

How Dentists Diagnose and Treat Defective Restorations: Evidence from The Dental Practice- based Research Network

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Clinical Relevance

Dentists who did not assess caries risk as a routine part of the treatment planning process were more likely to choose a surgical intervention and less likely to choose a preventive treatment.

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SUMMARY

Objectives: To (1) identify and quantify the types of treatment that dentists use to manage defective dental restorations and (2) identify characteristics that are associated with these dentists' decisions to replace existing restorations. The Dental Practice-Based Research Network (DPBRN) consists of dentists in outpatient practices from five regions: AL/MS: Alabama/Mississippi; FL/GA: Florida/Georgia; MN: dentists employed by HealthPartners and private practitioners in Minnesota; PDA: Permanente Dental Associates in cooperation with Kaiser Permanente's Center for Health Research and SK: Denmark, Norway and

Sweden. Methods: A questionnaire was sent to all DPBRN practitioner-investigators who reported doing some restorative dentistry (n=901). Questions included clinical case scenarios that used text and clinical photographs of defective restorations. Dentists were asked what type of treatment, if any, they would use in each scenario. Treatment options ranged from no treatment to full replacement of the restoration with or without different preventive treatment options. The authors of the current study used logistic regression to analyze associations between the decision to intervene surgically (repair or replace) and the specific dentist, practice and patient characteristics. **Results:** A total of 65% of dentists would replace a composite restoration when the defective margin was located on dentin and 49% would repair it when the defective margin was located on enamel. Most (52%) dentists would not intervene surgically when the restoration in the scenario was amalgam. Dentists participating in a solo or small private practice (SPP) chose surgical intervention more often than dentists participating in large group practices (LGP) or in public health practices (PHP) ($p < .0001$). Dentists who do not routinely assess caries risk during treatment planning were more likely to intervene surgically and less likely to choose prevention treatment ($p < .05$). Dentists from the SK region chose the “no treatment” option more often than dentists in the other regions. **Conclusions:** Dentists were more likely to intervene surgically when the restoration was an existing composite, compared to an amalgam restoration. Treatment options chosen by dentists varied significantly by specific clinical case scenario, whether the dentist routinely performs caries risk assessment, type of practice and DPBRN region.

INTRODUCTION

About half of all restorations placed in adults in general dental practice are replacements.^{1,2} The clinical diagnosis of secondary caries or caries adjacent to a restoration is the main reason for replacing these restorations.³⁻⁷ However, the diagnosis of secondary caries in contrast to other defects, such as marginal discolorations,^{8,10} does not have specific diagnostic criteria that are based on a single profession-wide consensus or “gold standard.” Although secondary caries is histologically similar to primary caries, its physical features can create diagnostic challenges, because lesions may not always be seen at the interface between the restorative material and the tooth. Consequently, restorations may be replaced prematurely, because dentists do not have a consistent method to diagnose these lesions and

therefore may treat them when treatment is not necessary.

As the population ages and life expectancy increases,^{9,11} the time at which the first dental restoration is placed becomes very salient, because replacement will most likely be necessary years later, as predicted by the “cycle of rorestorations.”¹² Another equally important point is the development of reliable diagnostic criteria for evaluating existing restorations, because each time a restoration is replaced, more tooth structure is lost.¹³⁻¹⁵ Therefore, the clinical evaluation of existing restorations is essential, because: (1) the replacement of existing restorations contributes to a major part of the dental treatment that is provided to patients in general dental practice and (2) uncertainty exists with regard to the need to replace or repair existing restorations.¹⁶ Improving the accuracy of caries diagnoses may reduce unnecessary treatment and dental care costs.

