2017

A Comparison of Treatment Planning Modalities for the Pediatric Dental Patient

Martha M. Holland
Virginia Commonwealth University

A Comparison of Treatment Planning Modalities for the Pediatric Dental Patient

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

By

Martha M. Holland, DMD

BA, The University of Mississippi, 2010

DMD, The University of Mississippi, 2015

Thesis Advisor: Tiffany Williams, DDS, MSD

Assistant Professor, Department of Pediatric Dentistry

Virginia Commonwealth University

Richmond, Virginia

May 2017

Acknowledgments

I would like to thank the Department of Pediatric Dentistry at Virginia Commonwealth University; over the past two years, you have nurtured me in my journey to become a pediatric dentist. You are indeed my "Virginia Family." To my co-residents, thank you for your friendship and encouragement. To my thesis committee, Dr. Tiffany Williams, Dr. Patrice Wunsch, Dr. Bill Dahlke, and Dr. Caroline Carrico, thank you all for your mentorship and expertise throughout this entire process. I am truly grateful for the key role each of you has played in seeing this project to completion.

To my precious family, there are not enough words to adequately thank you for your boundless support, even from over 800 miles away. Thank you for believing in me every step of the way, for pushing me to achieve my goals, and for cheering me on, all the way from Mississippi. To my loving husband, Eric, you are my best friend and my biggest cheerleader. Without you, I simply would not have had the courage or stamina to complete this journey. Thank you for bringing me along for this incredible adventure in Virginia. I cannot wait for our next chapter in North Carolina.

To my Heavenly Father, thank you for blessing me with much more than I deserve. I am eternally grateful for the incredible mentors, encouragers, and supporters you have placed in my life along the way. I am humbled by your provision and sovereignty in this long journey to becoming a pediatric dentist. May you receive all of the glory and honor.

"But I trust in your unfailing love; my heart rejoices in your salvation.
I will sing the Lord's praise, for he has been good to me."
Psalm 13:5-6

Table of Contents

List of Tables

List of Figures

Abstract

A COMPARISON OF TREATMENT PLANNING MODALITIES FOR THE PEDIATRIC DENTAL PATIENT

By Martha M. Holland, DMD

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

Virginia Commonwealth University, 2017

Thesis Advisor: Tiffany Williams, DDS, MSD

Department of Pediatric Dentistry

Purpose: To assess the treatment modalities of pediatric dentists for restoring Class II lesions in primary molars.

Methods: A survey of eight cases was emailed to AAPD members, who were asked to choose a stainless steel crown (SSC) or composite resin. Treatment choice was associated with provider type, years in practice, behavior management, lesion detection, and patient age.

Results: Clinically detectable caries restored under general anesthesia were treated more often with a SSC. Faculty and residents chose a SSC at a greater rate. Providers with 10 or more years experience chose a SSC more often.

Conclusions: The scope of treatment planning encompasses numerous factors. Because of the multifactorial nature of treatment planning for the pediatric dental patient, it would be beneficial for the AAPD to produce a treatment planning decision tree in order to better direct practitioners in their development of patient-centered treatment plans.

Introduction

Over the past fifty years, there has been a remarkable reduction of dental caries incidence in children.[1] Most commonly, the interproximal surfaces of primary teeth experience caries, accounting for around 80% of occlusoproximal restorations.[2–4] Caries treatment in primary teeth remains the subject of a vigorous and continuous debate, especially the most effective approach for restoring multisurface lesions.[4–6] The availability of a large variety of materials for the same restorative purpose makes selecting the appropriate material difficult for the clinician.[7] Stainless steel crowns have been common treatment in the past, but now many practitioners do not utilize them at all.[1] Frequently in primary teeth with a carious lesion that is small enough to consider alternative restorative options, the choice of utilizing a stainless steel crown is not clear cut. Factors such as the condition of the tooth being restored, restoration longevity, caries risk factors, and effectiveness must be considered. In high-risk patients, it is better over time for primary teeth to be treated more aggressively with stainless steel crowns rather than multisurface intracoronal restorations.[8,9] The location and size of the prepared cavities, physical properties of the restorative material, the gender, age and socioeconomic status of the patient, esthetics, the dentition being treated, the type of practice, and the clinician's experience are also important factors when selecting a restorative material.[7,10] Contrary to historical belief, practitioners now recognize that the disease process of dental caries is not eliminated by restorative treatment alone, and the lifespan of restorations is finite.[11,12] An understanding of the caries disease process coupled with an individual's risk for caries plays an important role in the contemporary

management of carious lesions, including the emphasis on active surveillance, preventive services, and surgical intervention when necessary.[11,13]

Sensitivity values of 0.30 have been obtained in clinical studies in measuring the detection of proximal carious lesions of permanent teeth by visual examination, leaving seventy percent of carious lesions undetected via visual inspection.[14,15] Similar figures were obtained in a study by Novaes in clinically detecting proximal cavitated lesions of primary molars.[15,16] As an adjunct to the clinical exam, the use of a bitewing radiograph could identify occlusal and proximal caries into dentin and better estimate the depth of the carious lesion.[15] Minimal information validating caries diagnosis in primary teeth exists. Due to broadened proximal contacts and thinner enamel and dentin, different criteria for caries diagnosis may be required for primary teeth, and primary teeth may be more prone to failure of restorations than permanent teeth. [11,17,18]

Current guidelines from both the American Academy of Pediatric Dentistry and the British Society for Paediatric Dentistry recommend that primary molar teeth with dental decay be restored with either a filling or crown after carious tissue has been removed.[19] Considerable variations in opinion exist regarding when to restore a tooth with a crown or when a filling would be more appropriate.[19–21] Each primary tooth has a known life expectancy; therefore, the dental practitioner should match the appropriate restoration with the expected life span of the tooth in order to provide a definitive restoration that never has to be replaced. The average life expectancy of an amalgam restoration is two years in primary teeth; therefore, if the patient is younger than age 6 or the restoration needs to last more than two years, then evidence dictates that the best practice would be to place a stainless steel crown when restoring molars, especially first primary molars, in young children.[9,22,23] Blinkhorn found in a case scenario survey in 2003

that eighty eight percent of dentists in the United States would place a crown on a decayed primary molar tooth compared to four percent of respondents in the United Kingdom.[19,24] A tailored preventive program must be prepared in conjunction with the restorative treatment plan for each individual patient. Because of the differences in morphology of primary teeth, restorations differ significantly compared to permanent teeth. In pediatric dentistry, the more common restorative materials include stainless steel alloys, amalgam alloys, glass ionomers, composites, and other resin systems; however, silver amalgam alloys are progressively being used less in pediatric dental practices.[25]

A critical component of pediatric restorative dentistry is the use of resin-based composite.[26] With varying levels of success, resin-based composites have been used for more than thirty years for Class II restorations in adult and pediatric teeth, and for fifteen of those years, they have been relatively successful when used the composite material is used properly to restore teeth with only a small or moderate amount of dental caries.[27] Composite resin is an excellent treatment choice for pediatric posterior teeth when placed well; however, placement requires significant time due to the need to place small increments of material, which necessitates increased curing time. Composite restorations must also be finished meticulously in order to prevent marginal breakdown. The quality of composite restorations is often compromised due to uncooperative behavior with pediatric patients.[1] Restoration size, tooth position, and operator experience contribute to the longevity of a resin composite restoration.[11,28] Clinical studies have shown a minimum of three years of longevity in the primary dentition and four years in the permanent dentition.[26,29–32] The acid etch technique aids in providing retention for composite restorations in both the primary and permanent dentitions, as originally recommended by Buonocore.[26,33] Class II resin-based composite restorations in the primary

dentition are recommended by the American Dental Association for preparations not extending beyond the proximal line angles; however, resin-based composite may be the best treatment of choice for those teeth expected to exfoliate in one to two years.[26] Original form re-establishment of a primary molar can be difficult with a filling material, especially with multi-surface cavities. Premature restoration failure is often a result of an increase in occlusal load on multi-surface restorations.[19] The structural integrity of the first primary molars can be compromised with the removal of even small carious lesions; therefore, the major limiting factor of restoration choice is the strength of the primary tooth itself. The contact area in the primary molar is broad, requiring a large truncated box to place the margins of the restoration in a self-cleansing area. The buccal and lingual retaining walls in the first primary molar become thin and weak with little remaining dentinal support.[9]

For children's teeth that have been greatly destroyed by caries, clinicians have been placing stainless steel crowns since 1950 and have saved many teeth that would have otherwise been extracted.[27] Stainless steel crowns are relatively inexpensive, extremely durable, and have minimal technique sensitivity during placement; the main disadvantage of the stainless steel crown is its appearance.[9] Crowns have been deemed appropriate when two or more surfaces are carious, or if there are extensive two surface caries; they may also be indicated to restore primary molars affected by enamel hypoplasia, amelogenesis imperfecta, or dentinogenesis imperfecta;[19] they have also been indicated for the following clinical scenarios: anticipated failure of other restorative materials, following pulp therapy, to restore a tooth that is to be used as a space maintainer abutment, for high caries-risk patients, and for patients whose restorative dentistry is being completed under sedation or general anesthesia.[11] Stainless steel crowns are adapted to individual teeth, and a biocompatible luting agent is used for cementation. The stainless steel

crown has been deemed the best restorative practice for posterior primary teeth with dental caries in young children ages four and under from low income families with evidence of early childhood caries and for who timely recall for preventative services is questionable.[9]

In a study by Guelmann, it was noted that sixty percent of clinicians prefer stainless steel crowns when three or more surfaces are carious.[7] Stainless steel crowns have been recommended globally by national pediatric dental organizations for the treatment of decayed primary molar teeth, and evidence supports the conclusion that proximal amalgam restorations are inferior to stainless steel crowns for primary molar teeth. [11,34] In terms of both clinical skills and patient cooperation, fitting a crown can be a demanding task[19,35] It has been suggested that inadequately contoured crowns and cement residue in the gingival sulcus are associated with gingivitis and stainless steel crowns. [11,22] Less gingival bleeding was observed in composite restorations versus stainless steel crowns in a two year randomized clinical study. Limited prospective randomized clinical trials that compare the outcome of intracoronal restorations to stainless steel crowns exist. [11,36] In a 2015 Cochrane Review, it was concluded that restoring carious primary molar teeth with stainless steel crowns decreases the risk of pain or major failure long term when compared to fillings. It is believed that by encasing the tooth, regardless of the material of the crown or the method by which it is placed, the structural integrity of the tooth is increased and the tooth is protected from developing additional caries. [19,25] The most important purpose of the primary molars is to act as a space maintainer for the permanent successive teeth and to contribute to growth and development of the face and jaws. This function of primary molars can be compromised when primary molars are restored with a material that is likely to fail, increasing the likelihood of drifting of the permanent molars and space loss into the area of the lost or broken restorations. Furthermore, data indicates that that many of the less expensive

restorations, like Class II amalgams, will fail, and unless these restorations are followed through regular recall exams and replaced, many children will require orthodontic therapy to regain lost space and create adequate arch length for the permanent teeth. Thus the cost to replace the restoration is merely a small fraction of the expense that the patient may incur.[9,22]

