IMPROVING ORAL HYGIENE IN ADOLESCENT ORTHODONTIC PATIENTS WITH SBIRT-BASED INTERVENTION

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ABSTRACT

Objective: The aim of this study was to determine the effectiveness of an SBIRT-modeled intervention on improving oral hygiene in adolescent orthodontic patients with fixed appliances.

Methods: A prospective, randomized trial was designed to evaluate the effectiveness of an SBIRT-inspired strategy aimed at improving oral hygiene. Subjects were recruited from patients undergoing orthodontic treatment at the Temple University Kornberg School of Dentistry, Department of Orthodontics. The subjects were in the permanent dentition, and were being treated with full fixed appliances in both arches. Subjects were screened for caries risk, and individuals with moderate-high risk for caries were allocated randomly to either a control (traditional oral hygiene instruction) or intervention (SBIRT protocol) group. Plaque (PI) and gingival index (GI) scores were collected at baseline (T_0), 1-2 month follow-up (T_1), and 3-4 month follow-up (T_2). At the T_1 follow-up, those non-responsive to the intervention were referred for treatment by a hygienist. Subjects also completed a pre- and post-intervention survey to evaluate change in homecare habits and self-assessment of hygiene.

Results: A total of 25 (15 female, 10 male) patients were recruited for the study and had baseline (T_0) data collected. The majority of the sample was female (60.0%) and African American (68.0%), and the average age of the sample was 13.6±1.5 years. Regarding caries risk, 64.0% were classified as high risk, while 36.0% had moderate risk. No significant differences in baseline scores were observed between the two trial arms for key demographics. Of the initial 25 subjects, 19 (7 control, 12 intervention) had T_1

data collected. The mean PI and GI scores for both groups improved from T_0 to T_1. There were greater differences between T_0 to T_1 for the SBIRT group when compared to the control: PI improved 0.36±0.44 for the intervention group and 0.18±0.45 for the control group; GI improved 0.50±0.28 for the intervention group and 0.09±0.37 for the control group. Brushing and flossing frequency also increased for both groups.

Conclusions: The SBIRT intervention group had greater improvement in oral hygiene than traditional oral hygiene instruction after a 1-2 month follow up. An MI protocol for improving oral hygiene in adolescent patients undergoing fixed orthodontic treatment shows promise in changing patient behaviors and outlook in regards to oral health. However, due to small sample size and significant loss to follow-up as a result of school and clinic closures due to the novel coronavirus (SARS-Cov-2), a more extensive study with a larger sample size is necessary to definitively prove the effectiveness of MI in improving oral hygiene.

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CHAPTER 1

INTRODUCTION

Maintaining good oral hygiene during orthodontic treatment is an important, yet difficult, objective for both the orthodontist and patient. Orthodontic appliances increase the number of retentive areas, promoting a greater accumulation of plaque, and contributing to environmental changes that can result in greater concentrations of acid-producing bacteria (Balenseifen & Madonia 1970; Zachrisson & Zachrisson 1971). Plaque, if not removed, is the primary etiologic factor for several adverse conditions, such as the development of chronic hyperplastic gingivitis, periodontal breakdown, enamel decalcification or white spot lesions, and even carious lesions (Zachrisson & Zachrisson 1971; Atack et al. 1996). While for the majority of patients the gingival change is transient and resolves after appliance removal (Atack et al. 1996), when oral hygiene is neglected during orthodontic treatment, there can be destructive and progressive irreversible periodontal breakdown (Zachrisson 1974; Ristic et al. 2007). Plaque accumulation with orthodontic appliances poses an even greater threat to the enamel integrity in the form of demineralization, a condition less likely to resolve after it develops. White spot lesions can occur within six months of appliance placement (Tanner et al. 2012). These unaesthetic decalcifications are a widespread problem, reportedly affecting 23-89% of patients (Richter et al. 2011; Julien at al. 2013; Luccchese & Gherlone 2013). Risk of developing a white spot lesion during orthodontic treatment increases with poor oral hygiene (Julien at al. 2013; Sundararaj et al. 2015). When patients with poor oral hygiene show no explicit improvement in homecare after having

been properly notified and counseled, discontinuation of orthodontic treatment is recommended (Zachrisson & Zachrisson 1971). It is estimated that 5%–10% of orthodontic patients do not complete treatment due to poor oral hygiene (Mehra et al. 1998). As such, poor patient compliance in the form of poor oral hygiene can lead to not only permanent irreversible damage to the dentition and periodontium, but it can also interfere with obtaining a successful orthodontic treatment result.

Orthodontists are in unique position to affect a meaningful positive change in patients because patients are seen on a systematic, recurrent basis over an extended period of time (Clark 1976; Ukra et al. 2011). Moreover, orthodontists primarily treat adolescent patients during critical stages of their psychological development (Ukra et al. 2011). Adolescents have suboptimal manual ability and low motivation regarding oral hygiene maintenance (Rigau-Gay et al. 2018), and tend to present with greater levels of plaque and a higher incidence of gingivitis than adults (Acharya et al. 2011). So while maintaining good oral hygiene among adolescents undergoing orthodontic treatment poses a greater problem, it also presents a greater opportunity for orthodontists to stimulate a significant and lasting impact. It is generally accepted that measures should be taken to improve patient oral hygiene during orthodontic treatment (Zachrisson & Zachrisson 1971; Huang et al. 2018; Cerroni et al. 2018); however, orthodontists' attempts to reinforce good oral hygiene to patients are often unsuccessful (Richter et al. 2011). Conventional education is insufficient (Rigau-Gay et al. 2018), and often requires frequent repeating or reinforcement (Acharya et al. 2011; Marini et al. 2014). Motivational interviewing (MI) is an interventional method different from traditional oral hygiene instruction techniques that is used to achieve sustained behavioral changes in

patients (Miller & Rollnick 2009; Rigau-Gay et al. 2018). MI has shown some promise in its use in orthodontics (Rigau-Gay et al. 2018; Cozzani et al. 2016); however current systematic reviews of the literature demonstrate that evidence on the effect of MI on improving periodontal health is contradictory and inconclusive (Cascaes et al. 2014; Gao et al. 2014). Screening, Brief Intervention, and Referral to Treatment (SBIRT) is an intervention approach that was originally developed by behavioral scientists to address substance abuse problems, but like MI, has potential in its application to address problematic oral health behaviors (Cuevas & Chi 2016). SBIRT incorporates both prevention and treatment to improve oral health outcomes, and coordinates three steps: risk assessment through universal screening, delivery of a brief intervention immediately after screening, and then referral to a health professional for individuals non-responsive to the brief intervention (Cuevas & Chi 2016). There have been few studies in the dental field that examine the effectiveness of the SBIRT in improving oral health, and the strategy has yet to be applied in the orthodontic setting. Improving patient oral hygiene during orthodontic treatment stands to better overall patient well-being and health, but also to enhance the standards of orthodontic care.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Oral Health Implications of Orthodontic Treatment

Bacterial plaque is the major etiologic factor in the initiation and progression of both dental caries and periodontal conditions such as gingivitis and periodontitis (Atack et al. 1996). Orthodontic appliances increase the number of retentive areas around the dentition and gingival tissues, which can promote a greater accumulation of this bacterial plaque (Ristic et al. 2007; Clark 1976). The presence of more retentive areas also makes it more difficult for patients with fixed appliances to maintain proper oral hygiene (Bishara & Ostby 2008). While gingival changes are transient for the majority of orthodontic patients and resolve after appliance removal, when oral hygiene is neglected during orthodontic treatment, there can be destructive and progressive irreversible periodontal breakdown (Zachrisson 1974; Ristic et al. 2007). Ristic et al. (2007) observed the clinical and microbiological changes that occur after fixed appliance placement in adolescents aged 12-18. They found that all clinical parameters, defined by plaque index (PI), gingival index (GI), gingival bleeding index (BOP), and periodontal probing depths (PPD), increase after placement of the appliances, reaching a maximum at 3 months, followed by a decrease during the 6-month period of observation after. Their microbiological investigation for presence of periodontopathic anaerobes (*P. intermedia*, *A. actinomycetemcomitans*, *P. gingivalis*, *F. nucleatum*) exhibited a similar pattern, which shows that worsening periodontal health and inflammation is closely connected with the number of periodontopathic anaerobes in the subgingival plaque (Ristic et al.

2007). These patterns of periodontal changes in response to fixed appliances are supported by other authors. Jan van Gastel et al. (2008, 2011), Liu el al. (2011), and Ghijselings et al. (2014) all showed increases in various periodontal parameters after orthodontic appliance placement. In addition to the conclusion that orthodontic fixed appliances tend to increase periodontal inflammation and the presence of periodontal pathogens, the consensus is that these reactions are the consequences of gingival response only and not the result of deterioration of deeper periodontal tissues. This means that the periodontal changes tend to be reversible, and that proper maintenance of oral hygiene during fixed orthodontic treatment can preclude permanent periodontal damage (Cerroni et al. 2018).

Damage to the enamel, in the form of white spot lesions (WSLs), on the other hand is less likely to resolve after it develops. White spot lesions can occur within six months of appliance placement (Tanner et al. 2012), but have also been reported to appear as soon as 4 weeks into treatment (Ogaard et al. 1988). Orthodontic patients develop significantly more WSLs than non-orthodontic patients, and if left untreated, these decalcifications may progress to cavitated lesions, and at minimum present significant esthetic problems (Bishara 2008). The reported prevalence of WSLs varies greatly, with studies publishing statistics anywhere from 5% to 97% (Gorelick et al. 1982; Boersma et al. 2005). A recent meta-analysis by Sundararaj et al. that included data from 14 studies reported an incidence of 45.8% and a prevalence of 68.4% (Sundararaj et al. 2015). In that same study, certain factors were found to increase WSL incidence, such as poor oral hygiene, younger age of the patient at the start of treatment, male gender, and duration of the treatment. Salivary flow and preventive fluoride therapy throughout

treatment were considered protective against WSLs (Sundararaj et al. 2015). Due to the high prevalence and irreversible nature of these lesions in orthodontic patients, it is widely accepted that measures should be taken to prevent and counter the risk of developing WSLs. These measures may include fluoride treatments and/or improving patient oral hygiene techniques.

2.2 Prevention and Treatment of Orthodontic Enamel Demineralization

Several preventive measures and treatment modalities for WSLs have been suggested in the literature. A 2013 Cochrane Review looked at prevention of WSLs during fixed orthodontic treatment using fluoride-containing products, and found moderate evidence that fluoride varnish applied in 6-week intervals is an effective preventive measure against WSLs, but claimed that future studies are needed for definitive conclusions (Benson et. al 2013). A recent systematic review and meta-analysis acted as a follow-up to the Cochrane Review, and looked at several methods of WSL prevention in a total of 24 papers. This study suggested that active patient reminders and flat surface sealants and fluoride varnish around orthodontic brackets are associated with reduced WSLs, but they also concluded that further, high-quality, research is needed (Tasios et al. 2019). A study in 2012 looked at effectiveness of MI Paste Plus and PreviDent fluoride varnish in patients who already completed active orthodontic treatment and had developed WSLs. There were improvements in WSL appearance; however the authors found no significant differences between the treatment groups and the control group, which received no fluoride treatment (Huang et al. 2012). As WSLs

are a precursor to cavitated lesions, understanding caries risk for an individual patient can be an important screening tool in the prevention and management of dental caries.

2.3 Caries Risk Assessment

Caries Risk Assessment (CRA) tools have emerged as the main paradigm for managing and evaluating treatment and oral health interventions as they help identify individuals at high and moderate risk of developing caries and can reduce the potential redundancy of services for those at low risk (Halasa et al. 2019). Typically, past caries experience is the most accurate single predictor in defining future caries risk (Majare et al. 2014), but there are several CRA models in use today: DMFT/dmft, CAMBRA, AAPD, BCH, CARIOGRAM, and the ADA models, some of which are separated by age groups, above or below 5-6 years of age. Results have been mixed regarding the sensitivity and specificity of these various CRA tools (Halasa et al. 2019; Kutsch et al. 2014). Halasa et al. (2019) compared these CRA models and found substantial variation in the proportion of children categorized as having low, moderate, and high level. A 2006 American Dental Association panel stated that while "there is no single system for caries risk assessment shown to be valid and reliable…there is evidence that dentists can use simple clinical indicators to classify caries risk status that is predictive of future caries experience." The ADA CRA model consists of identifying known risk factors for an individual patient and noting any disease indicators (Kutsch et al. 2014). A patient is considered to be at a low risk for caries in the absence of moderate- or high-risk factors and at a high risk for caries when at least one high-risk factor is present or if the overall score exceeds nine (ADA 2011). High-risk factors are consumption of more than the

recommended daily sugar intake; have serious difficulty hearing, seeing, concentrating, walking, dressing or bathing, or doing errands alone; caries or previous experience with dental diseases; and/or use prescription drugs causing low salivary flow. Moderate risk patients are those with presence of plaque; no regular oral health care (have not visited a dentist in the past 6 months for routine dental examination); and/or no fluoride exposure. Low risk patients are those that use fluoride toothpaste; are given prescription fluoride drops or fluoride tablets; brush teeth twice a day; and have regular oral health care (have visited a dentist in the past 6 months for routine dental examination).

