

The Effect of Motivational Interviewing on Oral Hygiene Behavior in Patients With Fixed Orthodontic Appliances: A Randomised Clinical Trial

Efecto de la Entrevista Motivacional sobre el Comportamiento de Higiene Oral en Pacientes con Aparatología Ortodóncica Fija: Un Ensayo Clínico Aleatorizado

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ABSTRACT: The aim of this study was to evaluate the effectiveness of motivational interviewing on improving oral hygiene behavior in patients with fixed orthodontics appliances. A parallel-group randomized clinical trial was conducted with 45 patients of the Orthodontic Clinic of Unibe's Postgraduate Unit. A computer-generated list of numbers created with SPSS V21.0 was used to randomly allocate participants into the experimental or the control group. Monthly oral hygiene instructions and an oral hygiene kit from GUM® with special orthodontic hygiene tools were given to the participants. Furthermore, the experimental group underwent motivational interviewing sessions facilitated by a periodontist who received training from two expert psychologists. These psychologists also provided supervision to the interviewer, ensuring the accurate implementation of the intervention. Simplified Oral Hygiene Index (SOHI), Gingival Index (GI), Periodontal Probing Depth (PPD) and Bleeding on Probing (BoP) were recorded at baseline, three and six months after the beginning of the study. The participant and the evaluator (another periodontist who recorded the data) were masked. Repeated-measures mixed-model analysis of variance and chi-squared test were conducted. Mean SOHI, GI, PPD and BoP scores did not differ significantly across the three time points (baseline, three and six months). Nevertheless, a significant interaction on SOHI scores ($F(2, 58) = 3.463, p = .038, h^2 = .052$) was found between the sessions and the treatment conditions (experimental vs control group) at the third and sixth month. Motivational interviewing plus oral hygiene instructions appears to maintain a better control of dental biofilm and calculus in comparison with conventional oral hygiene instructions alone.

KEY WORDS: fixed orthodontic appliances, motivational interviewing, oral hygiene, treatment adherence.

INTRODUCTION

Fixed orthodontic appliances promote dental biofilm accumulation due to the presence of complex components attached to the teeth surface that increase plaque-retentive sites, especially around the gingival margin (Alstad & Zachrisson, 1979; Yavan *et al.*, 2019). Furthermore, these devices disturb not only the self-cleaning process provided by natural mechanisms, but also the access of oral hygiene tools (Arici *et al.*, 2007; Ousehal *et al.*, 2011; Moshkelgosha *et al.*, 2017; Petrauskiene *et al.*, 2019). In this context, patients with inappropriate biofilm control are prone to develop oral illness, such as dental caries lesions and periodontal diseases, which could threaten the duration and

success of the orthodontic treatment (Skidmore *et al.*, 2006; Huang *et al.*, 2018; Rigau-Gay *et al.*, 2018).

Therefore, oral hygiene instructions (OHI) represent an essential part of the orthodontic treatment (Huang *et al.*, 2018; Madariaga *et al.*, 2020). Conventionally, clinicians base the patient education routine on disseminating information and giving normative advice. Nevertheless, even though these efforts could improve patient knowledge, they don't guarantee a compliance with oral hygiene instructions (Kay & Locker, 1998; Gao *et al.*, 2014). In this framework, behavioral sciences have been used to

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enhance the adherence to the dentists' recommendations, with the ultimate goal to preserve the health of the oral cavity tissues (Renz *et al.*, 2007; McGrath, 2019).

Motivational interviewing (MI) is an interesting intervention that has gained attention in the dentistry field. It is a collaborative, person-centered method, which uses the intrinsic desire of the person as a driving force of behavior change (Rollnick *et al.*, 2008; Miller & Rollnick, 2009; Brand *et al.*, 2013). MI allows a conversation within a positive interpersonal atmosphere, full of acceptance and compassion, guided to encourage the resolution of the individual's ambivalence about how to change (Miller & Rollnick, 2002; Miller & Rollnick, 2013; Cascaes *et al.*, 2014; Gao *et al.*, 2015; Kay *et al.*, 2016). This scenario is characterized by the clinician empathy and the individually-tailored attention, where patients and their circumstances are the protagonists (Miller, 2001; Cascaes *et al.*, 2014; Kay *et al.*, 2016). The professional needs to understand that "people are the expert on themselves", being capable of taking their own decision regardless someone else intentions and efforts. Thereby, the role of the interviewer is limited to evoke the patient's motivation to change and not to blame, demand or expect anything (Miller, 2001; Cascaes *et al.*, 2014; Kay *et al.*, 2016).

