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Effect of motivational interviewing on oral and dental health of adolescents with fixed orthodontic appliances

Shima Ziari [1], Mahdia Gholami [2*], Sarvin Sarmadi [3]

1. School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

2. Research Center for Caries Prevention, Dentistry Research Institute, Tehran University of Medical Sciences, Tehran, Iran; Department of Community Oral Health, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

3. Department of Orthodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

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**Corresponding author:*
Mahdia Gholami

Research Center for Caries Prevention, Dentistry Research Institute, Tehran University of Medical Sciences, Tehran, Iran; Department of Community Oral Health, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

Tel: +98-21-88015960
Fax: +98-21-88015961
Email: m_gholami@Sina.tums.ac.ir

ABSTRACT

Introduction: Orthodontic appliances increase the risk of dental caries and gum disease. Since it is rather difficult to maintain oral hygiene in patients with fixed orthodontic appliances due to the presence of brackets, bands, and arch wires, they should be persuaded to take care of their oral cavity. Therefore, the present study was conducted to evaluate the effect of an oral and dental health educational intervention using motivational interviewing in adolescents with fixed orthodontic appliances.

Materials and Methods: Thirty adolescents with fixed orthodontic appliances aged 12-16 years presenting to orthodontics departments of school of dentistry, Tehran University of Medical Sciences, received individual counselling, verbal guidelines, and training for correct brushing and flossing techniques by a senior student of dentistry during a 20-minute motivational interview. To evaluate the effect of the intervention, oral health behaviors including brushing, flossing, and consumption of sugary snacks were collected in a self-report manner. Moreover, plaque and gingival indexes were measured before and one-month post intervention. The SPSS software version 23 was used for data analysis.

Results: Among oral health behaviors, optimal frequency of brushing increased after the intervention (p=0.002). The mean plaque index was 0.99±0.43 before and 0.37±0.16 after the intervention, indicating a significant difference (p<0.001). Moreover, the mean gingival index (average inflammation) was 0.99±0.56 before the intervention, which improved to 0.30±0.20 after the intervention (p<0.001).

Conclusion: Educational intervention based on motivational interviewing reduced dental plaques and gingival inflammation and increased the frequency of brushing in the short term among adolescents with fixed orthodontic appliances.

Keywords: Adolescent; Behavioral sciences; Fixed orthodontic appliances; Motivational interviewing; Oral health.

Introduction

Oral and dental disease prevention and oral hygiene improvement are the responsibility of dentists. Moreover, the patients should be aware of their role in dental and oral care. In orthodontic patients, especially fixed orthodontic appliances, it is rather difficult to maintain a good oral hygiene due to the presence of

arch wires and brackets. Therefore, it is necessary to generate motivation for preventive behavior and provide guideline methods to ensure mechanical control of dental plaque [1]. Gingivitis is one of the most common findings in orthodontic patients. The severity of gingivitis is related to oral hygiene status such that gingival inflammation increases during orthodontic treatment with fixed appliances if plaques around brackets are not removed correctly and completely [2]. Moreover, following dental biofilm formation, white spots and different degrees of enamel demineralization occur in the teeth.

Gingivitis and enamel demineralization are two complications in about 50-70% of patients undergoing fixed orthodontic appliances, which can cause orthodontic treatment failure in some patients if not controlled [3]. Therefore, oral hygiene is of paramount importance in orthodontic patients and should be taught to the patient through proper education and counseling by clinicians. The aim of counselling is to find ways to maintain correct behaviors, correct improper routine care practices, and persuade people to improve their oral health. For this reason, the dentists try to reduce the difference between the current and expected practice. They also encourage the patients to choose what they can undertake and help them to consider the pros and cons of this behavior [4].