The risk for future caries is best predicted by the patient's previous caries experience; this is a very important treatment planning consideration in the primary and mixed dentitions.[8,9] Numerous clinical factors contribute to choosing a restorative treatment modality and should be considered when fabricating a treatment plan for the pediatric dental patient. Questions offering a simple overview of the patient's risk assessment should include: (1) How many carious lesions exist? (2) What is the patient's past caries history? (3) What is the patient's oral hygiene status? (4) At the free gingival margin of the anatomical crown, is there significant enamel demineralization? (5) Will the patient return for preventive care at regular recall intervals? (6) Can adequate isolation of the tooth be achieved? (7) What size will the restoration be? (8) Is the carious lesion in a primary or permanent tooth? (9) What are the patient and parent expectations? Unless the factors mentioned in questions one to five can be modified, these children with high risk behaviors are not candidates for restorations with resin-based composite. Furthermore, restorations that are extensive and teeth that cannot be isolated should be restored with alternative restorative materials.[26,37] Caries risk indicators for patients at high risk have been documented by Tinanoff and include the following: DMFS (decayed, missing, and filled tooth surfaces) greater than the child's age, numerous white-spot lesions, high *Streptococcus mutans* titers, the development of two or more lesions in one year, appliances in the mouth, low socioeconomic status, high caries rates of the parent, caregiver, and sibling, and a history of sugar consumption at high frequencies.[8,9]

Changes in the epidemiology of caries, technological advancements, and restorative materials have contributed to a more conservative treatment philosophy with a tailored treatment plan based on the disease status of each patient. Each individual clinical situation is complex, as each patient presents with a past and current caries experience, dietary habits, physiological factors, and caries preventive behaviors, which all contribute to formulating a treatment plan.[38] In a comprehensive review of dental restorative materials used in pediatric dentistry, Berg advised that material selection should be based on the needs of the individual once the clinician fully understands the properties of the material.[7,39] The goal of caries-risk assessment is to identify and minimize caries-causing factors and to optimize protective factors, making it a key element of preventive care for infants, children, adolescents, and patients with special health care needs. [40,41] Changes in habits, oral microflora, or physical condition can alter a child's risk assessment; therefore, it must be documented and repeated regularly to maximize effectiveness. [13,41]

The cooperative potential of a pediatric dental patient must also be evaluated, as a child's reaction to care directly influences treatment planning. Accurately assessing the patient's temperament, developmental level, and dental attitudes is essential when treating children.[42] Unlike adults, children are not always willing or able to help control the environment of the oral cavity during restorative treatment, and control of saliva and tongue movement in young children is frequently impossible when placing and setting dental materials such as glass ionomer cements, resin composites, and amalgams. The stainless steel crown exhibits low sensitivity to oral conditions during placement and cementation, offering a strong advantage for its placement in an uncooperative and crying child; therefore, the stainless steel crown is indicated when the practitioner cannot efficiently control saliva. The setting in which restorative treatment is

delivered contributes to the process of treatment planning, specifically as a cost factor. If the quantity of dental treatment to be rendered, combined with the patient's inability to cooperate, requires that the patient be treated under moderate sedation or general anesthesia, a strong argument can be made that stainless steel crowns are the restorative treatment of choice based on their longevity and full coverage protection from secondary caries. An additional factor to consider is the risk associated with moderate sedation and general anesthesia and the possibility of limiting exposure to such risks by aggressively using the stainless steel crown in children who are at high risk for dental caries in addition to being uncooperative.[9,43] The dental practitioner must communicate treatment options, including risks and benefits, to assist the parent in choosing what is best for the child. Diagnostic and therapeutic services are successfully completed through a partnership of the dentist, parent, and child.[42,44]

The purpose of this study was to survey practicing pediatric dentists and pediatric dental residents to gain an understanding of the modalities utilized by practitioners when formulating a treatment plan for pediatric dental patients.

Aim 1: To investigate existing trends among pediatric dental practitioners with regard to the use of stainless steel crowns versus Class II composite restorations.

Aim 2: To determine if the treatment modality chosen by the pediatric dental practitioner is determined by age, caries risk, size of radiographic lesion, or method of behavior guidance (i.e. nitrous oxide analgesia, moderate sedation, and general anesthesia).

Aim 3: To identify if the use of stainless steel crowns increases with years of experience in clinical practice.

Materials and Methods

The participants from this study were acquired from the American Academy of Pediatric Dentistry's membership roll in July 2016. Inclusion criteria was as follows: members of the American Academy of Pediatric Dentistry who are 1) current pediatric dental residents or post-doctoral members; 2) current practitioners of pediatric dentistry in the private practice or academic setting; or 3) lifetime members who may have retired from the dental field. An email with the linked study survey was sent in August 2016 to 6,869 members of the American Academy of Pediatric Dentistry. Participants were informed that choosing to participate in the study was voluntary and yielded no compensation. Within the introductory email to members, it was clearly stated that all survey responses would be anonymous with no identifiers. By completing the survey, participants indicated their consent to participate in the study.

Study data were collected and managed using REDCap electronic data capture tools hosted at Virginia Commonwealth University. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies.[45]

Intraoral photographs and bitewing radiographs were obtained from the electronic health record of eight patients who were treated in the Department of Pediatric Dentistry at Virginia Commonwealth University. Clinical case scenarios were created utilizing dental treatment notes from each of the eight unidentified patients and were matched with the appropriate intraoral photograph and bitewing radiograph. The clinical case scenario for each patient included the following information: 1) age of the patient; 2) past medical history; 3) history of present illness;

4) oral hygiene status; 5) Frankl behavior score and description; 6) clinical and radiographic caries noted upon examination; 7) behavior management modality that was chosen to complete treatment (i.e. nitrous oxide analgesia, moderate sedation, or general anesthesia). A specific primary tooth was identified as being carious and needing restorative treatment, and each participant was asked to choose the restorative therapy that he or she would treatment plan when presented with the aforementioned clinical case scenario. A brief description of each case is given in Table 1. The following options were listed for the participant to select: 1) composite resin restoration; 2) stainless steel crown; 3) no treatment at this time. Each case scenario included a Frankl behavior score, which is one of the more frequently used behavior rating systems in both research and clinical dentistry. The Frankl scale includes four categories ranging from definitely negative (a score of 1) to definitely positive (a score of 4) and is used to document observed behavior in the dental setting.[42]

A section highlighting the demographics of each participant was included at the conclusion of the survey. The participants were asked to report the following demographics: 1) current status as a pediatric dental provider (i.e. pediatric dental resident, faculty member, or private practitioner); 2) practice setting description (i.e. rural, urban, metropolitan, or other); 3) the number of years practicing pediatric dentistry. If the demographics portion indicated that the participant was a current pediatric dental resident, then the participant was prompted to indicate the following: 1) the number of years of the individual's pediatric dental residency program; 2) the number of months that the individual has completed of his or her training; 3) the type of residency program in which the individual is enrolled (i.e. hospital-based program, clinic-based program, or a combined program).

***Table 1**: Characteristics of Sample Cases*

Case	Behavior Management Modality	Age	Number of lesions	Clinically/Radiographic detectable lesions
Case 1	Nitrous Oxide	>4yo	4+	Radiograph
Case 2	Moderate Sedation	>4yo	<4	Clinically
Case 3	Nitrous Oxide	<4yo	<4	Clinically
Case 4	Nitrous Oxide	<4yo	4+	Radiograph
Case 5	General Anesthesia	>4yo	<4	Clinically
Case 6	Moderate Sedation	<4yo	4+	Radiograph
Case 7	General Anesthesia	<4yo	4+	Clinically
Case 8	Moderate Sedation	>4yo	4+	Radiograph

The survey instrument was utilized to identify current trends in treatment modality selection of composite restorations or stainless steel crowns by analyzing responses from survey participants related to the following questions:

- Did the use of stainless steel crowns increase with years of practice?
- Did treatment modality trends change with the practice setting being identified as rural, urban, or metropolitan?
- Did pediatric dental residents select one treatment modality more often than the other and did this trend in treatment selection change as the months in residency increased?
- Which treatment modality was selected more for patients having treatment completed with general anesthesia, moderate sedation, or nitrous oxide analgesia?

- In those patients who were five years and younger, which treatment modality was chosen more frequently?
- If a patient presented with more than four carious lesions, was a treatment modality favored over the other? Did clinical and/or radiographic detection of caries influence the chosen treatment modality?

Approval for this study was obtained from the Institutional Review Board at Virginia Commonwealth University (VCU IRB #HM20006725). The research study qualified for exemption according to 45 CR 46.101(b), category.

Statistical Methods

Sample demographics and responses were summarized using descriptive statistics. Bivariate comparisons between treatment planning decisions and various respondent characteristics were assessed using chi-squared tests. Repeated measures logistic regression was used to determine overall predictors of SSC treatment selection (versus composite resin), which accounts for responses from the same respondent. Post hoc pairwise comparisons were performed using Tukey's adjustment for multiple comparisons.

Results

A total of 729 responses were collected, and the overall response rate was 11%. Among the respondents, 34 individuals were excluded from the analysis because these individuals did not respond to the question regarding provider type; therefore, the final sample size was 695. The majority of respondents were private practitioners (81%), followed by faculty members (12%), and residents (7%). Among the private practitioners, urban and metro practice areas were most common (44%, 37%, respectively). Experience ranged from current residents to greater than 15 years post-residency (45%). Full demographics are noted in Table 2.

