

EFFICACY OF FOUR MOTIVATIONAL TECHNIQUES FOR IMPROVING ORAL HYGIENE. TWO-YEAR FOLLOW-UP OF A RANDOMISED CONTROLLED TRIAL



MONICA GIANI

Dental Hygienist, private practice, Campi Bisenzio,
Florence, Italy

UMBERTO PAGLIARO, MD, DDS

Visiting Professor, Department of Experimental and
Clinical Medicine, University of Florence, Italy

LORENZO FRANCHI, DDS, PHD

Department of Experimental and Clinical Medicine,
University of Florence, Italy

ROBERTO ROTUNDO, DDS

Honorary Associate Professor in Periodontology, UCL
Eastman Dental Institute, London, UK

MICHELE NIERI, DDS, PhD

Department of Experimental and Clinical Medicine,
University of Florence, Italy

Correspondence to:

Michele Nieri

Department of Experimental and Clinical Medicine,
University of Florence,
Via del Ponte di Mezzo 46-48, 50127,
Florence, Italy
E-mail: michelenieri@gmail.com

PURPOSE. The aim of this randomised clinical trial with blinded examiner was to compare the efficacy of four different methods of enhancing oral hygiene motivation in: (i) reducing the full-mouth plaque score (FMPS) and full-mouth bleeding score (FMBS); (ii) modifying patient behaviour; (iii) the amount of intervention time required; and (iv) the degree of patient satisfaction at two-year follow-up.

MATERIALS AND METHODS. In a private practice, 100 subjects aged 18-75 years with at least 20 teeth/implants and an FMPS $\geq 40\%$ were consecutively recruited. From baseline to two-year follow-up, subjects were randomly allocated to four different oral hygiene motivational techniques: standard oral hygiene instructions (SOHI), reading a pamphlet (P), watching a video (V), or Brief Motivational Interview (BMI).

The outcome variables considered were: reduction in FMPS, reduction in FMBS, frequency of daily tooth brushing, frequency of daily flossing, motivational intervention time, degree of patient satisfaction, patient perception of oral health (by means of a questionnaire), and number of teeth lost in association with each method. A single operator delivered all motivational sessions and professional oral hygiene at baseline, and 1, 3, 6, 12, 18, and 24 months. Another operator, blinded to the methods used, recorded the variables at baseline, and at 6, 12, 18, and 24 months.

RESULTS. At 24-month follow-up, there were no significant differences between the four tested methods in either FMPS [-20.9 for SOHI, -23.1 for P, -25.1 for V, and -27.1 for BMI; $P = 0.4407$], FMBS [-1.9 for SOHI, -3.1 for P, -0.7 for V, and -4.0 for BMI; $P = 0.3110$], degree of patient satisfaction ($P = 0.3559$), improvement in perception of oral health ($P = 0.8069$), frequency of daily flossing ($P = 0.2118$), or number of teeth lost ($P = 0.2108$). Although the total time required for motivation was significantly greater for the BMI as compared to all other techniques ($P < 0.0001$), the frequency of daily tooth brushing significantly increased after BMI as compared to SOHI and V (the difference between BMI and SOHI was 0.6; 95%CI from 0.2 to 1.0, and the difference between BMI and V was 0.5 95%CI from 0.0 to 0.9; $P = 0.0022$).

CONCLUSIONS. All tested methods improved FMPS and FMBS and were appreciated by all subjects. The change in patient behaviour was more pronounced in the BMI group, but the intervention time required was greater than for the other techniques; nevertheless, it was compatible with a professional oral hygiene session of one-hour duration.

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INTRODUCTION

Periodontal diseases and dental caries can be slowed or stabilised by reducing and controlling bacterial biofilm. The quality of oral hygiene at home and patient compliance with an individualized dental and periodontal care programme is fundamental to prevent and treat oral diseases, and obtain long-term success¹⁻¹¹.

Nevertheless, some studies^{12,13} on the effectiveness of oral hygiene motivation have shown that patient adherence to a programme of home and professional periodontal maintenance remains generally poor¹³⁻¹⁵.

This consideration was the stimulus to identify and test many new tools and various methods of patient-centred motivation to change behaviour¹⁶.

Unfortunately, however, there is little evidence in the dental and periodontal literature on the effectiveness of these new tools in terms of increasing motivation and the quality of oral hygiene practices at home¹⁷⁻¹⁹.