This behavior model has been applied in different areas such as glycemic control for diabetics, smoking cessation, treatment of alcoholism and obesity problems (Koerber *et al.*, 2003; Spirito *et al.*, 2011; Tripp *et al.* 2011; Chen *et al.*, 2012). Currently, it has been used in dentistry to encourage good oral hygiene habits. However, the literature reports controversial results, which might be due to the need of proper training in this technique to ensure a structured and effective approach (Miller & Rose, 2009; Cascaes *et al.*, 2014; Gao *et al.*, 2014; Tonetti *et al.*, 2015; Sanz *et al.*, 2020).

The lack of evidence in this field and the importance of achieving stronger orthodontic patients' adherence to OHI imply the need of conduct further research in this regard. Thus, the aim of this study was to evaluate the effectiveness of motivational interviewing on improving oral hygiene behavior in patients with fixed orthodontics appliances. The study hypothesis was that motivational interview plus oral hygiene instructions would be more effective in maintaining long-term oral hygiene in comparison with conventional oral hygiene instructions alone.

MATERIAL AND METHOD

The present study was designed as a parallel-group randomized clinical trial. The approval number provided on June 6th, 2017 by UNIBE's Ethics Committee is CEI2017-06. It was registered at the US National Institutes of Health (ClinicalTrials.gov) with the identifier NCT04871373. This report was written up according to the CONSORT statement. The research was performed following the Declaration of Helsinki of 2013 (World Medical Association, 2013).

Sample and eligibility criteria. A power analysis was carried out to determine the number of participants needed to achieve a Simplified Oral Hygiene Index (SOHI) significant interaction with the study groups when applying repeated measures ANOVA. The total number of completed patients needed to achieve power of 0.90 with an alpha (α) of 0.05, an effect size (f) of at least .25 was determined to be 36; taking into consideration a possible 10 % attrition rate, 45 participants were recruited, consented and randomized to either the experimental or control group.

Since measures are repeated ANOVA treats each measurement as a separate variable, and it is preferable to apply listwise deletion, if one measurement is missing, the whole case gets dropped. Therefore and the incontrovertible fact that the trial suffers attrition, the sample for the three measurements was reduced to 30 participants (with a compromise power of .87).

The clinical trial was carried out at the Orthodontic Clinic of UNIBE's Postgraduate Unit, Santo Domingo, Dominican Republic, from June 2017 to November 2018. The established inclusion criteria were patients with 18-40 years old, systemically healthy, without active dental caries lesions or periodontal diseases, who were candidates for fixed orthodontic appliances. Smokers and pregnant patients were excluded. Participants were discarded if they decided to abandon the study voluntarily or if they didn't show for periodical check-ups.

Randomization. A simple randomization procedure was executed by the principal investigator to allocate the participants into one of the study groups. A computer-generated list of numbers was created using the software SPSS V21.0, with a 1:1.25 allocation ratio. The aforementioned researcher didn't participate in the data collection process.

Two dentists were in charge of the study logistics. They enrolled and allocated the participants according to the order of arrival and following the list of random numbers. A coding system was used as a concealment mechanism, which consisted of colored labels attached to the participants' file. This system was only known by the logistics managers and the interviewer (the periodontist who provided OHI and MI). Thus, the participant and the evaluator (the periodontist who recorded the data) were masked.

Study intervention. The patients were invited to participate in the research in their first appointment with the orthodontic postgraduate dentist. Then, on the second appointment, the fixed orthodontic appliance was placed and the intervention began. A questionnaire to collect sociodemographic information was administered by the interviewer.