A comprehensive review of the literature¹⁷ concluded that “the extent to which variation in dentists’ evaluation of existing restorations is associated with characteristics of the dentist and the practice is completely unknown.” To address this issue, the current study sought to determine how dentists in general dental practice evaluate and treat existing restorations. Data were obtained from questionnaire responses provided by dentist practitioner-investigators in The Dental Practice-Based Research Network (DPBRN). DPBRN has a wide representation of practice types, treatment philosophies and patient populations, including diversity with regard to the race, ethnicity, socio-economic status, geography and rural/urban area of residence of both its practitioner-investigators and their patients.¹⁸⁻¹⁹ The specific aims of the current study were to: (1) identify and profile the types of treatment that dentists in general dental practice use to manage defective dental restorations and (2) identify characteristics that are associated with variation in these dentists’ decisions to replace existing restorations.

METHODS AND MATERIALS

The cross-sectional study design employed the single administration of a questionnaire to all DPBRN dentist practitioner-investigators who indicated on their DPBRN Enrollment Questionnaire that they perform some restorative dentistry in their practices (n=901). The current study was approved by the respective Institutional Review Board (IRB) of all participating regions. As part of enrollment in DPBRN, all practitioner-investigators completed an Enrollment Questionnaire about their practice characteristics and themselves. This questionnaire and other details about DPBRN are publicly available at: <http://www.DentalPBRN.org> and www.dentalpbrn.org/users/related_links/default.asp.

This report provides results from certain questions (clinical case scenarios, including photographs of existing restorations) from the DPBRN "Assessment of Caries Diagnosis and Treatment" questionnaire. The full questionnaire is publicly available at: <http://www.dentalpbrn.org/users/publications/Supplement.aspx>. Methodologic particulars, such as sample selection, the recruitment process, the length of the field phase, the data collection process and procedures used during the pilot study and pre-testing of the questionnaire have been previously reported.²⁰

Questions referred to dentists' assessments of observations of high-resolution photographs of various defective restorations accompanied by case descriptions (Figure 1). The first case had a defective composite restoration with cement-dentinal margins and a description of a patient who had been a regular dental patient and had existing dental restorations (Figure 1). A second case had a defective composite restoration with enamel margins and a description of a patient at low caries risk (Figure 1). A third case had a defective amalgam restoration and a description of the same patient at low caries risk. Dentists were asked what type of treatment they deemed appropriate. The nine treatment options provided (Figure 1, treatment options "a-i") varied from no treatment to replacement of the entire restoration. Options "a-i" also included different preventive options. In a different part of the questionnaire, dentists were also asked about the assessment of caries risk ("Do you assess caries risk for individual patients in any way?").

The authors of the current study categorized these nine treatment options into three categories: (1) no treatment, (2) preventive treatment only and (3) any sort of surgical intervention (Table 1). The "surgical intervention" category was divided into four subcategories: (1) minimally-invasive intervention only, (2) minimally-invasive intervention and preventive treatment, (3) replacement of the entire restoration only and (4) replacement of the entire restoration and preventive treatment (Table 1).

Please use the following guide for the treatment codes used in scenarios 1-3. For each question, circle the letters which correspond to the treatment codes you would choose for scenarios described. You may circle more than one treatment code per question.

| | | Scenario 1 | Scenario 2 | Scenario 3 |
|-------|--|------------|------------|------------|
| I. | No treatment today, follow the patient regularly | a | a | a |
| II. | Instruct patient in plaque removal for the affected area | b | b | b |
| III. | In-office fluoride | c | c | c |
| IV. | Prescription for fluoride | d | d | d |
| V. | Recommend non-prescription fluoride | e | e | e |
| VI. | Use sealant or unfilled resin over tooth | f | f | f |
| VII. | Chlorhexidine treatment | g | g | g |
| VIII. | Polish, re-surface, or repair restoration, but not replace | h | h | h |
| IX. | Replace entire restoration | i | i | i |

1. Imagine that the patient is a 30-year old female with no relevant medical history. She has no complaints and is in your office today for a routine visit. She has been attending your practice once every two years on a regular basis for the past 6 years. She has 5 existing restorations, and is not missing any teeth. Indicate what treatment you would provide to the restoration shown by the arrow in the first picture on the left. Please circle your answers above.