2.4 Traditional Oral Hygiene Instruction Techniques

As bacterial plaque is the major etiologic factor in both periodontal issues and dental caries, prevention of periodontal breakdown and formation dental caries should be based on careful plaque control (Zachrisson 1974). Current forms of advice-giving by the dental health professional and other oral health education approaches appear to be unpredictable in accomplishing long-term changes (Ramseier & Suvan 2010). This lack of efficacy can lead to further frustration of both the patient and the clinician, as oral hygiene fails to improve despite seemingly appropriate counselling. It is generally accepted that measures should be taken to improve patient oral hygiene during orthodontic treatment (Zachrisson & Zachrisson 1971; Huang et al. 2018; Cerroni et al. 2018); however, orthodontists' attempts to reinforce good oral hygiene to patients are often unsuccessful (Richter et al. 2011). According to Rigau-Gay (2018), conventional education has so far proven insufficient, and often requires frequent repeating or reinforcement. In 2011, Acharya et al. conducted a study comparing the effect of three

different motivational techniques on oral hygiene of patients undergoing fixed orthodontic treatment. The first method of oral hygiene motivation was with conventional plaque control measures using disclosing tablets and instruction stressing plaque removal and the horizontal scrubbing technique. The second method of oral hygiene motivation consisted of education regarding the acidic nature of dental plaque and a demonstration with an indicator dye that changes color in the presence of acid, in addition to the conventional plaque control measures employed in the first group. The third method of hygiene motivation involved showing the patient live motile bacteria in their own plaque under a microscope, in addition to the conventional plaque control measures employed in the first group (Acharya et al. 2011). All patients received a prophylaxis after baseline plaque and gingival indices were recorded, and all patients were instructed to brush three times daily, for 5 minutes at a time, with a 1000ppm fluoride toothpaste. The authors observed improvements in plaque scores in all groups, but with a significant difference noted in the third group at six months. There were no significant differences between the groups for gingival scores at six months. The study concluded that the various motivational techniques resulted in improvement in the gingival health over a period of 6 months after placement of fixed orthodontic appliances, and that a phase contrast microscope may be an effective motivational tool for maintaining oral hygiene (Acharya et al. 2011). The practicality of implementing a contrast microscope as an oral hygiene motivational tool may preclude its use in practice, but of note in the Acharya paper is their assertation that dental plaque removal needs to be reinforced at regular intervals as it shows relapse to baseline values, if not reinforce at timely intervals, a claim further supported by Marini et al. in their 2014 study on effects of repeated oral hygiene

motivation. In their double-blinded, randomized clinical trial, treatment subjects were divided into four groups: powered toothbrush or manual toothbrush with OHI and motivation at baseline and 4 week intervals, or OHI and motivation only at baseline (Marini et al. 2014). The motivational technique employed in Marini's study was one-on-one instruction with a registered dental hygienist (RHD), who explained dental plaque's composition and effect on oral health, while also performing chairside plaque removal using and indicator solution to show the quantity and location of the dental plaque. The results of this study showed that the reduction in PI scores for the groups that received repeated OHI was significantly higher compared to the groups that only received OHI at baseline, regardless of the use of manual or electric toothbrush (Marini et al. 2014). In 2018, Huang et al. conducted a systematic review and meta-analysis on many of these motivational techniques in the orthodontic patient, and they concluded that the orthodontist must put in additional efforts to motivate patients to maintain good oral hygiene throughout treatment (Huang et al. 2018). Despite various promising methods for improving oral hygiene, there still is a need for a more definitive technique for changing patient behavior and improving oral hygiene in patients receiving fixed orthodontic treatment.

2.5 Motivational Interviewing

Motivational interviewing (MI) is an interventional method different from traditional oral hygiene instruction techniques, and it is used to achieve sustained behavioral changes (Miller & Rollnick 2009; Martins & McNeil 2009). MI is a way of communicating with others that is both collaborative and person-centered in order to

elicit change and strengthen motivation for change (Naar-King & Suarez 2011). It was originally developed as a behavioral technique for treating substance abuse (Miller et al. 1980), but MI has also been applied in the areas of diet and exercise, diabetes, and oral health (Martins & McNeil 2009). Systematic reviews looking at MI application across the entire dental field show mixed results and inconclusive effectiveness (Cascaes et al. 2014; Gao et al. 2014). The use of MI techniques has shown promise in improving oral hygiene practices in periodontal patients (Kopp et al. 2017) as well as tackling the problem of early childhood caries (ECC) (Ismail et al. 2011; Saengtipbovorn 2017; Colvara et al. 2018). In Kopp et al.'s systematic review, they identified five studies that looked at the effectiveness of MI on periodontal therapy success. They concluded that MI seems to have a positive influence on oral hygiene, periodontal inflammation, and psychological oral hygiene factors, yet this was based on limited and relatively weak data (Kopp et al. 2017). Saengtipbovorn (2017) demonstrated in a well-designed, randomized, double-blinded controlled trial that MI intervention targeting parents does has a protective effect against early childhood caries (ECC), and Colvara et al. (2018) came to similar conclusions in their study. However, Batliner et al. showed no difference in oral health outcomes between the intervention and control groups in the prevention of ECC (Batliner et al. 2018). Very few studies have looked at the application of motivational interviewing in the orthodontic patient, but in 2018, Rigau-Gay et al. conducted a randomized controlled trial to test the effectiveness of MI on improving oral hygiene in these types of subjects. They enrolled 130 Caucasian patients, aged 12-25 years, with fixed appliances in the first 6 months of treatment, who were then randomized to the control (CG) or intervention (IG) group. The study showed an immediate positive effect of a single MI

session that lasted 10-20 minutes on average. There was a decrease in plaque and gingival indices at a 1-month follow-up, which remained stable throughout the 6-month period of the study (Rigau-Gay et al. 2018). While it is important to note that the orthodontic population studied here was considered to have a high motivational level at baseline, and the clinician providing the MI session was highly trained, it still suggests potential of applying MI for better oral health, especially within the time constraints of a typical orthodontic visit. A short investment of time that produces satisfactory results with long-term beneficial effects is also a central theme of a similar behavioral change concept: SBIRT.

2.6 SBIRT – Screening, Brief Intervention, and Referral to Treatment

Screening, Brief Intervention, Referral and Treatment (SBIRT) is an additional alternative to traditional oral hygiene instruction tactics, and is described as a comprehensive, integrated, public health approach to the delivery of early intervention and treatment services for at-risk individuals (McCance-Katz & Satterfield 2012). SBIRT is heavily based on motivational interviewing techniques and theories, and was also originally developed by behavioral scientists to address substance abuse problems. SBIRT consists of three parts (Cuevas & Chi 2016), beginning with risk assessment using screening tools or assessments. The second step is delivery of a brief intervention to those individuals identified as higher-risk to help promote behavior change. The brief intervention may be delivered by a health professional or a lay person, for example, a dentist, physician, nurse, hygienist, assistant, community health worker, but it should be based on a health behavior theory or model (Cuevas & Chi 2016). The final component

is referral to a health professional for treatment of individuals who are non-responsive to the brief intervention. Therefore, SBIRT incorporates both prevention and treatment into its model. The brief interventions rely on the same themes and principles as motivational interviewing such as autonomy, collaboration, and evocation in addition to expressing empathy, developing discrepancy, rolling with resistance, and supporting self-efficacy (Miller & Rollnick 2009; Naar-King & Suarez 2011). However, in contrast with traditional MI, which tends to occur in approximately 45-minute sessions, brief interventions are defined as those that could be effective while only lasting 5 to 15 minutes during a regularly scheduled appointment (Ramseier & Suvan 2010).

Very few studies have applied SBIRT in the dental health setting. Cuevas & Chi (2016) reviewed the literature to identify SBIRT-based interventions aimed at improving health behaviors associated with dental caries (i.e. diet, fluoride exposure, dental care use) and reducing caries rates. Their search resulted in seven studies that incorporated various components of the SBIRT model. Only one study by Binkley et al. (2011) included all three of the SBIRT components, and they identified this as one of the first published studies describing a dental intervention based on the SBIRT model (Cuevas & Chi 2016). In that study, researchers implemented a 45–60 minute SBIRT-based intervention to improve dental utilization rates and found a significant increase in dental care use for children in the intervention group compared to those in the control group (Binkley 2011). In addition to the Binkley et al. study, Cuevas & Chi (2016) also identified one study that incorporated the screening and brief intervention components only, two studies that looked at the effect of brief intervention only, and three studies that included the brief intervention and referral to treatment portions of the SBIRT model. Of

those studies, two were non-randomized studies that showed improved dental utilization and caries rates; and four were randomized controlled trials where three showed no change between intervention and control groups, and one showed improved fluoride varnish use and decreased caries rates (Cuevas & Chi 2016). Despite challenges to implementing SBIRT interventions, such as disruptions to clinical workflow, limited support from clinic staff, and lack of reimbursement by insurance companies for behavior change services, Cuevas & Chi (2016) concluded that there is great potential for SBIRT interventions to be implemented within clinical practice. These opportunities to effect change in a short period of time may fit well into an orthodontic treatment setting, where the majority of appointments tend to be 15 minutes or less.

2.7 The Orthodontist's Role in Affecting Oral Hygiene Behaviors

Orthodontists are in unique position to affect a meaningful positive change in patients because patients are seen on a systematic, recurrent basis over an extended period of time (Clark 1976; Ukra et al. 2011). The majority of patients treated orthodontically are seen at 6-week intervals for 18-24 months, and according to the American Association of Orthodontist's Economics of Orthodontists/Patient Census Survey, over two-thirds of patients treated are between the ages of 8-17 years old (AAO 2017). Working with adolescents and young adults presents with unique challenges and opportunities during a period of substantial growth and development (Naar-King & Suarez 2011). Maintaining oral hygiene among adolescents undergoing orthodontic treatment poses a greater problem as this age group exhibits a higher level of supragingival plaque and a higher incidence of gingivitis than adults (Acharya et al.

2011). Therefore, the orthodontist is poised in a position of great potential for eliciting significant positive changes in a patient population that is in great need.

CHAPTER 3

AIMS OF THE INVESTIGATION

The aim of this study was to determine the effectiveness of a Screening, Brief Intervention, and Referral to Treatment (SBIRT)-modeled intervention on improving oral hygiene in adolescent orthodontic patients with fixed appliances by comparing differences in plaque and gingival scores and changes in oral hygiene perceptions and habits. If this study can demonstrate that after a brief motivational interviewing session, there is a significant difference in plaque and gingival scores between control and intervention groups, it could support the incorporation of SBIRT into daily orthodontic practice for improving patient oral hygiene for adolescents.

The null hypothesis for this study was that there would be no difference in plaque and gingival scores between the two trial arms after a brief intervention of a single 10 to 15 minute motivational interviewing session.