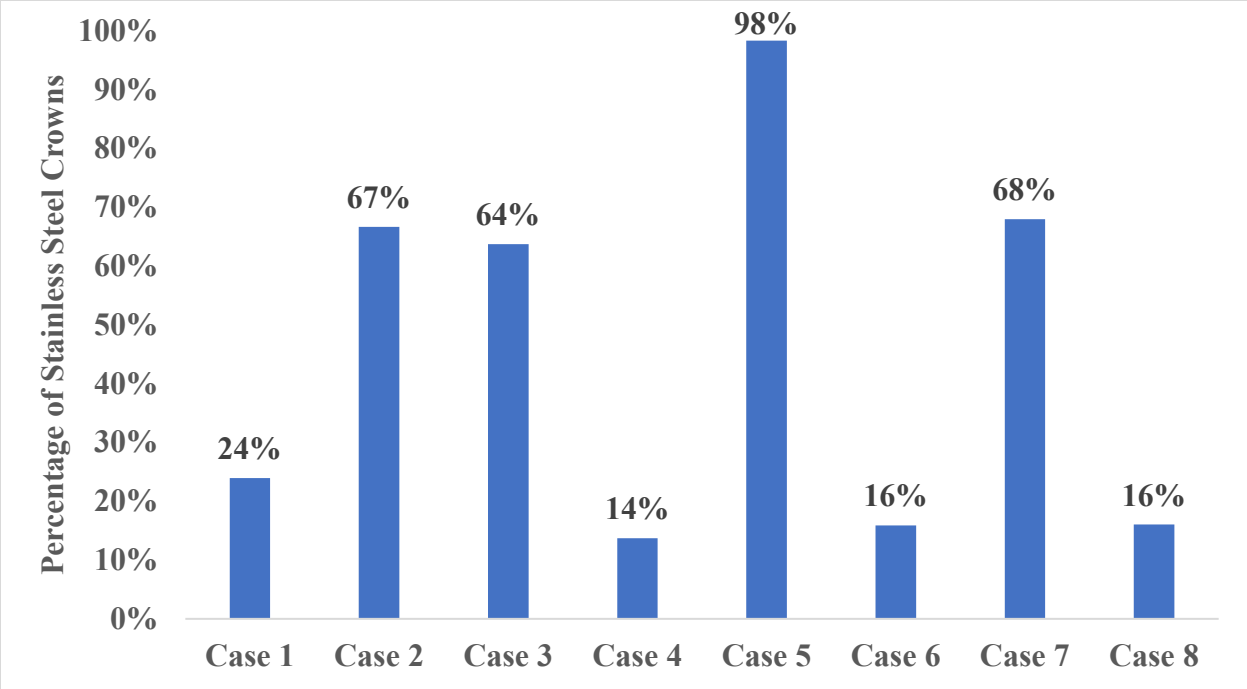
***Table 2**: Sample Demographics*

Sample Breakdown	**n, %**
Response Rate	729, 11%
Provider Type (n=695)	
Resident	51, 7%
Faculty Member	81, 12%
Private Practitioner	563, 81%
Practice Setting (n=563)	
Rural	88, 16%
Urban	249, 44%
Metropolitan	207, 37%
Other	19, 3%
Years in Practice (n=694)	
Current Resident	48, 7%
1-3 Years Post-Residency	142, 20%
4-9 Years Post-Residency	119, 17%
10-15 Years Post-Residency	73, 11%
>15 Years Post-Residency	312, 45%
Residency Setting (n=51)	
Hospital-based	15, 29%
Clinic-based	4, 8%
Combined	32, 63%

Treatment Selection

The percentage of respondents who chose the stainless steel crown treatment option ranged from 14%-98% across the eight cases that were presented. Stainless steel crown was chosen at the highest rate for Case 5 and at the lowest rate for Case 4. In Figure 1 below, the rate at which a stainless steel crown was chosen as the treatment choice is indicated.

***Figure 1**: Percent of Respondents Selecting Stainless Steel Crown for Treatment by Case*



Factors Associated with Treatment Selection

For specific cases, the practitioner type was associated with difference in treatment choice selection. Differences in treatment selection by provider type were significant for Cases 1, 2, 3, 4, 6, and 8. Private practitioners were generally less likely to treatment plan a stainless steel crown, while residents and faculty members tended to report a similar rate of stainless steel crown treatment selections. Figure 2 displays the breakdown of treatment selection by practitioner type across the 8 cases. Those cases marked with an asterisk have statistically significant differences between the practitioner type. Among the responding residents, the number of years in residency was not associated with significant differences in treatment planning decisions (p-values>0.20). The number of years in practice was associated with significant differences in treatment planning for cases 2, 3, and 7, and for these cases, the percent

of respondents indicating stainless steel crown as their treatment choice was lower for those with ten or more years of experience post-residency than those with less years in practice. The complete breakdown of the choice of a stainless steel crown by years in practice for cases 2, 3, and 7 is noted in Figure 3.

***Figure 2**: Percent Selecting Stainless Steel Crown by Case and Practitioner*

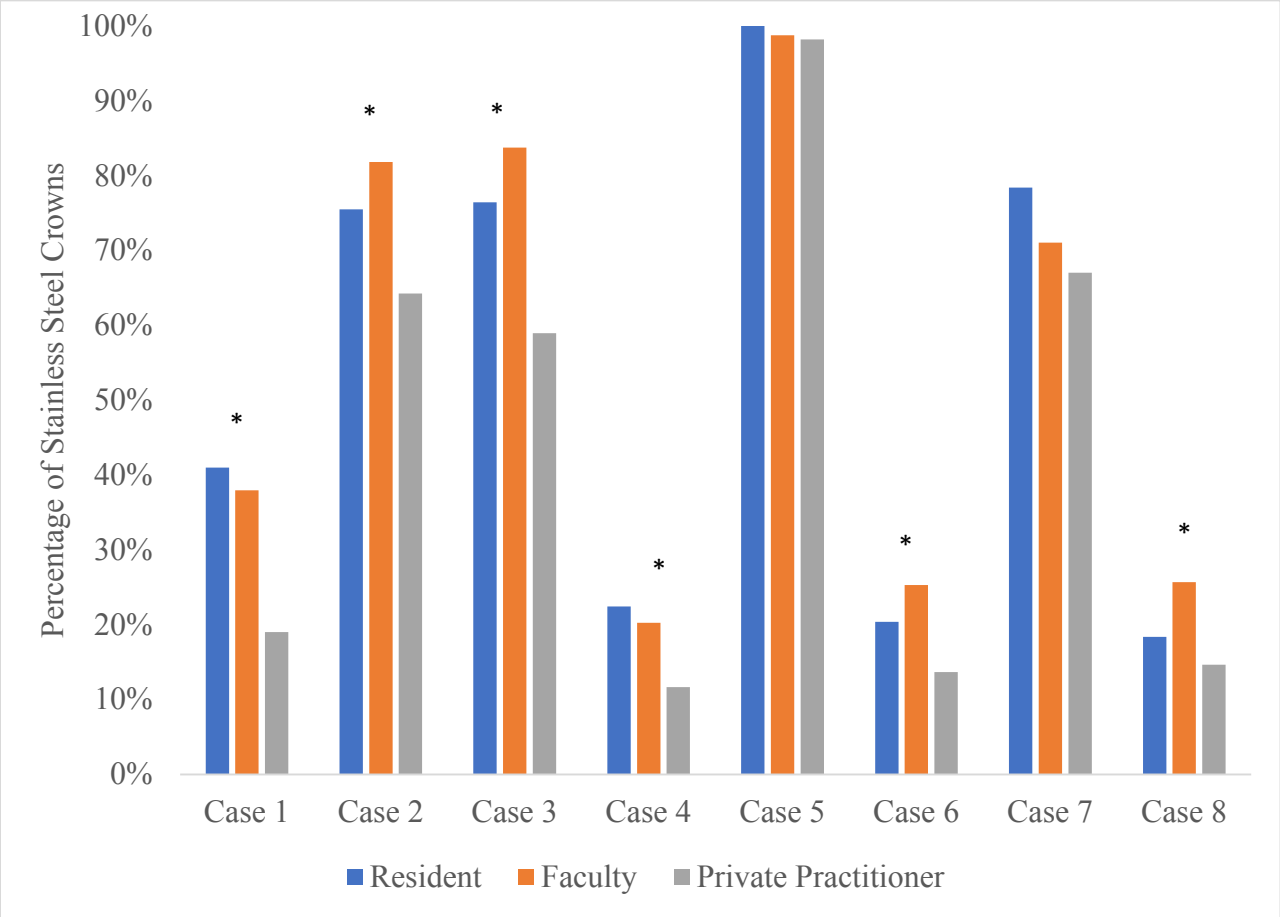
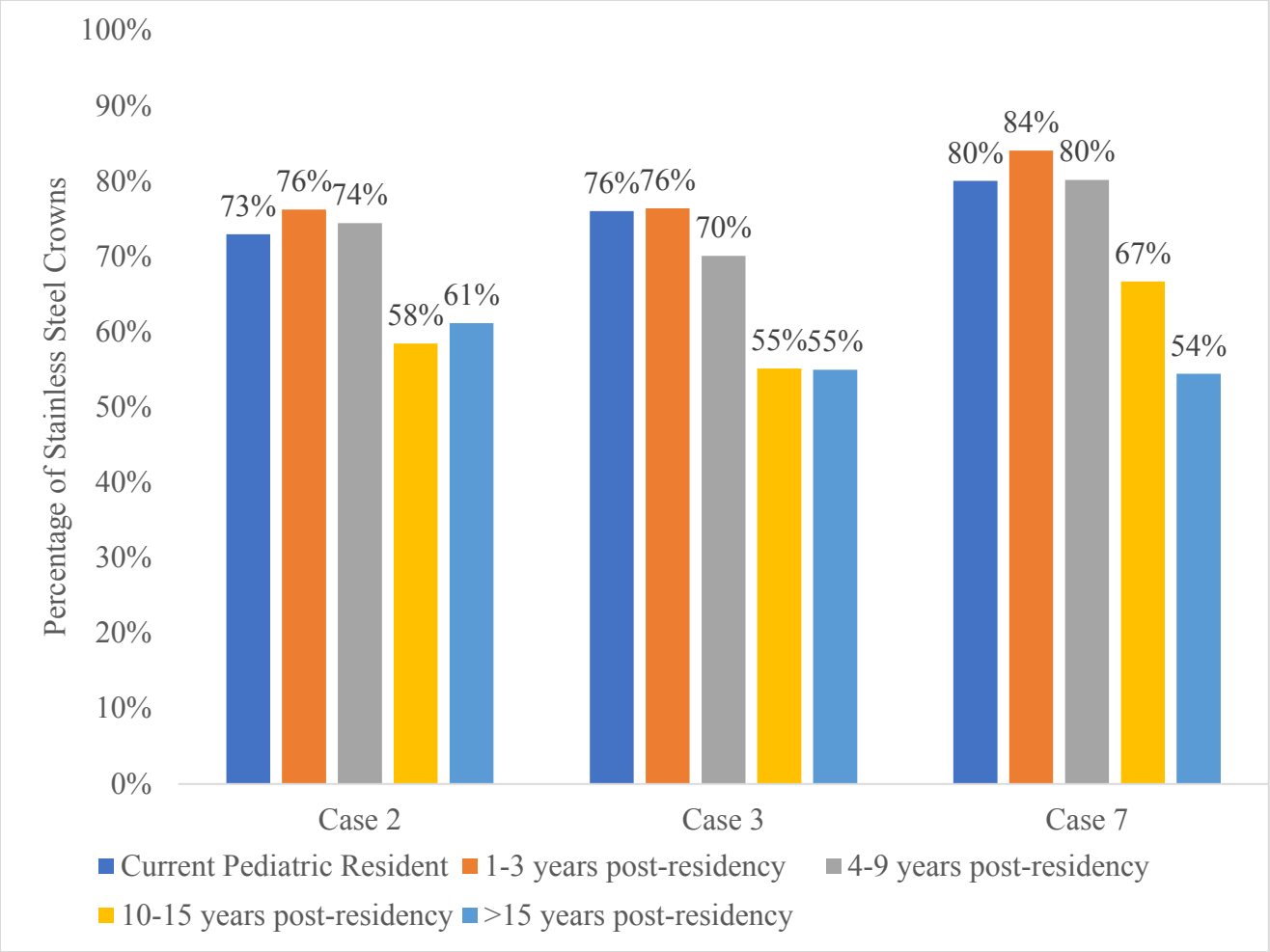