Different models have been developed for making changes in health-related behavior. One of these models, which has received attention in recent years for long-term behavior change resulting from health interventions, is motivational interviewing (MI) [5]. The MI model is an evidence-based person-centered technique. This approach focuses on facilitating individual decision-making for making a change with maximum internal motivation and minimum resistance [6]. This method has five stages including engaging defined as a establishing an agreement based on a truthful patient-physician relationship, focusing defined as determining an objective for behavior change, evoking defined as helping the patient eliciting their internal motivations and forming ideas for behavior change, planning defined as finding final solutions for behavior change by the patient and helping to expand them by the physician, and review defined as providing feedback to the physician by the patient in review sessions [7]. In the field of oral and dental health, several studies have shown the more effectiveness of MI compared to traditional oral health education methods [8,9]. The majority of fixed orthodontic treatments are carried out after 12 years of age due to relative stability of mandibular structures, i.e. during adolescence and youth. In this regard, oral hygiene may be affected in patients that undergo fixed orthodontic treatment due to common mental and behavioral characteristics of this age period including inadequate mental maturity, outburst of emotions, carelessness about health recommendations, non-internalization of proper health behaviors, unhealthy diets, etc. Therefore, since fixed orthodontic appliances hinder plaque control, it is necessary to design a health education intervention based on MI and evaluate its effectiveness in adolescents. Therefore, the present study was conducted to evaluate the effectiveness of a health educational intervention based on motivational interviewing in 12-16 year-old patients with fixed orthodontic appliances referring to the orthodontics department of school of dentistry, Tehran University of Medical Sciences in 2020.

Materials and Methods

A phase two clinical trial was conducted without a control group. In this study, an oral health education intervention based on motivational interviewing was carried out on 12-16 year-old patients with fixed orthodontic appliances presenting to the orthodontics department of school of dentistry, Tehran University of Medical Sciences in 2020. The participants had fixed orthodontic appliances in upper and lower jaws. Patients with cleft lip or palate, physical disabilities, systemic or underlying diseases, syndromic patients, and those consuming certain drugs were excluded from the study. Data collection was conducted in two phases. In phase one, a checklist containing demographic characteristics (such as age, sex, socioeconomic status of family (SES), parents' education level) and oral health behaviour (frequency of brushing, flossing, and consumption of sugary snacks between main meals) was completed by parents. In phase two, all participants underwent oral examination, including the measurement of plaque index (PI) and gingival index (GI) (based on the Löe and Silness criteria [10], on the dental chair by an examiner previously calibrated with an experienced dentist. To record the PI, the amount of dental plaque on four surfaces (mesio-buccal, mid-buccal, disto-buccal, and lingual) of six selected teeth [12,16,24,32,36,44] was scored on a 0 to 3 scale, and the obtained score was averaged. If a tooth was missing, a replacement tooth was considered. As for the GI, the above teeth were scored on a 0 (no inflammation) to 3 scale (severe inflammation), and the obtained value was averaged [10]. Educational intervention was conducted in the form of motivational interviewing with the patient in the presence of his/her parents.

Upon primary agreement, the researcher first explained the purpose of counselling and provided information on gingival inflammation and its causes, plaque formation, and effect of sugary and acidic foods on development of dental caries. Then, the reasons that could affect dental health behavior were discussed and solutions were presented to overcome the barriers. For example, the patients were asked to avoid postponing tooth brushing to late night hours to prevent the effect of fatigue on plaque control, brush their teeth with fluoride toothpaste after every meal for at least two minutes, and only spit out any excess toothpaste without rinsing their mouth. It was recommended that parents supervise their children while they were brushing their teeth. Moreover, it was explained that regular oral hygiene maintenance improves breath freshness, social interactions, and acceptance by others. Moreover, the participants were reminded of the need for better plaque control and cleaning interdental spaces due to the new circumstances arising from orthodontic treatment.

The patients were requested to put forward their questions and comments, positive practices were encouraged, barriers were identified, and possible solutions were offered. Then, the participants practiced flossing and brushing on a typodont followed by real teeth. During this stage, the patients followed the steps using a mirror and then repeated what they had learned in front of a mirror. A brochure containing information on correct brushing and flossing techniques was given to the participants at the end of the intervention. The subjects were contacted via phone once a week during the intervention, which took about one month, to improve their motivation, increase the effectiveness of the intervention, and receive feedback from them. To evaluate the educational intervention, the oral health related behavior of the patients, including the frequency of brushing and flossing and the amount of sugary snacks consumptions between main meals as well as PI and GI were measured one month after the intervention when the patients returned for a routine orthodontic checkup visit.

Outcomes

This study had two main outcomes, including PI change and GI change, with a predefined criterion of at least 0.44. The secondary outcomes were the frequency of brushing per day, with a predefined criterion of at least two times, frequency of flossing per day with a predefined criterion of at least one time, frequency of consuming sugary snacks per day with a predefined criterion of less than two times, and gingival inflammation status with a predefined criterion of good/excellent.