CHAPTER 4

MATERIALS AND METHODS

4.1 Inclusion, Exclusion Criteria, and Enrollment

Adolescent patients receiving comprehensive orthodontic treatment at the Temple University Kornberg School of Dentistry Orthodontic clinic were eligible for participation in the study. Subjects were enrolled at their regularly scheduled appointment. The inclusion and exclusion criteria are defined as follows:

Inclusion criteria:

- Age 11-17
- Permanent dentition
- Moderate-High Caries Risk as per the ADA's guidelines
- Currently receiving comprehensive fixed orthodontic treatment (upper and lower arches bonded with fixed appliances ≥ 4 weeks)
- No significant medical history

Exclusion criteria:

- Non-English speaking
- Expected to deband within 6 months

Patients were recruited to the study either at their consult appointment, bonding appointment, and if they arrived 30 minutes early to an adjustment appointment. If the patient was enrolled in the study at their consult or bonding appointment, they were asked to arrive 30 minutes prior to their first scheduled adjustment, which was scheduled for at least 4 weeks after the bonding

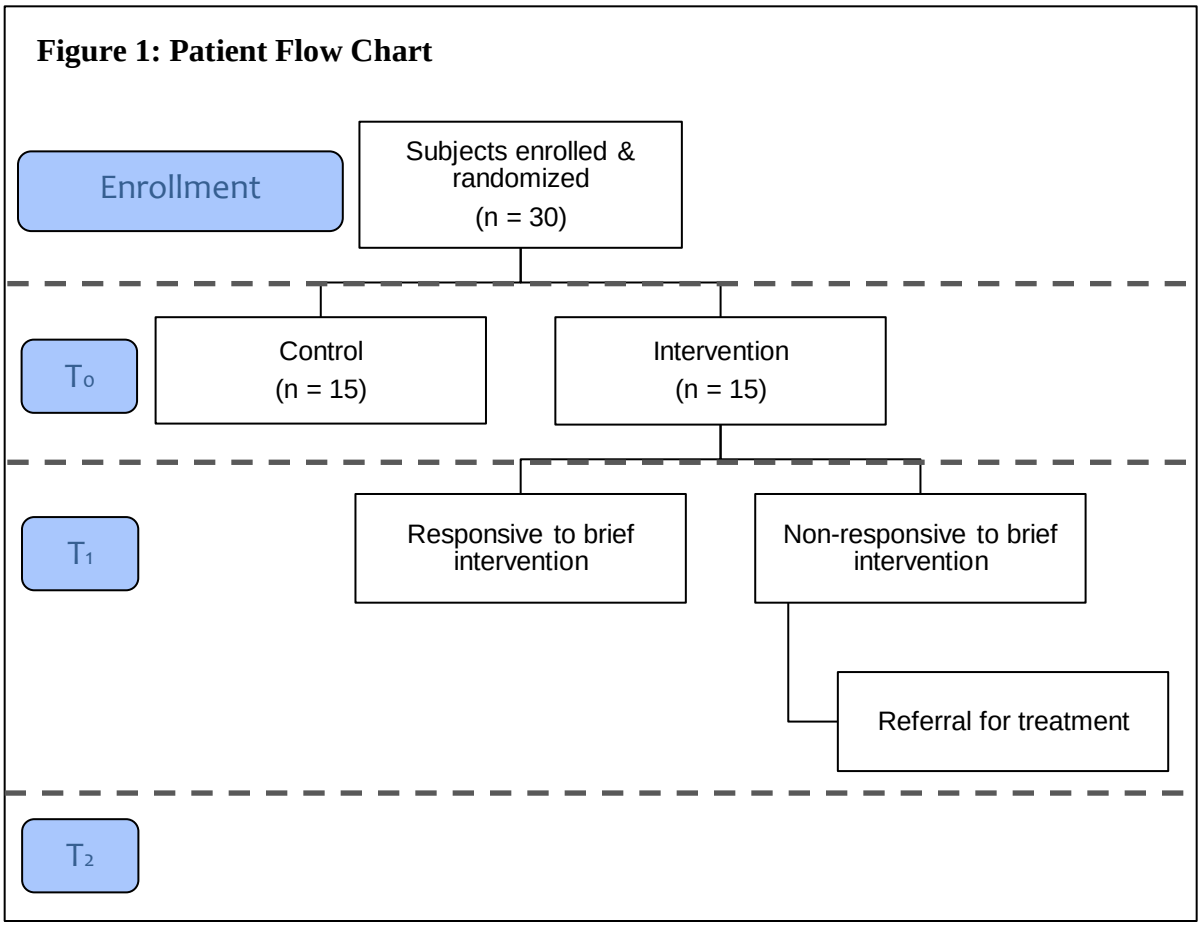
appointment. At the time of enrollment, consent was obtained from the subject's parent and assent was obtained from the patient. Subjects were offered entry in a raffle for one $250 gift card in exchange for their participation in the study. Subjects were screened for caries risk using the ADA Caries Risk Assessment form (Appendix A).

The subjects' consenting parent completed a Section A of the questionnaire (Appendix B), which recorded demographic data. Subjects completed Section B of the questionnaire, which recorded subjects' current oral hygiene habits, in the form of brushing and flossing frequency, and self-assessment on hygiene importance and efficacy.

Thirty subjects were to be recruited for the study, obtained as a convenience sample and randomized into either the control or intervention group. Those subjects in the intervention group would further be categorized based on improvements in PI and GI scores at the first follow-up, T_1. Intervention subjects who did not show improvement would be referred to a hygienist for treatment. Figure 1 illustrates the planned protocol patient flow.

The protocol of this study was reviewed and approved by the Institutional Review Board of Temple University in August 2019. Study ID No. 25952. The "resident investigator" was a second-year orthodontic resident of the Temple University Kornberg School of Dentistry, Department of Orthodontics. The "clinic psychologist" was an Assistant Professor at the Temple University Kornberg School of Dentistry, who also served as an advisor to the current study.

Figure 1: Patient Flow Chart



4.2 Patient Consent & Confidentiality

After obtaining consent from parent and assent from patient, each participating subject was linked to a unique identification number assigned by the principal investigator. The participants' confidentiality was protected, survey data collected was confidential, and all data was kept on a password-protected and encrypted file, on a password-protected computer. Participants' names and identifying information was not revealed in the presentation or publication of any results from the study. Any paper documentation of data collection did not include any patient identifiers, and was stored in a secured location.

4.3 Research Methodology and Strategy

Patients were screened for eligibility based on all inclusion/exclusion criteria prior to their regularly scheduled orthodontic appointment. If the patient satisfied the inclusion/exclusion criteria, they were asked to enroll in the study (consent from parent and assent from patient). Those that chose to enroll in the study completed the questionnaire, developed by the resident investigator, which contained ten items related to demographics, answered by the parent; and five items related to self-assessment of efficacy and importance of oral hygiene completed by the subject (see Appendix B). T_0 took place 30 minutes prior to the patient's first adjustment appointment after enrolling in the study. At this time, the subjects had their plaque indices (PI) and gingival indices (GI) recorded (see Appendix C) to represent baseline values (T_0). The subjects were then randomly assigned, by computer-generated randomized list, to the control or intervention group. The orthodontic resident conducting the study did not have access the randomization list, and the subjects were not assigned to a study group until after the baseline PI and GI scores were recorded. The Orthodontic Administrative Coordinator and two of the research advisors had access to the randomization list and provided the subject assignment when the resident requested it after completing the T_0 data collection. Subjects in the control group were advised that they need to improve their OH, but received no formal instruction. Subjects assigned to the intervention group received a brief (10-15-minute) MI-based intervention (see Appendix D, for script) performed by the orthodontic resident conducting the research study. At the subsequent adjustment appointment (T_1), 4-6 weeks later, all subjects, including controls, had their plaque and gingival indices logged again. Subjects that received the brief intervention that did not

show significant improvement in their plaque and gingival scores were referred to their general or pediatric dentist for a cleaning with the hygienist. The patients were counselled on the importance of making the hygiene appointment. At the following appointment, 4-6 weeks after T_1, PI and GI were recorded again (T_2), and it was determined if the patients who were referred for treatment followed up with the recommended hygiene appointment. All subjects, including controls, also completed Section B of the questionnaire (Appendix B) at the end of the third visit, which represented the end of the study.

4.4 Treatment Fidelity

In order to ensure quality control regarding the treatment intervention, The orthodontic resident conducting the research study had attended a 1-day MI training and one-on-one coaching sessions of with a clinical psychologist. The resident investigator used a script (Appendix D) developed by the clinical psychologist, thesis advisor, and resident investigator. Fidelity of the intervention was conducted in 4 random patients of the orthodontic clinic, of which the interview was audio-recorded and rated by the clinical psychologist using the MITI checklist taken from the Motivational Interviewing Treatment Integrity Coding Manual (Moyers, 2014) (Appendix E). The MITI checklist is used to evaluate the interviewers adherence to the spirit of motivational interviewing. Four global skills are rated on a scale of 1-5 (cultivating change talk, softening sustain talk, partnerships, and empathy) and several additional interviewer behaviors are recorded as a tally or count.

4.5 Outcome Measures

Primary outcomes used to measure oral hygiene were plaque and gingival scores using the indices originally described by Silness and Loë (Silness and Loë 1964, Loë 1967). For recording plaque score, the system modified by Williams was used. (Williams 1991, Al-Anezi 2012). The rating systems for these two indices use an ordinal scale from zero to three (Appendix F). A plaque score of zero indicates that "plaque is not visible following air drying nor can be wiped off with an explorer;" a plaque score of one indicates that "plaque is not visible following air drying, but can be wiped off with an explorer;" a plaque score of two indicates that "plaque is visible with or without air drying; and a plaque score of three indicates that "thick plaque is visible." A gingival score of zero indicates that normal appearance, no bleeding, and no inflammation; a gingival score of one indicates "slight change in color and mild edema with slight change in texture," but no bleeding and mild inflammation; a gingival score of two indicates "redness, hypertrophy, edema, glazing" accompanied by bleeding on probing and moderate inflammation; and a gingival score of three indicates "marked redness, hypertrophy, edema, ulceration" with spontaneous bleeding and severe inflammation. These indices utilize six "key" teeth to represent the overall oral health status. The six key teeth are the upper right first permanent molar, the upper right permanent lateral incisor, the upper left first permanent premolar, the lower left first permanent molar, the lower right permanent lateral incisor, and the lower right first permanent premolar (Figure 2). Williams et al. addressed shortcomings of the Silness and Loë index for bracketed teeth by modifying it to take into account the pattern of plaque accumulation in orthodontic patients (Al-Anezi 2012). With the modifications, the tooth is divided into

mesial, distal, gingival, and incisal regions in relation to the bracket (See Figure 3). Therefore, when recording plaque indices, scores for the mesial, distal, gingival, and incisal surfaces were recorded, but when recording gingival indices, scores for the mesial, distal, gingival, and lingual surfaces were recorded.

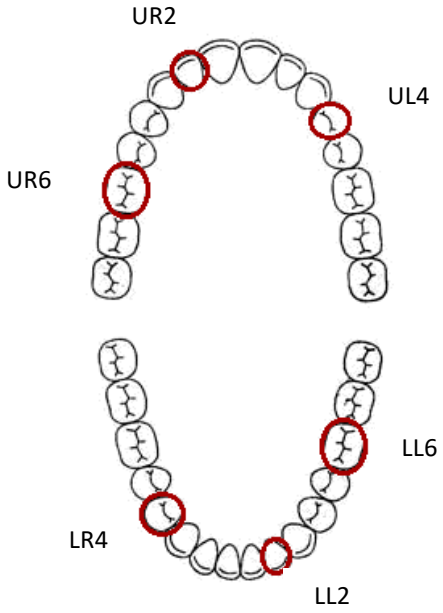


Figure 2: PI and GI Six Key Teeth

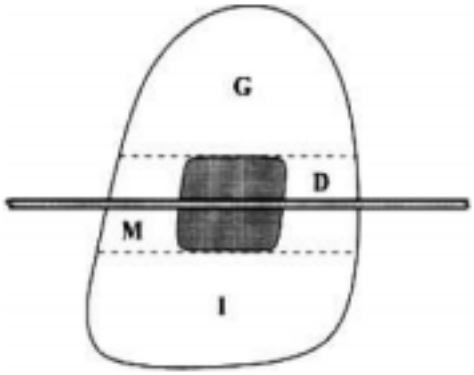


Figure 3: Modified Silness Loë Plaque Index Surfaces

Secondary outcomes were those evaluated by the questionnaire (Appendix B). Oral hygiene habits were recorded at baseline (T_0) and final follow-up (T_2) to evaluate if the number of times that the subject brushed and flossed increased, decreased, or stayed the same. Subjects' self-assessment of efficacy (how well they think they clean their teeth) and self-assessment of importance (how important they think it is to have good oral

hygiene) was also recorded on a scale of 1 to 5 and evaluated for change between baseline (T_0) and final follow-up (T_2). It was also recorded whether the patient had a cleaning in the last six months, whether they were referred for a cleaning during the study, and if so, whether they had the cleaning completed.

4.6 Statistical Analysis

Baseline differences across intervention and control groups were compared using fishers exact test for categorical variables and Wilcoxon Mann Whitney test for continuous variables to ensure that random assignment established comparability between the two groups. We computed mean scores of PI and GI, and performed Wilcoxon Mann Whitney test to determine if differences in scores between test and control groups were significant. Statistical significance was tested using two-sided p-value <0.05.

CHAPTER 5

RESULTS

5.1 Baseline Characteristics

A total of 25 subjects were recruited for the study and had baseline (T_0) data collected. The study sample consisted of 15 female subjects (60.0% of sample) and 10 male subjects (40.0% of the sample). Fourteen of the 25 enrolled subjects were randomly assigned to the intervention group, while eleven subjects were randomly assigned to the control group. The majority of the sample identified as Black or African American (68.0%), whereas 28.0% identified as Other and 8.0% identified as Caucasian. The majority of the subjects identifying as "Other" also classified themselves as Hispanic/Latino (see Table 1). Hispanic/Latino subjects made up 36.0% of the total sample. The average age of the sample was 13.6±1.5 years, with an age range from 11 to 17 years old.