***Figure 3**: Stainless Steel Crown Treatment Planning by Years in Practice and Case*

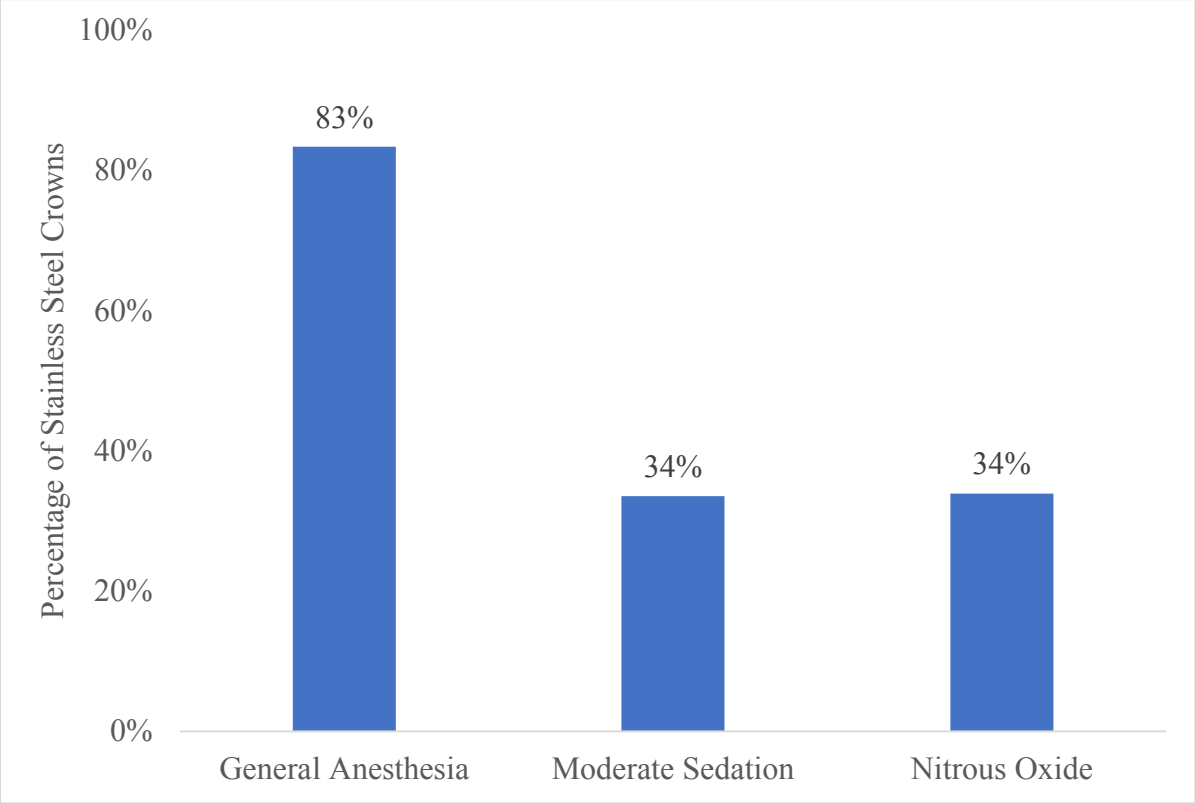


Provider location (private practitioners only) was only associated with significant differences in treatment planning choices for Case 4 (p-value=0.0177). For this case, 20% of respondents who indicated practicing in a rural setting chose a stainless steel crown as the treatment choice, while only 10% of those respondents practicing in an urban or metropolitan area indicated stainless steel crown.

Behavior management modality was significantly associated with differences in treatment plan choices as noted in Figure 4 below ($p<0.0001$). Among the cases where general anesthesia was indicated as the behavior management modality (cases 5 and 7), 83% of

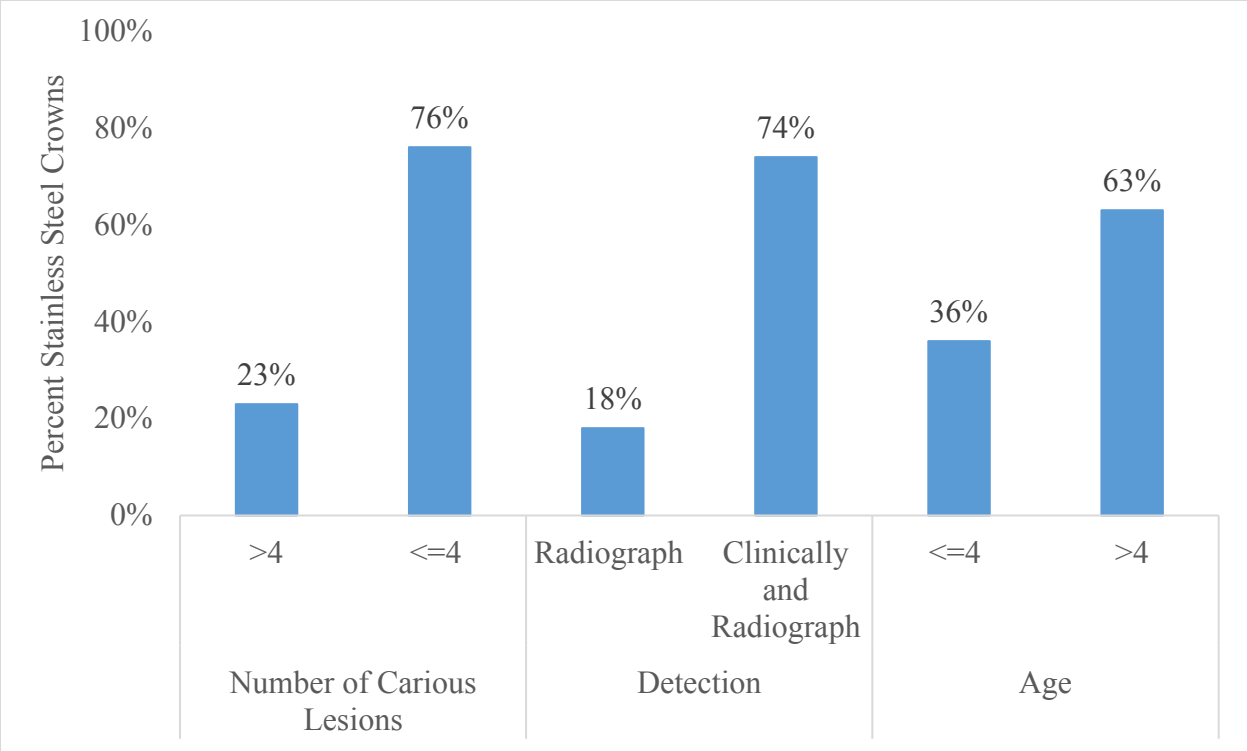
respondents selected a stainless steel crown, compared to 34% for both moderate sedation (cases 2, 6, and 8) and nitrous oxide (cases 1, 3, and 4).

***Figure 4**: Treatment with Stainless Steel Crown by Behavior Management Modality*



There was a significant difference in frequency of a stainless steel crown being treatment planned based on the overall number of caries detected in each patient (p-value <0.0001) and whether the caries could be detected both clinically and radiographically (p-value <0.0001). Participants were significantly more likely to choose a stainless steel crown in cases where less than four surfaces of caries were present (63% vs. 29%) and when caries could be detected clinically rather than simply radiographically (64% vs 15%). Patient age was also significantly associated with a difference in selecting a stainless steel crown (P-value<0.0001). Participants selected a stainless steel crown for 63% of cases where patients age was over 4 years old and just 36% for patients who were 4 years or younger.

***Figure 5**: Stainless Steel Crown Treatment Planning by Number of Caries, Detection, and Age*



Overall Model

Multivariable logistic regression was used to construct an overall model for predicting whether or not a provider would select a stainless steel crown rather than a composite resin restoration, while adjusting for repeated measures on the same survey respondent. Based on bivariate results, provider type was categorized into academic (residents and faculty) and private practice, since there were no differences between the residents and faculty. Additionally, moderate sedation and nitrous oxide were combined and labeled as conscious sedation to create two groups: general anesthesia and conscious sedation. The final change was in years of experience, which was also dichotomized based on bivariate results into: less than 10 years post-residency and greater than 10 years. Factors included in the model were: provider type (academic, private practitioner), provider years in practice (10 years or less post-residency, more than 10 years), treatment type (general anesthesia, conscious sedation), how the lesions could be detected (clinically,

radiographically), and a random effect for respondent. Practice setting could not be used because the question was only asked of private practitioners. Age of patient and number of lesions were not included in the final model due to multicollinearity. All were statistically significant in the overall model; results are presented in Table 3.

Cases involving clinically detectable caries, being treated with general anesthesia, by an academic provider (resident or faculty) were most likely to be treated with a stainless steel crown. A clinically detectable carious lesion was just over 4 times more likely to be treated with a stainless steel crown (95% CI: 3.7-5.2). Cases treated under general anesthesia were just over 7 times more likely to be treated with a stainless steel crown (95% CI: 6.1-8.5). When presented with the same case, academic providers were more likely to choose a stainless steel crown when compared to private practitioners (OR=1.7; 95% CI: 1.5-2.0). Providers who had practiced for more than 10 years were roughly half as likely as someone with less than 10 years of experience to treatment plan a stainless steel crown (OR: 0.64; 95% CI: 0.56, 0.72)

***Table 3**: Overall Model of Treatment Choice by Case Factors*

	Odds Ratio	95% CI	P-value*
Provider			<0.0001
Academic (Resident or Faculty)	1.70	(1.45, 2.00)	
Private Practitioner	Reference		
Years in Practice			<0.0001
Ten or more Years	0.64	(0.56, 0.72)	
Less than 10 Years	Reference		
Treatment Type			<0.0001
General Anesthesia	7.18	(6.09, 8.45)	
Conscious Sedation	Reference		
Detection			<0.0001
Clinically	4.38	(3.68, 5.19)	
Radiographically	Reference		

*P-value from multivariable logistic regression model

Discussion

The most effective approach for restoring carious lesions in the primary dentition remains a topic of recurring discussion, which can be attributed to the expansive variety of materials available for dental restorative purposes and the difficulty for the clinician to choose the most appropriate restoration.[4–7] Considerable variations in opinion exist regarding when to restore a tooth with a crown or a two-surface restoration.[19–21] Factors directly related to the patient such as adequate access to the carious lesion and the ability to cooperate with treatment may both be compromised in the often apprehensive young patient. The restorative technique needs to be as quick and simple as possible in these clinical scenarios in order to minimize the duration of treatment, while the restoration must be durable in order to reduce the chance for retreatment.[46]

This case scenario study was designed to survey and assess the treatment options that pediatric dental practitioners within the United States primarily choose when rendering treatment in pediatric patients with differing severities of primary molar caries. All of the participants were contacted via email through the use of the membership listserv of the American Academy of Pediatric Dentistry in order to maximize replies and minimize the cost of the study. All potential responders who had not responded were contacted by email two weeks following the initial email, and the survey was closed four weeks after the initial email. In this study's survey, the participants were allowed to only select their single most favored treatment option, and the options were limited to the following: stainless steel crown, composite resin restoration, or no

treatment. The range of responses from this survey instrument indicate the potential for wide variation in treatment planning between individual practitioners. There were 729 initial participants; however, 34 of the participants did not complete the survey in its entirety, resulting in 695 total participants. The percent of respondents indicating stainless steel crown as the best treatment option was lower for those practitioners with more than ten years of experience post-residency. Nearly half of the respondents reported practicing pediatric dentistry for more than fifteen years, and one could assume that aggressive treatment planning decreases with years in practice.

