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VS Brand
KK Bray
S MacNeill
D Catley
K Williams

Impact of single-session motivational interviewing on clinical outcomes following periodontal maintenance therapy

Authors' affiliations:
VS Brand, Department of Periodontics, University of Missouri-Kansas City School of Dentistry, Kansas, MO, USA
KK Bray, Division of Dental Hygiene, University of Missouri-Kansas City School of Dentistry, Kansas, MO, USA
S MacNeill, Advanced Education Program in Periodontics, University of Missouri-Kansas City School of Dentistry, Kansas, MO, USA
D Catley, Department of Psychology, University of Missouri-Kansas City, Kansas, MO, USA
K Williams, Department of Biomedical and Health Informatics, University of Missouri-Kansas City School of Medicine, Kansas, MO, USA

Correspondence to:
V.S. Brand
Department of Periodontology
University of Missouri-Kansas City School of Dentistry
650 E. 25th Street
Kansas City
MO 64108
USA
Tel.: +1 816 235 2147
Fax: +1 816 235 5472
E-mail: brandv@umkc.edu

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Brand VS, Bray KK, MacNeill S, Catley D, Williams K. Impact of single-session motivational interviewing on clinical outcomes following periodontal maintenance therapy.

Abstract: *Objectives:* Patient engagement in effective oral hygiene following periodontal therapy is essential to long-term success. Motivational interviewing (MI) is a behavioural counselling approach documented to positively influence behaviour change related to smoking, diabetes control and medication adherence. Emerging evidence suggests utility of MI to improve oral health. The objective of this study was to evaluate whether the use of brief motivational interviewing (BMI) is effective in improving internal motivation for oral hygiene behaviour. *Methods:* A convenience sample of fifty-six previously treated periodontal patients who were in maintenance yet presented with signs of clinical inflammation were recruited to participate in this single blind, randomized controlled trial. Patients were randomly assigned to receive either BMI in conjunction with traditional oral health education (TOHE), (n = 29) or TOHE alone (n = 27). Bleeding on probing scores (BOP), plaque index (PI), pocket depths (PD), motivation (M), autonomous regulation (AR) controlled regulation (CR) and oral health knowledge (K) were assessed at baseline, 6 weeks and 12 weeks. *Results:* Statistically significant decreases were found over time for BOP (P = 0.001), PI (P = 0.001) and PD 4–6 mm (P = 0.001) for both groups. Differences in clinical parameters between groups were not evident at either 6 or 12 weeks. *Conclusion:* Results show that a one-time MI session is insufficient for improving oral hygiene in long-standing maintenance patients.

Key words: dental health education; motivational interviewing; periodontal disease; periodontal maintenance

Introduction

It has been well documented that gingival inflammation can be slowed or eliminated by reducing and controlling biofilm through personal and professional care. While professional treatment is critical to control disease, an essential component to success is the patient's ability to control plaque at home and participate in an individualized periodontal maintenance (PM) programme (1–7). Traditionally, motivating patients to adhere to recommended dental and homecare therapies has been based on the premise that a patient's knowledge about the existence of their periodontal problem is sufficient to make them comply with homecare strategies, and PM (2, 8–10). Use of fear tactics through dire warnings about tooth loss if treatment is not rendered, and deteriorating outcomes if PM is not

provided was previously believed to be important in motivating individuals to make lifelong positive changes in their behaviours (9–15). Studies indicate that patients generally are not motivated by these methods, and they may actually impair motivation (5, 10, 12–15). Research findings from cognitive psychology may have utility for planning interventions that can improve oral health by increasing intrinsic motivation (16, 17).

Advancements in cognitive psychology have shown that healthcare providers can motivate patients to be more responsible for management of their own health through behavioural change (10, 14, 16–20). Changing health behaviours through motivation is the focus of motivational interviewing (MI) (17, 19).