Nonetheless, the literature tells us that patient-centred counselling techniques^{20,21} can replace the traditional methods of motivation, inducing behavioural changes. In fact, the results of one study showed that an individually tailored oral health education programme based on a behavioural medicine approach was preferable to a standard education programme as an intervention for improving oral hygiene behaviours in periodontal patients²². Advancements in cognitive psychology have shown that healthcare providers can motivate patients to be more responsible for managing their own health through behavioural changes²³⁻²⁹.

Changing health behaviours through motivation is the focus of Motivational Interviewing (MI). Motivational interviewing (MI)^{26,30} is a "collaborative, person-centred form of guiding to elicit and strengthen motivation for change". It is designed to strengthen personal motivation for and commitment to a specific goal by eliciting and exploring the person's own reasons for change within an atmosphere of acceptance and compassion³¹. This method enhances intrinsic motivation by exploring and resolving a person's ambivalence about change^{28,29}. MI has been shown to be effective for achieving behavioural changes related to obesity, drug rehabilitation, physical fitness, mental health, glycaemic control for diabetics, smoking cessation, alcoholism, HIV/AIDS, drug abuse, medication adherence, gambling, and eating disorders^{26,28,29,32-36}. Although MI has proved to be an effective method of counselling to change lifestyles, there is insufficient and contrasting information on its use in supportive dental and periodontal therapy³⁷⁻⁴⁷.

The Brief Motivational Interviewing (BMI) has been proposed as a useful tool in the field of prevention and health education and, more generally, in all those situations where it is desirable or necessary to promote adherence to therapies or reduce risky behaviours^{26,30}. Due to the reduced number of sessions and the specific tools provided, it is possible for operators in a dental clinic to use the BMI^{26,30} without the support of a psychologist and with sustainable costs. In a recent randomised controlled trial comparing four different methods of oral hygiene motivation with one year of follow-up⁴⁸, the BMI was able to change patient behaviour by significantly improving the frequency of daily tooth brushing with respect to standard oral hygiene instructions (SOHI) and video (V) method.

Nevertheless, BMI did not lead to a significant difference in FMPS and FMBS as compared to other oral hygiene methods⁴⁸. The aim of this study was to report the two-year outcomes of the same blind-examiner randomised controlled trial to see whether they could be maintained after two years of follow-up.

MATERIALS AND METHODS

Trial design

This was a single-centre, parallel randomised controlled trial with 4 arms, with an allocation ratio of 1:1:1:1 to the four motivational techniques, and a blinded examiner. The study was conducted according to the recommendations of the CONSORT Statement regarding the quality of randomised controlled trials⁴⁹.

Eligibility criteria for participants

Study participants were recruited among patients undergoing recall sessions for professional oral hygiene. All had already been provided with instructions on how to maintain oral hygiene at home, but nevertheless presented high dental plaque index (FMPS greater than 40%).

Inclusion criteria were:

- age between 18 and 75 years;
- presence of at least 20 teeth and/or implants (pontics were not considered);
- FMPS higher than 40%.

The exclusion criteria were:

- physical or cognitive disabilities, or inability to understand the tested motivational techniques;
- chemotherapy for cancer;
- pregnancy at baseline;
- diseases that could affect the frequency of attendance.

Setting and locations

The subjects were consecutively recruited from patients attending a private dental practice in Campi Bisenzio, Italy. The investigators explained to the patients the nature, aim, and methods of the trial, anticipating benefits and potential risks, as well as any form of discomfort that participation might entail. The patients read and asked questions inherent to the study prior to signing informed consent.

Interventions

The four methods of oral hygiene motivation tested were the following.

- **Standard oral hygiene instructions (SOHI)**: chairside instruction on toothbrushing and interproximal cleaning techniques.
- **Pamphlet (P)**: home reading of a 20-page printed pamphlet (text and images). The pamphlet had the same content as the video given to the video group.
- **Video (V)**: home viewing of a 20-minute video. A DVD containing the educational video was given to the patients. The video illustrated the risks of undisturbed accumulation of plaque in the oral cavity, and the proper techniques for both tooth brushing (roll technique) and the use of dental floss and/or toothpicks. The video had the same content as the pamphlet given to the P group.
- **Brief Motivational Interviewing (BMI)**: this method was based both on the *key concepts* [i.e., the importance of changing behaviour, the confidence to be able to do so (self-efficacy), and the willingness to change] and the *primary activities* (i.e., open questions, active listening, clarifying and summarizing, and negotiating goals and strategies) of motivational interviewing (MI). The BMI consisted of the administration of *primary activities* by *appropriate tools* [a) questionnaire on “importance” and “trust”; b) diary of the objectives, strategies to achieve them, and goals; c) home oral hygiene diary^{27,30}.