Decisions regarding restorative therapy generally have been regarded as a function of clinical judgment and have only been examined superficially.[11] It has been documented that stainless steel crowns are declining in use,[1] and the results of this study showed a wide range of stainless steel crown use from 14%-98% across the eight cases when choosing a treatment option. Although stainless steel crowns provide the most durable restoration, in cases of early or single surface caries, they may be considered as over-treatment.[46] Among the 695 respondents who completed the survey, the majority were private practitioners (81%), who tended to choose a composite resin restoration more frequently than faculty members (12%) and residents (7%). The data is consistent with the notion that faculty members in an academic institution play a key role and heavily influence the treatment choices of pediatric dental residents. It can be expected that while pediatric dentistry residents are participating in a post-doctoral education program, opinions for treatment planning may be conformed to the ideas of that specific program. This result raises the question of the experience and comfort level with placing Class II restorations of graduating pediatric dental residents. In a similar study surveying pediatric dentists in Florida, private practice pediatric dentistry showed to be more esthetically inclined when compared to

pediatric dental residency programs. Overall, clinicians preferred resin-based materials for restoring Class I and Class II lesions in primary molars; however, stainless steel crowns were the predominant material when three or more surfaces were involved. Guelmann proposed that the practitioner's choice of tooth-colored materials may be based on the esthetic demands of caregivers rather than the existing restoration longevity data.[7] This data potentially indicates that concern for esthetics drive private practitioners' treatment planning decisions when choosing between composite resin and stainless steel crowns.

In a similar study by Foley, an online structured questionnaire with different case scenarios was administered to pediatric dental residents, and it also rendered no consistency in responses of these practitioners within Europe. A wide variation of treatment options for children were chosen by postgraduate students, with more conventional forms of dental treatment being chosen for those patients who were non-anxious.[47] In addition, Pair and Tran identified considerable variations in opinion amongst pediatric dental practitioners about when to treat primary carious molars with a filling versus a stainless steel crown.[20,21] Also, in a case scenario study by Blinkhorn in 2003, decayed primary molars were restored with stainless steel crowns by 88% of respondents in the United States, compared to 4% in the United Kingdom.[19,24]

Early childhood caries is largely untreated in children under the age of three, and caries experience in these children has been shown to affect a high number of teeth. Restoring teeth with large carious lesions often require a stainless steel crown at this early age, because the tooth will be less likely to require retreatment. Because children with early childhood caries are at a greater risk of developing recurrent decay, a full coverage crown is often necessary. A practitioner's decision to use a more definitive restoration is not only influenced by the high rate of children requiring additional treatment but also the low levels of compliance with follow up

care.[48] A preformed crown is intended to provide a more durable restoration than a Class II composite resin restoration. As the tooth is prepared for a restoration, it can be left structurally weak, as sound tissue often needs to be removed to access the carious tissue, resulting in the stainless steel crown being the practitioner's restoration of choice.[19] Because primary teeth have been shown to be more susceptible to restoration failures than permanent teeth, the practitioner must consider the length of time remaining until tooth exfoliation prior to choosing a restoration.[11] In this study, patients who were four years or older were most likely to have a carious lesion restored with a stainless steel crown; however, this could be attributed to the fact that in the case reports presented, the patients over the age of four had more carious lesions that were both clinically and radiographically detectable. Practitioners were just under 4 times more likely to treat a carious lesion that was both clinically and radiographically detectable with a stainless steel crown instead of a composite resin restoration.

Composite resins for posterior teeth were developed with the increasing demand for esthetic restorative materials and concerns about mercury in amalgam restorations. Both inferior success rates and similar success rates have been reported when comparing composite resins and amalgam restorations.[49] From a meta-analysis of 59 randomized control trials of Class I and II composite and amalgam restorations, there is strong evidence showing an overall success rate of 90 percent after 10 years for both materials, with restoration longevity being increased significantly with rubber dam use.[50] The longevity of a resin composite is influenced by several factors including operator experience, restoration size, and tooth position. When compared to amalgams, resins are more technique sensitive and require more time to place; therefore, in cases where patient cooperation is in question, resin-based composite may not be the best restorative material of choice.[51] When composite resin is placed well, it provides an excellent restoration for

primary posterior teeth; however, in order to provide adequate restoration longevity, composite resin must be placed at a higher quality level, compared to amalgam restorations, which can be placed at a minimal quality level and still be successful.[1] Only one randomized controlled trial shows composite restorations in Class II preparations being successful in primary teeth that were expected to exfoliate within two years. There is however strong evidence that composite restorations in Class I preparations are successful.[17,52,53] The use of resin based composites is not supported in the dental literature for large multiple surface lesions in the posterior primary dentition.[26] In randomized controlled trials comparing composite restorations to amalgam restorations, strong evidence supports recurrent caries as the main reason for restoration failure in both materials.[28,52,54] Secondary caries rate has been reported as 3.5 times greater for composite restorations versus amalgam restorations.[28] Composite resin is not cariostatic, which is a desirable property for dental materials used for children. Composite resin is acceptable for some primary posterior teeth, but it is not considered the best material for routine use in all children.[1]

For the restoration of carious lesions in the primary dentition, evidence shows greater longevity of stainless steel crown restorations when compared to amalgam restorations.[11] Outcomes for preformed metal crowns compared to intracoronal restorations have only been compared in very few prospective randomized clinical trials.[36,55] The majority of clinical evidence for the use of preformed metal crowns (or stainless steel crowns) has come from nonrandomized and retrospective studies, as concluded in two systematic reviews and a Cochrane review; however, this evidence suggests, despite possible study bias of placing stainless steel crowns on teeth with larger carious lesions, that preformed metal crowns exhibit greater longevity than amalgam restorations .[17,19,23,56] An average five year failure rate of 26

percent for amalgam restorations has been shown in five retrospective studies compared to seven percent for preformed metal crowns.[23]

A limitation in this study was the limited amount of treatment options that were given to practitioners for treatment planning. In order to truly identify pediatric dental practitioners' treatment planning tendencies with regard to Class II restorations versus stainless steel crowns, it would have been more beneficial for the purposes of this study to include "Class II restoration" as a treatment option instead of including "composite resin restoration" as an option. Roughly ten survey respondents stated in their feedback that they were frequently using other restorative materials such as amalgam, resin-modified glass ionomer cements, and compomers to restore Class II lesions in primary molars. Respondents more frequently stated their extensive use of amalgam restorations, specifically in slightly uncooperative children and for financial reasons. It would have been an interesting component of a future study to assess how many practitioners would choose amalgam restorations over resin-based composites.

A second limitation to this study is that the case scenarios presented were hypothetical and actual care provided could be influenced by additional factors such as parental attitude, previous dental experience, and availability of resources. The inability to adequately portray the attitude of the parent toward treatment omits a major component of the treatment planning process, as clinicians are ultimately limited by the choices made by parents with regard to their child's dental treatment. An additional key component to the modalities of treatment planning is the ability of a pediatric dental specialist to adequately assess the cooperative potential of each patient that is encountered, giving the clinician a greater chance to create a more accurate treatment plan tailored to each specific patient. Moreover, each child presents with different life experiences, both personal experiences and dental experiences, that greatly influence the

outcome of treatment. Another crucial component of treatment planning is the availability of resources, as each restorative option presents a different monetary value. This heavily influences the treatment choices of the clinician, and more importantly, the choices made by the parent on behalf of their child.

A third limitation of this study was the sample size. There is a combined total of 7,725 active, life, and post-doctoral members of the American Academy of Pediatric Dentistry. Of this total, 89.2% are active or life members and 10.8% are post-doctoral members.[57] The sample size of this study was 695, yielding a low response rate of 10.6%. The sample for this study is appears to be a representative sample of the AAPD, with active and life members and post-doctoral members accounting for 92.7% and 7.3% of the study sample, respectively. It is assumed that those academic providers who are members of the AAPD are included in the category of active members of the association. The AAPD membership statistics do not include a category for academic providers because of the lack of requirement on the membership application to indicate such affiliation; therefore, this is a limitation in determining if the study sample is a true representative sample of the membership of the AAPD.

This study has indicated that a wide variation in treatment planning perspectives for managing carious lesions in primary molar teeth exists among specialists in pediatric dentistry in the United States. According to Donly, clinicians should ask themselves a wide spectrum of clinical scenario questions when choosing which material will be used to restore a carious lesion during the process of formulating a treatment plan for each individual patient. [26] In addition to Donly's list of inquisitions, the consideration could be made to add the following questions: (10) What is the expected life span of the tooth that needs to be restored? (11) What behavior management modality is being employed to complete treatment? In order to extrapolate the

answers to these questions, the American Academy of Pediatric Dentistry could consider developing a clinical form similar to Table 4 to be included in the Guidelines for Restorative Dentistry, to serve as a means of unifying treatment planning modalities for pediatric dental practitioners.