Motivational interviewing (MI) is a 'collaborative, person-centred form of guiding to elicit and strengthen motivation for change'. This directive method enhances intrinsic motivation by exploring and resolving a person's ambivalence about change (17, 19). MI originated in the addictions field, but has been shown to be effective for achieving behaviour change related to obesity, drug rehabilitation, physical fitness, mental health, glycemic control for diabetics, smoking cessation, treatment of alcoholism, HIV/AIDS, drug abuse, medication adherence, gambling and eating disorders (17, 19–28). Several studies have also provided support for the efficacy of MI in improving oral health behaviours and for the feasibility of training oral health care professionals to implement MI in the clinical setting (29–40).

Four randomized clinical trials, to date, have supported the potential for MI to reduce early childhood caries (30–33), improve oral hygiene in individuals with severe and persistent mental illness (34), and improve clinical measures in a population of periodontal patients (35, 36). In each of these studies, the MI intervention used was different ranging from a brief MI (BMI) one-time intervention to multiple 45-minute sessions. Additionally, the target populations in these studies differed considerably, leaving open the question as to what amount of MI intervention is effective for various individuals and populations. Given that the traditional prescriptive lecture method of health education does little to improve internal motivation (10–13), there is a need to explore other theoretically based strategies for motivating periodontal patients to improve their oral health (10–16). Almomani showed that a single 15-minute session of BMI had a positive effect improving the oral health in a population of subjects with severe mental illness over a two-month time period. The present study mirrors Almomani's methods to determine whether a similar result would occur in a population of periodontal patients with poor disease control. Therefore, the purpose of this study was to examine the efficacy of the addition of a single session of BMI to TOHE for eliciting the patient's internal motivation to engage in home care and PM adherence and for improving periodontal clinical measures among a population of periodontal patients attending an academic health centre dental clinic.

Methods and materials

Sample

A power analysis determined the number of subjects needed to achieve a bleeding on probing (BOP) score reduction of 40% with BOP as the primary outcome variable. This estimate was derived from measures of effect in adult patients from two previous MI studies, Almomani (34) and Jonsson (35). The total number of completed subjects needed to achieve power of 0.8 with an alpha (α) of 0.05 was determined to be 50; taking into consideration a possible 10% attrition rate, 56 subjects were recruited, consented and randomized to either the experimental group (TOHE plus BMI) or control group (TOHE alone) using a computer-generated table.

Adults from a university dental school graduate periodontics maintenance programme were invited to participate in this study (Fig. 1). To be eligible participants were required to be in the maintenance phase of periodontal therapy, defined as in PM for at least one year, and be 'compromised' with a (BOP) score of $\geq 40\%$ or at least two teeth with interproximal PD ≥ 5 mm. Additionally, participants could not require antibiotic prophylaxis prior to treatment and had to have a minimum of 12 teeth/implants. Exclusion criteria included active treatment for cancer, HIV/AIDS, taking anticoagulation drugs, having orthodontic appliances, pregnant or nursing or unable to comply with study procedures. Upon protocol approval by the University of Missouri's Adult Health Sciences Institutional Review Board subjects were provided information about the study, given an opportunity to ask questions and asked to sign consent forms to participate.

Measures

The primary outcome measure was BOP with secondary outcome defined as plaque index (PI) and percent of pockets (PD 4–6 mm and PD >7 mm). Additionally, two modified measures of motivation were used; Treatment Self-Regulation Questionnaire (TSRQ) (41) and motivation/readiness/confidence to adhere (MRCA) (42, 43). Knowledge about periodontal health was ascertained utilizing the oral health knowledge questionnaire (OHKQ) (34). All measures were collected at baseline, 6 weeks and 12 weeks. Usual care PM was provided for subjects at baseline and at the 12-week follow-up visit.