At baseline, a single operator, a dental hygienist with over 10 years of experience (MG), assessed whether participants met the inclusion criteria. The same dental hygienist carried out all the required motivational sessions and professional oral hygiene procedures at baseline, and at the scheduled recalls (one, two, three, six, twelve, eighteen, and twenty-four months). Patients were all given (by MG) a questionnaire to be filled out at baseline, and were randomised to one of the four groups: 1 (SOHI), 2 (P), 3 (V), or 4 (BMI), according to instructions contained within a sealed envelope. At each session, the time required to perform the randomly allocated motivational procedure was recorded with a chronometer. Patients were re-assessed at 1 and 3, 6, 12, 18 and 24 months, repeating the motivational technique each time. During each follow-up session, the instructions delivered to the patient at baseline were discussed; at all scheduled recalls, the dental hygienist (MG) reinforced the previously delivered motivational techniques. For patients allocated to the SOHI group, the dental hygienist reinforced the notions on cleaning techniques; with P and V group patients, the dental hygienist conducted an interview on the content of the two methods; and with the BMI group the dental hygienist reinforced the relevant strategies. Professional cleaning was performed according to individual needs at months 6, 12, 18, and 24.

Outcome measures

An assessor (UP) blinded to the selected treatment recorded all outcome measures. The examiner was subjected to an intra-rater agreement test for plaque, resulting in a kappa score of 0.85, considered almost perfect agreement⁵⁰.

At the scheduled 6-, 12-, 18- and 24-month appointments, the examiner (UP), blinded to the motivational technique administered, recorded the following clinical variables:

- plaque accumulation at six sites per tooth/implant⁵¹ via the full-mouth plaque score (FMPS). The examiner used a 3.2x magnification system and a staining liquid to detect the presence of plaque at each site assessed;
- bleeding on probing at six sites per tooth/implant⁵² via the full-mouth bleeding score (FMBS);
- frequency of daily tooth brushing, as reported on the questionnaire;
- frequency of daily flossing, as reported on the questionnaire;
- patient satisfaction (assessed on a VAS from 0 to 10) for the given technique, as reported on the questionnaire;
- patient perception of their own oral health level (assessed on a VAS from 0 to 10), as reported on the questionnaire;
- number of teeth lost.

The time required for each motivational session was recorded, and the total time spent for this purpose on each patient was recorded by the dental hygienist unblinded.

Sample size

Considering $\alpha = 0.05$, a power of 80%, a standard deviation of 10 in FMPS²² and 10 as a clinically significant difference, 17 patients per group were required. This number was increased to 25 per group, making a total of 100 subjects, due to the possibility of drop-outs and in order to make multiple comparisons.

Random sequence

A computer-generated list of random numbers was used for participant allocation. Blocked randomisation was applied to allocate 25 patients to each of the four treatment groups.

Allocation concealment

The allocation sequence was concealed from the researcher (MN) enrolling and assessing participants in sequentially numbered, opaque, sealed and stapled envelopes. Only after the patient was examined at baseline did the operator (MG) open the envelopes.

Blinding

Even though the operator and the patient were aware of the allocated arm, the outcome assessor was kept blind to the allocation.

Statistical analysis

Descriptive statistics were performed using mean and standard deviation for quantitative data, and frequency and percentage for qualitative data. The statistical unit of the analysis was the patient. Analysis of variance (ANOVA) was performed on the outcome variables patient satisfaction, number of teeth lost, and total motivation time. Analysis of covariance (ANCOVA) was performed on the outcome variables change in FMPS, change in FMBS, change in daily flossing, change in daily brushing, and change in perceived health. The value at baseline was the covariate. The interaction term (treatment x covariate) was added to the model only if significant.

In the event of statistical significance (ANOVA or ANCOVA), Tukey's HSD test for multiple comparisons of the differences between treatments was carried out with a 95% confidence interval. The intention-to-treat method of analysis was utilized. The statistical software used was JMP v. 13 (SAS Institute Inc, Cary, NC, USA).

RESULTS

Patients were recruited and treated at a private practice from September to December 2011. The final 24-month follow-up was conducted in December 2013. One hundred patients were consecutively enrolled in the trial and randomly allocated to the four experimental groups. As a consequence, 25 patients underwent each motivational approach, namely standard oral hygiene instructions (SOHI), pamphlet (P), video (V), or Brief Motivational Interviewing (BMI). Baseline patient characteristics are shown in **TABLE 1**. There were no apparent baseline imbalances between the four groups, except that more females were randomly allocated to the BMI group.