***Table 4**: Treatment Planning Considerations*

QUESTIONS TO CONSIDER	Class II Restoration vs.	Stainless Steel Crown
1.) How many carious lesions exist?	1 2	3 4 5 or more
2.) What is the patient's past caries history?	No lesions 1-2 lesions	3 or more lesions
3.) What is the patient's oral hygiene status?	Exceptional Good	Fair Poor
4.) At the free gingival margin of the anatomical crown, is there significant enamel demineralization?	No	Yes
5.) Will the patient return for preventive care at regular recall intervals?	Yes	No
6.) Can adequate isolation be achieved?	Yes	No
7.) What size will the restoration be?	Within prox. line angles	Outside prox. line angles
8.) Is the carious lesion in a primary or permanent tooth?	Permanent	Primary
9.) What are the patient and parent expectations?	Esthetic	Non-esthetic
10.) What is the expected life span of the tooth that needs to be restored?	1-2 years	3-5 years >5 years
11.) What behavior management modality is being employed to complete treatment?	Nitrous Oxide	Moderate Sedation General Anesthesia

Prospective randomized clinical trials are required in order to obtain meaningful information surrounding the durability of restorative techniques,[46] and in turn, restorative treatment choices for pediatric dental practitioners could possibly vary less from one provider to the next. It would be beneficial to compare the longevity of a stainless steel crown versus a Class II restoration after being placed in patients at the same chronological age to understand superiority of one restoration over the other. Prospective randomized clinical trials could also be

utilized to compare the quality of restorations placed under general anesthesia versus those placed utilizing either moderate sedation or nitrous oxide. Further research in the area of attitudes toward treatment planning for the pediatric dental patient is needed in order to better understand such modalities. It is acknowledged that the standard of care involves complete caries removal and a conventional restoration, and one can anticipate that all providers within the specialty of pediatric dentistry would strive to provide the accepted best practice. The sound professional judgment of the provider is key to selecting the best restoration to serve the patient in each clinical situation.[25]

Conclusions

The purpose of this study was to survey practicing pediatric dentists and pediatric dental residents to gain an understanding of the modalities utilized by practitioners when formulating a treatment plan for pediatric dental patients. The secondary aims included: (1) to investigate existing trends among pediatric dental practitioners with regard to the use of stainless steel crowns versus Class II composite restorations; (2) to determine if the treatment modality chosen by the pediatric dental practitioner is determined by age, caries risk, size of radiographic lesion, or method of behavior guidance (i.e. nitrous oxide analgesia, moderate sedation, and general anesthesia); and (3) to identify if the use of stainless steel crowns increases with years of experience in clinical practice.

Cases involving clinically detectable caries, being treated with general anesthesia by an academic provider (faculty member or resident) were most likely to be treated with a stainless steel crown. A clinically detectable carious lesion was just under four times more likely to be treated with a stainless steel crown. Cases treated under general anesthesia were seven times more likely to be treated with a stainless steel crowns than cases treated with conscious sedation (moderate sedation or nitrous oxide). Treatment selection was not significantly different between moderate sedation and nitrous oxide. When presented with the same case, faculty members and pediatric dental residents were more likely to choose a stainless steel crown when compared to private practitioners. There was no difference in treatment plan choice for faculty

members and residents. Providers who had practiced for more than 10 years were roughly half as likely as someone with less than 10 years of experience to treatment plan a stainless steel crown.

Pediatric dental providers are already using many of the appropriate clinical indicators for treatment planning modalities such as the size of the carious lesion and the employed behavior management modality as indicated in this study; however, the scope of treatment planning encompasses numerous factors that influence each treatment choice. Because of the multifactorial nature of treatment planning for the pediatric dental patient, it would be beneficial for the American Academy of Pediatric Dentistry to produce a treatment planning decision tree in order to better direct practitioners in their development of patient-centered treatment plans.

Literature Cited

1. Christensen GJ. Restoration of Pediatric Posterior Teeth. *J Am Dent Assoc*. 1996;127(1):106-108. doi:10.14219/jada.archive.1996.0004.
2. Martignon S, Tellez M, Santamaría RM, Gomez J, Ekstrand KR. Sealing distal proximal caries lesions in first primary molars: efficacy after 2.5 years. *Caries Res*. 2010;44(6):562-570. doi:10.1159/000321986.
3. Chadwick BL, Evans DJP. Restoration of class II cavities in primary molar teeth with conventional and resin modified glass ionomer cements: a systematic review of the literature. *Eur Arch Paediatr Dent*. 2007;8(1):14-21. doi:10.1007/BF03262565.
4. Santamaria RM, Innes NPT, Machiulskiene V, Evans DJP, Splieth CH. Caries Management Strategies for Primary Molars: 1-Yr Randomized Control Trial Results. *J Dent Res*. 2014;93(11):1062-1069. doi:10.1177/0022034514550717.
5. Ricketts D, Lamont T, Innes NP, Kidd E, Clarkson JE. Operative caries management in adults and children. In: Ricketts D, ed. *Cochrane Database of Systematic Reviews*. Chichester, UK: John Wiley & Sons, Ltd; 2013. doi:10.1002/14651858.CD003808.pub3.
6. Kidd E. Should deciduous teeth be restored? Reflections of a cariologist. *Dent Update*. 2012;39(3):159-162, 165-166. http://www.ncbi.nlm.nih.gov/pubmed/22675887. Accessed October 22, 2016.
7. Guelmann M, Mjor IA. Materials and techniques for restoration of primary molars by

pediatric dentists in Florida. *Pediatr Dent*. 2002;24(4):326-331. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=12212875.

8. Tinanoff N, Douglass JM. Clinical decision making for caries management in children. *Douglass Pediatr Dent* –. 2002;24(5).

9. Seale NS. The use of stainless steel crowns. *Pediatr Dent*. 2002;24(5):501-505. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=med4&NEWS=N&AN=12412965.

10. Ivar A. Mjör JEM. Selection of restorative materials in permanent teeth in general dental practice. *Acta Odontol Scand*. 1999;57(5):257-262. doi:10.1080/000163599428661.

11. American Academy of Pediatric Dentistry. Guideline on Restorative Dentistry. *Pediatr Dent*. 2015;37(6):232-243. http://www.ncbi.nlm.nih.gov/pubmed/23211906.

12. Sheiham A. Impact of dental treatment on the incidence of dental caries in children and adults. *Community Dent Oral Epidemiol*. 1997;25(1):104-112. http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0528.1997.tb00906.x/abstract%5Cnhttp://www.ncbi.nlm.nih.gov/pubmed/9088699.

13. American Academy of Pediatric Dentistry. Guideline on Caries-risk Assessment and Management for Infants , Children , and Adolescents. *Pediatr Dent*. 2013;37(6):132-139.

14. Virajsilp V, Thearmontree A. Comparison of Proximal Caries Detection in Primary Teeth Between Laser Fluorescence and Bitewing Radiography. *Pediatr Dent*. 2005;27(6):493-499.

15. Braga MM, Mendes FM, Ekstrand KR. Detection activity assessment and diagnosis of dental caries lesions. *Dent Clin North Am*. 2010;54(3):479-493.

doi:10.1016/j.cden.2010.03.006.

16. Novaes TF, Matos R, Braga MM, Imparato JCP, Raggio DP, Mendes FM. Performance of a pen-type laser fluorescence device and conventional methods in detecting approximal caries lesions in primary teeth--in vivo study. *Caries Res*. 2009;43(1):36-42. doi:10.1159/000189705.

17. Hickel R, Kaaden C, Paschos E, Buerkle V, García-Godoy F, Manhart J. Longevity of occlusally-stressed restorations in posterior primary teeth. *Am J Dent*. 2005;18(3):198-211.

18. Nelson S, Ash M. *Wheeler's Dental Anatomy, Physiology, and Occlusion 9th Edition*. Vol 53.; 2013. doi:10.1017/CBO9781107415324.004.

19. Innes N, Ricketts D, Chong L, Keightley A, Lamont T, Santamaria R. Preformed crowns for decayed primary molar teeth (Review). *Cochrane Database Syst Rev*. 2015;(12):1-53. doi:10.1002/14651858.CD005512.pub3.Copyright.

20. Pair RL, Udin RD, Tanbonliong T. Materials Used to Restore Class II Lesions in Primary Molars: A Survey of California Pediatric Dentists. *Pediatr Dent*. 2004;266.

21. Tran L, Messer LB. Clinicians' choices of restorative materials for children. *Aust Dent J*. 2003;48(4):221-232. doi:10.1111/j.1834-7819.2003.tb00035.x.

22. Randall RC. Preformed metal crowns for primary and permanent molar teeth: review of the literature. *Pediatr Dent*. 2002;24(5):489-500.

23. Randall RC, Vrijhoef MA, Wilson NF. Efficacy of Preformed Metal Crowns Vs. Amalgam Restorations. *J Am Dent Assoc*. 2000;131(3):337-343. doi:10.14219/jada.archive.2000.0177.

24. Blinkhorn A, Zadeh-Kabir R. Dental care of a child in pain -- a comparison of treatment

planning options offered by GDPs in California and the North-west of England. *Int J Paediatr Dent*. 2003;13(3):165-171. doi:10.1046/J.1365-263X.2003.00454.X.

25. McDonald RE, Avery DR, Dean JA. Restorative Dentistry. In: *McDonald and Avery: Dentistry for the Child and Adolescent*. Ninth Edit. Elsevier Inc.; 2011:322-342. doi:10.1016/B978-0-323-05724-0.50022-9.

26. Donly KJ, Garcia-Godoy F. The Use of Resin-based Composite in Children: An Update. *Pediatr Dent*. 2015;37(2):136-143.

27. Christensen GJ. Restorative dentistry for pediatric teeth. *J Am Dent Assoc*. 2001;132(March):379-381. doi:10.14219/jada.archive.2001.0182.

28. Bernardo M, Luis H, Martin MD, et al. Survival and reasons for failure of amalgam versus composite posterior restorations placed in a randomized clinical trial. *J Am Dent Assoc*. 2007;138(6):775-783. doi:10.14219/jada.archive.2007.0265.

29. Roberts MW, Broring CL, Moffa JP. Two-year cliniical evaluation of a proprietary composite resin for the restoration of primary posterior teeth. *Pediatr Dent*. 1985;7(1):14-18.

30. Oldenburg TR, Vann WF, Dilley DC. Composite restorations for primary molars: results after four years. *Pediatr Dent*. 1987;9(2):136-143.

31. Sturdevant JR, Lundeen TF, Sluder TB, Wilder AD, Taylor DF, Sturdevant JR. Five-year study of two light- cured posterior composite resins. *Dent Mater*. 1988;4(3).

32. Wilson NHF, Wastell DG, Norman RD. Five-year performance of high-copper content amalgam restorations in a multiclinical trial of a posterior composite. *J Dent*. 1996;24(3):203-210. doi:10.1016/0300-5712(94)00019-0.

33. Buonocore MG. A Simple Method of Increasing the Adhesion of Acrylic Filling Materials

to Enamel Surfaces. *J Dent Res*. 1955;34(6):849-853. doi:10.1177/00220345550340060801.

34. Brickhouse TH. Preformed metal crowns may be the most successful restorative treatment for primary molars. *J Evid Based Dent Pract*. 2011;11(1):12-13. doi:10.1016/j.jebdp.2010.12.002.

35. Roshan D, Curzon MEJ, Fairpo CG. Changes in dentists' attitudes and practice in paediatric dentistry. *Eur J Paediatr Dent*. 2003;4(1):21-27. http://www.ncbi.nlm.nih.gov/pubmed/12870984. Accessed October 18, 2016.

