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The Effectiveness of a Preventive Recall Strategy in Children Following Dental Rehabilitation Under General Anesthesia

Amanda Kerns Dr.

The Effectiveness of a Preventive Recall Strategy in Children Following Dental Rehabilitation Under General Anesthesia

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Dentistry at Virginia Commonwealth University.

By

Amanda Kerns, DDS

BS, North Carolina State University, 2009

DDS, University of North Carolina, 2014

Thesis Advisor: Elizabeth Berry, DDS, MPH, MSD

Vice Chair, Assistant Professor, Department of Pediatric Dentistry

Virginia Commonwealth University

Richmond, Virginia

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Abstract

THE EFFECTIVENESS OF A PREVENTIVE RECALL STRATEGY IN CHILDREN FOLLOWING DENTAL REHABILITATION UNDER GENERAL ANESTHESIA

By Amanda Kerns, DDS

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Thesis Advisor: Elizabeth Berry, DDS, MPH, MSD

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Purpose: This was a prospective randomized controlled trial assessing the impact of a preventive strategy following full-mouth dental rehabilitation (FMDR) in children with early childhood dental caries.

Methods: 130 patients completed FMDR and were included in the analysis. Caries risk assessment (CRA), dental exam, and a caregiver oral health knowledge (OHK) questionnaire was completed for each patient. Patients were randomized into two groups; intervention returned at 3 and 6 months and control returned at only 6 months post-surgery. At each recall, CRA and dental exam information was recorded, and at the six month recall, all caregivers completed the OHK questionnaire.

Results: Actual recall data showed a statistically significant difference in CRA at six months, with 71.8% of patients in the control and 44.8% of patients in the intervention assessed as high caries risk.

Conclusions: The actual recall data suggests this recall strategy is effective in reducing CRA level following FMDR.

Introduction

There has been a substantial decline in caries prevalence that has occurred over the past four decades among children around the world. Unfortunately, caries is still the most common chronic disease of childhood in the United States; more than 40% of children enter kindergarten with a history of dental decay.[1] This pattern shows a strong polarization, with a small group of children harboring high levels of dental caries and treatment needs.[2] The presence of one or more decayed, missing, or filled primary teeth surfaces in a child 71 months or younger has been defined as early childhood caries (ECC). Due to the amount of treatment needed, the age and behavior of the patient, and/or compounding medical issues, these patients often need general anesthesia (GA) to accomplish the full mouth dental rehabilitation (FMDR) that is required.

Consequences of ECC are well documented in the literature and include a higher risk of future decay, risk for delayed growth and development, loss of school days and diminished ability to learn, diminished quality of life, and increased hospitalizations and emergency room visits.[3,4] Additionally, children with ECC are predisposed to developing future carious lesions in their permanent and primary dentition.[4,5] In a study that surveyed 228 parents of children who underwent FMDR under general anesthesia, multiple improved treatment outcomes were noted, including: decrease in pain scores, as well as improved abilities to eat and sleep, by 86 %, 69%, and 41% of parents, respectively.[3]

However, FMDR under GA does not guarantee long-term success, as recidivism rates of future caries are high and presence of ECC is one of the strongest risk factors for the incidence of future caries.[6] Thus, the American Academy of Pediatric Dentistry encourages practitioners to

consider future caries risk when determining how aggressively to treat these ECC patients.[5] Worthen et al. reported that 20% of children treated under GA prior to the eruption of the primary second molars required an additional GA, which presents a unique challenge for practitioners faced with treating these patients.[7] Also, while GA does provide optimal conditions for comprehensive dental treatment, it also adds between $1,000 and $6,000 to the cost of dental care, a significant cost that must be taken into account when treatment planning.[8]

Almeida, et al. reported 79% of children treated under GA for FMDR had additional caries diagnosed within 2 years and Berkowitz, et al. reported 50% of patients treated under GA presented with caries needing further treatment at a 6 month recall appointment.[9,10] Numerous studies support the conclusion that the best outcomes following FMDR after GA result from aggressive treatment of caries, active follow up, and education of the patient and parent. Without intense and frequent preventative visits, the challenges that these families face will eventually lead to reoccurrence of ECC in their children.[2,11]

An understanding of the multifactorial nature of ECC is essential when developing a treatment approach for these patients; the patient, parent, and dentist all affect the outcomes. One challenge dentists often report with these ECC patients is a low level of compliance with recall appointments and preventative plans after FMDR. One study showed only 39% of 193 patients returned for their immediate follow up appointment and another study reported 62% of 269 patients had at least one recall in the 12 months after FMDR.[11,12] Mathu-Muju reported 47% of 100 patients returned for the immediate post-operative visit and concluded that patients with a dental home were more likely to return for preventative care then those without a continuous source of care, and that children who were ASA II/III had lower odds of returning for future care then children who were ASA I.[13] Patients who failed to attend their immediate post-operative

appointment were more likely to relapse and have new caries then patients who did attend an immediate post-operative appointment.[12] In an attempt to improve this number, Primosch, et al. evaluated whether an additional pre-operative consult appointment to educate the caregiver would improve follow-up rates but concluded that it did not.[14] More investigation is needed to identify an intervention strategy that increases follow-up compliance, thus reducing the significant consequences of dental neglect in these ECC patients. While aggressive restorative treatment under GA eliminates consequences of the disease, Gregory et al. demonstrated that MS levels remain unchanged following successful restorative procedures, leaving the patient at high risk for future caries and an additional GA visit.[15]

One study analyzed a population of GA patients, comparing those patients that required only one GA visit with the others that required at least two GA visits. The patients who irregularly attended recall appointments had a four times higher risk of needing a repeat GA.[16] Plonka, et al. evaluated children in three groups: 6-month Home Visits, 6 –month Telephone Calls, and a Control Group. After two years, three Home Visit children of 188 (1.5%) had new caries, compared to four Telephone Call children of 58 (6.8%) and nine Control children of 40 (22.5%). This study concluded that personal contact with patients and instruction in oral hygiene is associated with a decreased risk of future dental decay.[17] One study showed that there may be value in actively pursuing caregivers to promote preventive habits with more aggressive preventative measures, adding that it would be less costly than repeat GA procedures.[18,19] There is existing literature to support the theory that frequent education and follow-up makes a difference in rates of new decay among these patients, yet the best time and route of conveying this information is not yet clear.

In addition, there is also discussion in the literature of whether parental satisfaction post-FMDR has an effect on compliance with preventive follow-up. It would seem reasonable that parents reporting a positive experience with a dentist and particular office would be more likely to return for future visits. However, one study evaluating 228 families concluded that parental satisfaction with the FMDR experience did not have a statistically significant effect on compliance rate with future recall appointments.[5]

Numerous studies have evaluated the attendance rates and effectiveness of preventive recall programs in children who receive treatment under GA, but none have reported on an intervention with less than a 6-month recall interval.[9,10,11,14] The American Academy of Pediatric Dentistry (AAPD) recommends the use of a risk-based recall interval for all patients after completion of the caries risk assessment (CRA). These risk assessment instruments assist dental providers in the identification of oral health indicators, which then allow the identification of children at high, moderate, or low risk for developing caries.[20] The greatest indicator of future caries is past caries experience; therefore, patients who have undergone GA for dental rehabilitation are assigned a level of high caries-risk at their immediate post-operative appointment.[20] Although the presence or history of caries is the strongest predictor for future caries, it offers little utility in screening for caries-free children at risk for ECC. Although multiple CRA instruments exist, these prediction models have yet to be validated for accuracy in the pediatric population.[21,22,23] One retrospective study reported that the Caries Management by Risk Assessment (CAMBRA) tool provides prediction for cavitated lesions, but only between low risk and extreme risk individuals over the age of six.[23] Furthermore, no CRA instruments have been validated among an ECC population in respect to their risk for future caries, thus

assigning an accurate caries risk and corresponding future recall schedule remains a challenge for practitioners.

The AAPD guidelines state that high caries-risk patients should return every 3 months for recall visits, which includes an exam, oral hygiene instructions, caries risk assessment, and a fluoride varnish application.[20] Although there are specific guidelines for caries management according to each patient's risk status, current payment models generally reimburse for topical application of fluoride every 6 months, with similar limitations on the periodicity of exams, radiographs and prophylaxis, regardless of the patient's caries-risk level. Therefore, the 3-month recall interval is not routinely followed. Instead of reimbursing for preventive treatment, the current payment model incentivizes restorative treatment.[19,24]

Kannelis et al. found that less than 2% of Iowa's Medicaid-enrolled children 6 and under ,who received dental services, accounted for 25% of all dollars spent on this age group during one fiscal year, including hospital-based dental treatment under GA.[19] Sheller et al. determined that common risk factors for children requiring repeat dental care under GA included: child brushing his/her own teeth, poor cooperation in the medical/dental setting, difficult personality as described by the parent, dysfunctional social situation, and lack of follow up dental care. This study investigated that increased funding for aggressive preventative measures for high-risk children may be less costly than repeat GA.[18] A meta-analysis of the literature has shown that there is insufficient evidence based on previous randomized controlled trials (RCTs) to support or refute the traditional 6-month recall interval advocated by most providers.[19] Recent findings from a quality improvement project, the Early Childhood Caries Collaborative, have demonstrated improved oral health outcomes with the implementation of risk-based disease management protocol including more frequent recalls and increased preventive measures in

children under 5 years. Children participating in the Early Childhood Caries Collaborative reported less new cavitation, pain, and referrals to the operating room for restorative treatment compared to historical controls.[25] Despite the successes reported among patients within the collaborative, a challenge to the widespread adoption of this non-surgical management remains the existing reimbursement policy. These findings demonstrate a need for additional RCTs to identify caries risk assessment tools and recall intervals that result in improved oral health outcomes, especially for children with ECC.

Studies have also shown that the conventional approach of delivering a message to patients about oral health behaviors does not effect change in their behavior.[26,27] Motivational interviewing (MI) is emerging as an effective intervention technique to educate and motivate pediatric patients and caregivers to make positive changes in health behaviors.[28] MI is a patient-centered approach that encourages individuals to talk about their perception of health problems and discuss the pros and cons of changing with their health care provider. The ultimate goal of MI is to help remove the barriers, enabling the patient to resolve their ambivalence to change.[28,29,30,31] MI techniques have been employed successfully in the management of chronic conditions when traditional advice-giving has failed**,** including one study that reported a 64% success rate when motivational interviewing was used in brief encounters of 15 minutes, with improved success rates with increased numbers of encounters with each patient**.**[28]

It is encouraging that MI techniques should be used to assist caregivers in the management of ECC in their children. Several studies have shown that when caregivers of pediatric dental patients receive OHI in an MI style, the caregivers demonstrated improved oral health behaviors and the patients had less caries.[25,29,32,33] A goal selection sheet is an adjunctive tool used routinely during MI. The oral health goal sheet is designed for patient and caregiver

use and features several items in picture format that represent ideas for positive oral health behavior changes. After completing the CRA and dental exam, the provider summarizes the findings and explains the caries process to the caregiver. The caregiver and provider then review the goal sheet, and the caregiver is asked to select 1-2 home behaviors from the goal selection sheet to work toward. The use of a goal selection sheet during MI allows caregivers to set self-management goals, and by revisiting goals at subsequent recall visits, caregivers can receive positive reinforcement for the goals met and discuss obstacles faced in achieving the selected goal.[28,34]

At preventive recall visits, oral health information must be communicated in an effective manner between the dentist and caregiver. A recent systematic review on the effectiveness of MI compared to conventional health education (CE) did suggest that MI outperformed CE in improving oral health behaviors in infants and preschool children, particularly in relation to oral hygiene.[35] Thus, MI has been shown to be useful in raising awareness as a starting point for behavior change, but supplementing this with printed materials, such as the oral health goal sheet, and ongoing support may be necessary for longer tem behavioral change.[36,37]

The purpose of this study was to determine if the implementation of a preventive recall strategy utilizing MI techniques, more frequent recall intervals, and goal-setting will decrease the future caries risk assessment and incidence of new caries in an ECC population following FMDR under GA.

Aim 1: To assess the effect of a preventive recall strategy on the change in CRA level among patients treated at 3 and 6 months post-GA with those treated only 6 months post-GA.

Aim 2: To assess the effect of a preventative recall strategy on caries incidence among patients treated at 3 and 6 months post-GA with those treated only 6 months post-GA.

Materials and Methods

The subjects for this study were recruited from the VCU Pediatric Dental Clinic between July 2014 and January 2016, after they were identified as requiring FMDR under GA at their consultation visit due to ECC. Inclusion criteria were as follows: 1) children with extensive caries; 2) treatment planned for FMDR under GA; 3) less than 6 years of age. Exclusion criteria were as follows: 1) non-English speaking caregivers; 2) caregivers who chose not to participate in the study at the consultation visit. Informed consent was obtained from the caregivers of the eligible participants by pediatric dental residents and faculty, after explaining the aims and procedures of the study. After consent was obtained, the guardian completed a 36-item questionnaire regarding demographic information, patient medical history, current dietary and oral health behaviors of both caregiver and patient, and a brief 11-item Oral Health Knowledge (OHK) assessment. The OHK assessment underwent a pre-test prior to administration to participants. The information from the subject's CRA and findings from the dental exam within the electronic health record was recorded from the consultation visit.

The CRA instrument used at VCU follows the AAPD guidelines. The CRA instrument assigns patients an overall caries risk level of high, moderate or low, based on the caregiver's responses to the CRA questions, and the findings from the dental exam. For the dental exam, the caries status of each presenting tooth surface was recorded by lesion site and activity using a modified version of the International Caries Detection and Assessment System (ICDAS) criteria. The presenting tooth surfaces were scored as being caries-free (0), non-cavitated incipient lesion

(1), caries cavitated into enamel or dentin (2), or restored (3). All consultation examinations were performed by pediatric dentistry faculty or residents. Two calibrated pediatric residents (KN and AK) completed the recall appointments for all study patients following GA.