Three patients belonging to the SOHI group dropped out and declined follow-up: one at six months and two after 12 months. Two patients belonging to the P group dropped out: one at one month and one after 12 months. Seven patients belonging to the V group dropped out (two at 1-month follow-up, four at 3-month follow-up, and one at 6 months). Two patients belonging to the BMI group dropped out, at 1 month and 6 months, respectively. In addition, 4 patients did not attend at the 18-month appointment but did attend the 24-month follow-up check. One of these patients belonged to the P group, two to the V group, and one to the BMI group.

There were no deviations from the protocol. Results at 6 and 12 months were reported in a previous publication⁴⁸, while descriptive results at 18 months are shown in **TABLE 2**. Descriptive and inferential statistics at 24 months are shown in **TABLE 3**. At 24 months of follow-up, the improvement from baseline in terms of FMPS was substantial (20.9 for SOHI, 23.1 for P, 25.1 for V, and 27.1 for BMI), but differences between the four tested methods were not significant ($P = 0.4407$). In terms of FMBS, the changes were moderate (1.9 for SOHI, 3.1 for P, 0.7 for V, and 4.0 for BMI), with no significant differences between the four methods ($P = 0.3110$).

TABLE 1 CHARACTERISTICS OF THE 4 GROUPS AT BASELINE

Variable	SOHI Group N = 25	P Group N = 25	V Group N = 25	BMI Group N = 25
Age [years]	45.1 (12.7) [18; 64]	44.7 (14.0) [19; 66]	42.3 (12.2) [20; 65]	48.8 (13.7) [24; 73]
Gender [Females]	15 (60%)	10 (40%)	16 (64%)	20 (80%)
Smokers	8 (32%)	8 (32%)	6 (24%)	8 (32%)
FMPS	65.6 (11.2)	66.4 (11.6)	64.8 (11.3)	68.5 (10.0)
FMBS	5.7 (4.6)	7.4 (5.2)	5.1 (3.5)	7.4 (4.2)
Tooth brushing (times per day)	2.1 (0.5)	2.1 (0.6)	2.5 (0.6)	2.0 (0.5)
Flossing (times per day)	0.8 (0.6)	0.7 (0.7)	0.5 (0.5)	0.7 (0.6)
Health perception (VAS)	4.9 (1.3)	5.0 (1.0)	4.8 (1.2)	4.9 (1.6)

SOHI: Standard oral hygiene instruction; P: reading of a pamphlet; V: watching a video; BMI: Brief Motivational Interviewing; FMPS: full-mouth plaque score; FMBS: full-mouth bleeding score; VAS: Visual Analogue Scale

Standard deviations for quantitative variables and percentages for qualitative variables are in round brackets, while minimums and maximums are in square brackets

TABLE 2 RESULTS AT 18-MONTH FOLLOW-UP

Variable	SOHI Group N = 22	P Group N = 22	V Group N = 16	BMI Group N = 22
FMPS	47.5 (12.3)	42.7 (10.5)	38.5 (11.6)	39.9 (12.6)
FMBS	3.6 (3.1)	2.9 (2.7)	3.0 (3.9)	3.9 (3.9)
Tooth brushing (times per day)	2.0 (0.5)	2.3 (0.5)	2.6 (0.6)	2.5 (0.5)
Flossing (times per day)	0.8 (0.6)	0.8 (0.6)	0.7 (0.6)	1.0 (0.7)
Satisfaction score	8.7 (1.1)	8.7 (1.0)	8.7 (1.0)	8.4 (1.0)
Health perception (VAS)	5.5 (1.3)	6.7 (1.1)	5.8 (1.7)	6.2 (1.5)

SOHI: Standard oral hygiene instruction; P: reading of a pamphlet; V: watching a video; BMI: Brief Motivational Interviewing; FMPS: full-mouth plaque score; FMBS: full-mouth bleeding score; VAS: Visual Analogue Scale

Standard deviations are in round brackets

The change in daily frequency of tooth brushing was null for SOHI and V, while the BMI groups showed an increase of 0.5. The frequency of daily tooth brushing increased significantly in the BMI group, as compared to SOHI and V (the difference between BMI and SOHI was 0.6, 95% CI from 0.2 to 1.0; and the difference between BMI and V was 0.5, 95%CI from 0.0 to 0.9; $P = 0.0022$). In contrast, the improvement in daily flossing frequency was null or very low for all the 4 groups, and the difference between them was not statistically significant ($P = 0.2118$). Nevertheless, the interaction between the treatment and covariate was significant ($P = 0.0192$). In particular, for patients who did not use floss at baseline, there was no difference