Of the initial 25 subjects, only 19 (7 control, 12 intervention) had T_1 data collected. Six subjects were lost to follow-up (see Figure 4). Of the twelve intervention subjects, three were referred for treatment after no improvement in PI and GI scores from T_0 to T_1. Of those three patients referred for treatment, only one completed the hygiene appointment prior to the end of the study.

Regarding caries risk, 64.0% of the sample were classified as high caries risk, while 36.0% had moderate risk (see Table 2). There was a greater percentage of high caries risk patients in the intervention group. No significant differences in baseline data were observed between the two trial arms for key demographics.

Table 1: Baseline Characteristics – Demographics

	Control (N=11)	Intervention (N=14)	Total (N=25)	*p*-value
Gender				
Male	(3) 27.27%	(7) 50.0%	(10) 40.0%	0.3092
Female	(8) 72.73%	(7) 50.0%	(15) 60.0%	
Age*	13.3±1.5	13.9±1.5	13.6±1.5	0.2989
Race				
White Caucasian	(2) 18.18%	(0) 0.0%	(2) 8.0%	0.1740
Black or African American	(6) 54.55%	(11) 78.57%	(17) 68.0%	
Other	(4) 36.36%	(3) 21.43%	(7) 28.0%	
Ethnicity				
Hispanic/Latino	(6) 54.55%	(3) 21.43%	(9) 36.0%	0.1153
Non-Hispanic/Latino	(5) 45.45%	(11) 78.57%	(16) 64.0%	
Household Income				
< 19,999	(2) 18.18%	(5) 35.71%	(7) 28.0%	
20,000-49,999	(5) 45.45%	(7) 50.0%	(12) 48.0%	0.5372
> 50,000	(3) 27.27%	(2) 14.29%	(5) 20.0%	
Unanswered	(1) 9.09%	(0) 0.0%	(1) 4.0%	
Education of Parent				
Less than HS	(0) 0.0%	(1) 7.14%	(1) 4.0%	
Some HS	(2) 18.18%	(0) 0.0%	(2) 8.0%	
HS graduate	(3) 27.27%	(7) 50.0%	(10) 40.0%	0.2306
Some college	(6) 54.55%	(4) 28.57%	(10) 40.0%	
College graduate	(0) 0.0%	(1) 7.14%	(1) 4.0%	
Post-grad or Prof school	(0) 0.0%	(1) 7.14%	(1) 4.0%	

Baseline clinical parameters, such as caries risk and brushing and flossing frequency are reported in Table 2. There were no significant differences for these parameters observed between the two trial arms at baselines. Baselined composite plaque (PI) and gingival (GI) scores are reported in Table 3. No significant differences in baseline scores for PI and self-assessment of efficacy were observed between the two trial arms. However, there were significant differences in baseline scores for GI and self-assessment of importance.

Figure 4: CONSORT Patient Flow Diagram

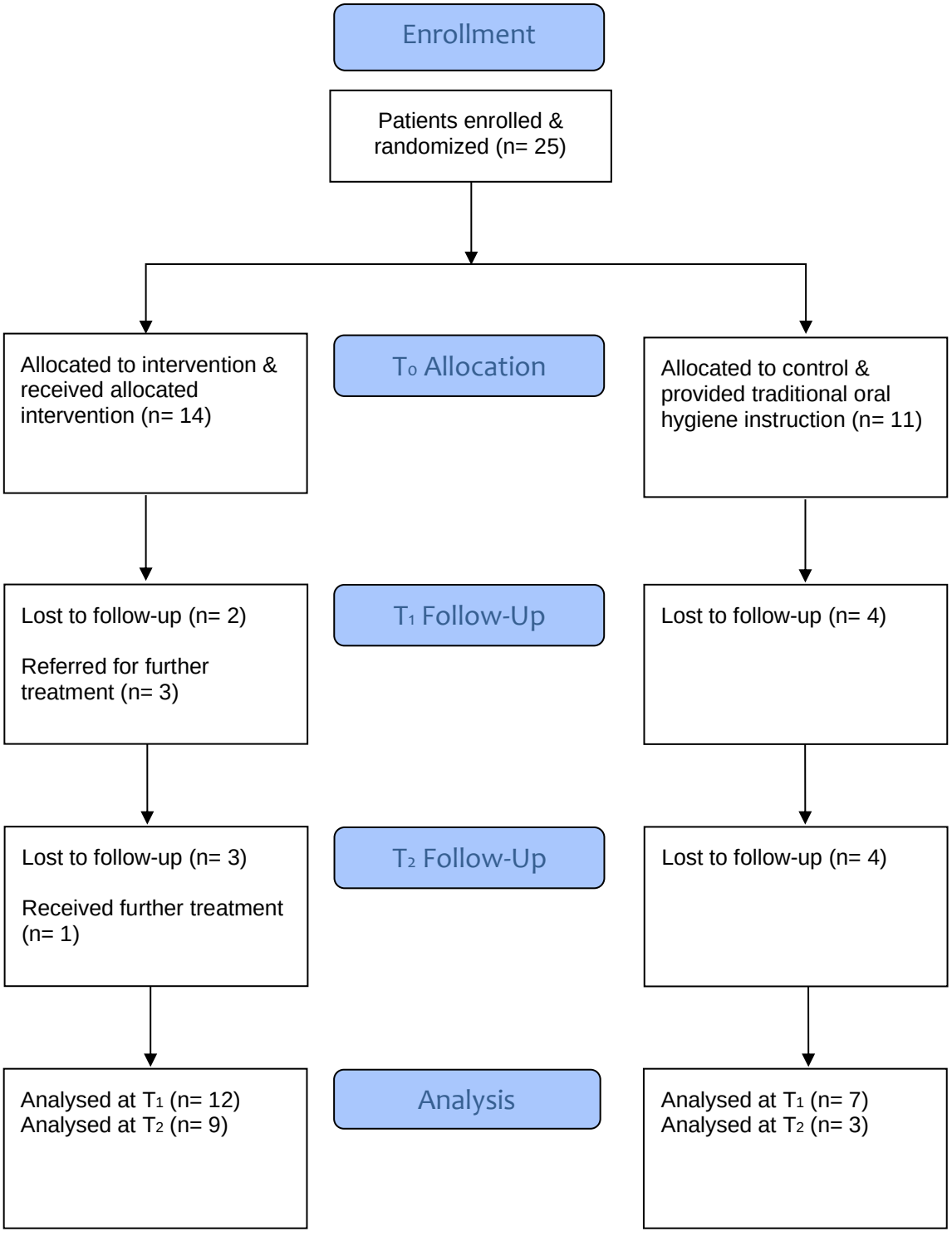


Table 2: Baseline Characteristics – Clinical Parameters

	Control (N=11)	**Intervention (N=14)**	**Total (N=25)**	***p*-value**
Caries Risk				
High	(6) 54.55%	(10) 71.43%	(16) 64.0%	0.4341
Moderate	(5) 45.45%	(4) 28.57%	(9) 36.0%	
Brushing Frequency (per day)				
Once	(2) 18.18%	(0) 0.0%	(2) 8.0%	
Twice	(7) 63.64%	(11) 78.57%	(18) 72.0%	0.5042
Three times	(1) 9.09%	(2) 14.29%	(3) 12.0%	
More than three times	(1) 9.09%	(1) 7.14%	(2) 8.0%	
Never	(0) 0.0%	(0) 0.0%	(0) 0.0%	
Flossing Frequency (per day)				
Once	(1) 9.09%	(7) 50.0%	(8) 32.0%	
Twice	(1) 9.09%	(2) 14.29%	(3) 12.0%	0.0846
Sometimes	(4) 36.36%	(2) 14.29%	(6) 24.0%	
Never	(5) 45.45%	(2) 14.29%	(7) 28.0%	
Don’t Know	(0) 0.0%	(1) 7.14%	(1) 4.0%	
Cleaning w/in 6 months				
Yes	(8) 72.73%	(10) 71.43%	(18) 72.0%	1.0000
No	(2) 18.18%	(2) 14.29%	(4) 16.0%	
Don’t Know	(1) 9.09%	(2) 14.29%	(3) 12.0%	

Table 3: Baseline Characteristics – Primary and Secondary Outcomes

	Control	**Intervention**	**Total**	***p*-value**
Composite PI at T_0	0.84±0.33	0.99±0.61	0.93±0.50	0.6411
Composite GI at T_0	1.17±0.33	1.49±0.45	1.35±0.43	0.0447*
Self-assessment of Efficacy	3.36±0.67	3.50±0.65	3.44±0.65	0.8062
Self-assessment of Importance	4.73±0.47	5.00±0.00	4.89±0.33	0.0463*

5.2 Follow-up Data Analysis

As stated previously, only 19 of the initial 25 subjects had T_1 data collected. For these 19 subjects, the composite plaque (PI) and gingival (GI) scores are reported in Table 4. The mean PI and GI scores for both groups improved from T_0 to T_1.

When comparing the change from baseline to the first follow-up appointment, the differences between T_0 to T_1 were greater for the SBIRT group than for the control group. At T_0, the mean plaque scores were 0.84±0.33 and 0.99±0.61 for the control and intervention groups, respectively (p>0.05). The mean gingival scores at T_0 for control and intervention groups were 1.17±0.33 and 1.49±0.45, respectively (p<0.05). Plaque and gingival scores improved for both groups. T_1 plaque scores for the control group decreased to 0.71.±0.45, whereas plaque scores for the intervention group decreased to 0.69±0.38 (p>0.5). T_1 gingival scores showed a similar trend where the control group's GI decreased to 1.21±0.19, and the intervention group's GI decreased to 0.94±0.42 (p>0.5). The differences in PI and GI scores are as follows: PI improved 0.36±0.44 for the intervention group and 0.18±0.45 for the control group; GI improved 0.50±0.28 for the intervention group and 0.09±0.37 for the control group.

Table 4: Differences in PI and GI Scores from T0 to T1

	Control (N=11 → 7)	**Intervention (N=14→12)**	**Total (N=25→19)**	***p*-value**
Composite PI at T_0	0.84±0.33	0.99±0.61	0.93±0.50	0.6411
Composite PI at T_1	0.71±0.45	0.69±0.38	0.70±0.39	1.0000
Mean difference in PI from T_0 to T_1	**-0.18±0.45**	**-0.36±0.44**	**-0.29±0.44**	**0.0309***
Composite GI at T_0	1.17±0.33	1.49±0.45	1.35±0.43	0.0447*
Composite GI at T_1	1.21±0.19	0.94±0.42	1.04±0.37	0.0686
Mean difference in GI from T_0 to T_1	**-0.09±0.37**	**-0.50±0.28**	**-0.35±0.37**	**0.0192***

Although the average PI and GI scores were not significantly different between the two groups at T_1, the mean differences in scores tome T_0 to T_1 were found to be statistically significantly different ($p<0.05$).

Of the 19 subjects who had T_1 data collected, only 12 also had T_2 follow-up completed. Of these twelve, three were from the control group, and nine were from the intervention group. The improvement in PI and GI scores stayed consistent through T_2. The average plaque scores were 0.51±0.31 and 0.56±0.37 for the control and intervention groups, respectively ($p>0.05$). The mean gingival scores at T_2 for control and intervention groups were 1.04±0.04 and 0.79±0.34, respectively ($p>0.05$). When comparing the plaque and gingival scores from T_2 to those from T_0 (Table 5), the differences in plaque scores were comparable (0.43±0.46 vs. 0.49±0.06), but the differences in gingival scores were substantially greater for the intervention group (0.56±0.27 vs. 0.18±0.28). Again, when comparing the mean differences in scores tome T_0 to T_2 statistically significant differences were found between the two groups ($p<0.05$).

Table 5: Differences in PI and GI Scores from T0 to T2

	Control (N = 11 → 3)	**Intervention (N =14 → 9)**	**Total (N = 25 → 12)**	***p*-value**
Composite PI at T_0	0.84±0.33	0.99±0.61	0.93±0.50	0.6411
Composite PI at T_2	0.51±0.31	0.56±0.37	0.55±0.35	1.0000
Mean difference in PI from T_0 to T_2	**-0.49±0.06**	**-0.43±0.46**	**-0.44±0.39**	**0.0063***
Composite GI at T_0	1.17±0.33	1.49±0.45	1.35±0.43	0.0447*
Composite GI at T_2	1.04±0.04	0.79±0.34	0.86±0.31	0.3075
Mean difference in GI from T_0 to T_2	**-0.18±0.28**	**-0.56±0.27**	**-0.46±0.31**	**0.0386***

Due to significant loss to follow-up, self-assessments are reported as frequencies. Scores ranged from 2 to 5 for self-assessment of efficacy, whereas only 4s and 5s were recorded for self-assessment of importance. Differences in self-assessment scores are reported in Figure 5 and 6 for efficacy and importance, respectively.