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2. Now imagine the patient has no other dental restorations or dental caries and is not missing any teeth. Indicate what treatment you would provide to the restoration in the second picture on the left. Please circle your answers above.



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3. Continue to imagine the patient has no other dental restorations or dental caries and is not missing any teeth. Indicate what treatment you would provide to the restoration in the third picture on the left. Please circle your answers above.



Courtesy of Dr. Ivar Mjör

Figure 1. Scenarios asked of participating dentists.

Study Population

The current study queried dentists participating in DPBRN, which comprises outpatient dental practices that have affiliated to investigate research questions and share experiences and expertise. DPBRN comprises five regions: AL/MS: Alabama/Mississippi; FL/GA: Florida/Georgia; MN: dentists employed by HealthPartners and private practitioners in Minnesota; PDA: Permanente Dental Associates in cooperation with Kaiser Permanente Center for Health Research and SK: Denmark, Norway and Sweden.²¹ DPBRN dentist practitioner-investigators were recruited through continuing education courses and mass mailings to

licensed dentists within the participating regions.

DPBRN dentists can also be characterized by “type of practice,” for which the authors of the current study categorized each dentist as being in either: (1) a solo or small group private practice (SPP), (2) a large group practice (LGP) or (3) a public health practice (PHP). “Small” practices were defined as those with three or fewer dentists. Public health practices were defined as those that receive the majority of their funding from public sources.

Analyses of the characteristics of DPBRN dentists and their practice characteristics suggest that DPBRN dentists have much in common with dentists at-large,¹⁸ while at the same time offering substantial diversity in terms of characteristics.¹⁹

Variable Selection

Potential explanatory variables for dentists’ decisions to treat defective restorations were identified based on extant literature related to theoretical models of factors associated with dentists’ treatment decisions²² and dental practice.²³⁻²⁴ The explanatory variables included during bivariate analyses are listed in Table 2 and include measures of: (1) the dentist’s individual characteristics (namely, year of graduation from dental school, race/ethnicity and gender); (2) practice setting (namely, practice busyness, waiting time for a restorative dentistry appointment, DPBRN region and type of practice); (3) patient population (namely, dental insurance coverage, number of patients who self-pay [pay out of their own resources], age distribution and racial/ethnic distribution) and (4) dental procedure characteristics (namely, percent of patient contact spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work, percent of patient contact time spent each day doing extractions and whether or not caries risk is done as a routine part of treatment planning).

Table 1: The Treatment Options Provided in Scenarios 1 Through 3

| Treatment Option | Treatment Description |
|---------------------------|--|
| No treatment | No treatment should be delivered. |
| Preventive treatment only | Patient instruction on plaque removal, in-office fluoride, prescription of fluoride, non-prescription fluoride, chlorhexidine treatment. |
| Surgical intervention | Minimally-invasive intervention only, done by either: 1) polishing the restoration; 2) re-surfacing the restoration with a sealant or 3) repairing the restoration but not replacing it entirely. |
| | Minimally-invasive intervention treatment and preventive treatment. |
| | Replace the entire restoration only, done with either: 1) amalgam; 2) composite or 3) indirect restoration |
| | Replace the entire restoration and preventive treatment. |

Table 2: Dental Practice Characteristics Tested for Their Association with the Treatment Options Chosen by DPBRN Practitioner-investigators

| Dentists’ Individual Characteristics | Practice Setting | Patient Population | Dental Procedure Characteristics |
|--|--|--|--|
| Year since graduation from dental school | Practice busyness ^a | Dental insurance coverage | Percent of patient contact time spent each day doing restorative work ^c |
| Race/ethnicity | Waiting time for restorative dentistry | Number of patients who self-pay (pay out of their own resources) | Percent of patient contact time spent each day doing esthetic work ^c |
| Gender | DPBRN region of practice | Age distribution | Percent of patient contact time spent each day doing extractions ^d |
| | Type of practice ^b | Racial/ethnic distribution | Whether or not caries risk is done as a routine part of treatment planning |