After consent was obtained, the participants were then randomly assigned to either the intervention group (3-month recall interval) or the control group (6-month recall interval) following GA. Randomization was completed with computer generation. A one-month post-surgery appointment was required for all patients in both groups. At the post-surgery appointment, a new CRA and dental exam were completed in the manner previously described. The caregiver was asked to select a home oral health behavior goal from a goal selection sheet to work towards reducing the patient's caries risk. The patients then returned for a recall visit either 3 or 6 months following the date of their GA visit, depending on the group to which they were randomly assigned. At each recall visit, the CRA, dental exam, prophylaxis, and fluoride varnish were completed, and the guardian selected a new oral health behavior goal. Throughout each visit, the pediatric dental resident (either KN or AK) incorporated MI techniques to address high caries-risk issues identified in the CRA, including: asking open-ended questions, reflective listening, and the use of the goal selection sheet to identify which oral health behavior changes are important and realistic to change according to the caregiver. The dental exam and CRA information were extracted from the dental record at the initial visit, the post-surgery visit, and all subsequent recall visits. The oral health behavior goal chosen by the caregiver was extracted from the dental chart at the post-operative and recall visits.

Approval for this study was obtained from the Institutional Review Board, Committee on Human Research (VCU IRB# HM 20001296). A modification was approved to this existing IRB in February 2015 that extended the timeline approved in the original IRB through January 2016.

Data analysis

The outcome variable for Aim 1 was CRA level, designated as high, moderate or low. A chi squared test was used to compare the CRA level at the consultation visit to the CRA level at the post-surgery and recall visits respectively. Aim #2 of this study was to evaluate if the preventative strategy used in this study impacted future caries incidence. Two incidence percentages were calculated, one for the percentage of available tooth surfaces moving from a less-carious state to a more-carious state, meaning the teeth became less healthy. This percentage was calculated by summing: the number of surfaces at caries=0 during the consultation visit that at the 6 month visit were either caries=1 or 2; and the number of surfaces at caries=1 during the consultation visit that at the 6 month visit was caries=2. The other incidence percentage counted the surfaces moving from a more-carious state to a less-carious state, meaning the tooth was getting healthier. This percentage was calculated by summing: the number of surfaces at caries=1 during the consultation visit that, at the 6 month visit were caries=0; and the number of caries=2 surfaces during the consultation visit that were caries=0 or 1 during the 6 month follow-up visit. The denominator for both of these percentages—that is "at risk"—was the surfaces that were caries=0, 1, 2 at consultation and not caries=4 (restored) at the 6 month follow-up visit.

The incidence percentage was compared across the groups using a logistic regression which equally weighted each patient in the study. Results were summarized using 95% confidence intervals. All analyses were performed using SAS software (SAS Institute Inc., Cary NC). The primary results were reported using an intent-to-treat analysis at the completion of the study. That is, some patients randomized to a 3-month recall did not actually return until the 6-month time point, and some patients randomized to the 6-month interval actually returned

earlier. All data available on a patient was included in each analysis. The planned recruitment of 150 patients accounted for some anticipated dropout at each time point.

All study variables were entered into a REDCap database. Results were described using counts/percentages or means/SD, as appropriate. 95% confidence intervals were reported for all of the estimates. All analyses were performed using SAS software (SAS version 9.3, JMP version 11, SAS Institute, Inc., Cary NC)

Results

The results will be presented in five sections. First, the characteristics of patients in the study were described and then the relationships between oral health knowledge and care-giver behavior. The oral health goals are then briefly discussed, followed by caries risk and the relationship with recall frequency. Lastly, the results of the clinical exam, including caries incidence and relationship with recall frequency was demonstrated.

Patient Characteristics

In this prospective study, as of January 6, 2016 there were 150 patients and caregivers who were eligible and consented to the study. Equal numbers (75 each) were randomized to the control and the intervention groups. However, some patients did not have their surgery for various reasons: patient and caregiver failing surgery appointment, cancelling appointment due to illness, financial and insurance issues, caregiver-cited scheduling conflicts, or caregiver's apprehension to dental treatment and/or general anesthesia. These patients and caregivers were contacted multiple times to reschedule their surgery appointment. Twenty patients were consented to the study but did not have surgery. There were 63 patients randomized to the control group and 67 patients randomized to the intervention group who received FMDR and are thus included in the results below. **Error! Reference source not found.** shows the flow of patients from eligibility, through randomization, GA surgery, GA follow-up, 3 month recall (intervention group only) and 6 month recall (intervention and control patients). After surgery, there was a post-surgery visit approximately one month later, and 38 control patients (out of 63) and 43 intervention patients (out of 67) completed this follow-up. Forty-nine patients failed to

attend this GA follow-up but did present for either a 3 or 6 month recall. After surgery, patients were also encouraged to attend a recall visit either at 3- or 6-months, as randomly assigned. In the control group (6 month recall), 51 patients did not return for a 3-month recall and did return for a recall at 6 months or later. In the intervention group (3 and 6 month recall), there were 28 patients who returned for a 3 month recall and at least one more recall at least 6 months after the 3 month recall. This thesis reports on all patients who completed surgery under GA, irrespective of group assignment.

Of the 150 patients included in the results, the average age was 46.8 months for the patients randomized to the control group and 47.9 months for the patients randomized to control group. The breakdown of patient race and parent level of highest education is shown in

Table 1. Overall, in the Control group, 35% identified as White and 52% identified as Black. In the Intervention group, 43% identified as White and 49% identified as Black. Of the patients who identified as "other," they all noted that they were Hispanic or from Latin-America.

Table 2 shows the breakdown of patient race based on whether they were compliant in completing the recall schedule to which they were randomized. In the group that did complete

their recall schedule, 27% of these patients were white and 61% of these patients were black. In the group that did not complete their recall schedule, 63% of these patients were white and 19% of these patients were black, which was a statistically significant difference (p=0.001).

Patient medical history is shown in

Table 3. The most common positive medical history item was a breathing disorder (17 % in the control group and 23% in the intervention group) followed by premature birth (8% in the control group and 9% in the intervention group). The "not listed" medical conditions included: Alexander's Disease, cerebral palsy, mild sleep apnea, eczema, osteochondroma, and seasonal allergies. There were no statistically significant differences between patients randomized to the control or intervention group for demographics or significant medical history.

The caregiver was asked questions about their child's dental care and the results are summarized in Table 4. In response to the question "Is it very difficult to get your child to the doctor or dentist?" 23% of caretakers in the control group and 20% of caretakers in the intervention group answered "Yes." There was no statistically significant difference between the two randomized groups regarding perceived barriers by the caregivers. Barriers listed include transportation, distance, finances, job conflict, and fear/anxiety, with transportation reported as the most common barrier (indicated by 14% of control caregivers and 9% of intervention caregivers).

Knowledge and Behavior

Caregivers were then asked 11 items regarding OHK, and the results are summarized in Table 5. A "Yes" answer is correct for each item. Every caregiver did not necessarily answer every item (75% answered 8 or more) and the number correct ranged from 1 to 11. Among all caregivers who completed their assigned recall schedule, the item answered correctly the least was "Adults who have tooth decay can pass tooth decay germs

to their children" (39% correct). The item answered correctly the most in both the control and intervention groups was "The risk of getting tooth decay increases when a person eats sugary snacks and drinks between mealtimes" (89% of caregivers in each group answered this correctly).

Table 6 demonstrates the percent of correctly answered items for caregivers who completed their assigned recall schedule and for those who had not completed a recall. There were no statistically significant differences in the percentage of caregivers that answered each question correctly when comparing the patients in the control and intervention groups or in the completed recall versus did not complete recall groups.

Questions regarding tooth care and nutritional habits were asked and findings are summarized in

Table 7. This table includes the presence of high caries risk factors such as frequency of sugary beverage and snack intake, as well as intake of sugary beverages via sippy cup or overnight. It also identifies the presence of protective factors such as frequency of tooth brushing with fluoride toothpaste, whether a parent is brushing for the patient, and frequency of fluoridated water intake. One finding that approached statistical significance when comparing tooth care habits between patients in the control and intervention groups was the habit of tooth brushing by an adult. Among patients in the intervention group, 81% of these had an adult brushing the child's teeth and in the control group 77% of patients have an adult brushing the child's teeth ($p= 0.057$).

Goals:

After surgery, as part of the follow-up, participants participated in a motivational interview and were asked to choose a goal. The number and percentages choosing each goal group are shown in

Table 8, Figure 3, and Figure 4. There is no reason to suspect that the two randomly assigned study groups would choose different goals, but a chi-square test was performed on each to compare the two groups. The p-values in the right column of

Table 8 indicate that only in the case of healthy snacks were the groups potentially different.

During the recall visits, the MI process is repeated and new goals may be set. The of each visit are shown in

Table 9. The change in goals across time is shown in Figure 5, Figure 6, and Figure 7.

Caries Risk Assessment

A caries risk assessment was completed at the consultation visit as well as at each recall visit and the results are summarized by recall group in Table 10, Table 11, Figure 8 and Figure 9 . Figure 8 and Table 10 show the caries risk assessment over time for the patients randomized into each group, regardless of when or how often the patients actually came for appointments. It does not take into account that some of these patients assigned to the control group actually came more frequently or that some of the patients assigned to the intervention group actually only came as if they had been assigned to the control group. All patients in both the control and

intervention group were assessed as high risk at their initial surgery consult, with a subsequent increase in protective behaviors and a decrease in high risk behaviors observed between the consult and post-surgery visit. This is demonstrated by a decrease from 100 % high caries risk to 63% high caries risk at the GA follow up appointment for both groups. At the six month recall time frame this distribution of high caries risk is maintained, with no significant difference in caries risk assessment between the control and intervention groups, as illustrated in Table 10.

Figure 9 and Table 11 demonstrate the same data but categorizes the control and intervention groups based on when the patients actually came in for appointments, regardless of which groups they were randomized into. For example, if a patient was randomized into the control group and thus was expected to come for only a six month recall visit but came in for a three and six month recall visit regardless, they were then included with the intervention group data. The same was done with the patients randomized into the intervention group, if they were supposed to come at both 3 and 6 month recalls but only attended a 6 month recall or later, they were grouped into the control data. All patients were assessed as high caries risk at the surgical consult appointment and all recall groups (regardless of how many recalls occurred) experienced an increase in protective factors and a decrease in high caries risk factors at the post-surgery visit, as demonstrated with fewer patients rated as high caries risk. By the six month recall appointment, there was a notable difference between the control (6 month recall only) and intervention (3 and 6 month recall) groups. The control group had 71.8% of patients assessed as high caries risk and the intervention group had 44.8% of patients assessed as high caries risk, which was a statistically significant difference.

Caries Incidence

Aim #2 for this study evaluated caries incidence and the main comparison was between the two intent-to-treat, randomly assigned recall groups. Every surface measured during the consultation visit and the 6 month follow-up visit was summarized in Table 12 **.** In the 2776 surfaces measured in the patients assigned to the control group, 82% were caries free and in the 2703 surfaces measured in the patients assigned to the intervention group, 77% were caries free during the consultation visit. In the control patients, 0.2% of the surfaces got worse (3 out of 1502) and 1.7% got better (25 out of 1502). In the intervention patients, 0.7% got worse and 5.7% got better. A logistic regression estimated the two incidence percentages and compared them across the two groups. These results are shown in Table 13**.** Note that the percentages in Table 12 and Table 13 are slightly different because the first weights surfaces equally and the second weights patients equally. There was no evidence for a significant difference between the two groups either for worsening ($P > 0.7$) or getting better ($P > 0.3$).

The secondary analyses compared the actual follow-up groups. Table 14 shows the patients who were actually seen at 3 months and those who were not seen until after that. The logistic regression results in Table 15 shows that there was no evidence that the actual follow-up interval resulted in a different worsening incidence ($P > 0.9$) or a difference improving incidence ($P > 0.2$).

Discussion

Early childhood caries affects 28% of children between 2-5 years of age, with 40% of children having experienced caries by the time they begin kindergarten.[38] Children of low socioeconomic status are disproportionately affected, with 33% of low-income children experiencing 75% of the caries burden. Additionally, oral health disparities exist among racial and ethnic minorities.[39,40] The racial composition of this study population for the control group is: 35% white, 52% black, and 17% other. The racial composition of this study population for the intervention group was 43% white, 49% black, and 23% other, with no statistically significant differences between the two groups.

Table 2 shows the subjects split into groups depending on whether they did or did not complete the recall schedule that they were randomized into. There were 27% of white patients and 61% of black patients that did complete the recalls they were assigned to and 63% of white and 19% of black patients that did not complete the recalls in which they were assigned. This is a statistically significant difference and does not agree with the bulk of existing literature, which

reports that minority patients are less likely to receive preventative dental care.[40,41]The VCU Department of Pediatric Dentistry where this study was conducted is located in Richmond, Virginia, an urban city of approximately 200,000 residents with about 50% African American inhabitants.[42] In contrast, the smaller, more rural towns located as far west as Williamsburg and as far east as Charlottesville have a considerably higher Caucasian population. Thus, it is likely that the reason this study reported a higher compliance rate in recall schedule among black patients then white patients was because these patients were originally referred from dentists in geographical locations closer to the VCU Department of Pediatric Dentistry. Thus, attending recalls at the VCU Department of Pediatric Dentistry was closer, easier, and more likely to occur for these caregivers then for patients that had been referred from one of the further away, more rural towns. The other likely reason to explain this difference is that patients referred from further geographical distances were more likely to return to their referring dentist for follow-up visits, regardless of whether they had been consented to the study. This finding is consistent with Enger, et al., who reported a significant difference in follow-up compliance with respect to distance traveled, with patients living within the city returning at higher rates than those living outside the city.[43] In future studies, it would be advisable to change inclusion criteria to reflect that only patients that intend to come back to the VCU Department of Pediatric Dentistry for their post-GA care should be included. Thus, patients who were referred from a long geographical distance and are unable to return for follow up care would be excluded from the study.

In the present study, 62% (81/130) of patients eligible for the one-month post-surgery visit attended. Other studies report post-operative attendance that varies, with Foster reporting 39%, Mathu-Muju reporting 47% and Jamieson and Vargas reporting 54% attendance.[12,13,44] In

the retrospective study by Primosch et al, they reported a 60% attendance rate for patients required to attend an additional pre-surgery preventive visit, while attendance among the control group was 48%. In the present study, the compliance in completing the assigned recall schedule for the control group was 81% (51/63) and the compliance in completing the assigned recall schedule for the intervention group was 61% (41/67). A patient was considered "compliant" regardless of whether they did attend the one-month post-operative appointment, as long as they attended the assigned subsequent recalls. This contrasts with the literature, which reports much lower rates of attendance at a recall visit 6 or more months following surgery.