TABLE 3 RESULTS AT 24-MONTH FOLLOW-UP

Variable	SOHI Group N = 22	P Group N = 23	V Group N = 18	BMI Group N = 23	P-value
FMPS	45.0 (13.7)	44.6 (15.1)	39.2 (11.5)	40.9 (13.1)	0.4407
Difference in FMPS between baseline and 24 months	20.9 (15.3)	23.1 (13.6)	25.1 (13.2)	27.1 (14.6)	0.4407
FMBS	4.0 (3.1)	4.0 (4.2)	4.6 (3.6)	3.3 (3.0)	0.3110
Difference in FMBS between baseline and 24 months	1.9 (5.4)	3.1 (5.0)	0.7 (3.3)	4.0 (3.4)	0.3110
Tooth brushing (times per day)	2.0 (0.6)	2.3 (0.4)	2.3 (0.7)	2.5 (0.5)	0.0022*
Difference in tooth brushing between baseline and 24 months	-0.1 (0.5)	0.2 (0.7)	-0.2 (0.6)	0.5 (0.5)	0.0022*
Flossing (times per day)	1.0 (0.7)	0.8 (0.6)	0.6 (0.4)	1.0 (0.6)	0.2118**
Difference in flossing between baseline and 24 months	0.1 (0.4)	0.1 (0.7)	0.1 (0.5)	0.3 (0.3)	0.2118**
Satisfaction score	8.8 (1.1)	8.8 (1.0)	8.7 (0.8)	8.3 (1.0)	0.3559
Health perception (VAS)	5.7 (1.3)	6.0 (1.4)	5.9 (2.0)	6.2 (1.7)	0.8069
Difference in health perception between baseline and 24 months	0.7 (1.4)	0.9 (1.5)	1.2 (2.0)	1.2 (1.9)	0.8069
Tooth loss	0.1 (0.3)	0.4 (1.0)	0.1 (0.3)	0.2 (0.4)	0.2108
Total time (minutes)	44.2 (7.2)	42.6 (11.8)	36.9 (7.5)	70.6 (12.6)	<0.0001***

SOHI: Standard oral hygiene instruction; P: reading of a pamphlet; V: watching a video; BMI: Brief Motivational Interviewing; FMPS: full-mouth plaque score; FMBS: full-mouth bleeding score; VAS: Visual Analogue Scale

Standard deviations are in round brackets

*Statistically significant BMI values as compared to SOHI and V ($P=0.0022$)

**Statistically significant interaction between treatment and covariate ($P=0.0192$)

***Statistically significant BMI values compared to all other methods ($P<0.0001$)

between treatments. Instead, the patients who flossed more in the SOHI and BMI groups remained more motivated to do so than those in the P and V groups.

The patient satisfaction score (assessed on a scale from 0 to 10) was high for all techniques, and the differences between them were not significant ($P = 0.3559$). There was also an improvement in oral health perception for all groups, with no significant differences between them ($P = 0.8069$). However, nineteen teeth had been lost in fourteen patients at 24-month follow-up. In the SOHI group two patients had lost one tooth each (one due to fracture and the other to periodontitis); in the P group five patients had lost a total of ten teeth (four teeth in one patient due to dysodontiasis, four teeth in two patient due to periodontitis, and two teeth in two patients due to fracture); in the V group two patients had lost one tooth each (one due to fracture and the other to periodontitis); in the BMI group, five patients lost one tooth each (two due to fracture, two due to periodontitis, and one due to caries). The difference between groups was not significant ($P = 0.2108$).

As for the total time spent for the motivation session, the BMI took the longest, with a statistically significant difference as compared to the other techniques (difference between BMI and SOHI was 26.4 minutes [95%CI from 18.4 to 34.4]; the difference between BMI and P was 28.0 minutes [95%CI from 20.1 to 35.9]; and the difference between BMI and V was 33.7 minutes [95%CI from 25.2 to 42.1], $P < 0.0001$).

DISCUSSION

This investigation revealed that four different methods of motivation to oral hygiene, specifically standard oral hygiene instructions, pamphlets, educational video, and Brief Motivational Interviewing, are all effective. All tested methods were appreciated by all enrolled subjects, who showed improved FMPS and FMBS at two-year follow-up.

No statistically significant differences were observed between the four methods of motivation in terms of FMPS, FMBS, mean number of teeth lost, degree of patient satisfaction or perception of oral health. However, BMI induced a statistically significant increase in the frequency of daily brushing as compared to the SOHI and V ($P = 0.0022$). While the BMI required a significantly greater total motivation time with respect to all other tested methods ($P < 0.0001$), the time dedicated to the BMI at each appointment was compatible with the operational requirements of a 1-hour session of professional oral hygiene.