^a = 1= too busy to treat all people requesting appointments, 2 = provided care to all who requested appointments, but the practice was overburdened; 3 = provided care to all who requested appointments, and the practice was not overburdened; 4 = not busy enough—the practice could have treated more patients.
^b = 1= solo or small group private practice; 2 = large group practice; 3 = public health practice.
^c = 0 = none; 1 = 1-30% of the time; 2 = 31 to 50% of the time; 3 = more than 50% of the time.
^d = 0 = none; 1 = 1-20% of the time; 2 = 21 to 30% of the time; 3 = more than 30% of the time.

Additionally, a logistic regression model was tested, which included practice busyness, type of practice, number of patients who self-pay, age distribution of patients, percent of patient contact spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work, percent of patient contact time spent each day doing extractions and whether or not caries risk is done as a routine part of treatment planning. The race/ethnicity of the dentist was not used in analysis because of small cell sizes.

Statistical Analysis

Data were analyzed using SAS software version 9.1 (Cary, NC, USA). A p-value of .05 or less was considered statistically significant. Bivariate analyses examined associations between the explanatory variables and treatment decisions. Chi-square tests were used for bivariate analysis when explanatory variables were

categorical. ANOVA and multiple comparison tests were used when explanatory variables were continuous.

RESULTS

Questionnaires were mailed to 901 dentists and 512 (57%) were completed and returned. Not all dentists responded to all questions, therefore, the sample size in each response differs in some instances.

Tables 3 through 5 report the clinical treatment options chosen by dentists' and practice characteristics. For all three scenarios, dentists participating in solo or small group private practice (SPP) chose replacement of the entire restoration more often than dentists who participated in large group practices (LGP) or public health practices (PHP) ($p < .0001$). For all three case scenarios, dentists in PHP chose the "no treatment" option more

often than dentists in SPP or LGP, and dentists in LGP were the most likely to recommend prevention alone or in combination with other treatments ($p < .0001$). Also common to all three case scenarios, dentists who did not assess caries risk as part of treatment planning were most likely to choose one of the surgical treatment options and less likely to choose the prevention treatment ($p < .05$).

For the first case scenario, Table 3 shows that male dentists chose the "replace the entire restoration" option more often than female dentists ($p = .016$). Also, for the first case scenario, dentists participating in practices with a high percent of patients who "self-pay" chose "surgical intervention" options less often and prevention treatment more often ($p = .0003$). For both the first and second case scenarios, dentists from the SK region chose the "no treatment" option more often than

Table 3: Treatment Options Chosen by DPBRN Practitioner-investigators When Evaluating an Existing Composite Restoration That Interfaces with a Dentin Surface (scenario 1) By Dentist and Practice Characteristics

| N=512 | No Treatment | Preventive Treatment Only | Minimally-invasive Intervention Only | Replace the Entire Restoration Only | Minimally-invasive Intervention and Prevention | Replace the Entire Restoration and Preventive | p-value |
|--|----------------|---------------------------|--------------------------------------|-------------------------------------|--|---|-------------------|
| Years since graduation from dental school Mean (SD) | 23.3 (10.3) | 20.7 (8.2) | 21.4 (10.3) | 19.7 (11.2) | 19.0 (11.3) | 19.3 (9.4) | .2280 |
| Gender of dentist | | | | | | | .016* |
| Male (422) | 9% | 4% | 9% | 36% | 10% | 32% | |
| Female (90) | 11% | 3% | 10% | 19% | 20% | 37% | |
| Region | | | | | | | <.0001* |
| AL/MS (296) | 6% | 2% | 8% | 43% | 9% | 32% | |
| FL/GA (99) | 7% | 2% | 17% | 27% | 7% | 40% | |
| MN (30) | 3% | 7% | 10% | 23% | 20% | 37% | |
| PDA (50) | 10% | 6% | 8% | 8% | 32% | 36% | |
| SK (37) | 43% | 16% | 8% | 8% | 22% | 3% | |
| Type of practice | | | | | | | <.0001* |
| SPP (415) | 9% | 3% | 11% | 37% | 7% | 33% | |
| LGP (77) | 8% | 6% | 8% | 13% | 29% | 36% | |
| PHP (20) | 20% | 20% | 5% | 10% | 35% | 10% | |
| Number of patients who self-pay (pay out of their own resources) | | | | | | | .0003* |
| 0% (14) | 14% | 21% | 0% | 0% | 22% | 43% | |
| 1-30% (239) | 7% | 3% | 11% | 35% | 14% | 30% | |
| 31-50% (126) | 6% | 3% | 9% | 37% | 7% | 38% | |
| >51% (108) | 18% | 4% | 12% | 27% | 9% | 30% | |
| Whether or not caries risk is done as a routine part of treatment planning | | | | | | | .02* |
| Yes (357) | 10% | 4% | 10% | 30% | 14% | 32% | |
| No (133) | 8% | 4% | 10% | 43% | 5% | 30% | |