Figure 5: Differences in Self-Assessment of Efficacy T0 to T2

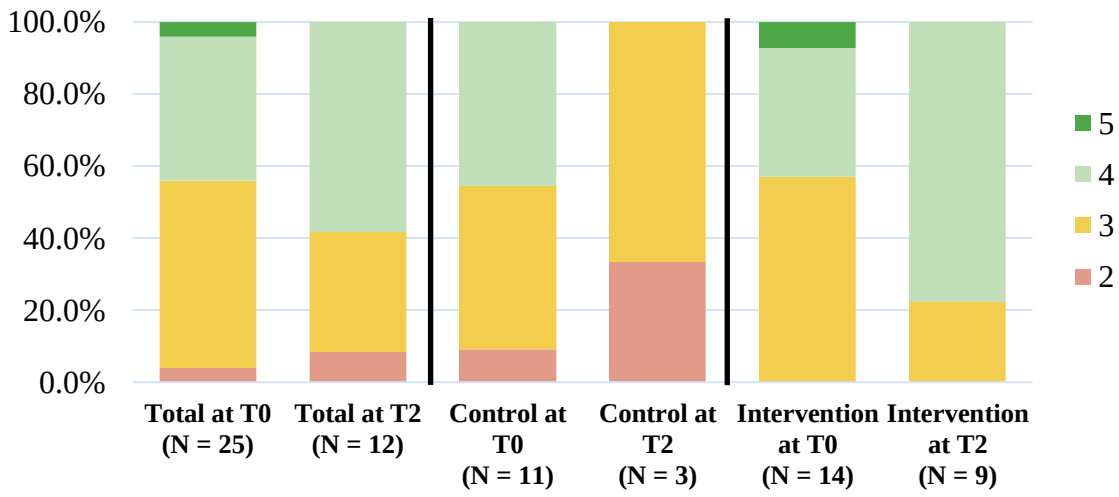
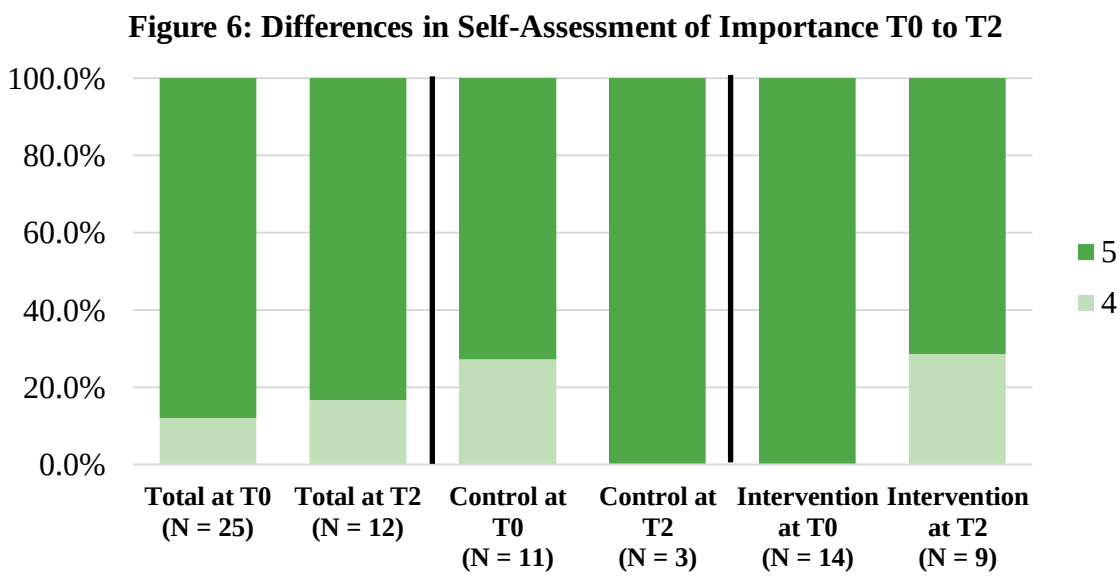


Figure 6: Differences in Self-Assessment of Importance T0 to T2



Subject oral hygiene and homecare habits recorded by the questionnaire regarding brushing and flossing were also reported as frequencies at T_0 and T_2 (Figures 7 and 8).

Figure 7: Differences in Brushing Frequency T0 to T2

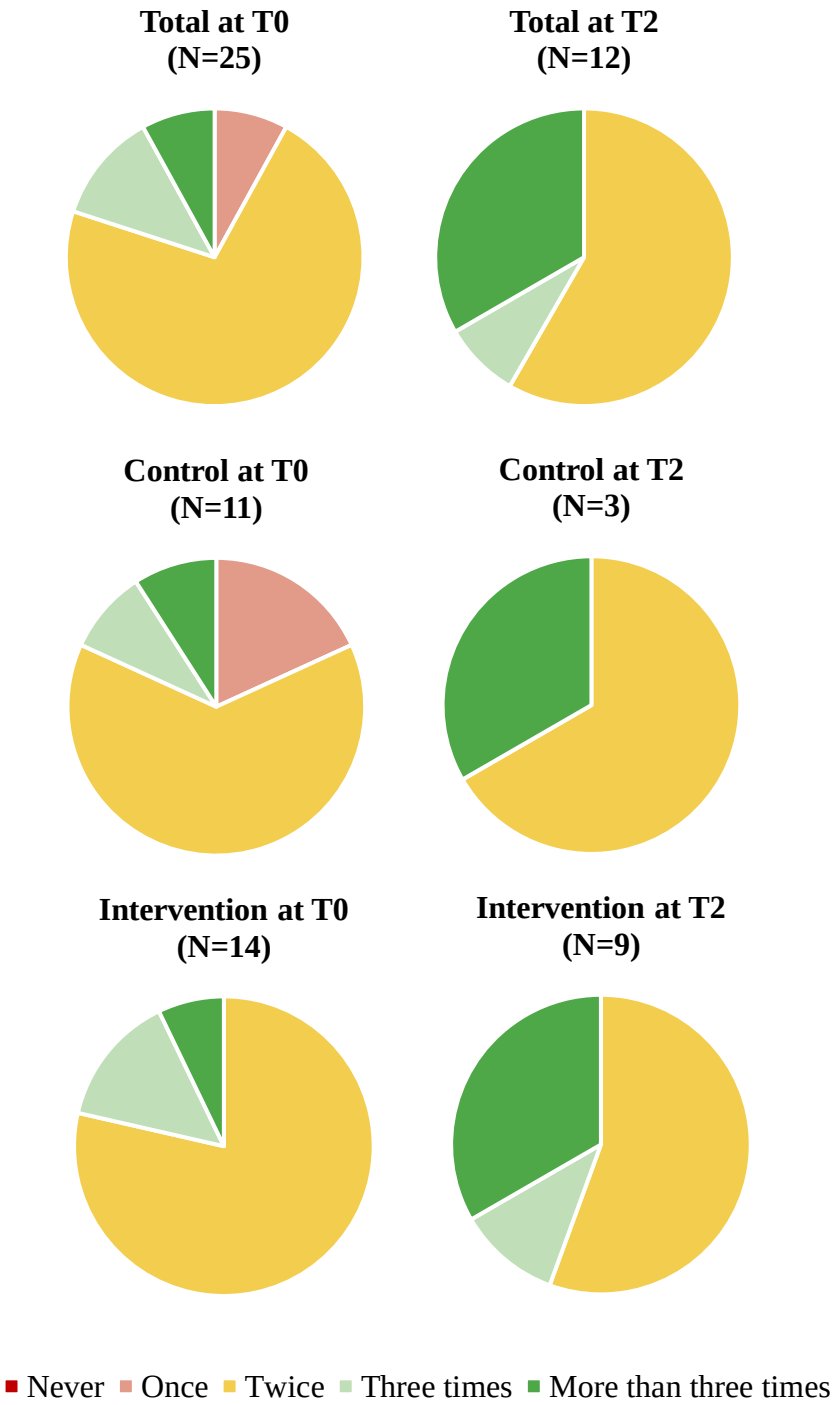
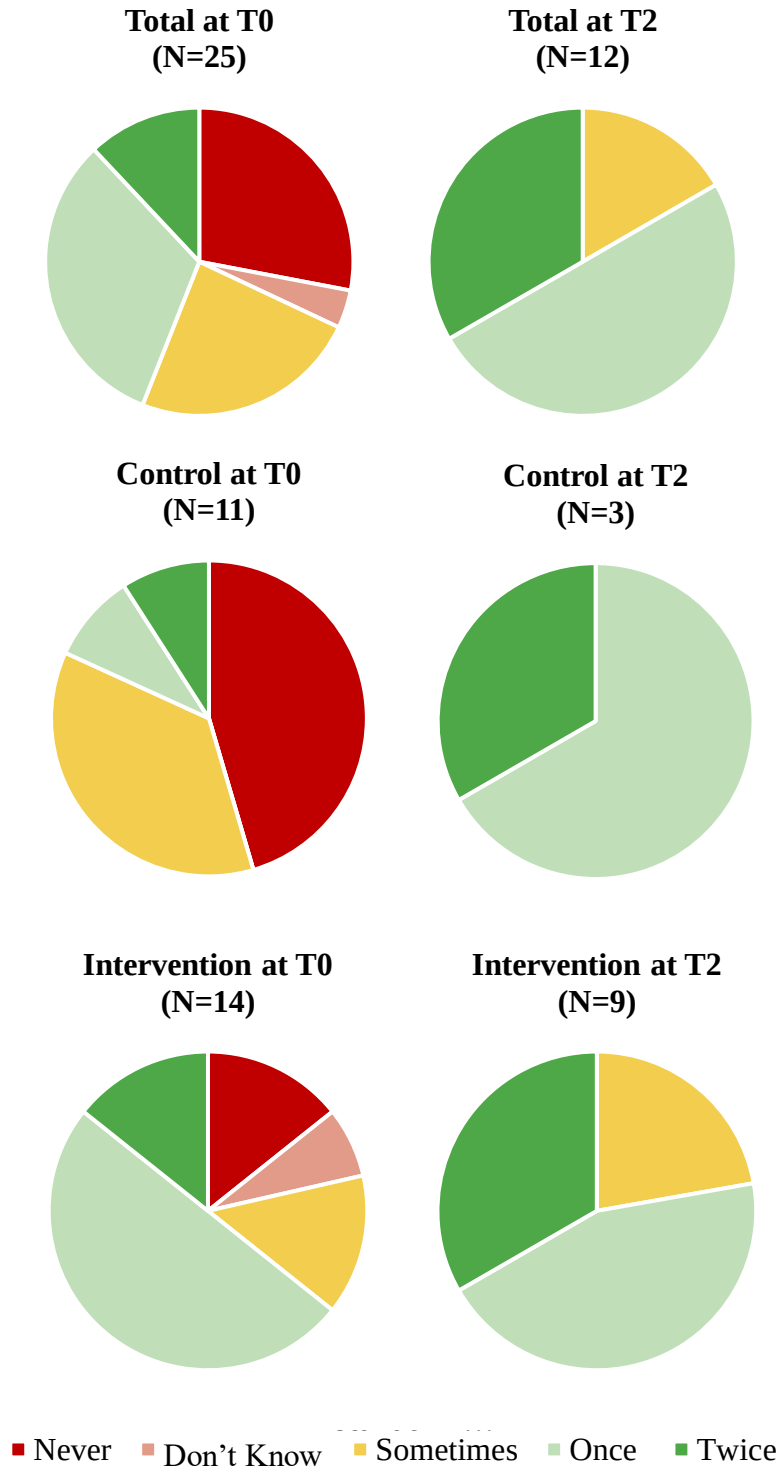


Figure 8: Differences in Flossing Frequency T0 to T2



5.3 COVID-19 ADDENDUM

The current study received IRB approval August 09, 2019. After treatment fidelity was completed, enrollment and data collection began in October 2019, with the goal to have at least thirty subjects enrolled and follow-ups completed by May 2020. In December 2019, an outbreak of pneumonia of unknown cause began in Wuhan, China, which was later identified as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Hui et al. 2020; Shi et al. 2020). The disease resulting from infection with SARS-CoV-2 is referred to as coronavirus disease 2019 (COVID-19) (Shi et al. 2020). On March 11, 2020, the World Health Organization (WHO) declared the novel coronavirus outbreak a global pandemic (Cucinotta & Vanelli 2020). Subsequently, the president of the Unites States and all fifty governors declared health emergencies and enacted several protocols to counteract the spread of the virus. These measures included stay-at-home orders and restricting and closing non-essential businesses (Gostin & Wiley 2020). The Temple University Kornberg School of Dentistry closed on March 17, 2020. As such, data collection for the current study was unfinished and unable to be completed prior to the thesis defense.

