



Effectiveness of brief motivational interviewing on perceived importance, interest and self-efficacy of oral health behaviors: A randomized clinical trial[☆]

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ABSTRACT

Objective: To investigate periodontal patients' perceived importance, interest and self-efficacy of oral hygiene (OH) behaviors.

Methods: Secondary outcomes from a randomized single-site examiner-blinded clinical trial investigated the control group (traditional oral hygiene instructions) and the test group (brief motivational interviewing) over four time points. Analyses were performed using R version 4.1.1.

Results: Sixty participants were eligible, and 58 completed the pre and post questionnaires for a 97% response rate. Importance was higher in the test group for good oral health and daily oral self-care (4.86 vs. 4.80). Interest in taking care of teeth and gums and changing a homecare routine was higher in the test group (4.89). Self-efficacy was higher in the test group for taking care of teeth and gums (4.18 vs. 4.07), making a change to improve oral health (4.29 vs. 4.27), and maintaining a change long-term (4.32 vs. 4.17). Statistical significance for self-efficacy was achieved for maintaining an OH behavior long-term.

Conclusion: A brief motivational interviewing intervention was superior to enhance perceived importance, interest and self-efficacy of oral hygiene behaviors.

Innovation: Contrary to previous motivational interviewing research, this study used a novel approach to evaluate MI-fidelity to determine the most effective MI strategies to support self-efficacy.

1. Introduction

There is a complex relationship between the lifestyle of an individual and the behavior change process. The Transtheoretical Model (TTM), also known as the Stages of Change acknowledges that most individuals are indecisive about changing their behavior and due to complex internal and external barriers, behavior change is not quick [1]. To maintain a lifelong positive behavior change, an individual may go through the Stages of Changes (Fig. 1) process many times because of barriers, lack of intrinsic motivation, and ambivalence for change [1].

In dentistry, traditional oral hygiene instructions (OHI) enhance knowledge, but the nature of advice-giving does not support sustained lifelong behavior change [2-4]. Motivational interviewing (MI) is a patient-centered counseling approach to support patient autonomy through the exploration of ambivalence and evocation of intrinsic motivation to build self-efficacy (SE) for a behavior change [4]. Self-efficacy is a fundamental component of sustained behavior change [4]. Motivational interviewing has been

adopted as a communication approach to support changing behaviors that increase the risk of oral diseases [2,3,5-11]. Further, a derivative of MI, brief-motivational interviewing (BMI) has been used in dentistry due to providers having limited time to support behavior change during patient care [2,3,7,12,13]. However, both MI and BMI research have focused on clinical outcomes with mixed results of significance compared to traditional OHI delivered through advice-giving [2,5-10]. Arnett et al. suggested MI research should pivot away from clinical outcomes and focus on the patient experience [3]. While another study, Tellez et al. revealed clinical outcomes do not assess the impact of patient education on the individual's SE for a behavior change [14].

Building patient SE encompasses the shared decision making process between the patient and the provider. Self-efficacy is an integral component of MI and BMI to engage and support a patient to focus on a specific behavior change [1,4,15-17]. Woelber et al. found SE in oral hygiene (OH) behaviors showed a positive impact on reducing disease indicators of periodontitis in periodontal patients [17]. According to Chen and

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Precontemplation	The patient does not believe the behavior has an impact on their health, nor are they planning to change a behavior.
Contemplation	The patient has some awareness that their behavior has consequences on their health.
Determination	The patient has made a commitment to make a positive behavior change.
Action	The patient believes they have the ability to change their behavior and is taking actions to change a behavior that impacts their health.
Relapse	The patient resorts back to prior habits/behavior that has a negative impact on their health.
Maintenance	The patient is able to resist temptations of prior poor behaviors that had a negative impact on their health and well-being.

Fig. 1. Stages of change [1].

colleagues, SE is required for behavior change and behavior change maintenance, despite the level of intrinsic motivation [16]. Further, Woelber and colleagues reported periodontal patients had higher SE after education sessions with MI-trained dental students [18]. Arnett et al. emphasized the significance of patient-provider trust and rapport during MI patient education to reduce clinical markers of periodontal disease [3]. The role of the provider and continuous support via MI-adherent strategies may have an impact on patients SE. To sustain lifelong behavior change, patients need SE to take action and maintain a positive behavior change to resist a relapse.

Research has explored interventions based on the TTM and MI for behavior change for psychiatric patients, management of diabetes, adherence to antiretroviral medications, suicide, and depression [19-23]. Anastopoulou and colleagues used a TTM framework and MI intervention to improve nutritional behaviors of psychiatric patients [19]. This study found the MI intervention to be effective in moving patients through the Stages of Change [19]. Selçuk-Tosun et al. applied a TTM-based MI intervention to enhance the development of SE for behaviors of exercise, medication compliance, and positive nutritional habits in type 2 diabetic individuals [20]. Another TTM MI study investigated the management of depression in hospitalized patients with coronary heart disease and results showed higher SE and faster progression through the stages of change when utilizing two 20-minute sessions with MI-trained nurses [21].