Bivariate analyses were conducted on the following explanatory variables: practice busyness, waiting time for restorative treatment, patients dental insurance coverage, age and racial/ethnic distribution of patients seen in the practice, percent of patient contact time spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work and percent of patient contact time spent each day doing extractions. None of the variables were significant. Additionally, logistic regression analyses were done for both outcomes, which included the following explanatory variables: the dentist's year since graduation from dental school and gender, practice busyness, type of practice, age distribution of patients, number of patients who self-pay (pay out of their own resources), percent of patient contact time spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work, percent of patient contact time spent each day doing extractions and whether or not caries risk is done as a routine part of treatment planning. The results of the logistic regression did not differ from those found in the bivariate analyses.

Table 4: Treatment Options Chosen by DPBRN Practitioner-investigators When Evaluating an Existing Composite Restoration That Interfaces with a Dentin Surface (scenario 1) By Dentist and Practice Characteristics

| N=512 | No Treatment | Preventive Treatment Only | Minimally-invasive Intervention Only | Replace the Entire Restoration Only | Minimally-invasive Intervention and Prevention | Replace the Entire Restoration and Preventive | p-value |
|--|--------------|---------------------------|--------------------------------------|-------------------------------------|--|---|---------|
| Years since graduation from dental school Mean (SD) | 19.9 (10.5) | 20.0 (8.6) | 20.5 (9.5) | 20.9 (11.5) | 18.0 (10.0) | 19.2 (10.8) | .4898 |
| Gender of dentist | | | | | | | .08 |
| Male (420) | 10% | 5% | 35% | 25% | 14% | 11% | |
| Female (89) | 11% | 10% | 29% | 18% | 23% | 9% | |
| Region | | | | | | | <.0001* |
| AL/MS (292) | 7% | 5% | 32% | 32% | 12% | 12% | |
| FL/GA (99) | 11% | 4% | 41% | 21% | 11% | 12% | |
| MN (31) | 13% | 17% | 35% | 6% | 26% | 3% | |
| PDA (51) | 8% | 8% | 29% | 0% | 43% | 126% | |
| SK (36) | 31% | 7% | 42% | 14% | 3% | 3% | |
| Type of practice | | | | | | | <.0001* |
| SPP (412) | 9% | 5% | 34% | 30% | 11% | 11% | |
| LGP (78) | 9% | 10% | 32% | 1% | 39% | 9% | |
| PHP (19) | 32% | 5% | 37% | 5% | 16% | 5% | |
| Number of patients who self-pay (pay out of their own resources) | | | | | | | .106 |
| 0% (14) | 14% | 22% | 36% | 0% | 21% | 8% | |
| 1-30% (235) | 9% | 5% | 31% | 26% | 19% | 10% | |
| 31-50% (126) | 9% | 5% | 37% | 27% | 9% | 13% | |
| >51% (109) | 15% | 4% | 36% | 23% | 13% | 9% | |
| Whether or not caries risk is done as a routine part of treatment planning | | | | | | | .001* |
| Yes (354) | 11% | 6% | 35% | 20% | 16% | 12% | |
| No (132) | 8% | 4% | 34% | 37% | 11% | 6% | |