Clinical data were collected by two dental hygiene examiners with extensive periodontal experience and who were blind to group assignment. Prior to study implementation, examiners were calibrated on probing method until inter-rater and intra-rater reliability and bleeding score achieved a level of >0.7. The Hu-Friedy PCV12PT Colorvue periodontal probe was used for all measurements. Pocket depth (PD) measurements and associated BOP were obtained from six sites on each tooth and (PI) scored using the Modified Quigley-Hein Plaque Index (44) on the buccal and lingual surfaces of the Ramfjord teeth (Universal Numbering System Teeth 3,9,12,19,25 and 28) (45). Where Ramfjord teeth were missing,

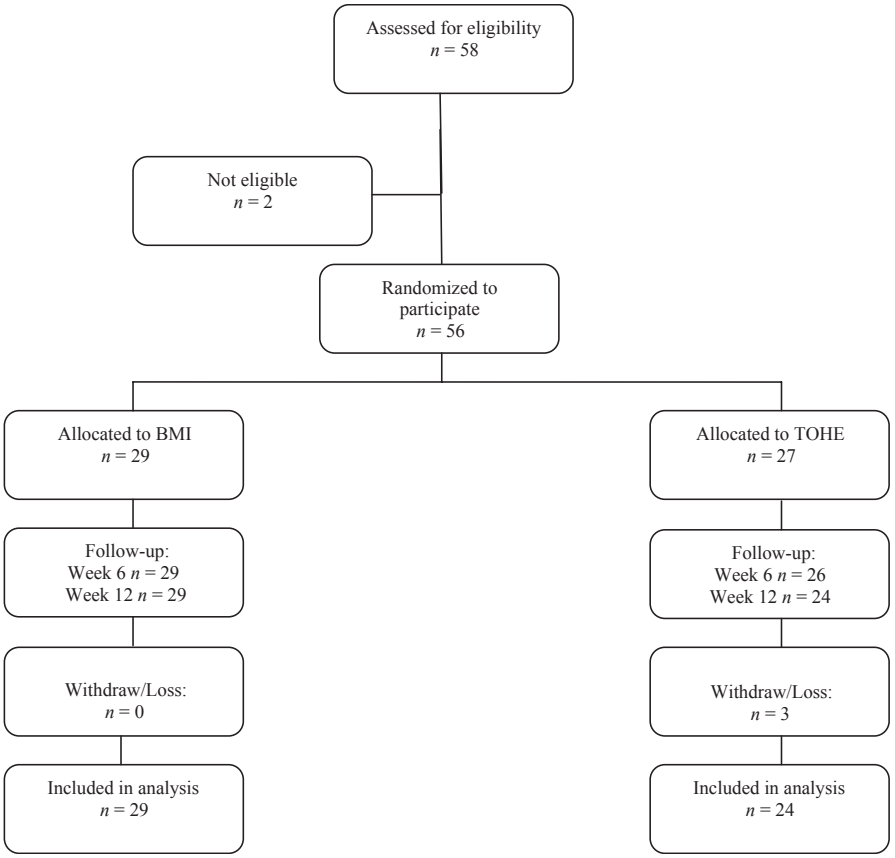

Fig. 1. Participant flowchart.

the most proximal tooth was scored. A mean PI score was calculated for each subject at baseline, 6 weeks and 12 weeks. Teeth with crowns or cervical restorations were excluded from PI scoring. Teeth were stained with a disclosant, Red-Cote® (John O Butler Co., Chicago, IL, USA) to facilitate visualization of plaque for obtaining the PI.

A 13-item OHKQ developed and used by Almomani (34) was modified and used to assess the subject's knowledge about oral health, oral hygiene and mouthcare procedures, possible effects of both smoking and medications on periodontal disease (46, 47). Each question was scored correct or incorrect and summed to create a total score. Total scores could range from 0 to 13 with a score of 13 being total possible correct.

The Treatment Self-regulation Questionnaire (TSRQ) was modified to assess each participant's level of motivation to improve home care and adherence to recommended PM intervals (41). The scale includes two subscales (5 items each), assessing participant's autonomous regulation and controlled regulation. Autonomous regulation assesses the degree to which the behaviour is valued, whereas controlled regulation assesses motivation that comes from an external source. The TSRQ uses a Likert-type response scale of 1 to 7, with 1 'strongly disagree' and 7 'strongly agree'.