The interviewer was also in charge of providing oral hygiene instructions for both groups. All the participants received a GUM® oral care kit with special orthodontic hygiene tools (orthodontic tooth brush, interproximal brush, orthodontic floss, orthodontic wax and GUM canker X®). Then, the patients of the experimental group received a motivational interviewing session. It is important to point out that the periodontist was trained and evaluated by two expert psychologists in MI, who also supervised the interviewer to ensure that the intervention was properly applied.

Afterwards, the clinical parameters were measured by another periodontist. The primary endpoint with respect of the efficacy of MI was the

Simplified Oral Hygiene Index (SOHI) (Greene & Vermillion, 1964; Raju *et al.*, 2015). Additional parameters were recorded, such as the Gingival Index (GI) (Löe, 1967), Periodontal Probing Depth (PPD) and Bleeding on Probing (BoP) (Chapple *et al.*, 2018), with the purpose of evaluating the periodontal stability.

Monthly follow-up appointments were scheduled for the orthodontic check-ups, to deliver a new GUM® kit, to reinforce the OHI and MI, and to register the periodontal parameters. The important data for this research was the one recorded at baseline, three and six months after the intervention.

Statistical analysis. Mean SOHI, GI, PPD and BoP scores were compared between groups across three time points using repeated-measures mixed-model analysis of variance. Tests for equality of variances and sphericity to check for homoscedasticity were performed due to the sample attrition problem. SPSS software was used for all calculations (IBM SPSS 25th version). Due to the nominal level of measurement of the variable BoP, chi-squared test was performed for each three time points to check if there were any differences between the two experimental conditions.

RESULTS

A total of 45 participants were recruited to be divided into a control group (20 patients) and an experimental group (25 patients). As previously detailed, listwise deletion was used to handle missing values due to attrition. Thereby, for data analysis the sample was reduced to 30 participants divided into a control group (12 patients) and an experimental group (18 patients). The workflow of the study is shown in Fig. 1.

Sociodemographic characteristics and descriptive statistics for the baseline dental indexes are shown in Table I. In summary, mean (SD) age was 26.53 years (8.22), 33 were female (73.3 %), and most of the patients (52 %) had a high education level (technical formation or higher education). No differences in sociodemographic nor indexes at baseline data were found between the two groups.

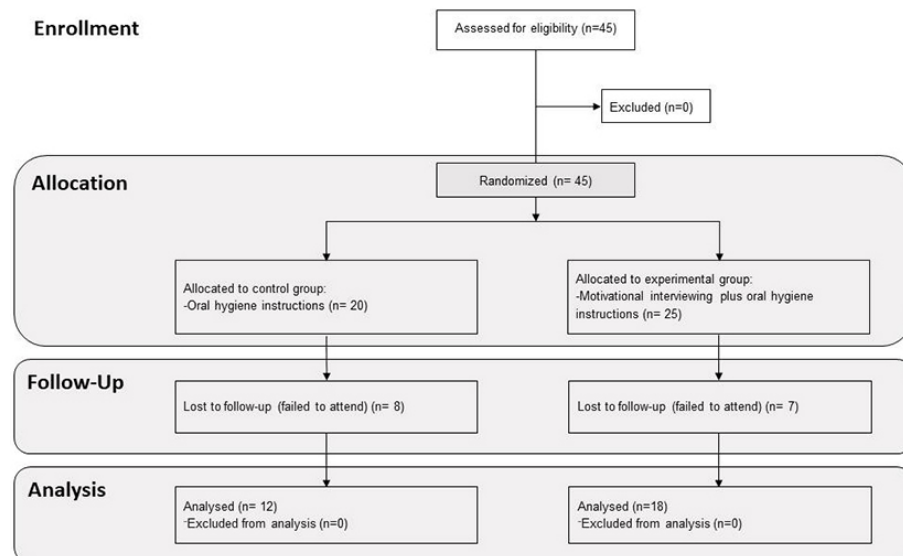


Fig. 1. CONSORT flowchart.