Evaluation of caries risk was an important component of this study, as the AAPD recommends the use of caries risk assessment in determining the proper recall frequency and preventative recommendations for patients. Currently, no existing CRA instruments have been validated among an ECC population with respect to the patients risk for future decay. The greatest indicator of future caries is past caries experience; therefor, all patients who have undergone GA for dental rehabilitation are assigned a level of high-caries risk initially, and the patients in this study were no exception. [20,21] Twetman et al. argues that this predictor is far from ideal, and that caries risk may not only change over time in individuals but also on a community level.[45,46] If the AAPD CRA instrument is followed, the patients in this study could remain high caries risk indefinitely due to their prior history of caries. This provides a high sensitivity but a low specificity, resulting in an over diagnosis of high caries risk overall.[20] Patients in the present study were determined to be at moderate risk at a post-surgery visit only if caregivers answered "no" to the following high risk factors: patient put to bed with bottle containing natural or added sugar, more than 3 sugar containing snacks or drinks, and patient has obvious white spot lesions or decay present. In addition, to be considered moderate risk, caregivers had to report "yes" to

protective factors: patient receives fluoridated drinking water or supplements, and patients teeth are brushed daily with fluoridated toothpaste.

All patients in the present study were assessed as high caries risk at the surgical consult appointment and all recall groups experienced an increase in protective factors and a decrease in high caries risk factors at the post-surgery visit, as demonstrated with fewer patients rated as high caries risk. When the actual recall data is analyzed, by the six month recall appointment, there was a notable difference between the control (6 month recall only) and intervention (3 and 6 month recall) groups. The control group had 71.8% of patients assessed as high caries risk and the intervention group had 44.8% of patients assessed as high caries risk, which was a statistically significant difference. There is no statistically significant difference in caries risk at the 6 month post-surgery caries risk assessments between the control and intervention groups when the randomly assigned recall data is used. Thus, it is possible that the patients who came at 3 and 6 months and were thus included in the intervention data analysis were inherently more motivated to lower their child's caries risk. It is also possible that the occurrence of an additional recall visit using MI techniques helped educate and motivate more caregivers to improve protective factors and decrease risk factors, thus lowering the caries risk for more patients.

Traditionally, health care providers have been trained with a directive style of communication with their patients**.** However, there are instances when a health provider cannot just direct the patient to a certain outcome, especially true when the situation calls for change in behavior or lifestyle. When a change in behavior is necessary, it is essential to engage the patient's own energy, motivation, and commitment. It is well documented that patients generally prefer a patient-centered communication style, such as MI, over this traditional directive approach.[47,48] Rather than the health professional taking on the role of the "expert," MI places the

patient/caregiver in that role, providing them the opportunity to interpret information in the context of their own life and social circumstances and decide whether it is relevant for them.[49]

Weinstein,et al. reported findings from a two year blinded randomized controlled trial involving 240 infants aged 6-18 months. All mothers in the study received a dental health pamphlet and video, but only the experimental group mothers also received MI delivered by trained women lay counselors (non-health professionals) using a specifically developed protocol. After two years, a 46% lower prevalence of decayed tooth surfaces was reported for children whose mothers were in the experimental group. Families in the experimental group more routinely received fluoride varnish application (4.1 fluoride applications versus 0.3 applications for the control group), which was likely responsible for the lower caries rate. This may suggest that mothers in the MI group felt more positive about oral health care for their children and more motivated to access preventative dental services.[50] Naidu, et al. demonstrated a statistically significant difference in retention rates among patients in their study, with patients in the intervention group that received MI via telephone calls being more likely to remain in the study and thus to obtain preventative dental services over time.[49]

MI has been shown to reduce ECC prevalence, even in the absence of improved preventative services, such as fluoride varnish. One study specifically examined the use of MI by primary care physicians (PCPs) in the absence of fluoride varnish and at one-year follow up, the ECC prevalence for the intervention group was 17.7 %, compared to 31.7 % at the control site.[51] An evidence-based national clinical guideline for caries prevention from the United Kingdom in 2014 states that "oral health promotion interventions should be based on recognized health history behavior and models such as MI." [52] As more RCTs provide support for the effect that MI

provides for caries risk and incidence, potentially changes in reimbursement models will drive clinicians to make this integral change in the management of ECC.

The existing paradigm for establishing early dental care has been met with limited success; despite the 2014 American Academy of Pediatrics (AAP) policy outlining the need for early screening, risk assessment, and the establishment of a dental home by 12 months, Medicaid data from 2008 in Iowa revealed that only 9% of one to two year olds received a preventative dental visit.[53] The challenges are multifactorial- few pediatricians refer children for dental care at age one, few dentists are comfortable treating patients under the age of three, fewer will provide necessary restorative care younger kids, and many do not accept Medicaid because of low reimbursement rates in their state.[54] The reality of these challenges necessitate the identification of new strategies for managing ECC and ending this epidemic. The AAP developed a simplified screening tool, and through the Quality Improvement Innovation Network pilot of the tool revealed that over 80% of primary care practices found the tool easy to implement, that it only took two minutes during the well child visit, and that identification of high risk patients for oral health referral increased from 11% to 87% with tool use.[54] This is particularly impactful since though preventative visits to the dentist are rare among children under three years of age, children average over 10 or more visits with their primary care physician (PCP) during the first two years of life alone.[5] The limited resources mentioned above, mainly dentists willing and able to treat these ECC patients, make caries risk assessment and subsequent referral by the PCPs based on risk an invaluable part of the management of this disease.

There are many external factors that affect access to care among families with children that have ECC, including: availability of providers, lack of transportation, lack of insurance, inadequate time off work, and difficulty in navigating the system to identify available

resources.[55] Access to care and utilization remains an issue for patients of low socioeconomic status and those with Medicaid insurance. In this study, 23% and 20% of the control and intervention groups, respectively, reported experiencing barriers to accessing dental care for their children, with transportation being listed as the most common barrier. This is consistent with a study of 183 urban caregivers from Texas and their children's missed appointments, reporting that an inability to access transportation resulted in at least one missed appointment for 25 % of the sample.[56] Even when common barriers are addressed, such as the provision of Medicaid insurance, Medicaid arranged transportation, and Medicaid-accepting providers, the presence of financial distress is a significant predictor of unmet dental needs.[57] Thus, patients of low SES are less likely to access regular dental care and are more likely to miss dental appointments.

The term "case management" refers to a collaborative process of assessment, planning, and facilitation to help these families access healthcare through communication and connecting them with available resources.[50] One example of case management and the effects it can produce is the Access to Baby and Child Dentistry (ABCD) program, instituted in Spokane County, Washington State in 1995. This program consisted of four components: outreach, training and certification of dental professionals, enhanced dental benefits, and enhanced dental fees. With considerable input from local dentists, the local health department provided orientations and follow up for families at high risk of ECC, ensuring they knew how to identify a provider for their children, how to access preventative care appropriately, and understood the importance of being on time and not missing appointments. Faculty from the University of Washington dental school provided training to local dentists on behavior management, preventive education, fluoride varnishes and fluoride-releasing glass ionomers. ABCD-certified dentists were incentivized to treat these patients through a series of add-on fees that raised the maximum

allowable payments to the 75 percentile of all usual and customary fees. Data showed that children participating in the ABCD program were 5.3 X as likely to have experienced a preventative dental visit as compared to Medicaid-enrolled children not included in the ABCD program.[58] This program is an excellent example of using a multi-layered approach to effectively break down the barriers that prevent patients with ECC from accessing dental care. In the present study, the pediatric dentist was the person to call the family to schedule and re-schedule appointments, an attempt at limited case management that may partially explain why compliance rates at the post-surgery and subsequent recall visits were higher in this study then among others in the literature. It also brings up the issue of reimbursement as a barrier for dentists not treating ECC.

Currently, the American Academy of Pediatric Dentistry (AAPD) and the AAP have policies supporting early screening and risk assessment, as well as the establishment of a dental home by age one year. While these policies are important and grounded on the knowledge that high caries-risk habits are often present in children by age one year, these policies continue to isolate oral health from the overall health continuum. Currently, our existing medical model depends on PCPs to provide primary prevention for most medical conditions, with subsequent referrals to specialists for patients at high risk or those with the disease. It appears reasonable that this model would also work for oral health, with the dentist being the specialist. Importantly, fluoride varnish application in the medical setting has proven successful in reducing ECC prevalence and intensity. For example, the Into the Mouth of Babes (IMB) program in North Carolina in 2007, where pediatric medical residents provided an oral screening, oral health counseling and if necessary, referral to a dentist. This program demonstrated a 17 % reduction on average in dental-caries related treatments for children with at least 4 IMB visits as compared to

children with no IMB visits.[59] In addition to improving access to oral health preventative services, a costs/analysis proved that this program contributed to the financial viability of the pediatric medical clinic overall.[59]

Reimbursement and policies to support reimbursement are important change drivers in health care. The US Preventative Services Task Force felt that evidence for the effectiveness of fluoride varnish was strong enough to recommend its application for all children starting at tooth eruption, regardless of the child's caries risk.[60] Reimbursement to PCPs for fluoride varnish application and oral health assessment has shifted dramatically over the past decade, such that now only four states do not reimburse for fluoride varnish in the primary care setting.[61] A comparative analysis of strategies to integrate medical and oral health care suggests that the most cost efficient way to significantly impact ECC is to employ the use of trained community health care professionals to provide ongoing risk assessment and counseling as an interprofessional collaborative to manage ECC. To realize such change, insurance programs would have to recognize the work of these community health professionals or change reimbursement models to incentivize counseling and prevention, rather than traditional restorative treatment. Meeting this challenge will require medical and dental insurance companies to work collaboratively to realize improved health outcomes and savings.[62]

Some limitations of the present study must be considered when interpreting the findings. Sample sizes and subsequent group allocations were relatively small due to limitation in principal investigator resources. The relatively high rate of attendance at both the post-surgery and recall appointments may be the result of increased effort made by the principal investigator, such as having the dentist call to schedule/reschedule participants, as well as the $20 cash incentive given at the 6- month recall appointment. Additionally, volunteer bias may account for

a higher percent of attendance at follow-up visits when compared to past studies, which were mainly retrospective in nature; caregivers who were willing to participate in the study may have been more motivated to return for follow-up care regardless of participation. The duration of the study was short, as each participant was only followed 6 months after their surgery. This design was to avoid further drop out and loss of contact with participants. It is possible that additional changes in caries risk, incidence, and oral health knowledge between the experimental and control groups might have been detected if participants were followed for 12 months post-surgery. Self-reported questionnaires can be affected by participant recall. Also, response bias may have resulted from 'social desirability,' meaning that parents in-accurately reported their own or their children's nutritional or oral hygiene habits, tending to over-report behaviors considered socially desirable, and under-report habits viewed as undesirable. It was difficult to confirm that the same caregiver completed both the initial (at FMDR consult) and 6- month recall OKC survey because all data was de-identified. Thus, some data may be skewed because different caregivers completed each survey and there is no true baseline to compare the 6 month recall survey with.

Future studies should address whether or not the preventive strategy implemented in this study would result in a significantly reduced incidence of new caries following FMDR. Differences in caries risk assessment and incidence of new caries evaluated among patients who return at 3-month vs. 6-month intervals over a two-year period post-FMDR would be ideal. Efforts should be made to identify and design the study to minimize subject drop-out over the two-year follow up.

Conclusions

The purpose of the study was to determine if the implementation of a preventive recall strategy utilizing MI techniques, more frequent recall intervals, and goal-setting would decrease the caries risk in an ECC population following FMDR. A secondary aim was to determine the effect of this preventive recall strategy on the incidence of new carious lesions in this population post-GA. Prior to FMDR, all patients were high caries risk. Actual recall data showed a statistically significant difference in caries risk assessment at six months post-GA, with 71.8% of patients in the control group and 44.8% of patients in the intervention group being assessed as high caries risk. There was no significant difference in caries risk assessment when patients were analyzed in the groups to which they were randomized. There was no significant difference in incidence of new caries between the two groups; all patients had a lower caries incidence compared to historical controls. The actual recall data suggests that the preventive recall strategy is effective in reducing CRA level in ECC children following FMDR and in preventing new caries post-GA.

Literature Cited

1. "Guideline on Infant Oral Health Care." *American Academy of Pediatric Dentistry Council on Clinical Affairs.* (2014 Revision).

2. Alkilzy, Mohammad, et al. "Referral patterns and general anesthesia in a specialized pediatric dental service." *International Journal of Pediatric Dentistry. (2014)*

3. Acs, George. "Perceived outcomes and parental satisfaction following dental rehabilitation under general anesthesia." *American Academy of Pediatric Dentistry.* V23 (2000) p.419-423.

4. Okunseri, Christopher. "Pilot survey of oral health-related quality of life: a cross-sectional study of adults in Benin City, Edo State, Nigeria." *BMC Oral Health.* V5:7 (2005)

5. "Policy on Early Childhood Caries (ECC): Unique Challenges and Treatment Options." *American Academy of Pediatric Dentistry Council on Clinical Affairs.* (2014 Revision).

6. Batawi, H. "Factors affecting clinical outcome following treatment of early childhood caries under general anesthesia: a two year follow-up." *Pediatric Dentistry.* September 13, 2013.

7. Worthen TB, Mueller W. Implications of parental compliance on decision making in care provided using general anesthesia in a low-income population. *ASDC J Dent Child*. 2000;67:197-9, 161.

8. Tinanoff, N, et al. "Update on early childhood caries since the Surgeon General's Report." *Academy of Pediatrics.* V9 (2009) p. 396-403.

9. Almeida, AG, et al. "Future caries susceptibility in children with Early Childhood Caries following treatment under general anesthesia." *Pediatric Dentistry*. V. 22 (2000) p. 302-306.

10. Berkowitz, RJ, et al. "Clinical outcomes for nursing caries treated using general anesthesia." *J Dent Child.* V. 64 (1997) p. 210-211.

11. Amin, MS, et al. "Early childhood caries: recurrence after comprehensive dental treatment under general anesthesia." *European Archives of Pediatric Dentistry.* V11 (2010) p.269-273.

12. Foster T, Perinpanayagam H, Pfaffenbach A, Certo M. Recurrence of early childhood caries after comprehensive treatment with general anesthesia and follow-up. *J Dent Child (Chic)*. 2006;73:25-30.