36. Atieh M. Stainless steel crown versus modified open-sandwich restorations for primary molars: a 2-year randomized clinical trial. *Int J Paediatr Dent*. 2008;18(5):325-332. doi:10.1111/j.1365-263X.2007.00900.x.

37. Bohaty BS, Ye Q, Misra A, Sene F, Spencer P. Posterior composite restoration update: Focus on factors influencing form and function. *Clin Cosmet Investig Dent*. 2013;5:33-42. doi:10.2147CCIDE.S42044.

38. Bader JD, Shugars DA. The Evidence Supporting Alternative Management Strategies For Early Occlusal Caries and Suspected Occlusal Dentinal Caries. *J Evid Based Dent Pract*. 2006;6(1):91-100. doi:10.1016/j.jebdp.2005.12.004.

39. Berg JH. The continuum of restorative materials in pediatric dentistry-a review for the clinician. *Pediatr Dent*. 1998;202:93-100.

40. Fontana M, Zero DT. Assessing patients' caries risk. *J Am Dent Assoc*. 2006;137(9):1231-1239. doi:10.14219/jada.archive.2006.0380.

41. American Academy of Pediatric Dentistry. Guideline on periodicity of examination, preventive dental services, anticipatory guidance, and oral treatment for children. *Pediatr*

Dent. 2015;37(6):123-130.

42. American Academy of Pediatric Dentistry. Guideline on Behavior Guidance for the Pediatric Dental Patient: Reference Manual. *Pediatr Dent*. 2015;37(6):180-193.

43. O'Sullivan EA, Curzon ME. The efficacy of comprehensive dental care for children under general anesthesia. *Br Dent J*. 1991;171(2):56-58. http://www.ncbi.nlm.nih.gov/pubmed/1873095. Accessed October 23, 2016.

44. Feigal RJ. Guiding and Managing the Child Dental Patient: A Fresh Look at Old Pedagogy. *J Dent Educ*. 2001;65(12):1369-1377.

45. Harris, Paul; Taylor, Robert; Thielke, Robert; Payne, Jonathon; Gonzalez, Nathaniel; Conde J. Research electronic data capture (REDCap) - – A metadata-driven methodology and workflow process for providing translational research informatics support. 2009:42(2):377-81.

46. Kilpatrick NM. Durability of restorations in primary molars. *J Dent*. 1993;21(2):67-73.

47. Foley JI. Short communication : A pan-European comparison of the management of carious primary molar teeth by postgraduates in paediatric dentistry. *Eur Arch Paediatr Dent*. 2012;13(1):41-46.

48. American Academy of Pediatric Dentistry. Policy on early childhood caries (ECC): unique challenges and treatment options. *Pediatr Dent*. 2015;37(6):53-55.

49. Papathanasiou, Anastasios G; Curzon, Martin E; Fairpo CG. The influence of restorative material on the survival rate of restorations in primary molars. *Oral Health*. 1996;86(1)(January):7-16. http://proxy.library.vcu.edu/login?url=http://search.proquest.com/docview/210781997?accountid=14780.

50. Heintze SD, Rousson V. Clinical Effectiveness of Direct Class II Restorations - A Meta-Analysis. *J Adhes Dent*. 2012;14(5):407-431. doi:10.3290/j.jad.a28390.

51. Antony K, Genser D, Hiebinger C, Windisch F. Longevity of dental amalgam in comparison to composite materials. *GMS Health Technol Assess*. 2008;4. http://www.ncbi.nlm.nih.gov/pubmed/21289917. Accessed January 26, 2017.

52. Soncini JA, Maserejian NN, Trachtenberg F, Tavares M, Hayes C. The longevity of amalgam versus compomer/composite restorations in posterior primary and permanent teeth: findings From the New England Children's Amalgam Trial. *J Am Dent Assoc*. 2007;138(6):763-772. http://www.ncbi.nlm.nih.gov/pubmed/17545265. Accessed January 26, 2017.

53. Fuks AB, Araujo FB, Osorio LB, Hadani PE, Pinto AS. Clinical and radiographic assessment of Class II esthetic restorations in primary molars. *Pediatr Dent*. 22(6):479-485. http://www.ncbi.nlm.nih.gov/pubmed/11132507. Accessed January 26, 2017.

54. Alves Dos Santos M, Passos M, Luiz RR, Maia LC. A randomized trial of resin-based restorations in class I and class II beveled preparations in primary molars: 24-month results. *J Am Dent Assoc*. 2009;140(2):156-66-8. http://www.ncbi.nlm.nih.gov/pubmed/19188412. Accessed January 26, 2017.

55. Hutcheson C, Seale NS, McWhorter A, Kerins C, Wright J. Multi-surface composite vs stainless steel crown restorations after mineral trioxide aggregate pulpotomy: a randomized controlled trial. *Pediatr Dent*. 34(7):460-467. http://www.ncbi.nlm.nih.gov/pubmed/23265162. Accessed January 26, 2017.

56. Attari N, Roberts JF. Restoration of primary teeth with crowns: a systematic review of the literature. *Eur Arch Paediatr Dent*. 2006;7(2):58-62.

http://www.ncbi.nlm.nih.gov/pubmed/17140529. Accessed January 26, 2017.

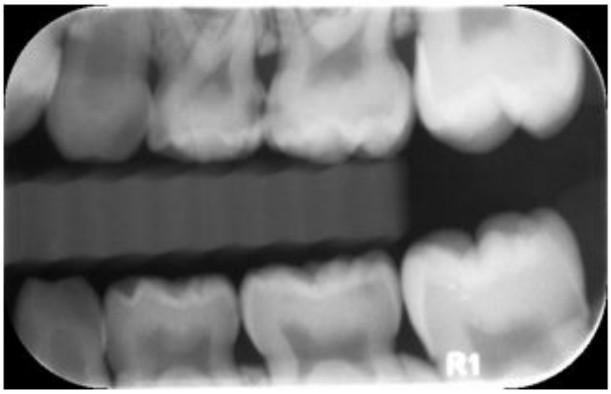
57. Membership Statistics | The American Academy of Pediatric Dentistry. http://www.aapd.org/about/stats/. Published 2016. Accessed March 18, 2017.

Appendix A

A Comparison of Treatment Planning Modalities for the Pediatric Dental Patient

vompletion of this REDCap survey will take approximately 10 minutes. Participation in this research study is completely voluntary, and you may choose not to participate. All responses are anonymous, and no identifiers will be used. The results will be used for research purposes only. There is no compensation for completing this survey, and no risks for participating are anticipated. Completion of the survey will indicate your consent to participate in this research.

Case 1



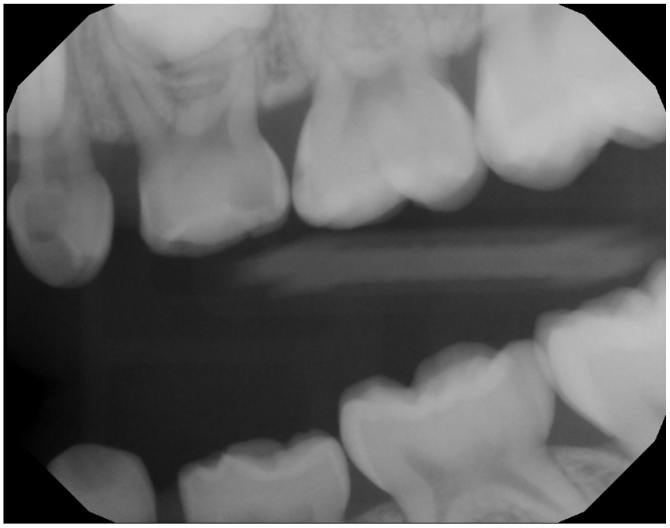
An 8 year old female presents to your office for her first dental visit. Patient has an unremarkable past medical history and no special healthcare needs. The patient has excellent oral hygiene. A Frankl behavior score of 3 was noted; she was cooperative for radiographs and cleaning but was slightly nervous because it was her first time at the dentist. Clinical and radiographic caries were noted on #B-DO, #I-DO, #J-MO, #K-O, #L-DO, and #T-DO. The patient is asymptomatic. The patient's guardian chose to complete treatment with nitrous oxide. What would you treatment plan for tooth #J?

What would you treatment plan for tooth #J?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Case 2

Case 2



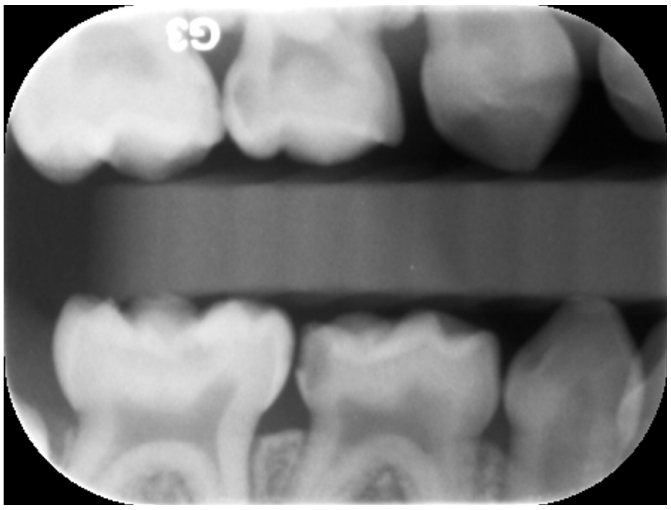
A 7 year old female presents to your office for a consultation appointment. Patient has mild asthma, and her last asthma attack was three years ago. The patient has good oral hygiene. A Frankl behavior score of 3 was noted; she was cooperative but mildly apprehensive. Clinical and radiographic caries are noted on #B-DO, #I-DO, #J-MO and #S-DO. The patient is asymptomatic. The patient's guardian chose to complete treatment utilizing moderate sedation. What would you treatment plan for tooth #I?

What would you treatment plan for tooth #I?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Case 3

Case 3



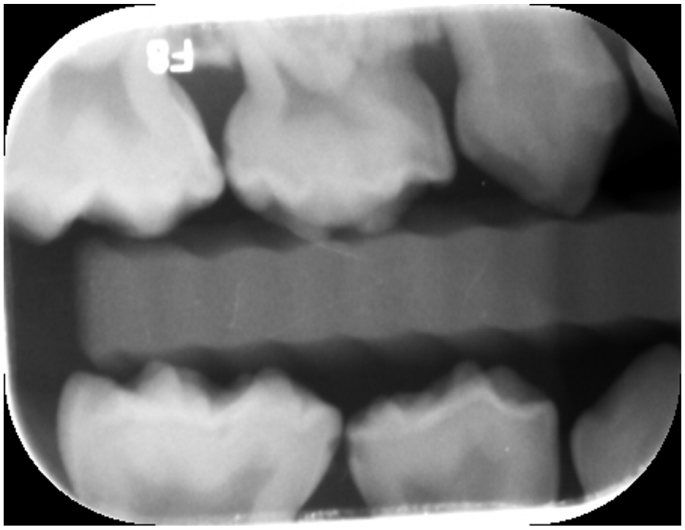
A 4 year old female presents to your office for her six month recall appointment. Patient has an unremarkable past medical history and no special healthcare needs. Patient has good oral hygiene. A Frankl behavior score of 3 was noted; she was semi-cooperative in the chair and did great for radiographs. Clinical and radiographic caries are noted on #B-DO, #K-O, #S-DO, #T-O. The patient is asymptomatic. The patient's guardian chose to complete treatment with nitrous oxide. What would you treatment plan for tooth #S?