Table I. Sociodemographic characteristics, overall and by group

	Overall	Control group	Experimental group	p-value
N	45	20	25	
Sex (female), n (%)	33(73.3)	15(75)	18(72)	.821
Age (years), mean (SD)	26.53(8.22)	24.65(6.854)	28.04(9.025)	.172
Academic level				.383
• Illiterate	1(2.2)	0(0)	1(4)	
• Technical level	14(31.1)	9(45)	5(20)	
• Higher education	5(11.1)	2(10)	3(12)	
• Graduate	21(46.7)	7(35)	14(56)	
• Others	4(8.9)	2(10)	2(8)	
Simplified Oral Hygiene Index	1.256(0.5812)	1.263(0.452)	1.25(0.676)	0.942
The Gingival Index	0.3256(0.5657)	2.421(0.607)	2.75(0.608)	0.085
Periodontal Probing Depth	2.605(0.6226)	0.211(0.419)	0.167(0.381)	0.721
Bleeding on Probing	0.186(0.3937)	2.263(0.562)	2.292(0.55)	0.868

A mixed repeated measures ANOVA was performed to check for significant changes on the Simplified Oral Hygiene Index (SOHI) through the sessions and conditions. Table II shows the descriptive results for this variable. The repeated-measures ANOVA determined that mean SOHI scores did not differ significantly across three time points ($F(2, 58) = .917, p = .406$). Nonetheless, a significant interaction ($F(2, 58) = 3.463, p = .038, \eta^2 = .052$) was found between the sessions and the treatment conditions (experimental vs control group). Post hoc pairwise comparison using the Bonferroni correction showed an increased SOHI score between baseline and three months later in the experimental group, but this was not statistically significant (Mean difference: -389, 95 % CI: -0.894-0.116, $p = .327$). However, the SOHI scores decreased between the three months session to the six months session, although did not reach significance (Mean difference: 0.33, 95 % CI: -0.172-0.839, $p = .718$). This change on the scores across sessions and group explains the significant interaction. The mean value for the experimental group ended up in an index of 1.16 at the sixth month evaluation; meanwhile the control group obtained a mean score of 1.417.

Table II. Mean (SD) of Simplified Oral Hygiene Index (SOHI) scores at baseline, three months, and six months.

Simplified Oral Hygiene Index	Group	Mean	SD	N
Baseline	Control	1.167	0.389	12
	Experimental	1.111	0.583	18
Three months	Control	1.083	0.515	12
	Experimental	1.500	0.786	18
Six months	Control	1.417	0.669	12
	Experimental	1.167	0.514	18

Concerning the Gingival Index (GI) the same analysis was performed. Table III shows the descriptive results for this variable. The mixed repeated-measures ANOVA determined that mean GI scores did not differ significantly across three time points ($F(2, 56) = 2.047, p = .139$). On the other hand, no significant interaction ($F(2, 56) = 0.829, p = .442$) was found between the sessions and the treatment conditions (experimental vs control group).

Table III. Mean (SD) of Gingival Index (GI) scores at baseline, three months, and six months

Gingival Index	Group	Mean	SD	N
Baseline	Control	0.250	0.452	12
	Experimental	0.278	0.575	18
Three months	Control	0.500	0.798	12
	Experimental	0.333	0.594	18
Six months	Control	0.750	0.866	12
	Experimental	0.389	0.608	18

The same results were obtained for the Periodontal Probing Depth (PPD). Scores did not differ significantly across three time points (neither for PPD, $F(2, 56) = 1.544, p = .222$; nor for BP $F(2, 56) = 2.136, p = .128$). On the other hand, no significant interaction was found ($F(2, 56) = 1.203, p = .308$).

For the variable Bleeding on Probing (BoP), a chi-squared test was performed for each three time points to check if there were any differences between the two experimental conditions. No significant differences were found at baseline ($\chi^2 = 0.13, p = 0.71$), three months later ($\chi^2 = 0.22, p = 0.27$), or six months later ($\chi^2 = 0.06, p = 0.81$).