An important aspect to investigate SE with a TTM-based MI intervention is to determine fidelity to ensure MI-adherence and integrity of the MI counselor. Global scores capture the philosophy of the "Spirit of MI" to build rapport and trust for the patient-provider relationship and enhance patient autonomy [24]. Behavior counts record the frequency of MI techniques for MI-adherence and non-MI-adherence [25]. Motivational interviewing fidelity is necessary to confirm MI-adherence in clinical trials, validity of the behavioral intervention, and is also a mechanism for MI training, coaching, and feedback [24-26]. There is limited evidence on MI counselor's MI fidelity rating as it relates to patients' importance, interest and SE of OH behaviors.

To date, a BMI intervention with a TTM framework of periodontal patients' perceived importance, interest, and SE of oral self-care has not been investigated. Further, the impact of MI fidelity on periodontal patients' importance, interest and SE of oral self-care has been limitedly explored. Investigating this gap in the literature is relevant because adopting a positive behavior change and building SE of OH behaviors may reduce the risk and prevalence of periodontitis. According to the National Health and Nutrition Examination Survey (NHANES), 42.2% of United States (US) adults have periodontitis [27]. Periodontitis is an inflammatory disease that destroys the hard and soft tissues that support the dentition, may result in tooth loss, and the prevalence increases with age [27,28]. Periodontitis is a multifactorial disease; however OH of bio-film removal is a foundational skill and positive behavior for the prevention of disease progression [27,28].

The purpose of this study was to investigate periodontal patients' perceived importance, interest, and SE of OH behaviors in BMI and traditional OHI groups. In addition, to identify the impact of MI fidelity on periodontal patients' importance, interest and SE of OH behaviors in the BMI group. This study had three specific aims: 1) assess the effectiveness of BMI and traditional OHI in enhancing periodontal patients' perceived importance and interest of OH behaviors, 2) evaluate the effectiveness of BMI and traditional OHI in enhancing periodontal patients' perceived SE for OH behaviors and 3) determine the impact of MI fidelity on periodontal patients' importance, interest and SE of OH behaviors.

2. Methods

Secondary outcomes were investigated of periodontal patients' perceived importance, interest and SE from a single-site, randomized examiner-blinded clinical trial (STUDY00003697) approved by the University of Minnesota (UMN) Institutional Review Board (IRB) and registered with [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT03571958). A convenience sample of 60 participants from the UMN School of Dentistry (SOD) in the periodontal maintenance phase of treatment completed a pre and post questionnaire during the clinical trial investigating BMI sessions compared to traditional. A power analysis for the clinical trial determined 30 participants per group would have an 80% power to detect an effect size of 0.74 using a two-group t-test at the 0.05 level of significance.

2.1. Instruments

There was no known validated or reliable questionnaire to measure a BMI intervention and the association of periodontal patients' perceived importance, interest and SE. The principal investigator and three co-investigators used the TTM (Stages of Change) as a framework for survey development (Fig. 1) [1]. The importance and interest questions were developed to measure the precontemplation, contemplation and determination stages. The SE questions were developed to measure the action and maintenance stages. The importance, interest and SE questions on the post questionnaire were developed to measure all stages including the relapse stage. The initial pre and post questionnaires was pilot tested by six UMN SOD dental hygiene faculty with experience and knowledge on the topic. Modifications were made from the pilot test feedback and reviewed by the developers to confirm face validity that the developed instrument met the aims of the study.

The final questionnaires included demographic information of age, gender, race, and highest level of education was collected. The 21-item pre questionnaire included four questions on frequency of professional dental examinations and periodontal maintenances and frequency of OH (brushing and interdental cleaning). Four questions on perceived general health, oral health, oral OH skills, and diet. Four questions on perceived importance of good oral health, professional dental examinations and

periodontal maintenance, and OH. Three questions to determine interest in OH and improving or changing OH. Three questions on perceived SE of current OH, improving or maintaining OH.

The 25-item post questionnaire included the two questions from the pre questionnaire on frequency of OH (brushing and interdental cleaning). The same questions from the pre questionnaire on perceived general health, oral health, OH skills and diet were included. The questions addressing perceived importance of good oral health, professional dental examinations and periodontal maintenance, and OH were asked again on the post questionnaire. The questions on perceived interest in OH, improving or changing OH and perceived SE of current OH, improving or maintaining OH were included in the post questionnaire. Additionally, six questions were asked to determine the participant's perceived interaction with the dental hygiene MI provider.

