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Concordance between Responses to Questionnaire Scenarios and Actual Treatment to Repair or Replace Dental Restorations in the National Dental PBRN

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Abstract

Objective—To quantify the agreement between treatment recommended during hypothetical clinical scenarios and actual treatment provided in comparable clinical circumstances.

Methods—A total of 193 practitioners in the National Dental Practice-Based Research Network participated in both a questionnaire and a clinical study. The questionnaire included three hypothetical scenarios about treatment of existing restorations. Clinicians then participated in a

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An Internet site devoted to details about the nation's network is located at <http://NationalDentalPBRN.org>. Persons who comprise the National Dental PBRN Collaborative Group are listed at <http://nationaldentalpbrn.org/publication.php>. The informed consent of all human subjects who participated in this investigation was obtained after the nature of the procedures had been explained fully.

clinical study about repair or replacement of existing restorations. We quantified the overall concordance between their questionnaire responses and what they did in actual clinical treatment.

Results—Practitioners who recommended repair (instead of replacement) of more scenario restorations also had higher repair percentages in clinical practice. Additionally, for each of the three hypothetical scenario restorations, practitioners who recommended repair had higher repair percentages in clinical practice.

Conclusions—The questionnaire scenarios were a valid measure of clinicians' tendency to repair or replace restorations in actual clinical practice.

Clinical implications—Although there was substantial variation in practitioners' tendency to repair or replace restorations, responses to questionnaire scenarios by individual practitioners were concordant with what they did in actual clinical practice.

Keywords

Restoration repair/replacement; Decision-making; Health services research

INTRODUCTION

General dental practice frequently involves examination for secondary dental caries.¹ The decision to intervene on a restoration is usually based upon clinical appearance, tactile feel, and radiographs.¹ Decisions to treat secondary caries may be more variable than those for primary caries.²³⁴ Except in the cases of extreme disease or lack of disease, studies of treatment decisions for existing restorations find moderate to low agreement among clinicians for the same restoration.³⁵⁶ Diagnostic decisions about caries associated with existing restorations showed a significant lack of agreement.⁷⁸⁹

Evaluations of dentists' treatment recommendations for caries are typically based on in vitro examinations alone.¹⁰¹¹¹²¹³ However, the National Dental Practice-Based Research Network has conducted studies of restorative treatment decisions that have included both questionnaire and clinical data.¹⁴ Some network practitioners participated in both studies, which allowed the evaluation of concordance of treatment decisions across studies. Therefore, the objective for this study is to quantify the agreement between treatment recommended during hypothetical clinical scenarios and actual treatment provided in comparable clinical circumstances by the same dentists.

MATERIALS AND METHODS

The network is composed of dentists in the United States and Scandinavia, but at the time of the studies it was mainly concentrated in five regions: Alabama/Mississippi; Florida/Georgia; dentists in Minnesota, either employed by HealthPartners (HP) in Minnesota or in private practice; Permanente Dental Associates (PDA), in cooperation with Kaiser Permanente's Center for Health Research in Oregon; and Norway, Sweden, and Denmark (SK).¹⁵ Recruitment of practitioners into the network was done through continuing education courses and mass mailings to licensed dentists in outpatient dental practices.

A total of 193 practitioners participated in two studies about the treatment of secondary caries. The first study ("Study A") was a questionnaire that included items about whether existing restorations should be treated. These hypothetical clinical scenarios included photographs, caries risk information, and treatment options. The full questionnaire is publicly available at <http://nationaldentalpbrn.org/pdf/Study%201%20questionnaire%20FINAL%20after%20pretesting%20021306.pdf>. The second study ("Study B") was of actual clinical treatment that involved repair or replacement of existing restorations done during the course of normal patient treatment. The data collection forms used in Study B are publicly available at http://nationaldentalpbrn.org/pdf/Study5.Data%20collection%20_2_.pdf. Both studies were approved by the respective Institutional Review Boards of participating regions.

Study A was postal mailed to all network practitioners who indicated on their enrollment questionnaire that they perform at least some restorative dentistry. The questionnaire was pilot-tested to assess the feasibility and comprehension of each item; test-retest reliability of items was good.¹

Study A's questionnaire included scenarios that represented three types of existing restorations (Q27, Q28, and Q29) of questionable status. The restorations were typed as: (1) a composite restoration with dentinal caries; (2) a composite restoration with enamel stain; and (3) an amalgam restoration with discolored tooth. Each scenario consisted of treatment options, a description of the patient including caries risk, and photographs of the restorations (Figs. 1-3). The practitioners were asked what type of treatment(s) they deemed appropriate. Nine treatment options, labelled "a"–"i", covered the spectrum from no treatment to replacement of the entire restoration. The options also included different preventive options. For the sake of analysis, treatment options for each of the three scenarios were classified as: (1) no operative treatment (options a–e and g), (2) operative repair treatment (options f and h), and (3) operative replacement treatment (option i). The present investigation examines responses in the #2 and #3 categories; specifically, whether the restoration was recommended for repair or replacement.