13. Mathu-Muju KR, Bush HM, Ho LA, Golden S, Roberts MW, Wright TJ. Socio-ecological factors associated with returning for post-operative care after dental treatment under general anesthesia. *Pediatr Dent*. 2010;32:27-34.

14. Primosch, RE, et al. "Outcomes assessment an intervention strategy to improve parental compliance to follow up evaluations after treatment of early childhood caries using general anesthesia in a Medicaid population." *ASDC Journal of Dentistry for Children; 68:102-8. (2001) p. 80.*

15. Gregory RL, el-Rahman AM, Avery DR. Effect of restorative treatment on mutans streptococci and IgA antibodies. *Pediatr Dent*. 1998;20:273-277.

16. Kakaounaki, Eirini, et al. "Repeat General Anesthesia, a 6-year follow up." *International Journal of Pediatric Dentistry.* V21 (2011) p.126-131.

17. Plonka, Kathyrn, et al. "A controlled, longitudinal study of home visits compared to telephone contacts to prevent early childhood caries." International Journal of Pediatric Dentistry. V23 (2013) p.23-31.

18. Sheller, Barbara, et al. "Reasons for dental treatment under general anesthesia for the healthy child." *Pediatric Dentistry* v. 25 No. 6 (2003) p. 546-552.

19. Kanellis, MJ, et al. "Medicaid costs associated with the hospitalization of young children for restorative dental treatment under general anesthesia." *Journal of Public Health Dentistry.* V.60 (2000) p. 28-32.

20. American Academy of Pediatric Dentistry. Guideline on caries-risk assessment and management for infants, children, and adolescents. *Pediatr Dent*. 2013;35:E157-64.

21. Schwendicke F. Baseline caries prevalence was the most accurate single predictor of caries risk in all age groups. *Evid Based Dent*. 2013;14:102.

22. Mejare I, Axelsson S, Dahlen G, et al. Caries risk assessment. A systematic review. *Acta Odontol Scand*. 2014;72:81-91.

23. Carson SJ. Limited evidence for existing caries assessment systems. *Evid Based Dent*. 2013;14:10-11.

24. Tinanoff N. Potential to improve oral health care through evidence, protocols, and payment models. *J Public Health Dent*. 2012;72 Suppl 1:S48-51.

25. Ng MW, Ramos-Gomez F, Lieberman M, et al. Disease Management of Early Childhood Caries: ECC Collaborative Project. *Int J Dent*. 2014;2014:327801.

26. Cotugna N, Vickery CE, Carpenter-Haefele KM. Evaluation of literacy level of patient education pages in health-related journals. *J Community Health*. 2005;30:213-219.

27. Tinanoff N, Daley NS, O'Sullivan DM, Douglass JM. Failure of intense preventive efforts to arrest early childhood and rampant caries: three case reports. *Pediatr Dent*. 1999;21:160-163.

28. Rubak S, Sandbaek A, Lauritzen T, Christensen B. Motivational interviewing: a systematic review and meta-analysis. *Br J Gen Pract*. 2005;55:305-312.

29. Freudenthal JJ, Bowen DM. Motivational interviewing to decrease parental risk-related behaviors for early childhood caries. *J Dent Hyg*. 2010;84:29-34.

30. Harrison R, Benton T, Everson-Stewart S, Weinstein P. Effect of motivational interviewing on rates of early childhood caries: a randomized trial. *Pediatr Dent*. 2007;29:16-22.

31. Gianos E, Schoenthaler A, Mushailov M, Fisher, E. Rationale and design of the Investigation of Motivational Interviewing and Prevention Consults to Achieve Cardiovascular Targets (IMPACT) trial. *Am Heart J.* 2015; 170(3): 430-437.

32. Naidu R, Nunn J, Irwin JD. The effect of motivational interviewing on oral healthcare knowledge, attitudes, and behavior of parents and caregivers of preschool children: an exploratory cluster randomized controlled study. *BMC Oral Health.* 2015; 15(1): 101.

33. Benitez C, O'Sullivan D, Tinanoff N. Effect of a preventive approach for the treatment of nursing bottle caries. *ASDC J Dent Child.* 1994; 61:46-49.

34. Griffith L. The Psychiatrist's Guide to Motivational Interviewing. *Psychiatry.* 2008; 5(4):42-47.

35. Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh D. Building caries risk assessment models for children. *J Dent Res*. 2010;89:637-643.

36. Miller E, Lee JY, DeWalt DA, Vann WF,Jr. Impact of caregiver literacy on children's oral health outcomes. *Pediatrics*. 2010;126:107-114.

37. Rollnick S, Bell A, Richmond R. Effects of brief counselling among male heavy drinkers identified on general hospital wards. *Drug Alcohol Rev*. 1996;15:29-38.

38. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat 11*. 2007;(248):1-92.

39. Pierce KM, Rozier RG, Vann WF,Jr. Accuracy of pediatric primary care providers' screening and referral for early childhood caries. *Pediatrics*. 2002;109:E82-2.

40. Fisher-Owens SA, Barker JC, Adams S, et al. Giving policy some teeth: routes to reducing disparities in oral health. *Health Aff (Millwood)*. 2008;27:404-412.

41. Edelstein BL. Disparities in oral health and access to care: findings of national surveys. Ambul Pediatr. 2002 Mar-Apr;2(2 Suppl):141–7.

42. United States Census Bureau, "Richmond, Virginia." Search completed 2/26/2016.

43. Enger DJ, Mourino AP. A survey of 200 pediatric dental general anesthesia cases. *ASDC J Dent Child*. 1985;52:36-41.

44. Jamieson WJ, Vargas K. Recall rates and caries experience of patients undergoing general anesthesia for dental treatment. *Pediatr Dent*. 2007;29:253-257.

45. Twetman S, Fontana M, Featherstone JD. Risk assessment - can we achieve consensus? *Community Dent Oral Epidemiol*. 2013;41:e64-70.

46. Dellasega C, Añel-Tiangco RM, Gabbay RA. How Patients with Type 2 Diabetes Mellitus Respond to Motivational Interviewing. *Diabetes research and clinical practice*. 2012;95(1):37-41. doi:10.1016/j.diabres.2011.08.011.

47. Swenson SL, et al. Patient-centered communication: do patients really prefer it? J Gen Intern Med.2004;19(11):1069–79.

48. Krupat E, et al. The practice orientations of physicians and patients: the effect of doctor-patient congruence on satisfaction. Patient Educ Couns. 2000;39(1):49–59.

49. Naidu R, Nunn J, Irwin J. The effect of motivational interviewing on oral healthcare knowledge, attitudes and behavior of parents and caregivers of preschool children: an exploratory cluster randomized controlled study. *BMC Oral Health.* 2015; 15:101.

50. Weinstein P, Harrison R, Benton T. Motivating parents to prevent caries in their young children: one-year findings. *J Am Dent Assoc*. 2004;135:731-738.

51. Kressin NRL, Nunn ME, Singh H, et al. Pediatric clinicians can help reduce rates of early childhood caries: effects of a practice based intervention. Med Care 2009; 47:1121-8.

52. Scottish Intercollegiate Guideline Network (SIGN). Dental interventions to prevent caries in children. Healthcare Improvement Scotland. Edinburgh: 2014.

53. Bouchery E. Utilization of dental services among Medicaid-enrolled children. Medicare Medicaid Res Re.003.03.b04.

54. Douglass J, Clark M. Integrating Oral Health into overall health care to prevent early childhood caries: Need, Evidence, and Solutions. *Pediatric Dentistry.* 2015; 37:3.

55. Mofidi M, Rozier RG, King RS. Problems with access to dental care for Medicaid-insured children: what caregivers think. *Am J Public Health*. 2002;92:53-58.

56. Yang S, Zarr RL, Kass-Hout TA, Kourosh A, Kelly NR. Transportation barriers to accessing health care for urban children. Journal of Health Care for the Poor and Underserved. 2006;17(4):928–943.

57. Kruger JS, Kodjebacheva GD, Kunkel L, Smith KD, Kruger DJ. Caregiver Financial Distress, depressive symptoms and limited social capital as barriers to childrens dental care in a mid-western county in the United States. *Community Dent Health.* 2015; 32(4):252-6.

58. Grembowski D, Milgrom PM. Increasing access to dental care for medicaid preschool children: the Access to Baby and Child Dentistry (ABCD) program.*Public Health Reports*. 2000;115(5):448-459.

59. Grant J, Roberts M, Brown W, Quinonez R. Integrating dental screening and flouride varnish application into a pediatric residency outpatient program: clinical and financial implications. *J Clin Pediatr Dent.* 2007; 31(3):175-8.

60. Chou R, Cantor A, Zakher B, Mitchell J, Pappas M. Prevention of Dental Caries in children younger then 5 years old: Systematic review to update the U.S. Preventive Services Task Force Recommendation (internet). Rockville (MD): Agency for Healthcare Research and Quality (US); 2014 May. Report No.: 12-05170-EF-1.

61. Milgrom P, Hujoel P, Grembowski D, Fong R. A community strategy for Medicaid child dental services. *Public Health Reports.* 1999; 11:528-32.

62. Moyer V. Prevention of dental caries in children from birth through age 5 years: US Preventative Services Task Force Recommendation Statement. *Pediatrics.* 2014; 133:1-

Tables

Table 1: Patient and Parent Demographics by Randomly Assigned Recall Group (N=150)

	Control- 6 mo recall (N=75)		Intervention- 3mo recall (N=75)		
Demographics	N	Percent	N	Percent	P-value
Child's race/ethnicity					
White	26	35	32	43	0.314
Black/ African American	39	52	37	49	0.744
Asian	3	4	7	9	0.185
Native Hawaiian or Pacific Islander	0	0	0	0	NA
American Indian or Alaska Native	2	3	1	1	0.556
Other	1	1	2	3	0.556
Hispanic	7	9	7	10	0.979
Parent's Education					
Elementary and middle school	3	4	5	7	0.637
High school	43	59	39	53	
College	23	32	27	37	
Graduate school beyond college	4	5	2	3	
	Mean	SD	Mean	SD	
Child age (months)	46.8	12.5	47.9	13.5	0.594
Number of adults in addition to caregiver	2.1	1.0	2.3	1.0	0.385
Number of children	2.8	1.6	2.7	1.4	0.596

Notes: Since child's race/ethnicity was a "check all that apply" item, the n's will not sum to 75, nor will the percentages total 100%. The groups were compared using chi-square or t-test, as appropriate.

Table 2. Patient and Parent Demographics by Completion Status (N=150)

	Not Complete (N=16)		Complete (N=92)		Not Due (N=22)		
Demographics	N	Percent	N	Percent	N	Percent	P-value
Child's race/ethnicity							
White	10	63	25	27	13	59	0.002
Black/ African American	3	19	56	61	7	32	0.001
Asian	1	6	7	8	1	5	0.863
Native Hawaiian or Pacific Islander	0	0	0	0	0	0	NA
American Indian or Alaska Native	0	0	3	3	0	0	0.349
Other	0	0	1	1	1	5	0.473
Hispanic	2	13	11	12	0	0	0.085
Parent's Education							
Elementary and middle school	0	0	3	3	5	24	0.030
High school	8	50	49	54	11	52	
College	6	38	34	38	5	24	
Graduate school beyond college	2	13	4	4	0	0	
	Mean	SD	Mean	SD	Mean	SD	
Child age (months)	45.2	10.9	48.4	13.0	45.7	14.1	0.493
Number of adults in addition to caregiver	2.2	0.5	2.3	1.1	2.3	0.7	0.924
Number of children	2.6	1.1	2.5	1.5	3.7	1.1	0.002

Notes: Since child's race/ethnicity was a "check all that apply" item, the n's will not sum to the total, nor will the percentages total 100%. The groups were compared using chi-square or ANOVA, as appropriate.

Table 3. Patient Medical History by Randomly Assigned Recall Group (N=150)

	Control-6mo recall (N=75)		Intervention-3mo recall (N=75)		
Medical History	N	Percent	N	Percent	P-value
Breathing disorder	13	17	17	23	0.414
Heart disorder	3	4	2	3	0.648
Brain disorder	1	1	4	5	0.158
ADD/ADHD	4	5	2	3	0.400
Premature birth	6	8	7	9	0.772
Blood disorder	2	3	0	0	0.094
Genetic disorder/syndrome	0	0	3	4	0.040
Developmental delay	3	4	5	7	0.465
Other medical condition	9	12	5	7	0.259

Notes: Since medical history was a “check all that apply” item, the n’s will not sum to 75, nor will the percentages total 100%.