2.2. Recruitment and randomization

Participants for the clinical trial were identified for recruitment using a dental management software (axiUm, Exan; Las Vegas, NV). Dental charts were pre-screened for inclusion criteria. Participants who met the inclusion criteria were mailed an invitation letter. Following the invitation letter, a follow-up phone call utilizing a phone script was made 2-3 weeks later to recruit participants. Recruitment fliers were also posted on each floor of the UMN SOD for interested individuals to volunteer to be pre-screened for eligibility. A total of 184 charts were pre-screened and 65 candidates were eligible for a screening visit. The eligibility criteria for the clinical trial is provided in Table 1. Eligible participants were screened for by the principal investigator and enrolled if they met the inclusion criteria and no exclusion criteria. All participants were given the option to opt out of participation at any time during the study. Research activities took place at the UMN SOD Oral Health Clinical Research Center (OHCRC). Enrolled participants were randomized to either the control (traditional OHI) or test (BMI) group using the International Business Machines Statistical Package for the Social Sciences (SPSS). The principal investigator concealed the key of the allocated participants from the blinded examiner.

Table 1
Inclusion, exclusion, premature exclusion and participant withdrawal.

Inclusion Criteria	
•	Male or Female
•	≥ 18 years old
•	Periodontal maintenance phase (at least one year)
•	Plaque score ≥ 30% (O'Leary plaque score)
•	Minimum of two sites with BOP
•	Willingness to fulfill all study requirements
•	Patient of Record at the University of Minnesota School of Dentistry
Exclusion Criteria	
•	Current smoker or quit smoking less than one year
•	Pregnant, planning to become pregnant, or unsure of pregnancy status (self-reported)
•	Uncontrolled diabetes (HbA1C > 7)
•	Medical conditions that may influence the outcome of the study (neurologic or psychiatric disorders, systemic infections, cancer, and/or HIV/AIDS)
•	Current use of oral bisphosphonates
•	History of IV bisphosphonates
•	Require pre-medication or on long-term antibiotics
•	Current orthodontic treatment or planning to begin orthodontic treatment during the study
•	Unable to comply with the study protocol
Premature Exclusion Criteria/ Participant Withdrawal	
•	The researcher believes that it is not the best interest of the participant to stay in the study
•	If the participant becomes ineligible to participate based on the exclusion criteria
•	If the participant's medical condition requires interventions which preclude involvement in the study (examples: radiation therapy, chemotherapy, or pre-medication)
•	If the participant does not follow study related instructions
•	The study is suspended or canceled
•	Numerous missed, canceled, or broken research visits

2.3. Intervention

The principal investigator facilitated the control and test group assigned OHI session at four time points over a one year period. Both control and test group OHI sessions were audio recorded. The control group received traditional OHI (tell-show-do) customized to their plaque score, bleeding on probing (BOP) and gingival index (GI). The test group received OHI utilizing BMI strategies measured by global scores and behavior counts customized to their interest to reduce plaque score, BOP and GI. The test (BMI) group participants were asked two standardized open-ended questions to gauge their interest in their plaque score and ask permission to proceed. The principal investigator is an experienced licensed dental hygienist and MI-trained. The principal investigator's training included MI workshops held for the dental hygiene faculty at the University of Michigan SOD (2016), the UMN SOD (2018), and she completed a 2-day training course with a motivational interviewing treatment integrity (MITI) MI trainer (2019). In addition, the principal investigator teaches MI curriculum at the UMN SOD and has published numerous MI studies in peer-reviewed journals and has presented the topic at national dental conferences.

The blinded examiner disseminated the control and test group pre questionnaire at visit 1 baseline (V_1) and the post questionnaire at visit 4 (V_4). The time points between V_1 and V_4 was approximately one year (12 month recall \pm one month from V_1) for both the traditional OHI (control) and the BMI (test) group. The blinded examiner was an experienced licensed dental hygienist and the dental hygiene clinical director in the Bachelor of Science program and director of the Master of Science in dental hygiene program at the UMN SOD.

2.4. Outcomes

Primary outcomes for this clinical trial including plaque score, BOP and GI over one year are provided in a prior publication [3]. Secondary outcomes of perceived importance, interest and SE of OH behaviors in BMI and traditional OHI groups were measured with a pre and post questionnaire. The MI Treatment Integrity Coding Manual 4.2.1 (MITI 4.2.1) was used to measure MI fidelity including global scores and behavior counts [21]. Global scores evaluate the MI counselors overall ability in four dimensions: 1) cultivating change talk to encourage and build confidence; 2) softening sustain talk to evoke change by overcoming barriers and ambivalence; 3) partnership to understand and support autonomy; and 4) empathy to understand patient's perspectives [21]. Behavior counts measured giving information; persuade (with or without a questions); reflections (simple or complex); affirm; collaboration; autonomy; and confront [21]. Persuade without permission and confront are non-MI-adherent behavior counts [21]. Behavior counts were modified with permission to only include open questions, affirmations, reflections, and summaries (OARS), importance/confidence ruler, give information with permission, and emphasizing autonomy. Recorded test (BMI) group sessions were coded for global scores and modified behavior counts using the MITI 4.2.1 [25]. Processes to calibrate and confirm MI fidelity is reported in a prior publication [3]. Global scores included: partnership, empathy, change talk, and sustain talk on a 5-point Likert-scale [25]. Operational definitions are provided in a prior publication [3].