What would you treatment plan for tooth #S?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Case 4

Case 4



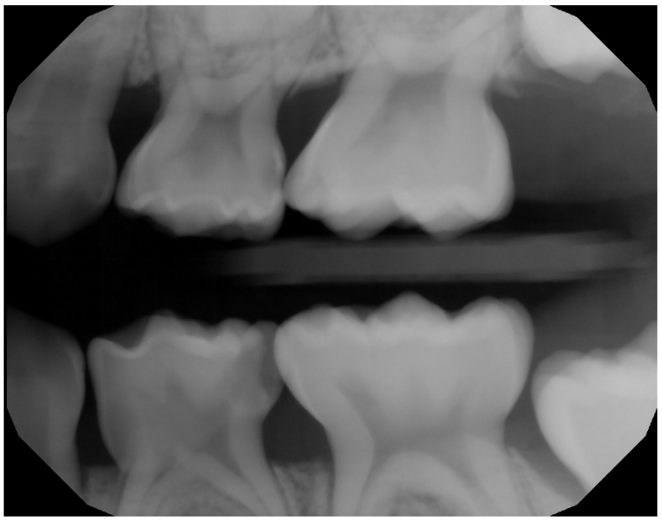
A 4 year old female presents to your office for her six month recall appointment. Patient's medical history includes asthma and seasonal allergies, and she uses a nebulizer as needed. The patient has excellent oral hygiene. A Frankl behavior score of 4 was noted; she was great in the chair for her recall appointment. Clinical and radiographic caries are noted on #B-DO, #J-O, #K-O, #S-DO, #T-MO. The patient is asymptomatic. The patient's guardian chose to complete treatment with nitrous oxide. What would you treatment plan for tooth #S?

What would you treatment plan for tooth #S?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Case 5

Case5



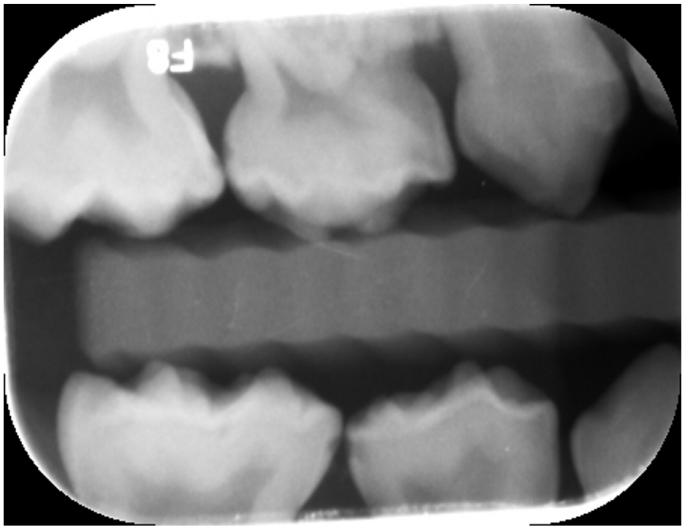
A 6 year old male presents to your office for a consultation. Patient's medical history includes febrile seizures; however, the patient's last seizure was two years ago. The patient has poor oral hygiene. A Frankl behavior score of 3 was noted; the patient was very energetic and had a difficult time with bitewings. Clinical and radiographic caries noted on #B-DO, #I-DO, #L-DO, and #S-DO. The patient experiences sensitivity on the lower left when he chews. The patient's guardian chose general anesthesia to complete treatment. What would you treatment plan for tooth #L?

What would you treatment plan for tooth #L?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Case 6

Case 6



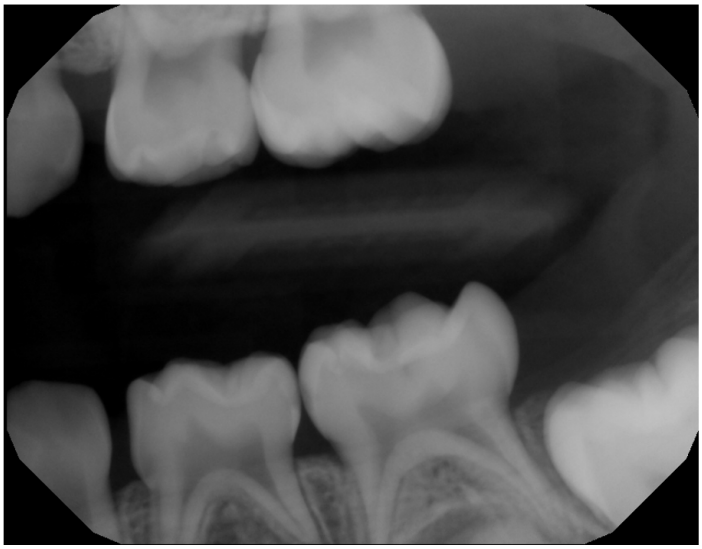
A 4 year old female presents to your office for her six month recall appointment. Patient's medical history includes asthma and seasonal allergies, and she uses a nebulizer as needed. The patient has excellent oral hygiene. A Frankl behavior score of 4 was noted; she was great in the chair for her recall appointment. Clinical and radiographic caries are noted on #B-DO, #J-O, #K-O, #S-DO, #T-MO. The patient is asymptomatic. The patient's guardian chose to complete treatment with moderate sedation. What would you treatment plan for tooth #S?

What would you treatment plan for tooth #S?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Case 7

Case 7



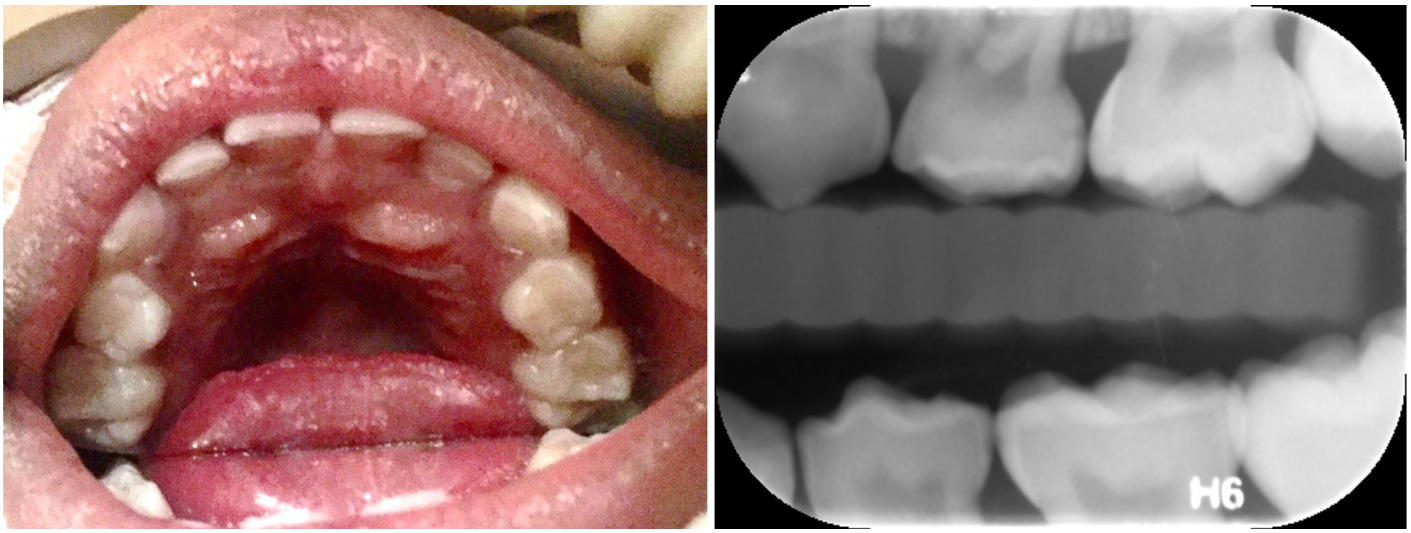
A 4 year old female presents to your office for a consultation. Patient's medical history includes sickle cell anemia. The patient has fair oral hygiene. A Frankl behavior score of 3 was noted; she was slightly fearful but allowed you to perform an exam. Patient required a large amount of tell-show-do and could not tolerate bitewing radiographs. Clinical and radiographic caries are noted on #A-OL, #B-O, #I-O, #J-OL, #K-MO, #L-DO, #S-O, #T-O. The patient is asymptomatic. After clearance from the patient's physician, the patient's guardian chose general anesthesia to complete dental treatment. What would you treatment plan for tooth #K?

What would you treatment plan for tooth #K?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Case 8

Case 8



A 5 year old female presents to your office for a new patient exam. Patient has a benign past medical history. The patient has fair oral hygiene. A Frankl behavior score of 3 was noted; she was very cooperative, but her attention span was very short. She is not extremely interactive or verbal. Clinical and radiographic caries are noted on #B-DO, #I-DO, #L-DO, #M-F, #R-F, #S-DO. The patient is asymptomatic. The patient's guardian chose moderate sedation to complete dental treatment. What would you treatment plan for tooth #I?

What would you treatment plan for tooth #I?

◯ Composite resin restoration
◯ Stainless steel crown
◯ No treatment at this time.

Demographics

Please indicate your current status as a pediatric dental provider:

- ◯ Pediatric Dental Resident
- ◯ Faculty Member Private
- ◯ Practitioner

How many years is your Pediatric Residency Program?

- ◯ 1
- ◯ 2
- ◯ 3

How many months of your residency training have you completed?

- ◯ 0-3 months
- ◯ 4-6 months
- ◯ 7-12 months
- ◯ 13+ months

Please select the option that best describes your Pediatric Dental Residency Program setting:

- ◯ Hospital-based program
- ◯ Clinic-based program
- ◯ Combined hospital and clinic-based program

Please select the response that best describes your practice setting:

- ◯ Rural area Urban
- ◯ area Metropolitan
- ◯ area Other
- ◯

Please use the space provided to describe your practice setting: _____

How many years have you practiced pediatric dentistry?

- ◯ Current Pediatric Dental Resident (1-3 years)
- ◯ 1-3 years post-residency
- ◯ 4-9 years post-residency
- ◯ 10-15 years post-residency
- ◯ >15 years post-residency