Study B collected data during routine clinical practice about restorations that were repaired or replaced. Adult patients 19 years of age and older were included in the analysis. Research coordinators trained practitioners and their staff regarding the protocol and data collection forms. The practitioners recorded information for an average of 50 consecutive restorations that they repaired or replaced.

Study B collected data on 9,828 consecutive repair or replacement treatments in 7,463 patients treated by 197 dentists. For the analysis, we included only restorations placed due to the dentist indicating treatment as "repair" or "replace". Dentists who did not respond "repair" or "replace" to at least one of the Study A scenarios (Q27, Q28, or Q29) or who did not enroll any Study B restorations meeting one of the three restoration types were excluded. All of the Study B practitioners also completed Study A.

The dataset created after application of the above criteria was used to determine if practitioners who recommended less or more repairs in Study A also performed similar

repairs in their practices during Study B. At the level of the specific Study A questionable restorations we selected those repair treatments from Study B teeth with similar questionable restorations. The inclusion criteria for the Study B restorations are found in Table 2.

Data Analysis

The percentage of repairs in Study B was calculated for each practitioner as the number of restorations that were repaired divided by the total number of restorations that were repaired or replaced by that practitioner. Practitioners were grouped by the number of repairs each recommended in Study A (0-3). Overall mean Study B repair percentages were compared among these groups (Table 3). Mean Study B repair percentages were also compared between dentists who chose repair and those who chose replacement for each of the three individual questionable restoration scenarios in Study A (Table 4).

Statistical Methods

Mean percentages of repairs performed on Study B restorations were compared among categories defined by Study A responses using rank-based one-way analysis of variance (ANOVA), followed by the Tukey test for pairwise comparisons. Comparisons of percentages between “Repair” and “Replace” groups were conducted using Wilcoxon’s rank sums tests.

RESULTS

A total of 3,478 restorations placed by 193 dentists in 2,758 patients had complete data for both Study A and Study B. Characteristics of the dentists and their practices are described in Table 1. 609 restorations fit the composite restoration with dentinal caries description, 312 fit the composite restoration with enamel stain description, and 2,557 fit the amalgam restoration with discolored tooth description (Table 2).

For the total number of repairs (0-3) recommended by the dentists in the three Study A scenarios, we found that dentists who recommended more repairs in the questionnaire scenarios also demonstrated higher repair percentages in Study B (Table 3). There was a statistically significant difference in the percentage of repairs between the dentists recommending 0 or 1 repairs and those recommending 3 repairs in the questionnaire-based study.

We also obtained results for each type of restoration (Table 4). For the composite restoration with dentinal caries questionnaire scenario, the majority of dentists chose to replace it in Study A. However, when the composite in the questionnaire had stain on the enamel, the majority of the dentists chose to repair it. The majority of dentists chose in Study A to replace the amalgam restoration that had discolored tooth structure.

For each of the three restoration types, the repair percentages in Study B were consistently higher for the dentists who chose repair in the Study A questionnaire scenarios. In the cases of the composite restoration with dentinal caries and the amalgam restoration with discolored tooth, the repair means were statistically significantly higher, $p < 0.05$, than the replace means.

A majority of dentists (60/83=72%) chose repair over replacement for the composite with enamel stain, as compared to the composite with dentinal caries (41/109=38%) (Table 4).

DISCUSSION

The present investigation found concordance between practitioners' treatment recommendations during hypothetical clinical scenarios and actual clinical treatment. This concordance was observed overall and for each of the three specific restoration scenarios. This is relevant to a previous study⁴ that involved the same group of clinicians. In that study we observed that practitioners with a more-conservative approach to restoration of primary caries also recommended more repairs of existing questionable restorations for these hypothetical scenarios.⁴ This establishes an overall pattern of agreement within individual practitioners (consistent with regard to conservativeness of approach to treatment and consistent even across hypothetical versus actual treatment), in the face of substantial variation between practitioners.