2.5. Statistical analysis

Analyses were performed using R version 4.1.1. Demographic characteristics were summarized using counts and rates or means (M) and standard deviations (SD). Pre and post questionnaire items were summarized using M, SD, and compared between groups using the two sample *t*-test. Global scores were compared across V_1 - V_4 using linear mixed-effects models. Behavioral counts were compared across visits using mixed-effects negative binomial models for count data. Average M of MI session V_1 - V_4 and behavior counts calculated on the number of times each MI technique was used in the MI session for MI-adherent was analyzed. Spearman correlation coefficients between MI group post questionnaire and global

scores and behavioral counts (average V₁-V₄) compared to the specific aims of importance, interest and SE were analyzed.

3. Results

A total of 65 participants were recruited and consented, 60 participants were eligible, and 58 completed the pre and post questionnaires for a 97% response rate. Fig. 2 provides the participants enrolled and included in data analysis. Recruitment began in September 2018 and concluded in August 2019. Research visits occurred September 2018 and data collection for the last participant enrolled ended September 2020. Table 2 provides the demographic information of the participants. The average age of both test and control participants was >60 years of age. The test group gender ratio was similar (male n = 13, female n = 14) and the control group had more men compared to women (male n = 20, female n = 10). The majority of the participants reported ethnicity was White (control n = 29, test n = 25).

The average M and SD for both groups pre and post questionnaire are provided in Table 3. Importance was higher on a 5-point Likert scale for the post-questionnaire in the test group compared to the control group for good oral health (4.86 vs. 4.80), professional cleanings (4.96 vs. 4.90), and daily oral self-care (4.79 vs. 4.77). Interest in taking care of your teeth and gums was higher for the test group (4.89) compared to the control group (4.77) post-questionnaire. Interest in changing a homecare routine was higher in the test group (4.32) compared to the control group (4.17) post-questionnaire. Self-efficacy was higher for the test group post-questionnaire compared to the control group for confidence in taking care of their teeth and gums (4.18 vs. 4.07), confidence in making a change to improve their oral health (4.29 vs. 4.27), and confidence in maintaining a change in homecare routine long-term (4.32 vs. 4.17). Regarding interest in discussing homecare routine or other health behavior changes with an

Table 2
Demographics.

Category	Control = 30	Test = 28
Age Mean (SD)	66.60 (9.43)	63.54 (10.75)
Gender n (%)		
Male	20 (66.7)	14 (50.0)
Female	10 (33.3)	14 (50.0)
Ethnicity n (%)		
White	29 (96.7)	25 (89.3)
Black/African American	1 (3.3)	0 (0.0)
Hispanic/Latino	0 (0.0)	0 (0.0)
Native American/American Indian	0 (0.0)	0 (0.0)
Asian/Pacific Islander	0 (0.0)	2 (7.1)
Other	0 (0.0)	1 (3.6)
Highest Level of Education n (%)		
Some High School	0 (0.0)	0 (0.0)
Graduated High School	1 (3.3)	0 (0.0)
Some College	6 (20.0)	9 (32.1)
Associates Degree	7 (23.3)	3 (10.7)
Bachelor Degree	7 (22.6)	9 (32.1)
Master Degree	9 (30.0)	5 (17.9)
Doctorate Degree	0 (0.0)	2 (7.1)

oral health care provider in the future on the post-questionnaire tended to be higher in the test group than the control group (4.78 vs. 4.43, p = 0.06).

Fig. 3 includes global scores and behavioral counts V₁-V₄. The average global scores on a 5-point Likert scale were high (partnership 4.54, empathy 4.44, change talk 4.35, and sustain talk 4.68). Behavior counts were calculated on the number of times each MI technique was used in the MI session for MI-adherence. The most frequent behavior counts for MI-adherent during test group BMI sessions were affirmations (3.51) and reflective listening (3.25). Asking permission (2.46) and open questions