It is important to note that the significant loss to follow-up presented in this study is due to the mandated school closure, and not due to subject non-compliance. Unfortunately, due to the small sample size with complete data, more comprehensive data analysis was not possible. However, there is potential for the study to continue and data collection be completed at a later date.

CHAPTER 6

DISCUSSION

The main goal of this study was to determine the effectiveness of an SBIRT-modeled intervention on improving oral hygiene in adolescent orthodontic patients with fixed appliances. This pilot clinical study supports a positive effect of a single session of a brief motivational interview by showing a decrease in plaque and gingival indexes at a one to two month follow-up, compared to a control group that only received traditional oral hygiene instruction. The control group also showed a decrease in plaque and gingival indices, but the change was not as substantial as the intervention group. Motivational interviewing has shown promise in promoting behavior change in several different areas of study, but has yet to be widely applied in the field of dentistry, let alone the specialty of orthodontics. Yet with the prevalence of white spot lesions, gingival hyperplasia, and a general decline in oral hygiene associated with orthodontic fixed appliances, the potential for motivational interviewing is significant.

A previous study evaluating the efficacy of MI intervention in orthodontic patients showed significant improvements in plaque and gingival scores after a single MI session that remained stable after six months (Rigau-Gay et al. 2018); however, the success of their results could have been explained by the fact that their study population started at a high motivational level. Motivational level was not directly measured in the same way in the current study, but self-assessment scores of oral hygiene efficacy and importance were relatively high at baseline. The intent of the current protocol was to more closely model the theory behind SBIRT intervention, which implements motivational interviewing, but targets those who are at greatest risk. In previous studies

evaluating effectiveness of MI treatment on oral hygiene improvement, caries risk was never recorded. In this study, only patients with moderate-high caries risk were included; however due to poor reliability and validity associated with current caries risk assessment systems, this may not have been the best method to evaluate "at risk" patients.

In addition to subjects presenting with relatively high self-assessment scores at baseline, both control and intervention groups also had relatively low PI and GI scores to start. The greatest change in score was seen for the plaque index difference recorded for the intervention group from T_0 to T_2, which was -0.56±0.27. While all of the mean difference measure between time points showed a statistically significant difference between trial arms, it begs the question of whether this is clinically significant.

Another important difference between the current study and the study conducted by Rigau-Gay et al. in 2018, was the degree of MI training received by the clinician. The orthodontist who delivered the MI session in the Rigau-Gay study had spent much more time training than the clinician in the current study (more than 112 hours over 2 years, compared to 3 to 4 hours over a couple weeks). Practitioners may feel intimidated by the lengthy time investment often associated with motivational interviewing and decide that learning the principles of MI are not worth integrating into their practice. However, as long as intervention fidelity (evaluated by the MITI checklist) is achieved, MI can still easily and successfully be implemented into practice without a significant time investment. The current study shows that even with limited training, incorporating a short (10 to 15 minute) MI session within in a regularly scheduled orthodontic appointment for those patients who are at greater risk for poor oral hygiene is not only feasible, it can also produce satisfactory results.

Rigau-Gay et al. were the first to attempt to introduce a single session of MI in the style according to Miller and Rollnick in an orthodontic population. To our knowledge, the current study is the first to do the same, but in a population that could be considered high risk. The current study is also the first to implement a "referral for treatment" protocol for those patients that do not respond positively to the intervention. Unfortunately, due to the small sample size and a large portion of study subjects lost to follow-up, it was not possible to draw conclusions about the effect of this part of the protocol.

In previous systematic reviews (Gao et al. 2014 and Kopp et al. 2017), there have been contradictory results concerning the effectiveness of MI on improving oral health behaviors. Some of the discrepancies can be explained due to confusing methodological quality, where there is a lack of definition of MI frequency, duration, and fidelity, which are all clearly defined in this study. Other strengths of this study are that it was a randomized controlled clinical trial, where the study subjects were randomized using a computer generated list. The clinician was blinded to the group assignment for baseline data collection – subjects were not allocated until after baseline plaque and gingival indices were recorded. Allocation concealment was also maintained for study subjects.

The main study limitation was the small sample size and significant loss to follow-up that favored the control group. In addition, all outcome assessments were done by the same orthodontic resident who delivered the MI session, and it was not possible to maintain allocation concealment after T_0. It is also possible that the Hawthorne effect could have been a factor in this study, but it would have affected both groups equally and baseline levels were similar for both groups.

Based on the findings and observations of this study, combining a brief session of MI with conventional oral hygiene instruction appears to be beneficial for improving oral hygiene in adolescent patients with fixed orthodontic appliances. Due to small sample sizes and significant loss to follow-up definitive conclusions cannot be made; however, the current study provides insights and a good framework for future studies.

CHAPTER 7

CONCLUSIONS

The SBIRT intervention group had greater improvement in oral hygiene than traditional oral hygiene instruction after a 1-2 month follow up. An MI protocol of a brief (10 to 15 minute) intervention session decreased plaque and gingival indexes in adolescents undergoing fixed orthodontic treatment. Motivational interviewing practices aimed at improving oral hygiene in these patients shows promise in changing patient behaviors and outlook in regards to oral health. While further and more extensive study with a larger sample size is necessary to definitively prove the effectiveness of MI in improving oral hygiene, this study demonstrates that it would be possible to easily implement this kind of intervention in the daily routine of an orthodontic practice.

REFERENCES CITED

AAO Economics of Orthodontists/Patient Census Survey Comparison Results. 2017. https://www1.aaoinfo.org/education/data-and-research/.

American Dental Association. Caries Risk Assessment Form (Age >6). Chicago, IL: American Dental Association; 2011.

American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride: evidence-based clinical recommendations. J Am Dent Assoc 2006;137(suppl):1151-9.

Acharya S, Goyal A, Utreja AK, Mohanty U. Effect of three different motivational techniques on oral hygiene and gingival health of patients undergoing multibracketed orthodontics. Angle Orthod. 2011 Sep;81(5):884-8.

Al-Anezi SA, Harradine NW. Quantifying plaque during orthodontic treatment. Angle Orthod. 2012 Jul;82(4):748-53.

Al-Jewair TS, Suri S, Tompson BD. Predictors of adolescent compliance with oral hygiene instructions during two-arch multibracket fixed orthodontic treatment. Angle Orthod. 2011 May;81(3):525-31.

Atack NE, Sandy JR, Addy M. Periodontal and microbiological changes associated with the placement of orthodontic appliances. A review. J Periodontol. 1996 Feb;67(2):78-85.

Balenseifen JW, Madonia JV. Study of dental plaque in orthodontic patients. J Dent Res. 1970 Mar-Apr;49(2):320-4.

Batliner TS, Tiwari T, Henderson WG, et al. Randomized Trial of Motivational Interviewing to Prevent Early Childhood Caries in American Indian Children. JDR Clin Trans Res. 2018;3(4):366-375.

Benson PE, Parkin N, Dyer F, Millett DT, Furness S, Germain P. Fluorides for the prevention of early tooth decay (demineralized white lesions) during fixed brace treatment. Cochrane Database Syst Rev. 2013 Dec 12;(12):CD003809.

Binkley CJ, Garrett B, Johnson KW. Increasing dental care utilization by Medicaid-eligible children: a dental care coordinator intervention. J Public Health Dent. 2010; 70:76–84.

Bishara, SE, Ostby AW. White Spot Lesions: Formation, Prevention, and Treatment. Seminars in Orthodontics. 2008; 14 (3): 174–182.

Boersma JG, van der Veen MH, Lagerweij MD, Bokhout B, Prahl-Andersen B. Caries prevalence measured with QLF after treatment with fixed orthodontic appliances: influencing factors. Caries Res. 2005 Jan-Feb;39(1):41-7.

Cascaes AM, Bielemann RM, Clark VL, Barros AJ. Effectiveness of motivational interviewing at improving oral health: a systematic review. Rev Saude Publica. 2014 Feb;48(1):142-53.

Cerroni S, Pasquantonio G, Condò R, Cerroni L. Orthodontic Fixed Appliance and Periodontal Status: An Updated Systematic Review. Open Dent J. 2018;12:614-622.

Clark JR. Oral hygiene in the orthodontic practice: Motivation, responsibilities, and concepts. Am J Orthod. 1976 Jan;69(1):72-82.

Colvara BC, Faustino-Silva DD, Meyer E, Hugo FN, Hilgert JB, Celeste RK. Motivational Interviewing in Preventing Early Childhood Caries in Primary Healthcare: A Community-based Randomized Cluster Trial. J Pediatr. 2018 Oct;201:190-195.

Cozzani M, Ragazzini G, Delucchi A, Mutinelli S, Barreca C, Rinchuse DJ, Servetto R, Piras V. Oral hygiene compliance in orthodontic patients: a randomized controlled study on the effects of a post-treatment communication. Prog Orthod. 2016 Dec;17(1):41.

Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. Acta Bio-medica : Atenei Parmensis. 2020 Mar;91(1):157-160.

Cuevas J, Chi DL. SBIRT-Based Interventions to Improve Pediatric Oral Health Behaviors and Outcomes: Considerations for Future Behavioral SBIRT Interventions in Dentistry. Curr Oral Health Rep. 2016 Sep;3(3):187-192.

Fischman SL. Current status of indices of plaque. J Clin Periodontol. 1986 May;13(5):371-4, 379-80.

Gao X, Lo EC, Kot SC, Chan KC. Motivational interviewing in improving oral health: a systematic review of randomized controlled trials. J Periodontol. 2014 Mar;85(3):426-37.

Gorelick L, Geiger AM, Gwinnett AJ. Incidence of white spot formation after bonding and banding. Am J Orthod. 1982 Feb;81(2):93-8.

Gostin LO, Wiley LF. Governmental Public Health Powers During the COVID-19 Pandemic: Stay-at-home Orders, Business Closures, and Travel Restrictions. JAMA. 2020;323(21):2137–2138.

Halasa-Rappel YA, Ng MW, Gaumer G, Banks DA. How useful are current caries risk assessment tools in informing the oral health care decision-making process?. J Am Dent Assoc. 2019 Feb;150(2):91-102.e2.

Huang GJ, Roloff-Chiang B, Mills BE, Shalchi S, Spiekerman C, Korpak AM, Starrett JL, Greenlee GM, Drangsholt RJ, Matunas JC. Effectiveness of MI Paste Plus and PreviDent fluoride varnish for treatment of white spot lesions: a randomized controlled trial. Am J Orthod Dentofacial Orthop. 2013 Jan;143(1):31-41.

Huang J, Yao Y, Jiang J, Li C. Effects of motivational methods on oral hygiene of orthodontic patients: A systematic review and meta-analysis. Medicine (Baltimore).2018 Nov;97(47):e13182.

Hui DS, I Azhar E, Madani TA, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China. Int J Infect Dis. 2020;91:264-266.

Ismail AI, Ondersma S, Jedele JM, Little RJ, Lepkowski JM. Evaluation of a brief tailored motivational intervention to prevent early childhood caries. Community Dent Oral Epidemiol. 2011 Oct;39(5):433-48.

Julien KC, Buschang PH, Campbell PM. Prevalence of white spot lesion formation during orthodontic treatment. Angle Orthod. 2013 Jul;83(4):641-7.

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.

Kutsch VK. Dental caries: an updated medical model of risk assessment. J Prosthet Dent. 2014 Apr;111(4):280-5. Epub 2013 Dec 10. Review.

Lucchese A, Gherlone E. Prevalence of white-spot lesions before and during orthodontic treatment with fixed appliances. Eur J Orthod. 2013 Oct;35(5):664-8.

Löe H. The Gingival Index, the Plaque Index and the Retention Index Systems. J Periodontol. 1967 Nov-Dec;38(6):Suppl:610-6.

Marini I, Bortolotti F, Parenti SI, Gatto MR, Bonetti GA. Combined effects of repeated oral hygiene motivation and type of toothbrush on orthodontic patients: a blind randomized clinical trial. Angle Orthod. 2014 Sep;84(5):896-901.

Martins RK, McNeil DW. Review of Motivational Interviewing in promoting health behaviors. Clin Psychol Rev. 2009 Jun;29(4):283-93.