Bivariate analyses were conducted on the following explanatory variables: practice busyness, waiting time for restorative treatment, patients dental insurance coverage, age and racial/ethnic distribution of patients seen in the practice, percent of patient contact time spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work and percent of patient contact time spent each day doing extractions. None of the variables was significant. Additionally, logistic regression analyses were done for both outcomes, which included the following explanatory variables: dentists' year since graduation from dental school and gender, practice busyness, type of practice, age distribution of patients, number of patients who self-pay (pay out of their own resources), percent of patient contact time spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work, percent of patient contact time spent each day doing extractions and whether or not caries risk is done as a routine part of treatment planning. The results of the logistic regression did not differ from those found in the bivariate analyses.

dentists from the AL/MS, FL/GA, MN and PDA regions ($p<.0001$).

Table 5 shows that, for the third case scenario, dentists from the AL/MS and FL/GA regions chose the “replace the entire restoration” option more often than dentists from the MN, PDA and SK regions ($p<.0001$). Also, for the third case scenario, dentists with fewer years since graduation were more likely to recommend preventive treatment than those with more years since graduation ($p=.0052$).

Table 6 summarizes the distribution of treatment options chosen by all participating dentists for each clinical case scenario. Differences were found for the type of restorative material used on the existing restoration (composite versus amalgam) and the type of margin where the composite restoration was located (enamel versus dentinal margins). In general, dentists

elected to replace the composite restoration with margin located on dentin (65%), repair the composite restoration with margin located on enamel (49%) and not treat the amalgam restoration (52%).

DISCUSSION

Comparisons of recommendations made for the treatment of existing restorations have shown remarkable differences among dentists.²⁵⁻³⁰ Findings from the current study corroborate these significant differences among dentists but also add to the literature by being able to compare and contrast these treatment recommendations by key dentist and practice characteristics.

The most prominent difference regarding the type of treatment chosen is related to the type of practice. Dentists participating in solo or small group private

Table 5: Treatment Options Chosen by DPBRN Practitioner-investigators When Evaluating an Existing Amalgam Restoration That Interfaces With an Enamel Surface (scenario 3) by Dentist and Practice Characteristics

| N=512 | No Treatment | Preventive Treatment Only | Minimally-invasive Intervention Only | Replace the Entire Restoration Only | Minimally-invasive Intervention and Prevention | Replace the Entire Restoration and Preventive | p-value |
|--|----------------|---------------------------|--------------------------------------|-------------------------------------|--|---|-------------------|
| Years since graduation from dental school Mean (SD) | 20.7 (10.5) | 12.0 (9.6) | 18.7 (10.2) | 20.59 (10.9) | 15.9 (9.9) | 20.9 (11.4) | .0052* |
| Gender of dentist | | | | | | | .08 |
| Male (407) | 51% | 4% | 6% | 30% | 4% | 5% | |
| Female (87) | 55% | 5% | 5% | 24% | 2% | 9% | |
| Region | | | | | | | <.0001* |
| AL/MS (282) | 53% | 2% | 4% | 32% | 3% | 6% | |
| FL/GA (97) | 46% | 0% | 8% | 36% | 3% | 7% | |
| MN (29) | 62% | 11% | 7% | 10% | 3% | 7% | |
| PDA (51) | 43% | 20% | 11% | 12% | 10% | 4% | |
| SK (35) | 62% | 3% | 9% | 23% | 0% | 3% | |
| Type of practice | | | | | | | <.0001* |
| SPP (399) | 52% | 1% | 6% | 33% | 2% | 6% | |
| LGP (76) | 53% | 17% | 9% | 9% | 8% | 4% | |
| PHP (19) | 58% | 5% | 5% | 16% | 16% | 0% | |
| Number of patients who self-pay (pay out of their own resources) | | | | | | | .173 |
| 0% (14) | 71% | 14% | 0% | 15% | 0% | 0% | |
| 1-30% (231) | 55% | 6% | 6% | 23% | 4% | 6% | |
| 31-50% (120) | 47% | 3% | 6% | 36% | 3% | 5% | |
| >51% (104) | 53% | 1% | 5% | 31% | 3% | 7% | |
| Whether or not caries risk is done as a routine part of treatment planning | | | | | | | .02* |
| Yes (344) | 57% | 1% | 6% | 31% | 0% | 5% | |
| No (128) | 50% | 6% | 6% | 28% | 5% | 5% | |