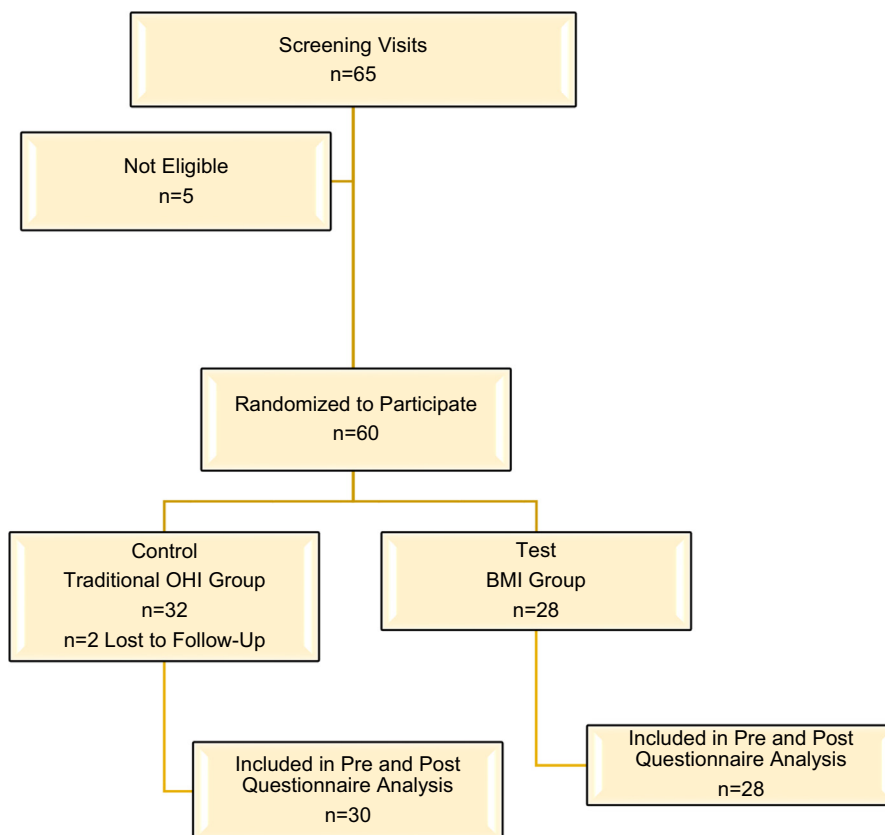


Fig. 2. Participants enrolled and included in data analysis.

Table 3
Mean and standard deviation by group pre and post questionnaire.

Question	Control		Test	
	M (SD)	M (SD)	M (SD)	M (SD)
	Pre	Post	Pre	Post
Importance				
How often do you brush your teeth?	3.20 (0.92)	3.37 (0.61)	3.36 (0.83)	3.36 (0.78)
How often do you clean between your teeth (floss, floss picks, tooth picks, interdental brushes, water flosser, or another homecare aid)	3.80 (1.06)	3.90 (1.09)	3.32 (1.22)	3.93 (1.02)
How important is good oral health to you?	4.77 (0.43)	4.80 (0.61)	4.79 (0.42)	4.86 (0.36)
How important are regular dental check-ups to you?	4.63 (0.67)	4.77 (0.63)	4.71 (0.66)	4.71 (0.66)
How important is it to you to have your teeth professionally cleaned?	4.87 (0.43)	4.90 (0.31)	4.82 (0.61)	4.96 (0.19)
How important is it for you to clean your teeth daily?	4.70 (0.65)	4.77 (0.57)	4.75 (0.44)	4.79 (0.50)
Interest				
How interested are you in taking care of your teeth and gums?	4.59 (0.68)	4.77 (0.43)	4.75 (0.59)	4.89 (0.31)
How interested are you in changing your homecare routine?	4.34 (0.81)	4.17 (0.93)	4.25 (0.65)	4.32 (0.61)
Self-Efficacy				
How confident are you in taking care of your teeth and gums?	3.83 (1.15)	4.07 (0.83)	3.71 (0.81)	4.18 (0.82)
How confident are you in making a change to improve your oral health?	4.30 (0.79)	4.27 (0.78)	4.32 (0.86)	4.29 (0.90)
How confident are you in <u>maintaining</u> a change in your homecare routine long-term?	4.27 (0.83)	4.17 (0.95)	4.14 (0.85)	4.32 (0.82)
Participant Perceptions				
How would you rate your general health?	4.07 (0.96)	3.97 (0.89)	4.11 (0.69)	3.89 (0.63)
How would you rate your oral health?	3.10 (0.90)	3.43 (0.97)	2.96 (0.79)	3.43 (0.79)
How would you rate your homecare skills (brushing & flossing) to remove plaque from your teeth?	2.86 (0.95)	3.33 (1.03)	3.29 (0.71)	3.75 (0.80)
How often did you feel your dental hygienist took a personal interest in your oral health needs?	--	5.00 (0.00)	--	5.00 (0.00)
How often did you feel your dental hygienist supported your own motivation for your specific oral health goals?	--	5.00 (0.00)	--	5.00 (0.00)
How interested are you in discussing your homecare routine or other health behavior changes with an oral health care provider in the future?	4.48 (0.69)	4.43 (0.77)	4.50 (0.64)	4.78 (0.51)

*Control versus Test: Statistical significance <0.05.

(2.71) followed as most frequently used. Summarizing was used 1.96 times, with autonomy used 1.46 times, and the readiness ruler used the least (0.38).