Sampling

The participants were selected using non-randomized convenience sampling. A formula for comparing two means was applied to compare the mean GI before and after the intervention assuming data independence. A standard deviation of 0.39 was considered according to a study by Rigau-Gay et al [11]. Assuming a type one error of 0.05 and type two error of 20%, a minimum of 15 subjects were required to test a difference of 0.4. formula for comparing two means was applied to compare the mean PI before and after the intervention assuming data independence. A standard deviation of 0.53 was considered according to a study by Rigau-Gay et al [11]. Assuming a type one error of 0.05 and type two error of 20%, a minimum of 28 subjects were required to test a difference of 0.4. Therefore, 30 participants were included in the study considering the probability of loss to follow-up.

Data analysis

Qualitative variables are presented as number and percentage and quantitative variables are reported as mean and standard deviation assuming a normal distribution. To evaluate the effect of educational intervention, since this study had a before-after design, the exact McNemar's test and repeated measured ANOVA were used for qualitative and quantitative variables, respectively. The level of significance was set at 0.05. As for the parents' education level, the patients were divided to two groups (participants with at least one parent with university education in one group and others in the second group). The patients were divided to two groups of good and weak SES. The frequency of tooth brushing was grouped as less than two times per day and two times or more per day. The frequency of flossing was categorized as daily use and irregular use. The frequency of sugary snacks consumption was analyzed as 1-2 times and more than 2 times.

Results

Sixteen out of 30 patients aged 12-16 years with fixed orthodontic appliances that presented to the orthodontics department of school of dentistry, were male (53.33%). The mean age of the participants was 14±1.44 years (range: 12-16 years). Table 1 presents the demographic characteristics of the participants. As for the parents' education level, the fathers of 11 patients

(36.67%) and the mothers of 13 patients (43.33%) had a university education. Moreover, 13 (53.33%) participants came from families with a below average income. Regarding the frequency of brushing, 14 patients (46.67%) brushed two times or more per day, which increased to 24 patients (80%) after the intervention (p=0.002). Furthermore, six patients (20%) flossed every day before the intervention, which increased to seven patients (23.33%) after the intervention (p=1.0). Therefore, the intervention had no significant effect on the frequency of flossing. As for the frequency of sugary snacks consumption, three patients consumed sugary snacks more than twice daily before and after the intervention (p=1.0) indicating that the intervention had no significant effect on this variable (Table 2). The mean PI was 0.99±0.43 before and 0.37±0.16 after the intervention, representing a significant reduction post intervention (p<0.001). The mean GI was 0.99±0.56 before the intervention, which improved to 0.30±20 after the intervention (p<0.001), indicating a significant decrease in gingival inflammation after the intervention (Table 3). According to Table 4, the intervention was more effective in boys such that the PI and GI improved by 0.66 (p<0.001) and 0.82 (p<0.001) in boys after the intervention, respectively. The PI improved by 0.65 in patients aged 15-16 years, which was significantly more than younger patients aged 12-14 years (p<0.001). The mean GI index also improved by 0.76 in older patients, which was significantly more than the improvement in younger patients (p<0.001). The mean PI change was 0.72 in patients who did not have a parent with a university education versus 0.51 in the other group, indicating a significant difference (p<0.001). This is while the mean GI change was greater in children with university-educated parents (0.71 versus 0.66, p<0.001).

Table 1. Demographic information of the patients with fixed orthodontic appliances (n=30).

Variable		*No.*	*%*
Gender	*Boy*	*16*	*53.33*
	Girl	*14*	*46.67*
	Total	*30*	*100*
Father's education	*Under diploma*	*5*	*16.67*
	Diploma	*14*	*46.67*
	Associated degree	*5*	*16.67*
	Bachelor	*4*	*13.32*
	Higher than bachelor degree	*2*	*6.67*
	Total	*30*	*100*
Mather's education	*Under diploma*	*7*	*23.33*
	Diploma	*10*	*33.33*
	Associated degree	*6*	*20.00*
	Bachelor	*5*	*16.67*
	Higher than bachelor degree	*2*	*6.67*
	Total	*30*	*100*
	Excellent	*1*	*3.33*
	Good	*14*	*13.33*
	Intermediate	*12*	*40.00*
	Poor	*11*	*36.67*
	Very Poor	*2*	*6.67*
	Total	*30*	*100*

Table 2. Frequency of oral health behaviors in patients with fixed orthodontic appliances (n=30).