Table 4. Barriers to Child Dental Care by Randomly Assigned Recall Group (N=150)

	6mo recall (N=73)		3mo recall (N=75)		
Parent/Caregiver	N	Percent	N	Percent	P-value
Is it very difficult to get your child to the doctor or dentist?					
No	56	77	60	80	0.627
Yes	17	23	15	20	
Barriers checked					
Transportation	10	14	7	9	0.404
Distance	4	5	2	3	0.382
Finances	6	8	4	5	0.483
Job conflict	5	7	1	1	0.077
Fear/Anxiety	5	7	6	8	0.789
Other	1	1	1	1	0.985

Notes: the Barriers were “check all that apply” and so the totals will not sum to 75 nor will the percentages total 100%

Table 5. Caregiver Knowledge Survey by Randomly Assigned Recall Group (N=150)

	Control-6mo recall (N=75)		Intervention-3mo recall (N=75)		
Knowledge item	N	Percent	N	Percent	P-value
Drinking juice from a sippy cup or bottle throughout the day can cause tooth decay.					
Yes	57	76	57	76	1.000
No	15	20	15	20	
Dont know	3	4	3	4	
Putting a child to bed with a bottle containing milk or juice can cause tooth decay in teeth.					
Yes	55	73	57	76	0.572
No	17	23	14	19	
Dont know	3	4	4	5	
Adults who have tooth decay can pass tooth decay germs to their children.					
Yes	28	37	23	31	0.770
No	26	35	24	32	
Dont know	21	28	28	37	
Fluoride can be used to coat and protect the teeth of infants and children.					
Yes	57	76	51	68	0.328
No	5	7	8	11	
Dont know	13	17	16	21	
All children should be checked by a dentist by the age of one, or around the time the first tooth comes in.					
Yes	55	73	60	80	0.895
No	5	7	5	7	
Dont know	15	20	10	13	
Tooth decay in a childs baby teeth affects his/her overall health.					
Yes	48	64	47	63	0.967
No	9	12	9	12	
Dont know	18	24	19	25	
The risk of getting tooth decay increases when a person eats sugary snacks and drinks between mealtimes.					
Yes	67	89	67	89	0.313
No	1	1	3	4	
Dont know	7	9	5	7	
Tooth decay in baby teeth can cause infections that can spread to the face and other parts of the body.					
Yes	33	44	40	53	0.311
No	10	13	7	9	

	Control-6mo recall (N=75)		Intervention-3mo recall (N=75)		
Knowledge item	N	Percent	N	Percent	P-value
Dont know	32	43	28	37	
Parents should start cleaning their childs teeth as soon as the first tooth comes in.					
Yes	60	80	71	95	0.213
No	1	1	0	0	
Dont know	14	19	4	5	
Tap water is good for childrens teeth.					
Yes	39	52	31	41	0.112
No	8	11	14	19	
Dont know	28	37	30	40	
Cavities in the baby teeth put children at higher risk for cavities in the permanent teeth.					
Yes	50	67	38	51	0.141
No	5	7	9	12	
Dont know	20	27	28	37	

Xx

Table 6. Caregiver Knowledge Survey by Completion Status (N=150)

	Complete (N=92)		Not Complete (N=16)		Not Due (N=22)		
Knowledge item	N	Percent	N	Percent	N	Percent	P-value
Drinking juice from a sippy cup or bottle throughout the day can cause tooth decay.							
Yes	68	74	13	81	19	86	0.072
No	22	24	2	13	1	5	
Dont know	2	2	1	6	2	9	
Putting a child to bed with a bottle containing milk or juice can cause tooth decay in teeth.							
Yes	66	72	14	88	16	73	0.208
No	23	25	2	13	2	9	
Dont know	3	3	0	0	4	18	
Adults who have tooth decay can pass tooth decay germs to their children.							
Yes	36	39	3	19	2	9	0.541
No	34	37	6	38	3	14	
Dont know	22	24	7	44	17	77	
Fluoride can be used to coat and protect the teeth of infants and children.							
Yes	74	80	11	69	9	41	0.552
No	7	8	2	13	2	9	
Dont know	11	12	3	19	11	50	
All children should be checked by a dentist by the age of one, or around the time the first tooth comes in.							
Yes	77	84	11	69	10	45	0.971
No	6	7	1	6	1	5	
Dont know	9	10	4	25	11	50	
Tooth decay in a childs baby teeth affects his/her overall health.							
Yes	63	68	11	69	4	18	0.421
No	15	16	2	13	0	0	
Dont know	14	15	3	19	18	82	
The risk of getting tooth decay increases when a person eats sugary snacks and drinks between mealtimes.							
Yes	82	89	15	94	19	86	0.257
No	4	4	0	0	0	0	
Dont know	6	7	1	6	3	14	
Tooth decay in baby teeth can cause infections that can spread to the face and other parts of the body.							
Yes	51	55	8	50	4	18	0.344
No	13	14	1	6	0	0	
Dont know	28	30	7	44	18	82	
Parents should start cleaning their childs teeth as soon as the first tooth comes in.							

Knowledge item	Complete (N=92) N	Complete (N=92) Percent	Not Complete (N=16) N	Not Complete (N=16) Percent	Not Due (N=22) N	Not Due (N=22) Percent	P-value
Yes	88	96	12	75	14	64	0.773
No	1	1	0	0	0	0	
Dont know	3	3	4	25	8	36	
Tap water is good for childrens teeth.							
Yes	48	52	8	50	5	23	0.277
No	12	13	3	19	0	0	
Dont know	32	35	5	31	17	77	
Cavities in the baby teeth put children at higher risk for cavities in the permanent teeth.							
Yes	63	68	10	63	2	9	0.192
No	9	10	1	6	2	9	
Dont know	20	22	5	31	18	82	

Table 7. Child Hygiene and Eating Habits by Randomly Assigned Recall Groups (N=150)

	Control-6mo recall		Intervention-3mo recall		
Behavior	N	Percent	N	Percent	P-value
How often does an adult brush your childs teeth?					
Daily	57	77	61	81	0.057
Weekly	17	23	10	13	
Monthly	0	0	1	1	
Never	0	0	3	4	
How often are your childs teeth brushed with fluoride toothpaste?					
Daily	52	70	52	69	0.101
Weekly	15	20	11	15	
Monthly	0	0	4	5	
Never	7	9	8	11	
How often are your childs teeth brushed with non-fluoride toothpaste?					
Daily	15	21	13	18	0.662
Weekly	7	10	7	9	
Monthly	0	0	1	1	
Never	50	69	53	72	
How often do you check your childs teeth for anything unusual?					
Daily	30	41	33	44	0.972
Weekly	22	30	21	28	
Monthly	12	16	11	15	
Never	9	12	10	13	
When brushing, how often do your childs gums bleed?					
Daily	5	7	3	4	0.681
Weekly	9	12	6	8	
Monthly	4	5	5	7	
Never	55	75	61	81	
Does your child usually (throughout the day) drink from a bottle or sippy cup?					
No	49	65	47	63	0.734
Yes	26	35	28	37	
How often does your child go to sleep while nursing, or go to sleep while drinking something besides water from a bottle/sippy cup?					
Daily	20	27	22	29	0.475
Weekly	9	12	4	5	
Monthly	1	1	2	3	
Never	44	59	47	63	
How often do you give your child sugary snacks such as raisins, candy, cookies, cakes or cereal between meals?					
Three or more times a day	9	12	16	22	0.118
One or two times a day	46	62	46	62	
Weekly	13	18	11	15	
Monthly	3	4	0	0	
Never	3	4	1	1	

How often do you give your child sugary drinks such as regular soda, sweet tea, chocolate milk, strawberry milk, fruit juice, sports drinks or koolaid					
Three or more times a day	17	23	25	33	0.091
One or two times a day	36	49	41	55	
Weekly	13	18	7	9	
Monthly	1	1	0	0	
Never	7	9	2	3	
How often does your child typically drink tap water- including filtered water from the refrigerator?					
Daily	48	64	52	69	0.681
Weekly	11	15	11	15	
Monthly	1	1	2	3	
Never	15	20	10	13	
Is there fluoride in your drinking water at home?					
Yes	25	33	26	35	0.484
No	11	15	16	21	
Don't know	39	52	33	44	

Table 8. Post-surgery Goals by Randomized Group

	Control-6mo recall (N=38)		Intervention-3mo recall (N=43)		
Goal	N	Percent	N	Percent	P-value
Favorable dental habits	16	42	18	42	0.982
Regular dental visits for child	3	8	3	7	0.875
Family receives dental treatment	3	8	3	7	0.875
Brush with fluoride toothpaste at least twice daily	13	34	13	30	0.702
Favorable oral health behaviors	10	26	17	40	0.206
Healthy snacks	1	3	8	19	0.015
Drink tap water	4	11	5	12	0.875
Less or no candy and junk food	5	13	5	12	0.835
Unfavorable oral health behaviors	17	45	19	44	0.960
No soda	4	11	5	12	0.875
Less or no juice	9	24	11	26	0.843
Only water or milk in sippy cup	2	5	0	0	0.079
Wean off bottle (At least no bottle for sleeping)	4	11	2	5	0.311
Chew gum with xylitol	1	3	2	5	0.627

Table 9. Post-surgery Goals by Randomized Group, Across Time

	Time Point								
	Post-surgery Followup		3 month recall		6 month recall		9-12 month recall		
Item	N	Percent	N	Percent	N	Percent	N	Percent	P-value
Favorable dental habits									
	Control-6mo recall								
Unchecked	22	58	6	46	10	28	3	30	0.052
Checked	16	42	7	54	26	72	7	70	
	Intervention-3 mo recall								
Unchecked	25	58	14	52	12	32	6	46	0.131
Checked	18	42	13	48	25	68	7	54	
Regular dental visits for child									
	Control-6mo recall								
Unchecked	35	92	12	92	27	75	6	60	0.045
Checked	3	8	1	8	9	25	4	40	
	Intervention-3 mo recall								
Unchecked	40	93	25	93	30	81	12	92	0.339
Checked	3	7	2	7	7	19	1	8	
Family receives dental treatment									
	Control-6mo recall								
Unchecked	35	92	12	92	34	94	9	90	0.961
Checked	3	8	1	8	2	6	1	10	
	Intervention-3 mo recall								
Unchecked	40	93	26	96	35	95	12	92	0.932
Checked	3	7	1	4	2	5	1	8	
Brush with fluoride toothpaste at least twice daily									
	Control-6mo recall								
Unchecked	25	66	6	46	18	50	5	50	0.443
Checked	13	34	7	54	18	50	5	50	
	Intervention-3 mo recall								
Unchecked	30	70	14	52	15	41	6	46	0.057
Checked	13	30	13	48	22	59	7	54	
Favorable oral health behaviors									
	Control-6mo recall								
Unchecked	28	74	7	54	23	64	7	70	0.581
Checked	10	26	6	46	13	36	3	30	
	Intervention-3 mo recall								
Unchecked	26	60	17	63	28	76	9	69	0.502
Checked	17	40	10	37	9	24	4	31	
Healthy snacks									
	Control-6mo recall								
Unchecked	37	97	8	62	28	78	8	80	0.007
Checked	1	3	5	38	8	22	2	20	

	Time Point								
	Post-surgery Followup		3 month recall		6 month recall		9-12 month recall		
Item	N	Percent	N	Percent	N	Percent	N	Percent	P-value
	Intervention-3 mo recall								
Unchecked	35	81	22	81	29	78	10	77	0.973
Checked	8	19	5	19	8	22	3	23	
Drink tap water									
	Control-6mo recall								
Unchecked	34	89	12	92	32	89	9	90	0.988
Checked	4	11	1	8	4	11	1	10	
	Intervention-3 mo recall								
Unchecked	38	88	25	93	37	100	12	92	0.087
Checked	5	12	2	7	0	0	1	8	
Less or no candy and junk food									
	Control-6mo recall								
Unchecked	33	87	13	100	35	97	10	100	0.099
Checked	5	13	0	0	1	3	0	0	
	Intervention-3 mo recall								
Unchecked	38	88	22	81	36	97	13	100	0.056
Checked	5	12	5	19	1	3	0	0	
Unfavorable oral health behaviors									
	Control-6mo recall								
Unchecked	21	55	9	69	28	78	8	80	0.165
Checked	17	45	4	31	8	22	2	20	
	Intervention-3 mo recall								
Unchecked	24	56	17	63	26	70	10	77	0.409
Checked	19	44	10	37	11	30	3	23	
No soda									
	Control-6mo recall								
Unchecked	34	89	12	92	35	97	10	100	0.354
Checked	4	11	1	8	1	3	0	0	
	Intervention-3 mo recall								
Unchecked	38	88	25	93	36	97	12	92	0.472
Checked	5	12	2	7	1	3	1	8	
Less or no juice									
	Control-6mo recall								
Unchecked	29	76	10	77	30	83	8	80	0.891
Checked	9	24	3	23	6	17	2	20	
	Intervention-3 mo recall								
Unchecked	32	74	21	78	27	73	10	77	0.973
Checked	11	26	6	22	10	27	3	23	
Only water or milk in sippy cup									
	Control-6mo recall								
Unchecked	36	95	13	100	36	100	10	100	0.282

	Time Point								
	Post-surgery Followup		3 month recall		6 month recall		9-12 month recall		
Item	N	Percent	N	Percent	N	Percent	N	Percent	P-value
Checked	2	5	0	0	0	0	0	0	
	Intervention-3 mo recall								
Unchecked	43	100	27	100	37	100	13	100	0.000
Checked	0	0	0	0	0	0	0	0	
Wean off bottle (At least no bottle for sleeping)									
	Control-6mo recall								
Unchecked	34	89	13	100	34	94	10	100	0.262
Checked	4	11	0	0	2	6	0	0	
	Intervention-3 mo recall								
Unchecked	41	95	25	93	36	97	13	100	0.585
Checked	2	5	2	7	1	3	0	0	
Chew gum with xylitol									
	Control-6mo recall								
Unchecked	37	97	13	100	36	100	10	100	0.595
Checked	1	3	0	0	0	0	0	0	
	Intervention-3 mo recall								
Unchecked	41	95	25	93	37	100	13	100	0.200
Checked	2	5	2	7	0	0	0	0	

Note: The P-value tests for a change across time within each randomized group, and is uncorrected for multiple comparisons.

Table 10. Comparing Caries Risk Assessment Across Time by Randomly Assigned Recall Groups

		Intervention-3 mo recall			Control-6mo recall			
Time	n	High	95% CI		High	95% CI		P-value
Consultation	130	100.0%			100.0%			
GA followup	81	63.3%	(48.0 to	76.3%)	63.4%	(47.3 to	77.0%)	0.987
3mo recall	41	58.1%	(39.6 to	74.6%)	77.4%	(48.0 to	92.7%)	0.240
6mo recall	73	60.0%	(43.6 to	74.4%)	64.4%	(47.8 to	78.1%)	0.701
9mo or later	23	62.5%	(35.2 to	83.7%)	41.8%	(17.6 to	70.7%)	0.317

Table 11. Comparing Caries Risk Assessment Across Time by Actual Recall Groups

	no recall			3mo recall			other recall			
Time	High	95% CI		High	95% CI		High	95% CI		P-value
Consultation	100.0 %			100.0 %			100.0 %			
GA followup	93.3 %	(64.8 to	99.1 %)	61.7 %	(43.8 to	76.9 %)	51.9 %	(35.7 to	67.7 %)	0.060
3mo recall				63.4 %	(47.9 to	76.6 %)				
6mo recall				44.8 %	(27.5 to	63.5 %)	71.8 %	(57.3 to	82.8 %)	0.025
9mo or later				54.2 %	(30.0 to	76.5 %)	51.2 %	(21.4 to	80.2 %)	0.888

Note: Comparisons made by repeated-measures logistic regression.