Table 4 provides the Spearman correlation coefficients between MI post questionnaire and global scores and behavior counts. Positive correlations indicate that higher MI fidelity for an item was associated with higher responses to the survey question. For the four categories of global scores, partnership was associated with increased post questionnaire responses for four of the six importance items and all of the interest and SE items. Empathy was associated with increased post questionnaire response for all of the importance items and statistical significance was achieved for importance of regular dental check-ups and for daily OH. Empathy achieved statistical significance for interest in taking care of their teeth and gums and changing their homecare routine. Empathy achieved statistical significance of SE in making a change to improve oral health and participants' interest in discussing their homecare routine or other health behavior changes with an oral health care provider in the future. Change talk was associated with increase for four of the six importance items and all of the interest and SE post questionnaire items. No statistical significance was achieved for change talk. Sustain talk was associated with increase for all importance, interest and SE post questionnaire items. Statistical significance was achieved for importance of regular check-ups, interest in taking care of their teeth and gums and changing their homecare routine. Statistical significance for SE was achieved for maintaining a change in their homecare routine long-term.

Behavior count positive correlations for open questions were obtained for five of the six importance items and all of the interest items on the post questionnaire. No positive correlations were achieved for open questions to enhance SE. Positive correlations of affirmations were achieved for five of the six importance items, all of the interest items, and two of the three SE items on the post questionnaire. Reflective listening achieved positive correlations for all post questionnaire items of importance, interest and SE. Summarizing achieved positive correlations for five of the six importance items, one of the interest and one of the SE post questionnaire items. The readiness ruler achieved positive correlations for three of the six importance items, one of the interest and one of the SE post

questionnaire items. Asking permission achieved positive correlations for five of the six importance items with statistical significance for regular check-ups and daily oral self-care; interest in changing their homecare routine; and SE in making and maintaining a homecare change long-term.

4. Discussion and conclusion

4.1. Discussion

The discrepancy in positive clinical outcomes poses a challenge to know which patient education method (traditional OHI or BMI) results in a behavior change to reduce indicators of periodontal disease. This study sought to investigate a BMI intervention with a TTM framework to measure perceptions of importance, interest and SE of periodontal patients. In addition to determine the impact of MI fidelity on perceptions of importance, interest, and SE. Using metrics to measure importance and interest may shed light on how to initiate a periodontal patient's precontemplation and contemplation Stages of Changes. Whereas, building SE may enhance a periodontal patient in the determination, action, and maintenance Stages of Change.

In this study, perceived importance for interdental OH, interest in taking care of their teeth and gums and changing OH routine was higher for BMI participants compared to traditional OHI. These findings indicate the BMI participants moved from the precontemplation to the contemplation Stage of Change from pre to post questionnaire. It is necessary for an individual to believe their behavior impacts their health (precontemplation) and have awareness that non-compliance of OH behaviors have a negative impact on periodontal status (contemplation) to reach the determination Stage of Change [1]. Tellez et al. reported an MI intervention was reliable for OH education for White geriatric patients [14]. This study's sample was unintentionally similar to Tellez et al. and also found higher importance, interest and SE in the BMI group. This is a promising finding to support BMI as the superior education approach for behavior change for older adults.

Self-efficacy is required for a periodontal patient to commit to an OH regimen, take action and maintain behaviors to reduce relapse [1]. In this