Bivariate analyses were conducted on the following explanatory variables: practice busyness, waiting time for restorative treatment, patients dental insurance coverage, age and racial/ethnic distribution of patients seen in the practice, percent of patient contact time spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work and percent of patient contact time spent each day doing extractions. None of the variables were significant. Additionally, logistic regression analyses were done for both outcomes, which included the following explanatory variables: the dentist's year since graduation from dental school and gender, practice busyness, type of practice, age distribution of patients, number of patients who self-pay (pay out of their own resources), percent of patient contact time spent each day doing restorative work, percent of patient contact time spent each day doing esthetic work, percent of patient contact time spent each day doing extractions and whether or not caries risk is done as a routine part of treatment planning. The results of the logistic regression did not differ from those found in the bivariate analyses.

practice in the United States chose the surgical intervention option more often than dentists who participated in large group practices or public health practices. In solo or small group private practices, practice revenues and costs are directly linked to the procedures being done and the amount of time used to deliver care. Because of the capitation model, dentists participating in this type of practice may feel the need to choose the surgical intervention option more often. Although dentists in large group practices or public health practices may have production or revenue incentives, this is not their main source of income. Therefore, participants in these types of practices may feel less pressured to recommend services that have higher fees. Additionally, dentists participating in large group practices might be under an organization in which standardization of diagnosis and treatment of

recurrent caries might be more available and consistent. In fact, the HealthPartners Dental Group has a manual for caries treatment that standardizes how dental caries is diagnosed clinically. The Permanente Dental Associates group of dentists also seeks to standardize treatment recommendations among its dentists by having a Clinical Effectiveness Committee, composed of dentists from each clinic who reviews evidence and sets practice standards.

DPBRN dentists who practice in non-fee-for-service settings chose preventive treatment more often than surgical intervention. This finding is consistent with a study of North Carolina dentists who reported that dentists involved in pediatric practices with a high volume of patients under public insurance had positive opinions about their practice and assessed risk factors in their patients.³¹ Additionally, the dentists who

Table 6: *Distribution of Treatment Options Chosen by DPBRN Practitioner-investigators for Scenarios 1 Through 3*

| Treatment Option Chosen | Scenario 1 (n=512) | Scenario 2 (n=509) | Scenario 3 (n=494) |
|---|-----------------------|-----------------------|-----------------------|
| No treatment | 9% | 10% | 52% |
| Preventive treatment only | 4% | 6% | 4% |
| Surgical intervention* | 87% | 84% | 44% |
| Sub-categories of surgical intervention | | | |
| Minimally-invasive intervention only | 10% | 34% | 6% |
| Minimally-invasive intervention with preventive treatment | 12% | 15% | 3% |
| Replace the entire restoration only | 33% | 24% | 29% |
| Replace the entire restoration with preventive treatment | 32% | 11% | 6% |

**The area highlighted in gray shows a breakdown of the surgical intervention treatment option.*

assessed caries risk had a more conservative restorative treatment approach. Similarly, in the current study, dentists who assessed caries risk as part of routine treatment planning were most likely to choose the “no treatment” and preventive treatment options.