Table 12. Caries Incidence by Randomly Assigned Recall Group

In the Control group (6-month recall scheduled)

	6 month Recall								
Consultation	0-caries free	1-white spot lesion	2-cavitated	3-restored surface	Total	Percent	Better	Worse	Total
0-caries free	1472	3	0	794	2269	81.7		3	1475
1-white spot lesion	9	2	0	59	70	2.5	9	0	11
2-cavitated	14	2	0	338	354	12.8	16		16
3-restored surface	14	0	0	69	83	3.0	25	3	1502
Total	1509	7	0	1260	2776		1.66%	0.20%	
Percent	54.4	0.3	0.0	45.4					

In the Intervention group (3-month recall scheduled)

	6 month Recall								
Consultation	0-caries free	1-white spot lesion	2-cavitated	3-restored surface	Total	Percent	Better	Worse	Total
0-caries free	1266	7	2	811	2086	77.2		9	1275
1-white spot lesion	10	8	1	57	76	2.8	10	1	19
2-cavitated	65	2	0	410	477	17.6	67		67
3-restored surface	16	0	0	48	64	2.4	77	10	1361
Total	1357	17	3	1326	2703		5.66%	0.73%	
Percent	50.2	0.6	0.1	49.1					

Notes: Restored surfaces are not included in the incidence analysis (greyed values).

Table 13. Caries Incidence by Randomly Assigned Recall Group Logistic Regression

Group	Estimate	95% CI		P-value
	Worse			
Control-6mo recall	0.224%	0.00%	69.28%	0.7684
Intervention-3 mo recall	0.733%	0.02%	26.42%	
	Better			
Control-6mo recall	1.832%	0.16%	17.57%	0.3081
Intervention-3 mo recall	7.238%	2.13%	21.89%	

Notes: Logistic regression weighting each patient equally. At risk = any surface not restored at either the consultation visit or the 6mo recall visit. Worse = any surface with a higher level of caries. Better = any surface with a lower level of caries.

Table 14. Caries Incidence by Actual Recall Group

In Patients who were seen at 3mo

	6 month Recall									
Consultation	0-caries free		1-white spot lesion			2-cavitated		3-restored surface		Total
	Percent		Better	Worse	Total					
0-caries free	1165	3	0	491	1659	79.3		3	1168	
1-white spot lesion	11	3	0	38	52	2.5		11	0	14
2-cavitated	59	3	0	288	350	16.7		62		62
3-restored surface	0	0	0	32	32	1.5		73	3	1244
Total 1235	9	0	849	2093			5.87%	0.24%		
Percent	59.0	0.4	0.0	40.6						

In patients who were seen after 3mo

	6 month Recall									
Consultation	0-caries free		1-white spot lesion			2-cavitated		3-restored surface		Total
	Percent		Better	Worse	Total					
0-caries free	1573	7	1	1114	2695	79.6		8	1581	
1-white spot lesion	8	7	1	78	94	2.8		8	1	16
2-cavitated	20	1	0	460	481	14.2		21		21
3-restored surface	30	0	0	85	115	3.4		29	9	1618
Total 1631	15	2	1737	3385			1.79%	0.56%		
Percent	48.2	0.4	0.1	51.3						

Notes: Restored surfaces are not included in the incidence analysis (greyed values).

Table 15. Caries Incidence by Actual Recall Group Logistic Regression

Group	Estimate	95% CI		P-value
	Worse			
3mo recall	0.385%	0.00%	63.13%	0.9312
other recall	0.530%	0.01%	23.76%	
	Better			
3mo recall	8.774%	2.47%	26.73%	0.2147
other recall	1.872%	0.22%	14.44%	

Notes: Logistic regression weighting each patient equally. At risk = any surface not restored at either the consultation visit or the 6mo recall visit. Worse = any surface with a higher level of caries. Better = any surface with a lower level of caries.

Figures

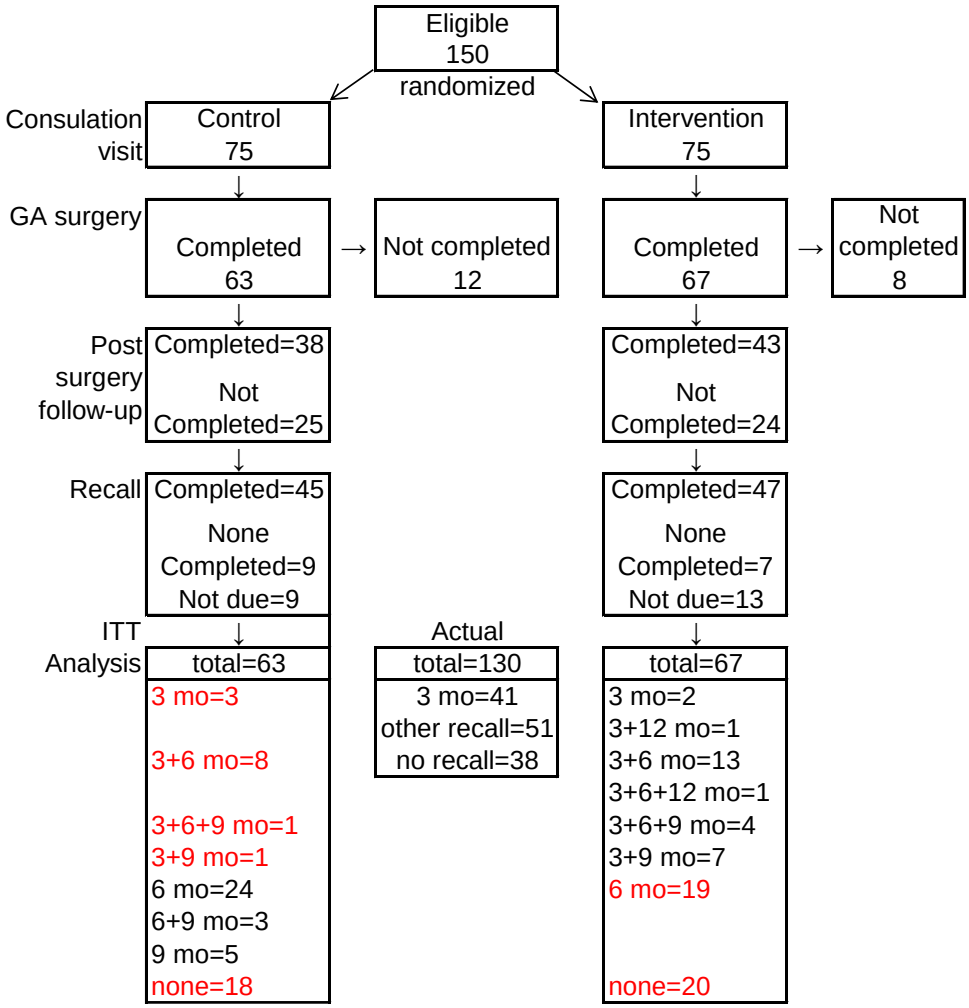

Figure 1. Patient Flow

Patients were randomly assigned to either a 6 month recall schedule (Control) or a 3-month recall schedule (Intervention) and then were to undergo treatment under general anesthesia. There were 130 patients eligible for the intent-to-treat (ITT) analysis. Compliance with the assigned recall schedule is shown in the bottom boxes. Patients assigned to the control group who came in for any 3-month recall are shown in red; patients assigned to the intervention group who did not come in for a 3-month recall are shown in red. The actual recall groups were thus: 38 who did not return for any recall, 41 who returned for a 3-month recall, and 51 who did not return for a 3-month recall but did return for a recall at 6-months or later.