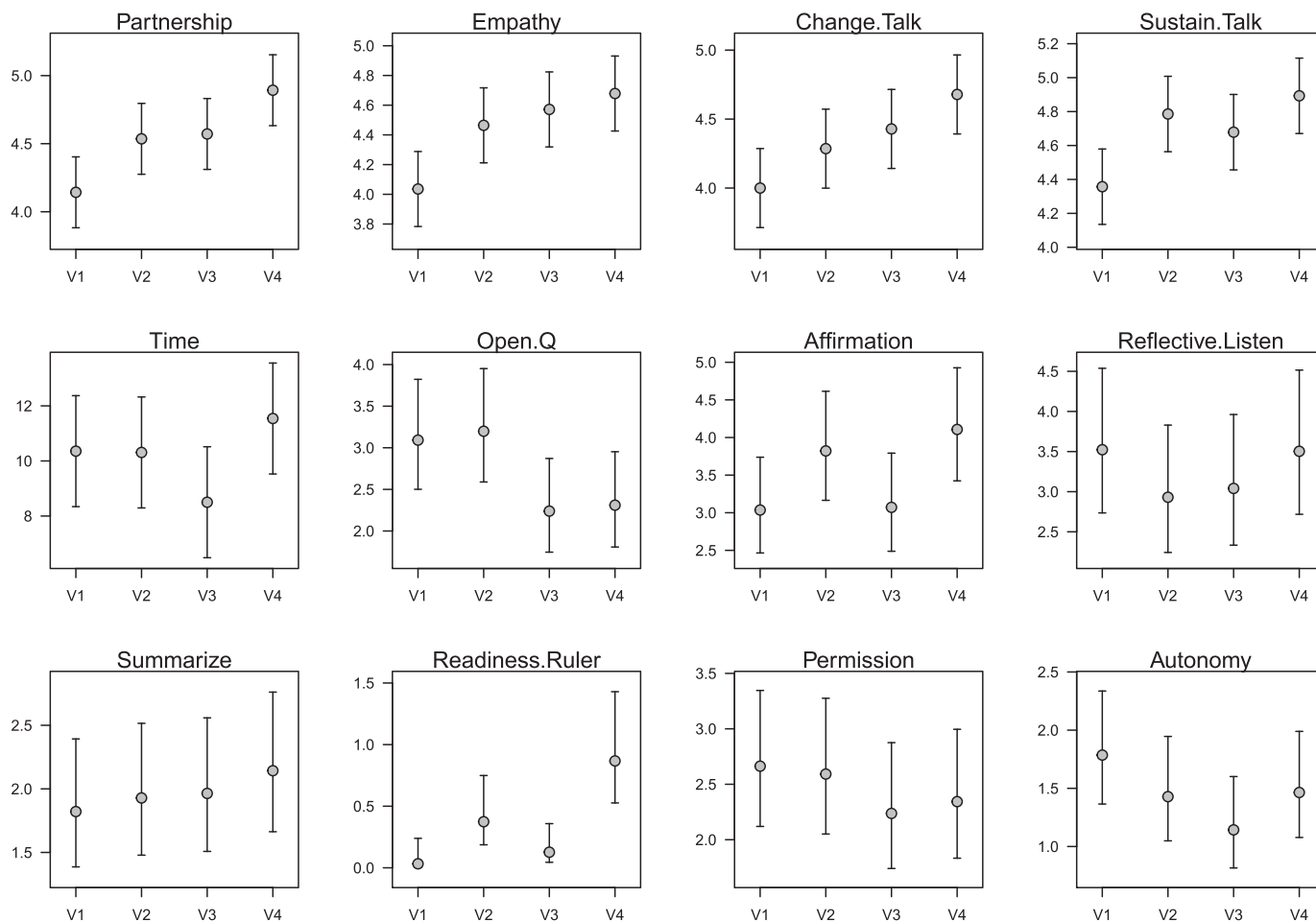


Fig. 3. Global scores and behavioral counts V1-V4.

study, BMI participants had increased SE from pre to post questionnaire for confidence in taking care of their teeth and gums and maintaining a change in OH long-term. Whereas, the traditional OHI group SE decreased over-time. These findings validate the current evidence that advice-giving tactics do not support a life-long positive behavior change, which is essential for prevention of disease progression [2-4]. Similar to Woelber et al. who reported positive OH SE to importance of oral health; this study also noted increased importance for good oral health, dental check-up, professional cleanings, and daily oral self-care in the BMI group [17]. In addition, the BMI group had an increased interest in taking care of their teeth and gums, and changing a homecare routine. Further, SE was higher for the BMI group in all three questionnaire items. An interesting reported finding by Woelber et al. is that women had a higher SE of OH in their study that was consistent with prior evidence [17,29]. In this study, gender did not have an impact on SE; however, the BMI intervention was found to have a positive influence on perceived SE. This is important to note as males have a higher prevalence of indicators of periodontal disease [27]. Increased SE for improved OH behaviors from a BMI intervention may reduce the rate of progression of periodontitis.

Historically, MI and BMI interventions have been cited in the literature for enhancing SE; however specific MI strategies have not been identified [14-17]. This is the first study to the authors knowledge to identify specific MI strategies that can be implemented in a BMI session (5-10 minutes) to build and maintain SE. This study found building a partnership, demonstrating empathy, and evoking change talk increased SE. These components are essential to demonstrating the Spirit of MI [4]. Arnett et al. reported the significance of the provider-patient relationship to demonstrate the Spirit of MI to enhance the “patient experience;” consequently impacting patient compliance and SE [3]. In regards to specific MI strategies to increase SE,

this study found that affirmations, reflective listening, and summaries are the three MI strategies to implement in a BMI session to enhance periodontal patients perceived importance, interest, and SE. It is noteworthy that asking open-ended questions are necessary for a provider to demonstrate these three MI strategies. Further, asking permission to elicit information is a key aspect in supporting patient autonomy and SE.

MI and BMI research emphasizes asking permission, but there was a lack in evidence-based metrics to support this approach. This study used the MITI 4.2.1 as a coding system for MI practice to identify the global scores that are most effective to enhance perceived importance, interest and SE. In addition to how many times an MI behavior count needs to be used to result in improved SE overtime. This study found an average of 2-3 OARS in one BMI session resulted in higher importance, interest and SE from pre to post questionnaires. This is a relevant finding because time constraints are reported as a major barrier to implementing MI in a dental setting [2,3,12,13]. Arnett et al. suggested implementing OARS, while following the elicit-provide-elicite technique of “asking permission” to support patient autonomy during BMI sessions [3]. The findings of this study align with the application of OARS resulting in increased importance, interest and SE for OH behaviors.

Limitations include self-reported perceptions and a sample of periodontal patients from a single U.S. dental school that cannot indicate generalizability to all periodontal patients. In addition, questionnaires with face validity to measure perceived importance, interest and SE. The pre and post questionnaires were not compared to clinical primary outcomes because the focus of this research was periodontal patients’ perceptions of their oral health and OH behaviors. Future research should include the OHIP-5, a reliable and validated instrument to measure oral health-related quality of life to the existing instrument used in this study to

Table 4

Spearman correlation coefficients between MI group post questionnaire and global scores and behavioral counts (average V1-V4).