For the simplified Oral Hygiene Index the Mauchly's W was 0.966, $p = .630$; for the Gingival Index

Table IV. Frequencies and percentages of Bleeding on Probing positive and negative

Group		Baseline			Three months			Six months		
		0	1	Total	0	1	Total	0	1	Total
Control	Count	15	4	19	14	2	16	12	1	13
	%	78.94 %	21.05 %	100.00 %	87.50 %	12.50 %	100.00 %	92.3 %	7.69 %	100.00 %
Experimental	Count	20	4	24	16	6	22	17	1	18
	%	83.33 %	16.67 %	100.00 %	72.73 %	27.27 %	100.00 %	94.44 %	5.56 %	100.00 %
Total	Count	35	8	43	30	8	38	29	2	31
	%	81.40 %	18.61 %	100.00 %	78.95 %	21.05 %	100.00 %	93.55 %	6.45 %	100.00 %

0.939, $p = .428$; for the Periodontal Probing Depth, 0.999, $p = .997$, and finally; for the Bleeding on Probing 0.918, $p = .316$ (Table IV).

DISCUSSION

Fixed orthodontic appliances represent a challenge for the complete removal of dental deposits. Thereby, oral hygiene gets more difficult once the appliances are placed (Rigau-Gay *et al.*, 2018). Studies focused on behavioral sciences have demonstrated that these approaches could add beneficial advantages to traditional oral hygiene instructions to strengthen the patients' adherence to the health team recommendations (Renz *et al.*, 2007; Rigau-Gay *et al.*, 2018; McGrath, 2019). Hence, the aim of this randomized clinical trial was to evaluate the effectiveness of motivational interviewing on improving oral hygiene behavior in patients with fixed orthodontics appliances.

At the sixth month evaluation, the experimental group ended with a good SOHI value, meanwhile the control group obtained a fair score. These outcomes indicate that the dental team could employ MI + OHI routinely in the orthodontic check-ups appointments to facilitate the patients' adherence to conventional OHI.

Rigau-Gay *et al.* (2018), also conducted a RCT to evaluate the effectiveness of a single session of motivational interviewing in enhancing oral hygiene in orthodontic patients compared with conventional education alone. The results showed an improvement in oral hygiene throughout the 6-month follow-up, with a decrease in the plaque and gingival index since the 1-month appointment. Regarding the control group, a plaque index reduction was also seen, but at the long term. In our study, the results indicated maintenance in the oral hygiene instead of an improvement.

Concerning to systematic reviews, the evidence is controversial. Discepoli *et al.* (2021), concluded that motivational interview doesn't have enough evidence

in the orthodontic population. Cascaes *et al.* (2014), explained that regarding the improvement on oral health behaviors applying MI the results were conflicting and couldn't be established with confidence. Nevertheless, Kay *et al.* (2016) indicated that MI has the potential for helping patients with poor oral health. On the other hand, Gao *et al.* (2015), found a better effect of MI in periodontal health in five trials and was absent in two trials.

In contrast to the results of the present study, a recent periodontal treatment guideline indicated that these kinds of psychological models haven't shown yet a significant impact regarding changing patient's compliance with oral hygiene practices (Sanz *et al.*, 2020).

At the clinical level, it's important to point out that there was no significant change in the mean values of the SOHI, GI, PPD and BoP. Thus, both groups could maintain an acceptable oral hygiene in spite of the orthodontic devices. Therefore, OHI provided by a qualified oral health team could be successful. In fact, studies of Discepoli *et al.* (2021), and Madariaga *et al.* (2020), demonstrated that traditional and repeated OHI are effective in patients undergoing orthodontic therapy.

The literature reports that when MI is used in conjunction with other approaches, this behavioral model presents a synergic repercussion and the effect of MI is maintained or increased over time (Hettema *et al.*, 2005; Borrelli *et al.*, 2015; Stenman *et al.*, 2018). Thus, the results of Rigau-Gay *et al.* (2018), and also the ones from the present research indicated better outcomes when combining the traditional techniques with sessions of MI. However, other authors reported that no significant value is added applying MI with the conventional methods (Brand *et al.*, 2013; Stenman *et al.*, 2018).