The second measure of motivation, readiness and commitment to adhere to oral health recommendations (MRCA), was used to ascertain the subject's desire, need, readiness, reasons and commitment for seeking PM and willingness to adhere to recommended homecare and maintenance schedule. The MRCA is comprised of five items with an eleven point, Likert-type response with 0 'not at all' and 11 'extremely' motivated. The MRCA was scored by summing item-level scores to produce a total mean score.

Intervention

Following baseline data collection, participants received their routine PM clinical care. All participants received the same toothbrush, toothpaste, dental floss and mouth rinse for homecare use. Subjects received individualized oral hygiene instructions based on their BOP, PD and PI scores.

The hygienist utilized the traditional advice-giving method of 'tell, show and do' for oral hygiene instructions (9, 14). Subjects were informed of the areas needing improvement, shown proper brushing and flossing technique, and the use of other oral hygiene aids as needed, thereby providing subjects with knowledge to improve their oral hygiene.

Subjects assigned to the BMI group returned within one week of the baseline visit to participate in a short MI session (approximately 15–20 min) delivered by a trained counsellor with extensive experience in MI. The sessions were audio recorded to assess the counsellor's fidelity in providing MI and were erased once reviewed and coded. The MI counselor was

not a dental professional and therefore received training in advance about periodontal disease, risk factors, goal of periodontal therapy and importance of maintenance. To assist the MI counselor with the intervention, a summary of the participant's periodontal condition and oral health needs was provided in advance of the session. The summary and dental history gave the counsellor insight into treatment and professional recommendations to sustain or attain optimal dental health. Additionally, the form included a description of the homecare recommendations that were provided during oral hygiene session (such as brushing longer/more thoroughly, interproximal cleaning, smoking cessation, follow-up for care and/or adherence to PM frequency, etc.).

Using the strategy of OARS(20) (open ended question, affirmations, reflective listening and summary), the BMI counsellor helped subjects to explore advantages and disadvantages related to improving their oral health and identify personal values that could be instrumental in making changes in their oral health. The directed discussions to facilitate subject's motivation, confidence in the ability to identify solutions and make behavioural changes. At the 6- and 12-week follow-up appointments, subjects were instructed not to inform clinical examiners of their group assignment to maintain blind evaluation.

Statistical analyses

Descriptive and inferential analyses were performed using the STATA 11.0 SE program (StataCorp LP, College Station, TX, USA). Bivariate analyses (Chi square and independent *t*-test) were used to compare treatment groups on baseline characteristics to assess group equivalence. Analyses of the primary outcomes started with the generation of profile plots for participants in each group across observation periods. As repeated observations for outcome variables were clustered within patient, mixed-effects regression models were used. Mixed-effects model provides an appropriate mechanism for handling the repeated measure nature of the clinical, motivation and knowledge outcomes. Based on the distribution of data and recommendations of Gardner for managing positively skewed count and rate data (48), Poisson mixed-effects regression models were fitted to assess effects of Intervention Group on per cent of pockets (4–6 and >7 mm) over time. Models were fitted with the two fixed-effect variables: Intervention Group and Time. Subject was the random effect variable. For all models, an alpha of 0.05 was the criterion for statistical significance.

Results

Fifty-six subjects were recruited and consented with 53 subjects (95%) completing all evaluations in the study (Fig. 1). Three subjects discontinued participation for various reasons: two encountered work-related scheduling problems and one subject experienced refractory periodontal disease that resulted in the need for immediate aggressive therapy. All three subjects were assigned to the control arm of the study; however, there were no clinical or demographic differences between subjects who completed the study and those that did not.

Subject's demographic data are presented in Table 1. The BMI and TOHE groups were demographically similar with no significant differences between groups ($P \geq 0.05$). The BMI group included 29 subjects (15 males and 14 females) and the TOHE group had 24 subjects (10 males and 14 females). Subject's mean age was 61.9 (11.0); 83% were non-smokers and mean number of teeth for both groups was 25.