		Before intervention		After intervention	
Variable		*No*	*%*	*No*	*%*
Brushing frequency	*Three times a day or more*	*4*	*13.33*	*4*	*13.33*
	Twice a day	*10*	*33.33*	*20*	*33.67*
	Once a day	*12*	*40.00*	*6*	*20.00*
	Not brushing daily	*4*	*13.34*	*-*	*-*
	Not brushing at all	*-*	*-*	*-*	*-*
Brushing frequency (dichotomous)	*Twice or more daily*	*14*	*46.67*	*24*	*80.00*
	Less than two times	*16*	*53.33*	*6*	*20.00*
Flossing frequency	*Daily*	*6*	*20.00*	*7*	*23.33*
	Sometimes in a week	*4*	*13.33*	*11*	*36.67*
	Sometimes in a month	*4*	*13.33*	*8*	*26.67*
	Never	*16*	*53.34*	*4*	*13.33*
Flossing frequency (dichotomous)	*Daily*	*6*	*20.00*	*7*	*23.33*
	Irregular	*24*	*50.00*	*23*	*76.67*
Eating sweet snacks frequency	*Once daily*	*15*	*50.00*	*18*	*60.00*
	Twice daily	*12*	*40.00*	*9*	*30.00*
	More than twice daily	*3*	*10.00*	*3*	*10.00*
Eating sweet snacks frequency (dichotomous)	*Once and twice daily*	*27*	*90.00*	*27*	*90.00*
	More than two times	*3*	*10.00*	*3*	*10.00*

Table 3. Comparison of changes in clinical indices among patients undergoing fixed orthodontic appliances following educational intervention (n=30).

	Before intervention		*After intervention*			
Index	*Mean (SD1)*	*95% CI2*	*Mean (SD)*	*95% CI*	*Index changes*	*p-Value* [3]
Plaque index	*0.99 (0.43)*	*0.829-1.150*	*0.37 (0.16)*	*0.313-0.433*	*0.62*	*<0.001*
Gingival index	*0.99 (0.56)*	*0.778-1.196*	*0.30 (0.20)*	*0.228-0.375*	*0.69*	*<0.001*

Table 4. Comparison of changes in clinical indices among patients undergoing fixed orthodontic appliances following educational intervention by gender, age and parents' education (n=30).

Variable		*Plaque index*			*Gingival index*		
		Index changes	*95% CI*	*p-Value**	*Index changes*	*95% CI*	*p-Value**
Gender	*Boy*	*0.66*	*0.45-0.87*	*<0.001*	*0.82*	*0.58-1.05*	*<0.001*
	Girl	*0.57*	*0.43-0.71*		*0.54*	*0.33-0.74*	
Avg	*12-14*	*0.60*	*0.49-0.70*	*<0.001*	*0.64*	*0.43-0.86*	*<0.001*
	15-16	*0.65*	*0.33-0.96*		*0.76*	*0.51-1.01*	
Parents' education	*Educated*	*0.51*	*0.36-0.67*	*<0.001*	*0.71*	*0.44-0.99*	*<0.001*
	Without academic education	*0.72*	*0.53-0.91*		*0.66*	*0.47-0.85*	

Discussion

The present study was conducted to determine the effectiveness of an oral health education intervention based on motivational interviewing in 12-16 year-old patients with fixed orthodontic appliances in school of dentistry, Tehran University of Medical Sciences. The results showed improvement in clinical indexes including PI and GI; in other words, the amount of plaque and gingival inflammation reduced, indicating the effectiveness of motivational interviewing in oral health improvement, which was consistent with previous studies. For example, Lalic et al evaluated the effectiveness of oral health counselling in oral hygiene in orthodontic patients with fixed appliances in Serbia. The results showed a significant reduction in PI and the prevalence of gingivitis six months after the intervention [4]. Similarly, Rigau-Gay evaluated the effectiveness of a single session of motivational interviewing hygiene compared to conventional education in improving oral in orthodontic patients in Spain. The results showed an immediate improvement in oral hygiene that remained stable throughout the 6-month follow-up [1]. In a study by Yetkin et al, orthodontic patients that received motivational interviewing and visual catalogue had a significantly lower PI value and BOP percentage compared to the control group after one month; moreover, they had the lowest GI value as well [12]. Another study in children aged 13-15 years in India found that motivational interviewing caused a marked improvement in oral health knowledge and behavior, including brushing and flossing, and reduced the mean GI and PI values [13].