McCance-Katz EF, Satterfield J. SBIRT: a key to integrate prevention and treatment of substance abuse in primary care. Am J Addict. 2012 Mar-Apr;21(2):176-7.

Mehra T, Nanda RS, Sinha PK. Orthodontists' assessment and management of patient compliance. Angle Orthod. 1998 Apr;68(2):115-22.

Mejàre I, Axelsson S, Dahlén G, Espelid I, Norlund A, Tranæus S, Twetman S. Caries risk assessment. A systematic review. Acta Odontol Scand. 2014 Feb;72(2):81-91.

Moyers, T.B., Manuel, J.K., & Ernst, D. (2014). Motivational Interviewing Treatment Integrity Coding Manual 4.1. Unpublished manual.

Miller WR, Rollnick S. Ten things that motivational interviewing is not. Behav Cogn Psychother 2009;37:129-140.

Miller WR, Taylor CA, West Jc. Focused versus broad-spectrum behavior therapy for problem drinkers. J Consult Clin Psychol. 1980 Oct;48(5):590-601.

Naar-King S, Suarez M. Motivaional Interviewing with Adolescents and Young Adults. The Guilford Press, 2011.

Ogaard B, Rølla G, Arends J. Orthodontic appliances and enamel demineralization. Part 1. Lesion development. Am J Orthod Dentofacial Orthop. 1988 Jul;94(1):68-73.

Paschos E, Bücher K, Huth KC, Crispin A, Wichelhaus A, Dietel T. Is there a need for orthodontic plaque indices?--diagnostic accuracy of four plaque indices. Clin Oral Investig. 2014 May;18(4):1351-1358.

Ramseier CA, Suvan JE. Health Behavior Change in the Dental Practice. Wiley-Blackwell, 2010.

Rasmussen M, Manson SM, Albino J. Randomized Trial of Motivational Interviewing to Prevent Early Childhood Caries in American Indian Children. JDR Clin Trans Res. 2018 Oct;3(4):366-375.

Richter AE, Arruda AO, Peters MC, Sohn W. Incidence of caries lesions among patients treated with comprehensive orthodontics. Am J Orthod Dentofacial Orthop. 2011 May;139(5):657-64.

Rigau-Gay MM, Claver-Garrido E, Benet M, Lusilla-Palacios P, Ustrell-Torrent JM. Effectiveness of motivational interviewing to improve oral hygiene in orthodontic patients: A randomized controlled trial [published online ahead of print, 2018 Sep 10]. J Health Psychol. 2018;1359105318793719.

Ristic M, Vlahovic Svabic M, Sasic M, Zelic O. Clinical and microbiological effects of fixed orthodontic appliances on periodontal tissues in adolescents. Orthod Craniofac Res. 2007 Nov;10(4):187-95.

Ross MC, Campbell PM, Tadlock LP, Taylor RW, Buschang PH. Effect of automated messaging on oral hygiene in adolescent orthodontic patients: A randomized controlled trial. Angle Orthod. 2019 Mar;89(2):262-267.

Silness J, Loe H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. Acta Odontol Scand. 1964 Feb;22:121-35.

Saengtipbovorn 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):123-129.

Shi Y, Wang G, Cai XP, et al. An overview of COVID-19. J Zhejiang Univ Sci B. 2020;21(5):343-360.

Sinha PK, Nanda RS, McNeil DW. Perceived orthodontist behaviors that predict patient satisfaction, orthodontist-patient relationship, and patient adherence in orthodontic treatment. Am J Orthod Dentofacial Orthop. 1996 Oct;110(4):370-7.

Sundararaj D, Venkatachalapathy S, Tandon A, Pereira A. Critical evaluation of incidence and prevalence of white spot lesions during fixed orthodontic appliance treatment: A meta-analysis. J Int Soc Prev Community Dent. 2015 Nov-Dec;5(6):433-9.

Tanner AC, Sonis AL, Lif Holgerson P, Starr JR, Nunez Y, Kressirer CA, Paster BJ, Johansson I. White-spot lesions and gingivitis microbiotas in orthodontic patients. J Dent Res. 2012 Sep;91(9):853-8.

Ukra A, Bennani F, Farella M. Psychological aspects of orthodontics in clinical practice. Part one: treatment-specific variables. Prog Orthod. 2011 Nov;12(2):143-8.

Williams P, Clerehugh V, Worthington HV, Shaw WC. Comparison of two plaque indices for use in fixed orthodontic appliance patients. J Dent Res. 1991;70:703. Abstract 276.

Zachrisson BU, Zachrisson S. Caries incidence and oral hygiene during orthodontic treatment. Scand J Dent Res. 1971;79(6):394-401

Zachrisson BU. Oral hygiene for orthodontic patients: current concepts and practical advice. Am J Orthod. 1974 Nov;66(5):487-97. Review.

APPENDIX A
CARIES RISK ASSESSMENT

ADA American Dental Association®
America's leading advocate for oral health

Caries Risk Assessment Form (Age >6)

Patient Name:				
Birth Date:			Date:	
Age:			Initials:	
		Low Risk	Moderate Risk	High Risk
Contributing Conditions		Check or Circle the conditions that apply		
I.	**Fluoride Exposure** (through drinking water, supplements, professional applications, toothpaste)	☐Yes	☐No	
II.	**Sugary Foods or Drinks** (including juice, carbonated or non-carbonated soft drinks, energy drinks, medicinal syrups)	Primarily at mealtimes ☐		Frequent or prolonged between meal exposures/day ☐
III.	**Caries Experience of Mother, Caregiver and/or other Siblings** (for patients ages 6-14)	No carious lesions in last 24 months ☐	Carious lesions in last 7-23 months ☐	Carious lesions in last 6 months ☐
IV.	**Dental Home**: established patient of record, receiving regular dental care in a dental office	☐Yes	☐No	
General Health Conditions		Check or Circle the conditions that apply		
I.	**Special Health Care Needs** (developmental, physical, medical or mental disabilities that prevent or limit performance of adequate oral health care by themselves or caregivers)	☐No	Yes (over age 14) ☐	Yes (ages 6-14) ☐
II.	**Chemo/Radiation Therapy**	☐No		☐Yes
III.	**Eating Disorders**	☐No	☐Yes	
IV.	**Medications that Reduce Salivary Flow**	☐No	☐Yes	
V.	**Drug/Alcohol Abuse**	☐No	☐Yes	
Clinical Conditions		Check or Circle the conditions that apply		
I.	**Cavitated or Non-Cavitated** (incipient) **Carious Lesions or Restorations** (visually or radiographically evident)	No new carious lesions or restorations in last 36 months ☐	1 or 2 new carious lesions or restorations in last 36 months ☐	3 or more carious lesions or restorations in last 36 months ☐
II.	**Teeth Missing Due to Caries in past 36 months**	☐No		☐Yes
III.	**Visible Plaque**	☐No	☐Yes	
IV.	**Unusual Tooth Morphology** that compromises oral hygiene	☐No	☐Yes	
V.	**Interproximal Restorations - 1 or more**	☐No	☐Yes	
VI.	**Exposed Root Surfaces** Present	☐No	☐Yes	
VII.	**Restorations with Overhangs** and/or **Open Margins**; **Open Contacts** with Food Impaction	☐No	☐Yes	
VIII.	**Dental/Orthodontic Appliances** (fixed or removable)	☐No	☐Yes	
IX.	**Severe Dry Mouth (Xerostomia)**	☐No		☐Yes

Overall assessment of dental caries risk: ☐ Low ☐ Moderate ☐ High

Patient Instructions:

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APPENDIX B
QUESTIONNAIRE

SBIRT-BASED INTERVENTION TO IMPROVE ORAL HYGIENE IN ADOLESCENT ORTHODONTIC PATIENTS WITH FIXED APPLIANCES

Questionnaire

INTERVIEWER ID: ____ _____

DATE OF INTERVIEW: ___/_____/____

Subject ID Number [_____]

Thank you for your participation in this study about improving oral hygiene for adolescent orthodontic patients. In this survey you will be asked a few questions about your background and questions related to you and your child's oral health. You will be asked to recall events experienced over the last years of your child's life. Please answer by your best memory.
Please feel free to ask about any question that does not seem clear. Whenever "child" is mentioned it refers to your child that is enrolled in the study. Place a check next to the choice that feels most appropriate for each question.

Section A (Demographics)

A1. What is the 5-digit ZIP code at your home address? [___]
[__ ___ ___ ___ ___]

A2. What is your gender? [___]
1) __Male
2) __Female

A3. What is your age? *(in years)*
[_____]

A4. What is your relation to the child? [___]
1) __Mother
2) __ Father
3) __ Other (_____)*please specify*

A5. What is the highest grade of school that you completed? [___]
1) __ Less than high school (grades 0-8)
2) __ Some high school (grades 9-11)
3) __ High school graduate (grades 12 or GED)
4) __ Some college (include vocational, trade, or technical school; no four-year degree)
5) __ College graduate (BS or other four year degree)
6) __ Post graduate or professional school after college

A6. What is your family's income level? [___]

1) __ Less than $19,999
2) __ $20,000 - $49,999
3) __ More than $50,000

A7. What is the child's age? *(in years)* [___]

[_____]

A8. What is the gender of your child? [___]

1) __Male
2) __Female

A9. What race do you consider the child to be? *(Place a check next to the correct answer)* [___]

1) __ White or Caucasian or European American
2) __ Black or African American
3) __ American Indian or Alaska Native
4) __ Asian
5) __ Native Hawaiian or Other Pacific Islander
6) __ Other (_____)

A10. Is the child of Hispanic or Latino origin or descent? [___]

1) ___Yes
2) ___ No

Section B (Main Predictors)

B1. How many times a day do you **brush** your teeth? [___]

1) ___Once
2) ___Twice
3) ___Three times
4) ___More than three times
5) ___Sometimes zero times
6) ___Often zero times
7) ___Don't know

B2. How many times a day do you **floss** your teeth? [___]

1) ___Once
2) ___Twice
3) ___Sometimes
4) ___Never
5) ___Don't know

B3. On a scale of 1-5, how well do you think you clean your teeth? [___]

1 2 3 4 5

B4. On a scale of 1-5, how important do you think it is to have a clean mouth? [___]

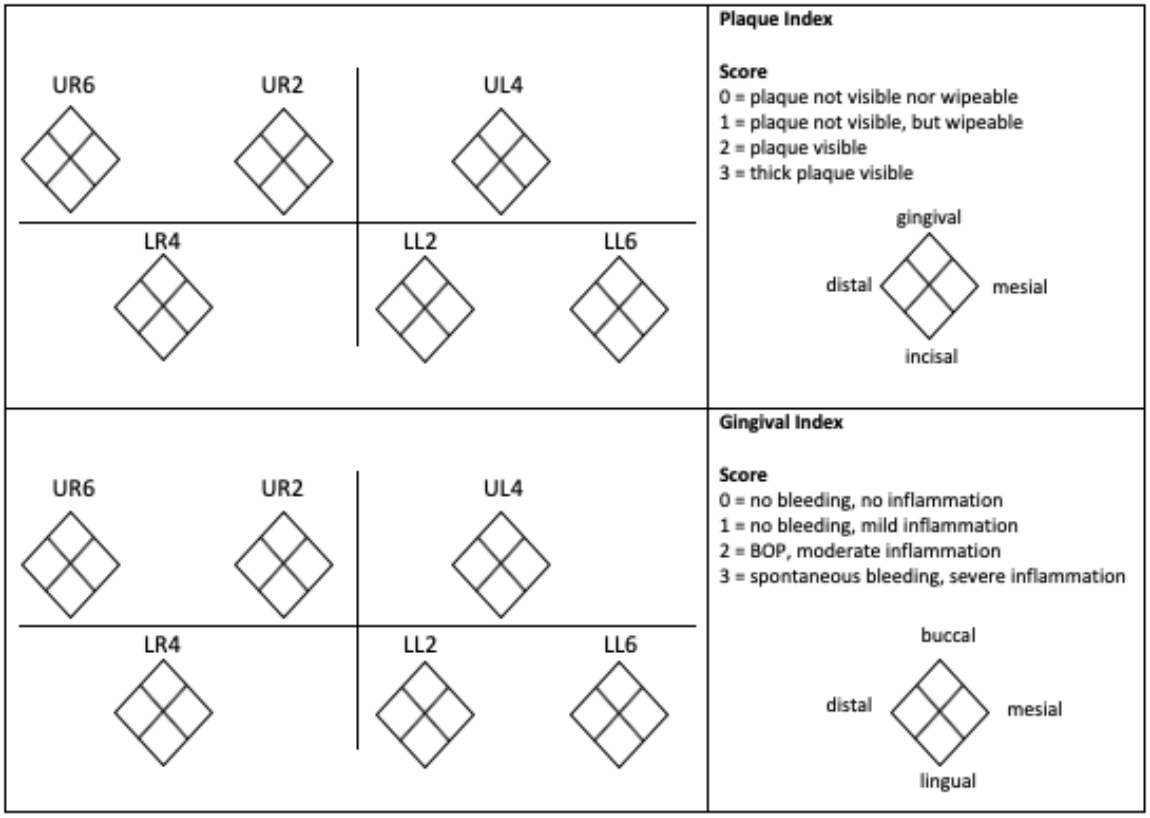
1 2 3 4 5

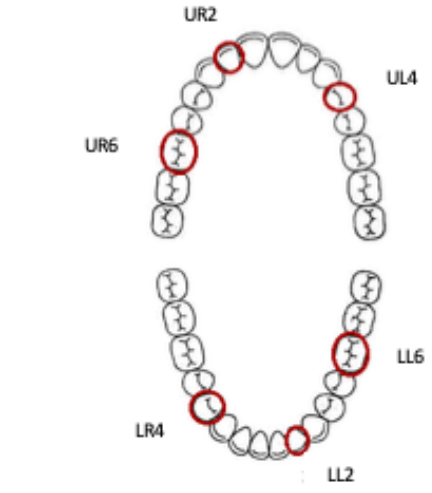
B5. In the last six months, have you had a cleaning at the dentist? [___]

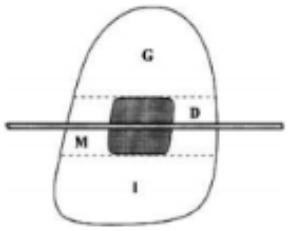
1) ____Yes
2) ____No
3) ____Don't Know

Thank you for your time, we appreciate your participation.