Descriptive data for clinical knowledge, self-regulation, motivation and clinical outcomes at baseline, 6- and 12-week observations are displayed in Table 2. At baseline, the TOHE group had a slightly higher mean BOP and 4–6 mm PD than the BMI group; however, these were not significantly different. There was a trend for BOP and 4–6 mm PD to decrease over the 12-week study period irrespective of treatment group. PI scores were similar at baseline for both groups with little difference between groups over the study duration. For PD >7 mm, both groups were similar at baseline with very little change during the study period; a similar effect was observed for knowledge scores. The MRCA, controlled regulation and autonomy regulation scores for both groups at baseline were similar. For motivation and autonomy, the BMI group's mean scores remained slightly higher over duration of the study.

Table 1. **Demographics of participants in experimental and control groups**

	BMI (SD) (*n* = 29)	TOHE (SD) (*n* = 27)	Total (SD) (*n* = 56)	*P*
Age	62.9 (10.4)	61.0 (11.6)	61.9 (11.0)	0.516
Gender				
Male	15 (52%)	12 (44%)	27 (48%)	0.586
Female	14 (48%)	15 (56%)	29 (52%)	
Ethnicity				
Caucasian	22 (76%)	18 (66%)	40 (71%)	0.615
African American	5 (17%)	7 (26%)	12 (21%)	
Hispanic	1 (3%)	1 (4%)	2 (4%)	
Asian	1 (3%)	–	1 (2%)	
Other	–	1 (4%)	1 (2%)	
Education				
Some high school	–	1 (4%)	1 (2%)	0.319
High school graduate	8 (28%)	4 (15%)	12 (21%)	
Some college or College graduate	21 (72%)	22 (39%)	43 (77%)	
Tobacco use				
Non-smoker	24 (83%)	21 (78%)	45 (80%)	0.639
Smoker	5 (17%)	6 (22%)	11 (20%)	
Periodontal case type				
Case type III	18 (62%)	15 (56%)	33 (59%)	0.621
Case type IV	11 (38%)	12 (44%)	23 (41%)	
Number of teeth				
Baseline	25.2 (2.7)	25.2 (3.6)		0.952
12 weeks	25.0 (3.1)	25.2 (3.6)		0.820

Table 2. **Descriptive data for outcomes**

	Baseline mean (SD)	6-week follow-up mean (SD)	12-week follow-up mean (SD)
BOP scores			
TOHE	55 % (18)	40 % (19)	36 % (20)
BMI	50 % (18)	31 % (14)	33 % (15)
Plaque index			
TOHE	2.6 (0.5)	2.2 (0.4)	2.3 (0.7)
BMI	2.4 (0.6)	1.9 (0.6)	2.1 (0.7)
Pockets 4–6 mm			
TOHE	23.3 (23.1)	18.9 (19.9)	16.1 (21.4)
BMI	23.8 (15.8)	23.5 (19.0)	20.3 (15.0)
Pockets>7 mm			
TOHE	1.8 (6.9)	2.7 (11.8)	1.4 (5.7)
BMI	2.0 (4.1)	1.7 (3.0)	1.7 (3.9)
OHKQ knowledge scores			
TOHE	7.9 (2.0)	7.3 (2.2)	7.8 (1.6)
BMI	7.5 (1.9)	7.9 (2.3)	7.3 (1.3)
MRCA motivation scores*			
TOHE	41.9 (6.5)	42.3 (6.9)	42.6 (6.3)
BMI	46.2 (5.4)	45.1 (5.9)	45.8 (5.8)
TSRQ self-regulation scores			
Control*			
TOHE	26.7 (6.3)	26.1 (7.8)	26.7 (7.3)
BMI	27.1 (8.0)	26.4 (8.5)	27.3 (8.1)
Autonomy*			
TOHE	30.2 (4.2)	29.1 (6.9)	29.8 (3.4)
BMI	31.3 (4.4)	31.2 (5.8)	32.6 (3.0)

*MRCA (motivation), TSRQ-C (control) and TSRQ-A (autonomy) are computed as mean scores on 7-point Likert scales. Knowledge scores were summed correct scores based on a total of 13 items.
BMI, brief motivational interviewing; BOP, bleeding on probe; MRCA, motivation/readiness/confidence to adhere; OHKQ, oral health knowledge questionnaire; TOHE, traditional oral health education; TSRQ, Treatment Self-Regulation Questionnaire.