Our finding relating to the frequency of daily flossing is more controversial. Specifically, the interaction between treatment and covariate was significant for this variable. This means that for patients who did not floss at baseline, there were no differences in outcome between motivational techniques. On the other hand, for patients who already flossed at baseline, patients in the SOHI and BMI groups reported a greater frequency of daily flossing after two years than the patients in the P and V groups.

Similar to our results, a meta-analysis on motivational interview versus education and/or information on gingivitis showed neither statistically nor clinically significant differences between them³⁹. However, significant improvements in oral health behaviour, and self-efficacy regarding tooth brushing, have been reported as linked to psychological interventions³⁹. That being said, the clinical relevance of these differences is difficult to estimate, and long-term effects have not been investigated elsewhere³⁹.

One RCT evaluated whether inclusion of a single psychologist-led motivational interview session administered as an adjunct to periodontal therapy might be beneficial for preventing relapse in oral hygiene behaviours among patients treated for chronic periodontitis⁴⁰. Marginal bleeding index and plaque index were assessed at 6 months and 3 years of follow-up^{40,53}. No differences were observed between the two groups, and the conclusions of the authors were that a single BMI session does not add beneficial effects to standard periodontal therapy for efficient oral hygiene behaviour⁴⁰. The findings on FMBS in that study⁴⁰ are similar to our own, despite the fact that in our study the BMI (and the other motivational techniques) was repeated at each session (baseline, 1-, 3-, 6-, 12-, 18-, and 24-month recall visits). In our study, however, a dental hygienist administered the BMI instead of a psychologist as in the Stenman study⁴⁰. It should be noted that repeating the BMI (and the other motivational techniques) at each recall session could be the reason why in our patients the FMPS values progressively improved up to 2 years, while in the Stenman study³⁴ they had worsened at the 3-year with respect to the 6-month follow-up, likely because only a single BMI motivation session was delivered. These results seen in our trial were possible because a dental hygienist, rather than a psychologist, conducted all the repeated sessions of BMI, which allowed us to reduce costs.

Changes over time have been observed for plaque, bleeding, pocket depth, and gingival recession without therapy or motivation technique⁵⁴, and in our study of adult subjects, differences between standard oral hygiene instructions, reading of a pamphlet and watching a video were not observed after two years of follow-up. All three methods seemed to be equally effective in improving home oral hygiene manoeuvres in adult subjects. However, this randomised controlled trial indicates that BMI is as effective as the other techniques in reducing the percentage of FMPS and FMBS, but was also able to induce changes in behaviour and lifestyle,

namely an increased frequency of daily tooth brushing. It is unclear whether these changes are clinically relevant. Nevertheless, this result was observed after one year⁴⁸, and now, in the same groups of patients it was also maintained and confirmed after 2 years. Accordingly, it is planned to extend follow-up to 10 years in order to assess the patients' long-term responses to the four motivational techniques, and the resulting quality of oral health.

CONCLUSIONS

All tested methods improved FMPS and FMBS and were appreciated by enrolled subjects. Nonetheless, BMI was able to change patient behaviour, significantly improving the frequency of daily tooth brushing with respect to SOHI and V, without, however, leading to a significantly greater difference in FMPS or FMBS than other oral hygiene methods over the course of two years. The time required for BMI was greater than the other methods, but still compatible with a 1-hour professional oral hygiene session.