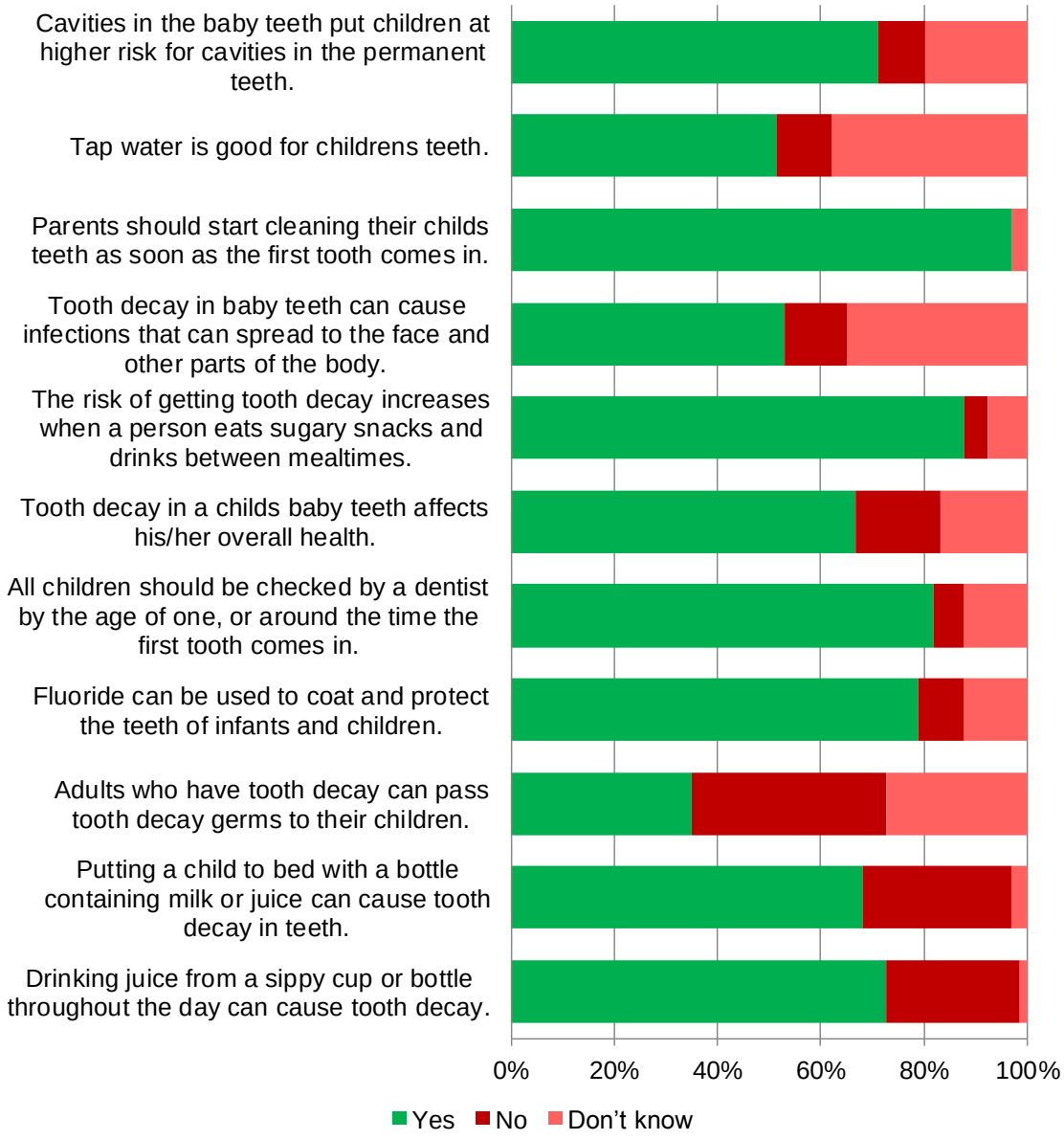

Figure 2. Caregiver Knowledge Survey

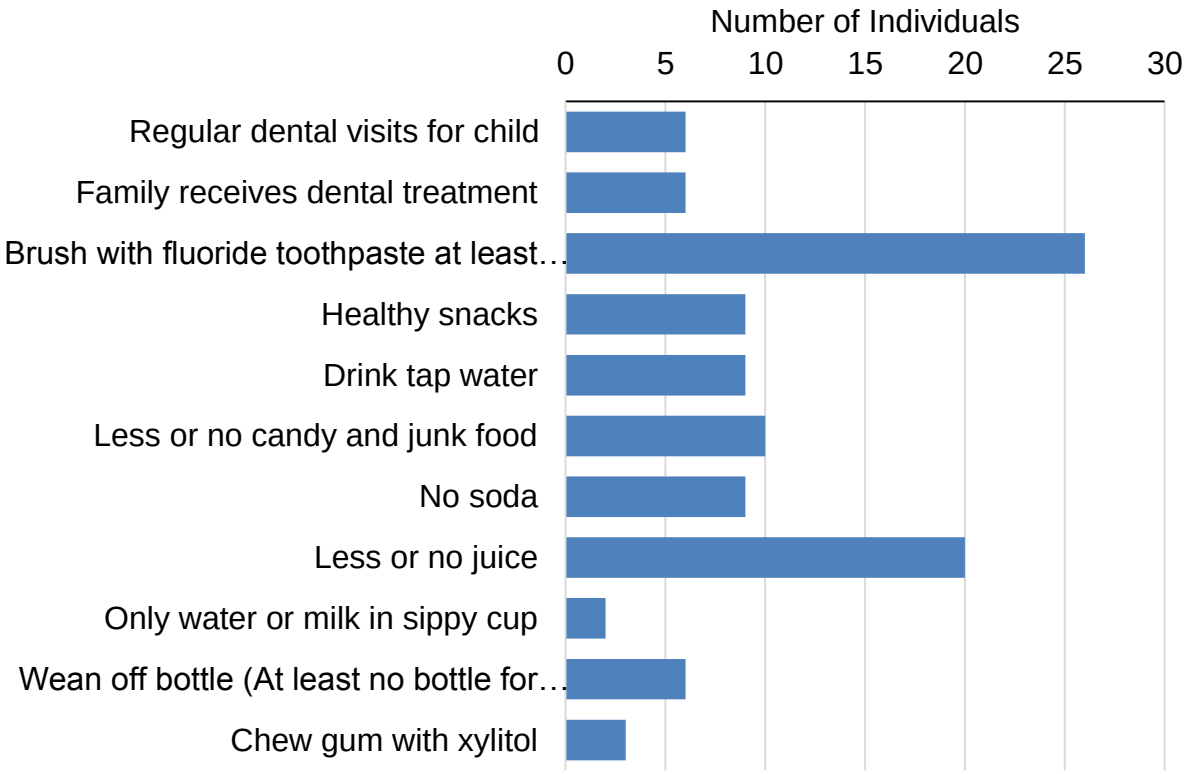

Figure 3. Individual Post-Surgery Goals

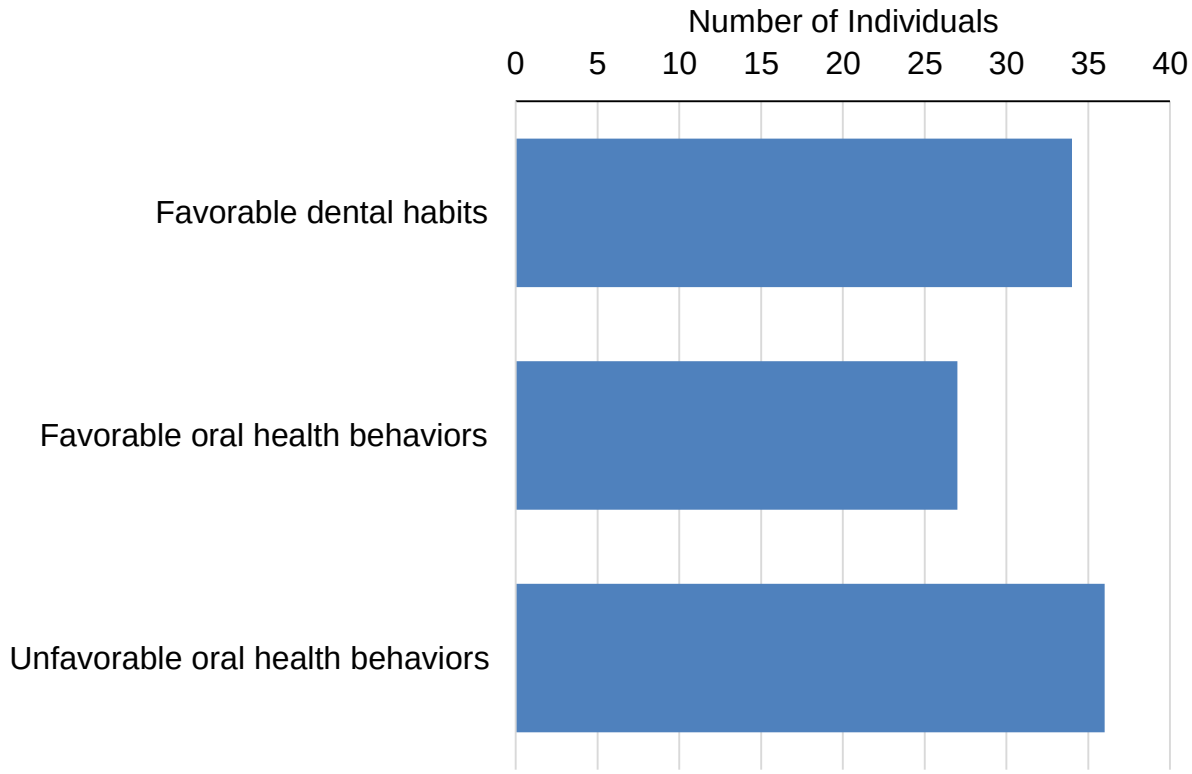

Figure 4. Post-Surgery Goals

	Control-6mo recall		Intervention-3 mo recall	
Time point	Percent	95% CI	Percent	95% CI
Post-surgery	42.3	(27.8 to 58.3)	41.8	(28.3 to 56.6)
3 month	49.8	(26.8 to 72.9)	49.4	(32.3 to 66.6)
6 month	73.7	(56.8 to 85.6)	66.8	(51.1 to 79.5)
9-12 month	73.3	(37.7 to 92.5)	62.8	(35.5 to 83.8)

Group difference P=0.572, Change across time P=0.002, Different change across time P=0.931.

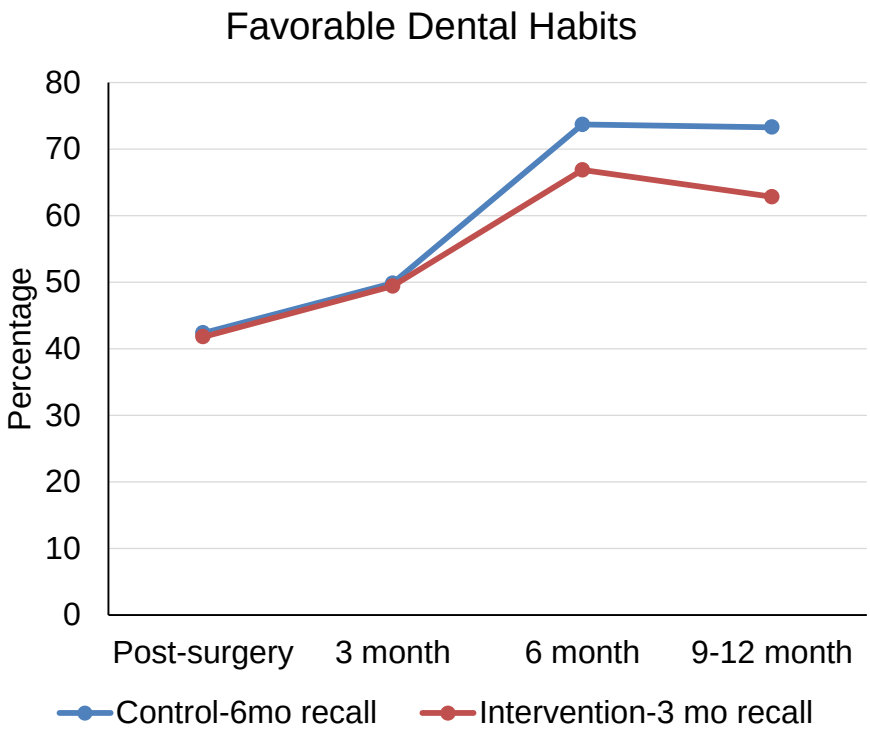

Figure 5. Favorable Dental Habit Goals across Time by Randomized Group

	Control-6mo recall		Intervention-3 mo recall	
Time point	Percent	95% CI	Percent	95% CI
Post-surgery	27.0	(15.3 to 43.2)	39.3	(26.0 to 54.3)
3 month	51.2	(25.8 to 76.0)	34.1	(19.1 to 53.2)
6 month	35.7	(21.9 to 52.4)	23.1	(12.3 to 39.2)
9-12 month	28.4	(9.0 to 61.4)	26.5	(9.6 to 55.0)

Group difference P=0.574, Change across time P=0.536, Different change across time P=0.316.

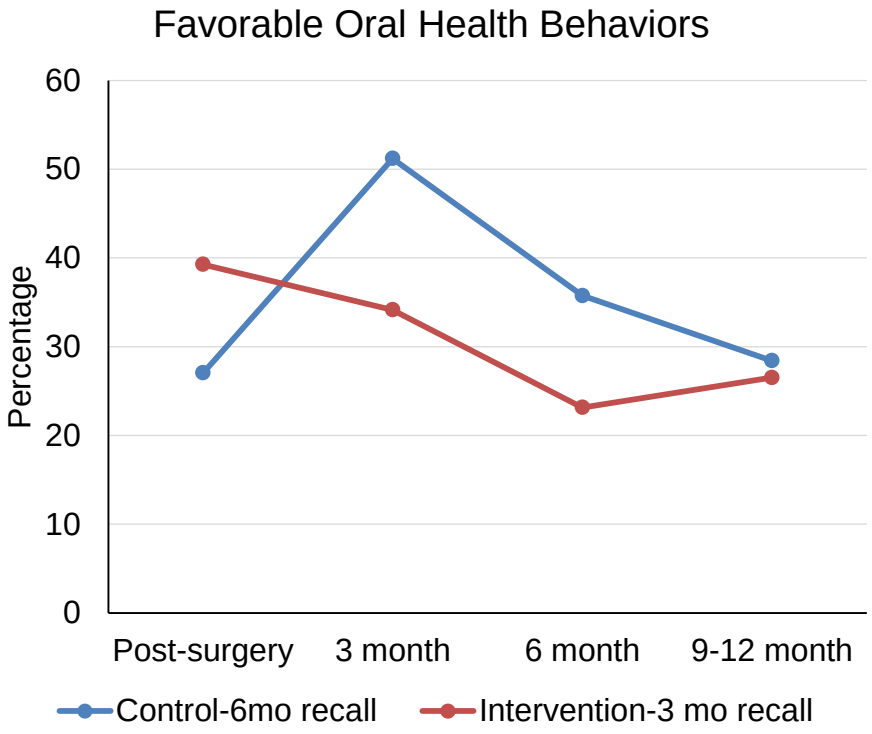

Figure 6. Favorable Oral Health Behavior Goals across Time by Randomized Group

	Control-6mo recall		Intervention-3 mo recall	
Time point	Percent	95% CI	Percent	95% CI
Post-surgery	45.3	(30.4 to 61.1)	44.6	(30.6 to 59.4)
3 month	31.0	(13.5 to 56.5)	37.8	(22.6 to 55.9)
6 month	21.1	(10.6 to 37.8)	29.9	(17.5 to 46.1)
9-12 month	23.9	(7.0 to 56.9)	21.7	(6.6 to 52.0)

Group difference P=0.688, Change across time P=0.052, Different change across time P=0.907.

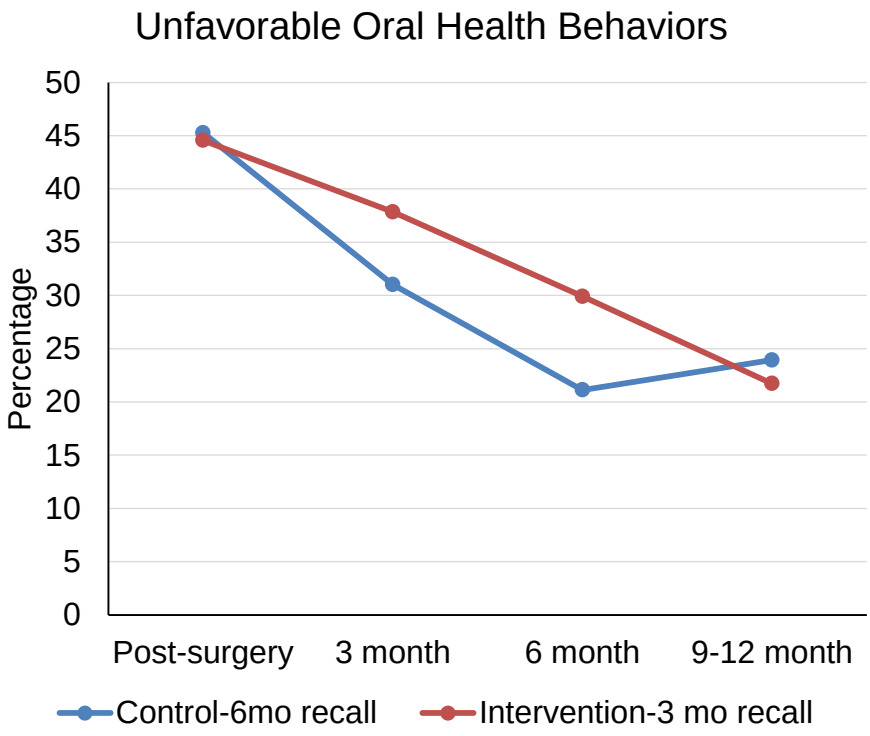

Figure 7. Unfavorable Oral Health Behavior Goals across Time by Randomized Group

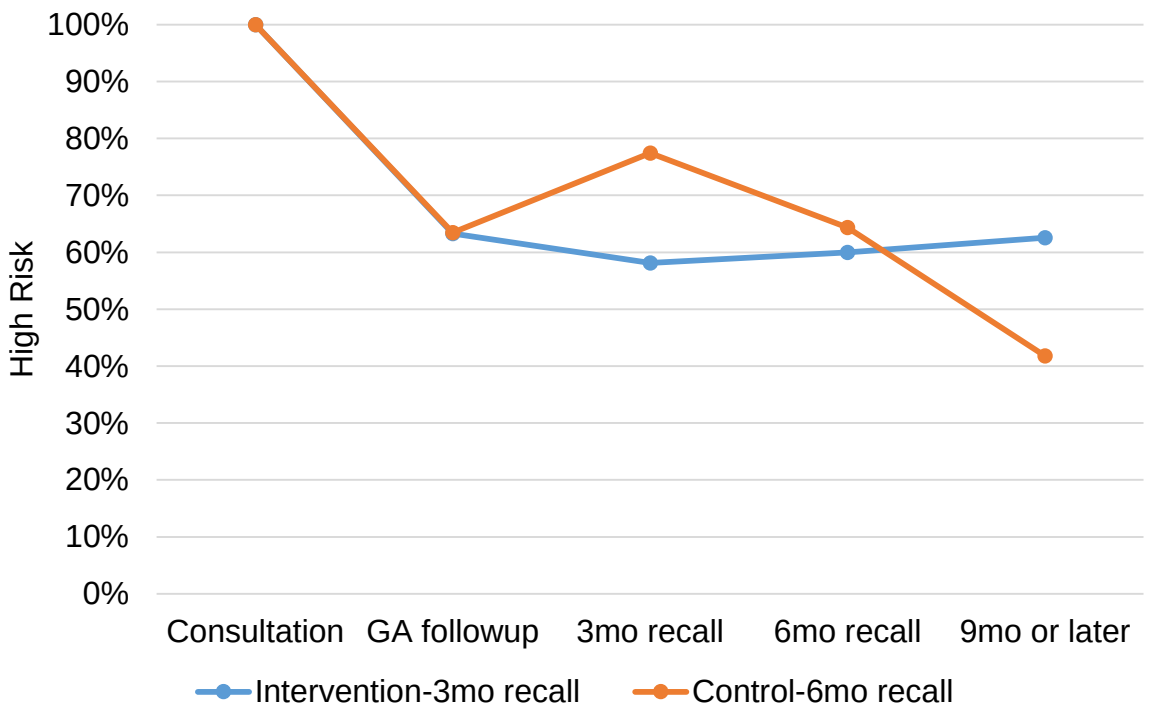

Figure 8. Comparing Caries Risk Assessment Change Across Time by Randomized Recall Group