APPENDIX C
PRIMARY OUTCOMES ASSESSMENT FORM







APPENDIX D
MI SCRIPT

PART 1A: Get to know the adolescent, complete the CRA, enroll the subject/obtain consent, and complete the randomization

- Introduction
    - **For my own patients:**

Hi, _____, how are you doing today? Are you having a good summer/school year so far? We're going to do something a little extra today. If it's okay with you, I'd like to ask you some questions and do a quick exam.

    - **For other residents' patients:**

Good morning/afternoon, _____, I don't think we've met before, have we? My name is Dr. Clark, and I am one of the other residents in the ortho clinic. How are you doing today? Potential additional questions to build rapport:

- ***Tell me about yourself?***
- ***How long have you had your braces for? Do you like them/how your teeth are looking?***
- ***Did you start school yet? What grade are you in?***
- ***Did you do anything fun this summer?***

If it's okay with you, I'd like to ask you some questions and do a quick exam.

- Caries Risk Assessment/Recruitment
    - **For patients who are low/moderate caries risk:**

It looks like you're doing a good job with your homecare, keep up the good work!

    - **For patients who are high caries risk:**

Brushing and flossing are important to reduce your risk for cavities. I'm doing a study to see how we can help patients like you improve their oral hygiene – would you like to be a part of this study?

[Have parent come back to exam chair. Review consent/assent form with parent/patient, if consent from parent and assent from subject is obtained, plaque and gingival indices will be recorded]

I am going to take some measurements of your teeth and gums that will give me some information on how clean the teeth are and how healthy the gums are, is that okay with you?

[Once PI/GI collected, subjects will be randomized using computer-generated list to either control or intervention group]

PART 1B: start discussion on overall importance of oral health

- **For CONTROL subjects:**

It looks like we can do a much better job of keeping our teeth and gums clean and healthy. It is important to brush after every meal when you have braces, and make sure that you are cleaning completely around the brackets and underneath the wire on every tooth. It is also important to make sure you are flossing at least once a day to reach the areas that the toothbrush can't. Having poor oral hygiene, like you do right now, puts you at risk of cavities and permanent staining of your teeth. But also, having good oral hygiene, when you keep your teeth clean and gums healthy, means that you will get your braces off sooner! Next time you come in, we are going to take the measurements of your teeth and gums again to see how you are doing.

- **For INTERVENTION subjects:**

I would like to ask you about your oral hygiene. On a scale of 1 to 10, with 1 being not important at all and 10 being extremely important, how important to you is it that your teeth are clean and your gums are healthy? [Ask patient to give a numerical response]

1. Patient's Health Importance Number: _____ (Write it here)
2. Choose from one of the Options below that match the patient's response:

-Option A: HIGH IMPORTANCE Patient chose a 7 or above:

You chose a _____. It sounds as though your oral health is really important to you. That's great!

-Option A: MEDIUM IMPORTANCE Patient chose a 5 or 6:

You chose a _____. It sounds as though your oral health is pretty important to you. That's really good.

-Option C: LOW IMPORTANCE Patient chose a 2, 3, or 4:

You chose a _____. It sounds as though your oral health is somewhat or a little important to you.

-Option D: NO IMPORTANCE Patient chose a 1

You chose a _____. It sounds as though your oral health is not that important to you. Can you tell me a little bit about that?

[Allow the patient to respond. Listen actively, and briefly reflect or summarize what the patient tells you. Resist correcting the patient or providing additional information. Respond by reflecting or offering empathy: "I understand. There are so many things going on in your life that it can be hard to put your oral health as a top priority" or "It sounds as though there are other things, such as _____, that are important to you."]

I wanted to talk about your oral health today because a healthy mouth is an important part of overall health. May I share some information about what I found from my exams?

- ***When I did my exam, it gives me an idea of how clean the teeth are and how healthy the gums are, and higher number means that the teeth can be cleaner and the gums healthier***
- ***I have some concerns about how puffy the gums are and how much plaque is on the teeth, how does that make you feel?***

Would it be OK for us to spend a minute talking about your teeth and gums?

- ***What concerns do you have about cleaning your teeth and keeping your gums healthy?***
- ***What do you want for your teeth and mouth in the future?***
- ***Is there anything about your teeth and mouth you would like to change?***

I see. So If I understand you correctly you hope that _____ and your biggest concern is_____, is that correct? Let's make a note of that in your record so we can both remember that.

PART 2: goals/barriers planning

What have you been told before about what you should be doing to brush and floss?

[Reflect back what the patient is saying. Resist the urge to correct the patient. If the patient is accurate about a statement, affirm the patient's knowledge.]

May I review some information with you?

People keep their teeth and gums clean and healthy by brushing and flossing. Having good oral hygiene, or keeping our teeth and gums clean and healthy, will help you get your braces off sooner. And having poor oral hygiene puts people at risk of cavities and permanent staining of their teeth. These are some things that people with braces should keep in mind when taking care of their teeth/I usually tell me patients that they need to:

- ***Brush after every meal***
- ***Clean completely around the brackets and underneath the wire on every tooth***
- ***Flossing at least once a day***

Of those things, which ones do you think you do a good job with?

Which things do you think you could do better?

How do you think I can help you do better with (insert patient response here)?

I want to share some ideas of what might help you. Here are some that I came up with:

- ***To help brush after every meal, maybe you can carry a toothbrush with you in your backpack/purse***
- ***To make sure that you are cleaning completely around the brackets and underneath the wire on every tooth, after you brush, you can check in the mirror and go back to get spots that you missed***
- ***To make sure that you are flossing every day, maybe you can keep track on a calendar of how many days in a row you flossed***

As I mentioned, we know it can be hard to brush and floss as you're told to. [Allow the patient to respond. At this point, don't argue or correct anything that the patient says. You are simply listening and gathering information. You can take notes]

What are some things that would stop you from achieving your goals?

Write patient's response (Patient barriers): _____

_____

Those are really common reasons that people struggle with achieving good oral hygiene. What do you think you can do if you run into that problem?

[Review common barriers/barriers that the Patient identified/you may suggest:

Barrier 1: I don't have any floss at home

Barrier 2: I forget to brush after lunch

Barrier 3: I'm too tired to brush at night

Barrier 4: Using the floss under the wire is too difficult]

What are some things that you think will help you achieve your goals?

Write patient's response (Patient facilitators): _____

_____

[Review common facilitators/facilitators that the Patient identified/you may suggest:

Facilitators 1: You can get floss at each of your orthodontic appointments, and if/when you run out you can ask you parent to buy more floss

Facilitators 2: Carry a toothbrush with you at all times

Facilitators 3: Brush after dinner, you don't need to wait until bedtime

Facilitators 4: Other interproximal tools like a proxabrush or a waterpik can help making flossing easier]

Part 3: making a plan

Now I'd like to spend the last couple of minutes talking about your goals and what you can do help reach those goals. What goal would you like to set for this next month?

Patient's Goal: _____

Plan to Reach the Goal:_____

- Allow the patient to give some suggestions about how they can reach that goal. Offer encouragement (e.g.***"That's great"***) or prompt for more detail if necessary (e.g.***"How might you go about doing that?"***)
- Offer additional suggestions based on the facilitators they identified

[Summarize Plan]

Great! It sounds like your goal is to _____ (brush after every meal; floss every day this week; spend more time brushing). We know that _____ may be a barrier for you, and you are going to address it by _____. Does that plan sound right to you?

How confident are you that you can do it? On a scale of 1 to 10, with 1 being not at all confident and 10 being extremely confident? [Choose from one of the Options below that match the patient's response:]

-Option A: HIGH CONFIDENCE Patient chose an 8, 9, or 10:

It sounds as though you are very confident in the plan that you made. That's great! Is there any additional information that I can provide that would be helpful?

-Option B: MEDIUM CONFIDENCE Patient chose a 5, 6, or 7

It sounds as though you are pretty confident in the plan that you made. That's great! Is there anything that could get your confidence from a _____ to a _____? (Increase by 2 points: '5' to a '7' or '6' to an '8' or '7' to a '9').

-Option C: LOW CONFIDENCE Patient chose below a 5

It sounds as though you are (somewhat/a little/not very) confident in the plan that you made. That's okay. As we have been talking about there are a lot of things that can get in the way. Is there anything that could get your confidence from a _____ to a _____? (Increase by 2 points: '1' to a '3' or '2' to a '4' or '3' to a '5').

[Possible ways you could increase confidence:

- Troubleshoot any issues that the patient brings up
- Ask the patient if there are any additional questions or information that you can provide
- Point out when they have been successful in the past (if applicable).
- Link the problem to something that is important to them (if applicable): ***You mentioned that part of the reason that having a healthy mouth is important to you is _____. Would reminding yourself about that help you with your plan?***

Has your confidence in the plan changed at all?

Part 4: summary

Thank you very much for taking the time to talk with me today about such an important topic. I really appreciate it. Here is a brief summary of our discussion:

Barriers: ***The things that might get in the way are:***

Barrier 1:_____

Barrier 2: _____

Facilitators: ***The things that might help you: _____.***

Goal: ***Your goal for next month is to _____.***

Plan: ***You are going to achieve that goal by _____.***

To address the barriers you are going to _____.

Part 5: wrap-up and close

Next time you come in, we are going to take the measurements of your teeth and gums again to see how you are doing.

How does that sound to you?

Is there any additional information I can provide you? Do you have any additional questions?

Again, thank you for your time.

APPENDIX E
MITI CHECKLIST

Recording #:_____ Coder:_____ Date: ____/____/____

Global Ratings

Technical Components					
Cultivating Change Talk	1	2	3	4	5
Softening Sustain Talk	1	2	3	4	5
Relational Components					
Partnership	1	2	3	4	5
Empathy	1	2	3	4	5

Target Change:_____

Behavior Counts

		Total
Giving Information (GI)		
Persuade (Persuade)		
Persuade with Permission (Persuade with)		
Question (Q)		
Simple Reflection (SR)		
Complex Reflection (CR)		
Affirm (AF)		
Seeking Collaboration (Seek)		
Emphasizing Autonomy (Emphasize)		
Confront (Confront)		

Start time and sentence:_____

End time and sentence:_____

APPENDIX F
PLAQUE AND GINGIVAL INDEX RATING

Plaque Index (Modified Silness & Loë 1964) four sites per tooth

Points	Appearance
0	Plaque is not visible following air drying nor can be wiped off with an explorer
1	Plaque is not visible following air drying, but can be wiped off with an explorer
2	Plaque is visible with or without air drying
3	Thick plaque is visible

Gingival Index (Loë 1967) four sites per tooth

Points	Appearance	Bleeding	Inflammation
0	Normal	No bleeding	None
1	Slight change in color and mild edema with slight change in texture	No bleeding	Mild
2	Redness, hypertrophy, edema, glazing	Bleeding on probing	Moderate
3	Marked redness, hypertrophy, edema, ulceration	Spontaneous bleeding	Severe