Dentists from the DPBRN Scandinavia region chose the “no treatment” option more often than the DPBRN United States dentists. Previous studies have shown that dentists in Scandinavia are more likely to recommend non-surgical dental treatment.³²⁻³³ Current treatment strategy in Scandinavia is based on the dentist’s assessment of patients’ caries risk.³⁴ In contrast, in North American dental schools, this concept was introduced only during the past decade.^{11,35} Furthermore, Scandinavian dental practices typically use restrictive criteria for intervention.³⁶ Additionally, the patient population of the Scandinavian region is substantially different from the United States patient population.³⁷⁻³⁹ Dental care in Scandinavia is mainly subsidized by the government and, as a result, patients receive regular dental care. Additionally, dental care for children is provided in school-based clinics that can readily set an expectation for regular visits. The expectation for socialized regular care during childhood leads to better compliance with dentists’ recommendations during adulthood, so Scandinavian dentists may be more comfortable with monitoring restorations that deviate from the ideal, instead of intervening surgically. In fact, the Norwegian Public Oral Health Act of 1983 (<http://www.lovdato.no/all/nl-19830603-054.htm>) states that prevention must be attempted before treatment.

DPBRN practitioner-investigators were less likely to intervene surgically in the amalgam restoration scenario as compared to composite restoration scenarios. This behavior is consistent with evidence from the literature that suggests that there is a poor correlation between the presence of defective margins and caries

after the removal of amalgam restorations.⁴⁰ Additionally, amalgam has been used in dentistry for more than 150 years, and various studies report on its superior longevity when compared to composite restorations.⁴¹

In the current study, dentists with fewer years since graduation from dental school recommended more prevention for the defective amalgam restoration scenario. The transition

from intervention to prevention in caries treatment has been a slow process. Within the last 10 years, dental school programs have attempted to incorporate various levels of disease control.⁴² Also, a more defined role for caries diagnosis and prevention has recently been introduced^{11,35} in North American textbooks of operative dentistry. Therefore, despite the slow translation of research findings to dental school programs, recently graduated clinicians seemed to have been given some exposure to these subjects.

Some dentists in the current study recommended complete replacement of restorations with defective margins. The lack of standards to determine restoration failure may cause the dentists to favor surgical intervention when faced with uncertainty about whether an appropriate diagnostic threshold has been reached. For example, many textbooks of operative dentistry or cariology do not distinguish whether recurrent caries lesions are active or arrested carious lesions, and this differentiation is often not included in diagnosis and treatment planning.⁴²⁻⁴³ This preference for surgical intervention may also be the result of a complex interplay between the lack of clear standards for replacing restorations and the lack of an existing reimbursement for these treatments. For composite restorations, dentists’ recommendations in these clinical scenarios may be substantially affected by the esthetic demands of the particular patient population that they care for on a regular basis.

Most dentists chose not to replace the entire restoration where the discoloration/defect was at the enamel margin (scenario 2) as compared with entire replacement when a dentin/cementum margin was affected (scenario 1). Recurrent caries in composite restorations does occur more frequently at the cervical area,⁴⁴ and this may explain the tendency of most dentists to opt for replacement of the entire composite restoration

that involved margins in dentin or cementum. Although the patients in both scenarios 1 and 2 had the same characteristics with regard to age, gender, dental visitation behavior, missing teeth and no other active caries, the patient in scenario 1 did have five existing restorations, while the patient in scenario 2 had no restorations other than the one being considered; therefore, some practitioner-investigators may have concluded that the patient in scenario 2 was at lower risk for caries.

CONCLUSIONS

Treatment options chosen by DPBRN dentists differed according to the specific case scenario, whether or not caries risk was a routine part of treatment planning, type of practice and DPBRN region.

- Dentists were more likely to intervene surgically in existing composite restorations than in existing amalgam restorations.
- Dentists who did not assess caries risk as a routine part of the treatment planning process were more likely to choose a surgical intervention and less likely to choose preventive treatment.
- Dentists participating in solo or small group private practice were more likely to recommend surgical intervention as compared to dentists who participated in large group practices or public health practices.

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