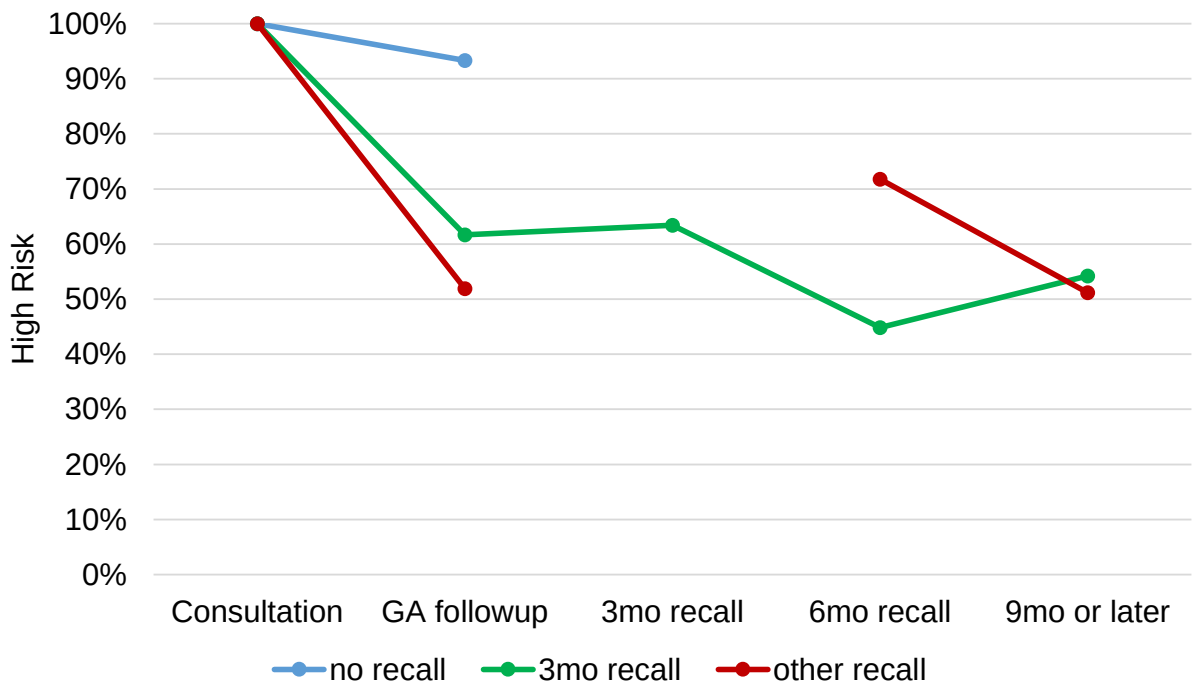

Figure 9. Comparing Caries Risk Assessment Change Across Time by Actual Recall Groups

Appendix 1

We are conducting a study about risks for tooth decay. Please select the best answer to the following questions. Thank you.

These basic questions are about your child's age and background.	
How old is your child?	Age: _____
What is *your child's* racial background? (check all that apply)	☐ White/Caucasian ☐ African American or Black ☐ Asian ☐ Native Hawaiian or Pacific Islander ☐ American Indian or Alaskan Native ☐ Other (specify)_____

Please help us understand your child's medical history (Select all that apply to your child)	
☐ **Breathing disorder** (examples: asthma, reactive airway disease)	☐ **Premature birth** (more than 3 weeks before the child's due date)
☐ **Heart disorder**	☐**Blood disorder** (Sickle cell anemia, hemophilia)
☐ **Brain disorder** (examples: autism, seizures, cerebral palsy)	☐**Genetic (hereditary) disorder/syndrome**
☐ **ADHD/ADD**	☐ **Developmental Delay**
☐ Other medical condition not listed:_____ _____	**Does your child take medications**? ☐Yes ☐No If yes, please list medications:_____ _____

We would like to know your opinion about children's dental health.	**(Circle one)**
1. Drinking juice or milk from a sippy cup or bottle throughout the day can cause tooth decay.	Yes No Don't know
2. Putting a child to bed with a bottle containing milk or juice can cause tooth decay in teeth.	Yes No Don't know
3. Adults who have tooth decay can pass tooth decay germs to their children.	Yes No Don't know
4. Fluoride can be used to coat and protect the teeth of infants and children.	Yes No Don't know
5. All children should be checked by a dentist by the age of one, or around the time the first tooth comes in.	Yes No Don't know
6. Tooth decay in a child's baby teeth affects his/her overall health.	Yes No Don't know
7. The risk of getting tooth decay increases when a person eats sugary snacks and drinks between mealtimes.	Yes No Don't know
8. Tooth decay in baby teeth can cause infections that can spread to the face and other parts of the body.	Yes No Don't know
9. Parents should start cleaning their child's teeth as soon as the first tooth comes in.	Yes No Don't know
10. Tap water is good for children's teeth.	Yes No Don't know
11. Cavities in the baby teeth put children at higher risk for cavities in the permanent teeth.	Yes No Don't know

Now we want to ask about your child's tooth care.	(Circle one)
12. How often does an adult brush your child's teeth?	Daily Weekly Monthly Never
13. How often are your child's teeth brushed with fluoride toothpaste?	Daily Weekly Monthly Never
14. How often are your child's teeth brushed with non-fluoride toothpaste?	Daily Weekly Monthly Never
15. How often do you check your child's teeth for anything unusual?	Daily Weekly Monthly Never
16. When brushing, how often do your child's gums bleed?	Daily Weekly Monthly Never

Next we ask about your child's eating habits	(Select one)
17. Does your child usually (throughout the day) drink from a bottle or sippy cup?	Yes No
18. How often does your child go to sleep while nursing, or go to sleep while drinking something besides water from a bottle/sippy cup?	Daily Weekly Monthly Never
19. How often do you give your child sugary snacks such as raisins, candy, cookies, cakes, or cereal between meals?	☐ Three or more times a day ☐ One or two times a day ☐ Weekly ☐ Monthly ☐Never
20. How often do you give your child sugary drinks such as regular soda, sweet tea, chocolate milk, strawberry milk, fruit juice, sports drinks or koolaid between meals?	☐ Three or more times a day ☐ One or two times a day ☐ Weekly ☐ Monthly ☐Never
21. How often does your child typically drink tap water-	Daily Weekly Monthly

including filtered water from the refrigerator?	Never
22. Is there fluoride in your drinking water at home?	Yes No Don't Know

These questions are about your teeth and your tooth care.	**(Circle one)**
22. Have you had tooth decay, fillings and/or teeth pulled in the last two years?	Yes No
23. How often do you brush your teeth with fluoride toothpaste?	Daily Weekly Monthly Never

These questions are about your eating habits	**(Select one)**
24. How often do you eat sugary snacks such as raisins, candy, cookies, cakes, or cereal bars between meals?	☐ Three or more times a day ☐ One or two times a day ☐ Weekly ☐ Monthly ☐Never
25. How often do you drink sugary drinks such as regular soda, sweet tea, chocolate milk, strawberry milk, sports drinks, kool aid or fruit juice between meals?	☐ Three or more times a day ☐ One or two times a day ☐ Weekly ☐ Monthly ☐Never

The following questions are about you and your child's dental care	**(Select one)**
26. Is it very difficult to get your child to the doctor or dentist?	Yes* No
*If you answered "Yes" to question 26, please check all reasons that apply from the list that makes it difficult for you to get your child to the doctor or dentist:	☐ Transportation ☐ Distance ☐ Finances ☐ Job Conflict ☐ Fear/anxiety ☐ Other: _____ _____ _____ _____ _____
	Yes No Don't know

27. Is your child covered by health insurance?	
28. Is your child covered by dental insurance?	Yes No Don't Know
29. Does your child participate in public assistance programs (example: WIC, Healthy Start, etc.)?	Yes No Don't Know

Now tell us a little bit about you…	
30. What is <u>your</u> racial background? (check all that apply)	☐ White/Caucasian ☐ African American or Black ☐ Asian ☐ Native Hawaiian or Pacific Islander ☐ American Indian or Alaskan Native ☐ Other (specify)_____
31. Do you consider yourself to be Spanish, Hispanic or Latino?	Yes No
32. What is the highest level of education that you completed?	☐ Elementary and Middle School ☐ High School ☐ College ☐ Graduate school beyond college
33. Counting you, how many adults live in the child's household? specify a number:	#Adults:_____
34. Counting your child, how many children live in the household? specify a number:	#Children:_____
35. How many adults in the household are employed? Specify a number:	#Adults:_____
36. Which of the following categories best represents the combined income of all family members in your	☐ Less than $5,000 ☐ $5,000-$9,999 ☐ $10,000-$19,999 ☐ $20,000-$29,999 ☐ $30,000-$39,999

household for the past 12 months? (select one)	☐ $40,000-$49,999 ☐ $50,000-$79,999 ☐ $80,000-$99,999 ☐ $100,000 or more ☐ Don't know

Thank you so much for answering these questions. This information will better help us to learn more about the relationship between tooth decay and children's dental health.

Appendix 2

Caries Risk Assessment

High Risk Factors

Primary caregiver has active caries? Y/N

Patient has > 3 between meal sugar-containing snacks or beverages per day? Y/N
(example: sippy cup or bottle with fluid other than water) Describe.

Patient is put to bed with a bottle containing natural or added sugar? Y/N

Patient has obvious white spot lesion(s) or decay present? Y/N

Patient has restorations present? Y/N

Moderate Risk Factors

Patient has a special health care need? Y/N

Patient has plaque on teeth? Y/N

Patient has intraoral appliance(s)? Y/N

Patient has defective restoration(s)? Y/N

Protective Factors

Patient receives fluoridated drinking water or fluorinated supplements? Y/N/not sure

Patient brushes teeth daily with fluoridated toothpaste? Y/N,
if yes choose: 0/1/2/3 or more times a day

Patient receives additional home measures (Prevident, MI paste, etc)? Y/N

Patient received fluoride varnish in last 6 months? Y/N

Overall assessment of dental caries risk? High/Moderate/Low

Appendix 3

Name: **Date:**

Subject #: **Axium #:**

2nd Molar	**lst Molar**	**Canine**	**Lateral**	**Central**	
A m o d b l	B m o d b l	C m d b l	D m d b l	E m d b l	**Upper Right**
J m o d b l	I m o d b l	H m d b l	G m d b l	F m d b l	**Upper Left**
K m o d b l	L m o d b l	M m d b l	N m d b l	O m d b l	**Lower Left**
T m o d b l	S m o d b l	R m d b l	Q m d b l	P m d b l	**Lower Right**

0 – Caries free **Please Circle Visit:** **Consult** **GA followup**
1 – White spot lesion
2 – Cavitated in enamel or dentin **3-Month Recall** **6-Month Recall**
3 –restored surface

Appendix 4

GOAL SELECTION SHEET

Select the goal that you would like to work towards by circling it.

Then, on a scale of 1-10, circle how confident you are that you can accomplish the goal.

Self-management Goals for Parent/Caregiver

Patient Name_____ DOB_____

Regular dental visits for child

Family receives dental treatment

Healthy snacks

Brush with fluoride tooth-paste at least twice daily

No soda

Less or no juice

Wean off bottle (At least no bottle for sleeping)

Only water or milk in sippy cup

Chew gum with xylitol

Drink tap water

Less or no candy and junk food

IMPORTANT:
The last thing that touches your child's teeth before bed-time is the tooth-brush with fluoride toothpaste.

Circle the goals you will focus on between today and your next visit.

On a scale of 1-10, how confident are you that you can accomplish the goals? 1 2 3 4 5 6 7 8 9 10

Not likely Definitely

My promise: I agree to the goals circled and understand that staff may ask me how I am doing with my goals.

Date:_____ Signed by:_____

Review Date:_____ Comments: _____ Staff Initials:_____

Review Date:_____ Comments: _____ Staff Initials:_____

Appendix 5

ID	Actual recall		Number of Surfaces At Risk	Worse	Better
Control-6mo recall					
2	6+9	other	24	0	0
3	3+6	3mo	37	1	2
8	6	other	24	0	0
12	6	other	24	0	0
17	6	other	31	0	0
19	6	other	40	0	0
21	6+9	other	42	0	0
22	3+6+9	3mo	48	0	0
28	6	other	32	0	2
32	6	other	42	0	0
41	3+6	3mo	40	0	0
42	6	other	42	0	0
46	6	other	47	0	0
49	6	other	27	0	0
52	6	other	25	1	3
54	3+6	3mo	35	0	7
55	6	other	25	0	0
56	6	other	32	0	0
62	6	other	51	0	1
65	6	other	22	0	0
67	6	other	32	0	0
69	3+6	3mo	34	0	2
71	6	other	58	0	2
72	6	other	62	0	0
75	6	other	32	0	0
76	6	other	43	0	0
79	6	other	34	0	0
83	6+9	other	72	0	1
90	6	other	40	0	2
91	6	other	40	0	0
93	3+6	3mo	69	0	0
94	6	other	74	1	1
97	3+6	3mo	52	0	0
102	3+6	3mo	55	0	1
103	3+6	3mo	69	0	1
107	6	other	46	0	0

ID	Actual recall		Number of Surfaces At Risk	Worse	Better
Intervention-3 mo recall					
5	3+6+9	3mo	72	0	4
10	3+6+9	3mo	24	1	0
11	3+6+12	3mo	37	0	20
15	6	other	28	2	0
16	3+6	3mo	64	0	0
23	3+6	3mo	41	0	2
24	6	other			
27	6	other	36	0	0
35	3+6	3mo	76	0	0
37	6	other	10	0	0
38	6	other	24	0	0
39	3+6+9	3mo	20	0	4
43	3+6+9	3mo	57	2	0
48	6	other	57	0	3
50	6	other	40	1	1
51	6	other	15	0	0
58	6	other	30	0	0
59	6	other			
63	3+6	3mo	58	0	2
66	6	other	36	0	8
70	6	other	27	0	0
73	6	other	48	4	0
74	3+6	3mo	54	0	0
77	6	other	30	0	0
78	3+6	3mo	56	0	2
80	3+6	3mo	40	0	0
87	6	other	48	0	1
88	6	other	40	0	0
89	3+6	3mo	28	0	0
92	3+6	3mo	16	0	9
96	6	other	35	0	0
98	3+6	3mo	32	0	2
100	3+6	3mo	57	0	2
106	6	other	32	0	1
110	3+6	3mo	29	0	13
111	3+6	3mo	45	0	0
120	6	other	19	0	3

Vita

Amanda Kilburn Kerns was born on June 23, 1988 in Fort Lauderdale, Florida. She received her Bachelor of Science in Biologic Sciences from North Carolina State University in 2009. She completed her Doctor of Dental Surgery degree from the University of North Carolina at Chapel Hill in 2014. Amanda will complete her Pediatric Dentistry Residency at Virginia Commonwealth University in June 2016.