The control scores did not change for either group during the study.

Results for the mixed regression and Poisson model analyses are displayed in Table 3. For the primary outcome variable BOP, there was no interaction effect for Intervention Group over Time, nor main effect of Intervention Group ($P = 0.84$ and 0.26, respectively). There was, however, a statistically significant decrease in BOP over time, irrespective of group ($P = 0.001$). Analysis of the means showed BOP reduced 19% in the TOHE group and 17% in the BMI group. Results were similar for PI, with a statistically significant reduction observed over time, irrespective of group ($P = 0.019$). There was no significant main effect for Intervention Group ($P = 0.390$) nor differential effect of Intervention Group over Time (Group × Time interaction $P = 0.752$).

For change in 4–6 mm PD, there was a statistically significant interaction of Intervention Group over Time ($P = 0.006$) favouring the TOHE. There was also a main effect of Time for PD 4–6 mm ($P = 0.0001$) with 4–6 mm pockets decreasing from baseline, 6 weeks and 12 weeks in both groups. There was no significant main effect for Intervention Group ($P = 0.777$). In PD >7 mm, there were no significant changes between Groups, over Time, nor interaction between Intervention Group over Time ($P = 0.844$, 0.200 and 0.869, respectively).

Table 3. **Mixed-effect regression models: effect of intervention, and time on outcome measures**

Outcome BOP*	Coef	SE	*P*
Intervention group (TOHE reference)	−6.91	6.18	0.263
Time period (baseline reference)	−9.21	1.74	0.001
Interaction: groups × time†	0.48	2.37	0.840
Constant	62.3	4.5	
Outcome plaque*	**Coef**	**SE**	***P***
Intervention group (TOHE reference)	−0.19	0.22	0.390
Time period (baseline reference)	−0.14	0.06	0.019
Interaction: groups × time†	−0.03	0.08	0.752
Constant	2.7	0.2	
Outcome 4–6 mm Pockets*	**IRR**	**95% CI**	***P***
Intervention group (TOHE reference)	0.93	(0.57, 1.52)	0.777
Time period (baseline reference)	0.82	(0.77, 0.88)	0.0001
Interaction: groups × time†	1.12	(1.03, 1.22)	0.006
Outcome >7 mm Pockets*	**IRR**	**95% CI**	***P***
Intervention group (TOHE comparison)	1.20	(0.21, 6.83)	0.844
Time period (baseline reference)	0.89	(0.74, 1.06)	0.200
Interaction: groups × time†	1.02	(0.79, 1.33)	0.869
Outcome motivation*	**Coef**	**SE**	***P***
Intervention group (TOHE reference)	4.40	2.0	0.260
Time period (baseline reference)	0.41	0.50	0.399
Interaction: groups × time†	−0.60	0.66	0.364
Constant	41.7	1.42	
Outcome autonomy*	**Coef**	**SE**	***P***
Intervention group (TOHE reference)	0.41	1.80	0.820
Time period (baseline reference)	−0.18	0.56	0.752
Interaction: groups × time†	0.80	0.77	0.297
Constant	30.1	1.30	

n for full models: 163 observations on 56 participants.
*Risk ratios were computed using the incident risk ratio (IRR) equation.
†Intervention over time.
BOP, bleeding on probing; CI, confidence index; Coef, coefficient; SE, standard error; TOHE, traditional oral health education.

The results for motivation (MRCA), controlled (TSRQ-C) and autonomous (TSRQ-A) motivation did not show any significant effects for Intervention Group, Time, nor Intervention Group over Time interaction for any of these outcomes. Both groups began and ended the study with approximately the same level of knowledge, autonomy and controlled regulation.