A proper training is required to perform a successful motivational interviewing (Rigau-Gay *et*

al., 2018). Additionally, reviews and follow-ups are needed to guarantee an effective intervention throughout the research (Faustino-Silva *et al.*, 2019). Indeed, in the present study, the periodontist who provided MI sessions previously received a three-day training (5 hours each) by two expert psychologists in MI, who were in charge of supervised the interviewer. However, the Motivational Interviewing Treatment Integrity (MITI) coding system was not employed to assess the fidelity of MI. This tool could have been useful to validate the interviewer skills (Moyers *et al.*, 2016).

Another limitation of this study was the sample attrition and the research period that could have affected the outcomes. The scientific evidence demonstrated that dose effect of MI tends to produce more behavioral change with more sessions and longer follow-ups (Lundahl & Burke, 2009; Lundahl *et al.*, 2019). This was reflected on the study results, seeing a better effect in the experimental group at the sixth month visit. Therefore, a longer study period could have led to more robust outcomes.

CONCLUSION

Within the limitations of this study, it can be concluded that motivational interviewing plus oral hygiene instructions appears to maintain a better control of dental biofilm and calculus in comparison with conventional oral hygiene instructions alone. However, longer clinical trials are needed to measure more variables and to explore in a more exhaustive way the adherence of patients when this behavior model is applied.

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ADAMES-VARGAS, H.; YUNES FRAGOSO, P.; RUIZ-MATUK, C. & FELIZ-MATOS, L. Efecto de la entrevista motivacional sobre el comportamiento de higiene oral en pacientes con aparatología ortodóncica fija: Un ensayo clínico aleatorizado. *Int. J. Odontostomat.*, 18(2):219-225, 2024.

RESUMEN: El objetivo de este trabajo fue evaluar la efectividad de las entrevistas motivacionales para mejorar el comportamiento de higiene oral en pacientes con aparatos ortodóncicos fijos. Se llevó a cabo un ensayo clínico aleatorizado de grupos paralelos con 45 pacientes de la Clínica de Ortodoncia de la Unidad de Posgrado de Unibe. Se utilizó una lista de números generada por computadora con SPSS V21.0 para asignar aleatoriamente a los participantes al grupo experimental o de control. Se les proporcionó a los participantes instrucciones mensuales de higiene oral y un kit de higiene oral de GUM® con utensilios de higiene especiales para ortodoncia. Además, el grupo experimental recibió sesiones de entrevista motivacional facilitadas por un periodoncista capacitado por dos psicólogas expertas. Estas psicólogas también supervisaron al entrevistador, asegurando la implementación precisa de la intervención. Se registró el Índice Simplificado de Higiene Oral (IHO-S), el Índice Gingival (IG), la Profundidad de Sondaje Periodontal (PS) y el Sangrado al Sondaje (SS) al inicio, a los tres y seis meses después del inicio del estudio. Tanto el participante como el evaluador (otro periodoncista que registró los datos) estaban enmascarados. Se realizaron análisis de varianza de medidas repetidas con modelo mixto y pruebas de chi-cuadrado. Las puntuaciones medias del IHO-S, IG, PS y SS no difirieron significativamente en los tres momentos (inicio, tres y seis meses). Sin embargo, se encontró una interacción significativa en las puntuaciones del IHO-S ($F(2, 58) = 3.463, p = .038, h^2 = .052$) entre las sesiones y las condiciones de tratamiento (grupo experimental vs grupo de control) en el tercer y sexto mes. Las entrevistas motivacionales junto con las instrucciones de higiene oral parecen mantener un mejor control de la biopelícula dental y el cálculo en comparación con las instrucciones convencionales de higiene oral por sí solas.

PALABRAS CLAVE: aparatos ortodóncicos fijos, entrevista motivacional, higiene oral, adherencia al tratamiento.

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