REFERENCES

- Hirschfeld I. The toothbrush: it's use and abuse. New York: Dental Items of Interest Publishing Co., 1939.
- Goldman MJ, Ross IF, Goteiner D. Effect of periodontal therapy on patients maintained for 15 years or longer. A retrospective study. *J Periodontol* 1986;57:347-53.
- Cobb CM. Non-surgical pocket therapy: Mechanical. *Ann Periodontol* 1996;1:443-90.
- Pihlstrom BL, Ammons WF. Treatment of gingivitis and periodontitis. Research, Science and Therapy Committee of the American Academy of Periodontology. *J Periodontol* 1997;68:1246-53.
- Albandar JM. Global risk factors and risk indicators for periodontal diseases. *Periodontology* 2000 2002;29:177-206.
- Leung WK, Ng DK, Jin L, Corbet EF. Tooth loss in treated periodontitis patients responsible for their supportive care arrangements. *J Clin Periodontol* 2006;4:265-75.
- Ramseier CA, Catley D, Krigel S, Bargramian RA. Motivational interviewing. In: Lang NP, Lindhe J. (eds). *Clinical Periodontology and Implant Dentistry*. 5th edition. Oxford: Blackwell Munksgaard 2008:695-702.
- Nieri M, Giani M, Pagliaro U, Picciullo A, Franceschi D, Rotundo R. Efficacy and preference of manual toothbrushes: a randomised, single blind, controlled trial. *Eur J Oral Implantol* 2013;6:181-8.
- Preus HR, Al-Lami Q, Baelum V. Oral hygiene revisited. The clinical effect of a prolonged oral hygiene phase prior to periodontal therapy in periodontitis patients. A randomized clinical study. *J Clin Periodontol* 2020;47(1):36-42.
- Fugazzaro F, Giani M, Pagliaro U, Franchi L, Nieri M. Plaque reduction after different numbers of interdental brush strokes – a split-mouth randomised controlled trial. *Clin Trials Dent* 2020;2(4):38-48.
- Nieri M, Giuntini V, Pagliaro U, Giani M, Franchi L, Franceschi D. Efficacy of a U-Shaped automatic electric toothbrush in dental plaque removal: a cross-over randomized controlled trial. *Int J Environ Res Public Health* 2020;17(13):4649.
- Johansson LA, Oster B, Hamp SE. Evaluation of cause-related periodontal therapy and compliance with maintenance care recommendations. *J Clin Periodontol* 1984;11:689-99.
- Schüz B, Sniehotta FF, Wiedemann A, Seemann R. Adherence to a daily flossing regimen in university students: effects of planning when, where, how and what to do in the face of barriers. *J Clin Periodontol* 2006;33:612-9.
- Wilson TG Jr, Glover ME, Schoen J, Baus C, Jacobs T. Compliance with maintenance therapy in a private periodontal practice. *J Periodontol* 1984;55:468-73.
- Demetriou N, Tsami-Pandi A, Parashis A. Compliance with supportive periodontal treatment in private periodontal practice. A 14-year retrospective study. *J Periodontol* 1995;66:145-9.
- Schlueter N, Klimek J, Ganss C. Relationship between plaque score and video-monitored brushing performance after repeated instruction – a controlled, randomised clinical trial. *Clin Oral Investig* 2013;17:659-67.
- Al Bardaweel S, Dashash M. E-learning or educational leaflet: does it make a difference in oral health promotion? A clustered randomized trial. *BMC Oral Health* 2018;18:81.
- Al-Ak'hali MS, Halboub ES, Asiri YM, Asiri AY, Maqbul AA, Khawaji MA. WhatsApp-assisted oral health education and motivation: a preliminary randomized clinical trial. *J Contemp Dent Pract* 2020;21:922-5.
- Yıldırım S, Kayaaltı-Yüksek S. The effects of motivational methods applied during tooth-brushing on children's oral hygiene and periodontal health. *Pediatr Dent* 2020;42:424-30.
- Renz AN, Newton JT. Changing the behavior of patients with periodontitis. *Periodontol* 2000 2009;51:252-68.
- Renz A, Ide M, Newton T, Robinson PG, Smith D. Psychological interventions to improve adherence to oral hygiene instructions in adults with periodontal diseases. *Cochrane Database Syst Rev* 2007 Apr 18;(2):CD005097.
- Jönsson B, Öhrn K, Oscarson N, Lindberg P. The effectiveness of an individually tailored oral health educational programme on oral hygiene behaviour in patients with periodontal disease: a blinded randomized-controlled clinical trial (one-year follow-up). *J Clin Periodontol* 2009;36:1025-34.

