed the data. HNU and VC—wrote the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by Cukurova University, Faculty of Medicine Ethics Committee of Non-invasive Clinical Researches in accordance with the Helsinki Declaration with number 2017/62-10. Written informed consent was obtained from the participant's parents for the present study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at <https://oss.jocpd.com/files/article/1675794791770537984/attachment/Supplementary%20material.docx>.

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