Question	Global scores				Behavioral counts					
	Partnership	Empathy	Change talk	Sustain change talk	Open questions	Affirmations	Reflective listening	Summarize	Readiness ruler	Permission
Importance										
How often do you brush your teeth?	0.00	0.34	-0.02	0.11	0.35	0.12	0.02	0.09	0.10	0.14
How often do you clean between your teeth (floss, floss picks, tooth picks, interdental brushes, water flosser, or another homecare aid)	-0.10	0.01	0.15	0.14	0.27	0.32	0.09	0.02	-0.05	0.00
How important is good oral health to you?	0.00	0.34	0.06	0.24	0.24	0.24	0.15	0.09	0.03	0.22
How important are regular dental check-ups to you?	0.25	0.54*	0.24	0.41*	0.00	0.17	0.31	0.15	-0.08	0.44*
How important is it to you to have your teeth professionally cleaned?	-0.07	0.16	-0.14	0.01	0.14	-0.24	0.10	-0.32	-0.21	-0.04
How important is it for you to clean your teeth daily?	0.26	0.49*	0.32	0.37	-0.08	0.29	0.25	0.21	0.12	0.39*
Interest										
How interested are you in taking care of your teeth and gums?	0.15	0.37*	0.22	0.39*	0.19	0.19	0.33	0.00	-0.02	0.27
How interested are you in changing your homecare routine?	0.24	0.41*	0.26	0.43*	0.04	0.16	0.26	0.28	0.07	0.52*
Self-Efficacy										
How confident are you in taking care of your teeth and gums?	0.31	0.31	0.09	0.13	-0.15	-0.17	0.12	-0.16	0.10	0.26
How confident are you in making a change to improve your oral health?	0.27	0.53*	0.24	0.36	-0.07	0.13	0.17	-0.02	-0.14	0.50*
How confident are you in <u>maintaining</u> a change in your homecare routine long-term?	0.36	0.34	0.25	0.49*	-0.17	0.12	0.17	0.16	-0.11	0.55*
Participant Perceptions										
How would you rate your general health?	-0.04	-0.12	-0.33	-0.31	-0.12	0.01	-0.36	-0.16	0.40*	-0.20
How would you rate your oral health?	0.07	0.00	-0.16	-0.22	-0.20	-0.10	-0.24	-0.33	0.04	-0.16
How would you rate your homecare skills (brushing & flossing) to remove plaque from your teeth?	-0.04	0.18	-0.09	0.10	-0.37	-0.02	0.00	-0.10	0.08	-0.19
How interested are you in discussing your homecare routine or other health behavior changes with an oral health care provider in the future?	0.08	0.42*	0.18	0.27	0.12	0.02	0.26	-0.13	-0.07	0.26

*Positive correlations indicate that higher MI fidelity for an item was associated with higher responses to the survey question; statistical significance <0.05.

evaluate a BMI intervention on patient experiences. Longitudinal research is needed to determine if a BMI intervention that includes OARS continues to maintain SE for OH behaviors. Furthermore, the frequency of BMI interventions need to be explored to maintain long-term SE for periodontal patients.

4.2. Innovation

This study used an innovated approach to pivot away from observed clinical outcome measures and focus on periodontal patients' perceived importance, interest and SE of OH behaviors. Building SE is a foundational approach to support patients' through the Stages of Change and life-long positive behavior change for disease prevention. Contrary to previous MI research, this study used a novel approach to evaluate MI-fidelity to determine the most effective MI strategies to support SE. The identification of the effectiveness of MI strategies has been a gap in MI medical and dental research.

The methods of this study identified the Spirit of MI enhanced partnership and empathy to evoke change talk, consequently increasing SE to advance individuals through the Stages of Change. Of the eight MI strategies, the application of OARS with the combination of asking permission were the most effective to initiate importance, interest and SE for OH behaviors. This study is the first to use novelty outcomes to contribute to the body of knowledge in MI research to support patients' SE to improve OH behaviors that may ultimately reduce indicators of periodontitis.

5. Conclusion

The outcomes of this study identified a BMI intervention was superior to enhance periodontal patients' self-reported perceived importance, interest and SE of OH behaviors to reduce indicators of periodontitis compared to

traditional OHI. The utilization of OARS, specifically affirmations and reflective listening increased SE. Evaluation of a BMI-TTM based intervention on periodontal patients' may be optimal to measure perceived importance, interest and SE of oral health and OH behaviors instead of observation of clinical outcomes.

Declaration of Competing Interest

I know of no conflict of interests associated with this publication, and there has been no financial support for this work that could have influenced its outcomes. As Corresponding Author, I confirm that the manuscript has been read and approved for submission by all the named authors and there are no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pecinn.2022.100092>.

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