Another finding of the present study was that brushing habit improved after the intervention, which was consistent with the results of studies conducted by Worthington on 10-year-old children in England [14] and Williford in the US [15]. Nonetheless, Schou reported that a short-term intervention failed to increase the frequency of brushing in subjects aged 18-64 years 16. It seems that the reason for this difference could be the older age range of the participants in the latter study since habits hardly change in older people. The reason for brushing habit improvement following the intervention could be that brushing was easier, more tangible, and more available to all participants. This is while the intervention caused no significant improvement in flossing, which could be due to unavailability of the floss and difficulty of threading the floss between brackets. It is possible that some participants thought that they flossed correctly and adequately before the intervention but then realized that their flossing technique was incorrect, and therefore reported a lower frequency of flossing in the second questionnaire compared to the first time. It seems that longer intervention and follow-up times may improve flossing as well. In this regard, Kamalikhah et al studied the dental flossing behavior of school students in 2017 and found that about half of them were in the pre-contemplation stage of flossing behavior change [17].

The present study found no significant change in the frequency of sugary snacks consumption after the intervention, which was consistent with the results of a study by Schou [16]. A reason for this finding could be the short time of the educational intervention for attitude and practice change. Moreover, since the participants were 12-16 years old, it seems that they were not independent enough in terms of food provision, suggesting that offering educational interventions to parents could be helpful in this regard. Finally, orthodontic brackets may cause limitations in eating, especially fruits and vegetables with hard texture and drives them toward having softer foods, which are usually rich in carbohydrates.

In the present study, the intervention was more effective in terms of clinical indexes in boys and older patients and improved GI and PI more in these subjects. The mean value of PI change was higher in patients without university-educated patients compared to the other group. This is while the mean value of GI change was larger in patients with university-educated parents, and the brushing behavior change was significant in this group. The reason may be that educated parents encourage their children to practice good oral hygiene and pay attention to recommendations provided in the intervention and therefore GI, which indicates regular oral cleaning, improved more during the study. It should be noted that PI might indicate oral cleaning status on the examination day.

The mean PI and GI values changed more in patients with a weak SES state compared to those with a good SES. The reason may be that less educational material is available for children in low SES families and therefore the educational intervention caused more changes in this group. In general, it seems that MI is a suitable technique for enhancing the motivation and commitment required for oral health-related behavior improvement, especially in orthodontic patients since regular dental checkups during orthodontic treatment, which is usually done once a month, provides a good opportunity for reinforcing the process of behavior improvement. However, it should be noted that a single

session of MI could not guarantee a significant long-term oral health improvement compared to traditional education. In this study, although the PI value and the prevalence of gingivitis reduced after the intervention, continuous efforts should be directed at motivation improvement in oral health education. Moreover, it may be necessary to reinforce behavior change with additional short-term counselling sessions during this time in some patients.

A strength of this study was that guideline was prepared for patients and counselling was done in a similar manner for all participants; therefore, similar methods and principles were applied during MI sessions. A limitation of this study was the lack of a control group as well as its before/after design. All patients presenting to the Orthodontics Department received traditional oral health education, as a basic education before the intervention. After MI, the effect of intervention was compared with traditional education. This study was conducted for a short term and the results cannot be used to predict long-term results.

Conclusion

Motivational interviewing increased the frequency of dental brushing and reduced GI and PI values significantly in 30 orthodontic patients with fixed appliances aged 12-16 years treated in the orthodontics department of school of dentistry, Tehran University of Medical Sciences. The results indicated the effectiveness of MI in improving oral hygiene. However, this study evaluated the improvement of clinical indexes and oral health related behavior in the short term. Further studies are required to evaluate oral hygiene in the long term.

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Conflict of Interest

There is no conflict of interest to declare.

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