Discussion

The results did not support our primary hypothesis that a single BMI session compared with TOHE alone would differentially improve participant's periodontal clinical measures, motivation for oral health behaviours or knowledge. None of the interactions (differential effect of Intervention over Time) for clinical measures (BOP, PI, 4–6 mm PD, >7 mm PD) were significantly different. Moreover, changes in other outcomes suggest that the intervention did not produce differential increases in motivation, autonomy or knowledge. Irrespective of group assignment, all subjects demonstrated improved BOP.

These results differ from other studies that explored the effectiveness of MI in adults (34–36). Almomani showed a statistically significant improvement in oral hygiene following a single BMI intervention; however, the target population in this study was individuals with severe and persistent mental illness who were not usual consumers of dental services. While these subjects showed a continuing trend for decreasing plaque scores over time (compared with traditional education), their results also showed that the MI group had an increase in introjected motivation (guilt-related motivation) that may have resulted in short-term gains. It is likely, given this type of motivation that the improved outcomes in the Almomani study may be more transient beyond the 2-month time frame in which participants were observed.

In contrast, Jonsson and colleagues (35, 36) demonstrated superiority of MI for improving periodontal parameters in a population of newly referred periodontal patients, and their effect was maintained over a 2-year period. Jonsson's study, however, used multiple exposures to the MI procedures in addition to multiple 'practice sessions' and 'relapse prevention' strategies. This sustained intervention along with the inclusion of newly referred patients, rather than patients with long-standing, poorly controlled periodontitis, may have increased the effectiveness of the MI intervention in that study. The BMI approach used in the current study was a segmented 15-minute intervention at a time separate from traditional education and periodontal maintenance visit and appears not to have been of sufficient intensity for poorly controlled periodontal patients who may be more resistant to behaviour change.

Additional research is needed to determine the optimal 'dose' of MI that produces the most improvement in periodontal populations with greatest efficiency. Although the repeated nature of PM visits affords the opportunity for multiple interventions and Jonsson and colleagues were able to achieve excellent results, the feasibility of implementing this intensive intervention in a traditional fee-for-service environment is dubious. Currently, there is no mechanism in third-party payment systems for reimbursing clinicians for preventive counselling at this intensive level. Until studies demonstrate conclusively that an optimal amount of BMI can actually reduce dental morbidity and related expenditures, BMI will undoubtedly be underutilized in the private sector.

Although our intervention failed to enhance motivation, it is notable that participants in both groups improved on their periodontal clinical measures. The observed improvement across both groups may be due to subjects who were motivated to help the examiner accomplish what they believed were the goals of this study. The lack of improvement on our theoretically relevant measures of motivation indicates the improvement was not related increased internalized motivation.

In interpreting the findings from this study, a number of limitations should be considered. First, although the MI counsellor was experienced, the use of a single counsellor raises the possibility that results may have been due to characteristics of this particular counsellor. In addition, although the study was powered based on prior research, the relatively small sample size may not have been sufficient to detect more modest treatment effects. A future study with independent subjects may eliminate some of the bias of the subjects wanting to help and please the examiners. Forthcoming studies should consider varying the duration of the MI contact to determine the appropriate 'dose' of MI that achieves maximum periodontal control over time. Finally, it should be noted that this convenience sample from an academic health centre clinic is likely quite different from patients who seek care in private dental practice. Therefore, generalizing these results back to a typical population of periodontal patients may not be scientifically indicated.

Adoption of MI in dental and dental hygiene education is currently in its infancy. As curricula continue to adopt evidence-based patient-engagement strategies, such as BMI, there will be additional opportunities to explore the effectiveness MI in multiple populations to improve oral health outcomes.

Conclusion

Based on the outcomes of this study, a single session of BMI in a population of poorly controlled periodontal patients is insufficient to improve oral health behaviours beyond that which is achievable from traditional oral hygiene.

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Conflict of interest

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