23. Evans RI. The social psychology of persuasion: the use of fear and other problems. *J Am Soc Prev Dent* 1972;2:18-21.
24. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development and well-being. *Am Psychol* 2000;55:68-78.
25. Schou L. The relevance of behavioural sciences in dental practice. *Int Dent J* 2000;50:324-32.
26. Miller WR, Rollnick S. Motivational interviewing: preparing people to change. New York, NY, USA: Guilford Press, 2002.
27. Nield-Gehrig JS, Willmann DE. Helping patients change behavior: periodontics for the dental hygienist. Baltimore, MD, USA: Lippincott, 2008.
28. Rollnick S, Miller WR, Butler C. Motivational interviewing in health care. Helping patients change behavior. New York, NY, USA: Guilford Press, 2008.
29. Miller WR, Rollnick S. Ten things that motivational interviewing is not. *Behav Cogn Psychother* 2009;37:129-40.
30. Rollnick S, Mason P, Butler C. Health behavior change. Harcourt Brace and Company Limited, 1999.
31. Jiang S, McGrath C, Lo EC, Ho SM, Gao X. Motivational interviewing to prevent early childhood caries: a randomized controlled trial. *J Dent* 2020;97:103349.
32. Rollnick S, Butler CC, Stott N. Helping smokers make decisions: the enhancement of brief intervention for general medical practice. *Patient Educ Couns* 1997;31:191-203.
33. Amrhein PC, Miller WR, Yahne CE, Palmer M, Fulcher L. Client commitment language during motivation interviewing predicts drug use outcomes. *J Consult Clin Psychol* 2003;71:862-78.
34. Butterworth S, Linden A, McClay W, Leo MC. Effect of motivational interviewing-based health coaching on employees' physical and mental health status. *J Occup Health Psychol* 2006;1:358-65.
35. Carels RA, Darby L, Cacciapaglia HM et al. Using motivational interviewing as a supplement to obesity treatment: a stepped-care approach. *Health Psychol* 2007;26:369-74.
36. Channon SJ, Huws-Thomas MV, Rollnick S et al. A multicenter randomized controlled trial of motivational interviewing in teenagers with diabetes. *Diabetes Care* 2007;30:1390-5.
37. López-Jornet P, Fabio CA, Consuelo RA, Paz AM. Effectiveness of a motivational-behavioural skills protocol for oral hygiene among patients with hyposalivation. *Gerodontology* 2014;31:288-95.
38. Kay EJ, Vascott D, Hocking A, Nield H. Motivational interviewing in general dental practice: a review of the evidence. *Br Dent J* 2016;221:785-91.
39. Werner H, Hakeberg M, Dahlström L, Eriksson M, Sjögren P, Strandell A, Svanberg T, Svensson L, Wide Boman U. Psychological interventions for poor oral health: a systematic review. *J Dent Res* 2016;95:506-14.
40. Stenman J, Wennström JL, Abrahamsson KH. A brief motivational interviewing as an adjunct to periodontal therapy - A potential tool to reduce relapse in oral hygiene behaviours. A three-year study. *Int J Dent Hyg* 2018;16:298-304.
41. Yevlakhova D, Satur J. Models for individual oral health promotion and their effectiveness: a systematic review. *Aust Dent J* 2009;54:190-7.
42. Gao X, Lo EC, Kot SC, Chan KC. Motivational interviewing in improving oral health: a systematic review of randomized controlled trials. *J Periodontol* 2014;85:426-37.
43. Kopp SL, Ramseier CA, Ratka-Krüger P, Woelber JP. Motivational interviewing as an adjunct to periodontal therapy - A systematic review. *Front Psychol* 2017;8:279.
44. Wu L, Gao X, Lo ECM, Ho SMY, McGrath C, Wong MCM. Motivational interviewing to promote oral health in adolescents. *J Adolesc Health* 2017;61(3):378-84.
45. Saengtibovorn S. Efficacy of Motivational Interviewing in Conjunction with Caries Risk Assessment (MICRA) programmes in improving the dental health status of preschool children: a randomised controlled trial. *Oral Health Prev Dent* 2017;15(2):123-9.
46. Carra MC, Detzen L, Kitzmann J, Woelber JP, Ramseier CA, Bouchard P. Promoting behavioural changes to improve oral hygiene in patients with periodontal diseases: a systematic review. *J Clin Periodontol* 2020;47(Suppl 22):72-89.
47. Colvara BC, Faustino-Silva DD, Meyer E, Hugo FN, Celeste RK, Hilgert JB. Motivational interviewing for preventing early childhood caries: a systematic review and meta-analysis. *Community Dent Oral Epidemiol* 2021;49:10-6.
48. Giani M, Pagliaro U, Franchi L, Rotundo R, Nieri M. Efficacy of four motivational techniques for improving oral hygiene. One-year follow-up of a randomised controlled trial. *Clin Trials Dent* 2019;1:79-88.
49. Moher D, Hopewell S, Schulz KF, Montori V, Gøtzsche PC, Devereaux PJ, Elbourne D, Egger M, Altman DG. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. *Br Med J* 2010;340:c869.
50. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;33:159-74.
51. O'Leary T. The periodontal screening examination. *J of Periodontol* 1967;38:617-24.
52. Ainamo J, Bay I. Problems and proposals for recording gingivitis and plaque. *Int Dent J* 1975;25:229-35.
53. Stenman J, Lundgren J, Wennström JL, Ericsson JS, Abrahamsson KH. A single session of motivational interviewing as an additive means to improve adherence in periodontal infection control: a randomized controlled trial. *J Clin Periodontol* 2012;39:947-54.
54. Nieri M, Ciancarelli S, Pagliaro U, Franchi L, Labriola A. Can periodontal probing improve clinical variables in untreated periodontal patients? A case series. *Clin Trials Dent* 2020;2(4):45-51.