In contrast to the consistency of treatment approaches within individual practitioners, treatment decisions across practitioners varied considerably.⁶⁴ The consistency within individual practitioners' treatment approaches across primary occlusal caries, primary proximal caries, and secondary caries suggests that diagnostic and treatment differences across practitioners for specific restorations may reflect fundamental differences in dentists' approaches to similar clinical findings.¹⁶¹⁷³ The lack of agreement over time will result in a specific patient receiving additional restorative treatment. Some of the additional treatment may be to teeth that will invariably require treatment, however, some will be to teeth that may remain stable over time, particularly in low caries risk populations.¹⁸ This unnecessary treatment has significant impact in the longevity of affected teeth, as well as on cost of treatment.¹⁹²⁰²¹

Clinical judgments about restoration of carious teeth have been reported as inconsistent and suggestions have been made to implement training programs to form a consensus.²²²³ Further, questionnaires completed by practitioners have observed that a significant number of clinicians do not consistently follow evidence-based recommendations.²⁴²⁵ The clinical uncertainty over the presence of a lesion and its future progression may be a major contributor to the inconsistencies found among individual practitioners and their decision making process.

It has been reported for approximal lesions that provider variation decreases with larger lesion size.²⁶²⁷ The use of certain technological devices has reduced clinical uncertainty and variability in treatment decisions between hospitals.²⁸ In dentistry various technologies²⁹ are under development that may assist the profession in the delivery of better care. The network is currently recruiting practitioners for a randomized clinical trial entitled: Decision Aids for the Management of Suspicious Occlusal Caries Lesions (SOCL) <http://www.nationaldentalpbrn.org/decision-aids-for-the-management-of-suspicious-occlusal-caries-lesions-socl.php>. Practitioners will use one of two diagnostic devices in their offices or none at all. The influence of the devices on treatment decisions will be examined and reported.

Additionally, PBRNs may help address these problems because they are practitioner-friendly environments that facilitate research. Initiatives in the networks can generate and spread relevant findings to help close the research-to-practice gap and translate evidence-based research to everyday clinical practice.³⁰ Indeed, clinician participation in dental PBRNs has helped the implementation of clinical scientific evidence into everyday patient care.³¹³²³³

Upon joining the network, practitioners completed a 101-item Enrollment Questionnaire, publicly available at <https://www.ndpbrn-research.org/enrollment/>, that included information about themselves and their practices. Network practitioners are not recruited randomly, so factors associated with network participation (e.g., an interest in clinical research) may make network dentists unrepresentative of dentists at large. However, network dentists have substantial diversity in a broad range of characteristics and have much in common with dentists at large.³⁴³⁵ These characteristics include: 1) substantial percentages of network general dentists are represented in the various response categories of the characteristics listed in Table 1; 2) findings from several network studies document that network dentists report patterns of diagnosis and treatment that are similar to patterns determined from non-network dentists,⁶³⁶³⁷²⁶ and 3) the similarity of network dentists to non-network dentists using the best available national source, the 2010 ADA Survey of Dental Practice.³⁸ The ADA survey samples both ADA members and non-ADA members, and it is based on a national probability sample, providing the most comprehensive information on the characteristics of United States dentists.

Conclusion

Dentists who chose to repair instead of replace in the three hypothetical clinical scenarios also had consistently higher repair percentages in clinical practice. The questionnaire scenarios were a valid measure of clinicians' tendency to repair or replace restorations in actual clinical practice. Although there was substantial variation in practitioners' tendency to repair or replace restorations, responses to questionnaire scenarios by individual practitioners were concordant with what they did in actual clinical practice.

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Figure 1.
Maxillary Incisor Existing Restoration. Reprinted with permission of Quintessence Publishing Co Inc, Chicago³⁹

Figure 2.
Maxillary Cuspid Existing Restoration. Reprinted with permission of Quintessence Publishing Co Inc, Berlin⁴⁰

Figure 3.
Mandibular Molar Existing Restoration. Courtesy of Dr. Ivar Mjör.

Table 1

Characteristics of the 193 Dentists and their Practices who Participated in both Studies A and B

Gender	N	Percent
Male	136	70.5
Female	57	29.5
Missing	0	
Race		
White	170	90.0
Black/		
African-American	5	2.7
American Indian		
or Alaska Native	1	0.5
Asian	13	6.9
Missing	4	
Practice type		
HP/PDA	72	45.9
Private	83	52.9
Public	2	1.3
Missing (SK)	36	
Workload		
Too busy to treat all	21	11.6
Provided care to all		
but overburdened	30	16.6
Provided care to all		
but not overburdened	108	59.7
Not busy enough	22	12.2
Missing	12	
Years Since Graduation		
=<5	30	16.2
5-15	35	18.9
15-20	25	13.5
20+	95	51.4
Mean	18.2	
Missing	8	

Table 2

Characteristics of the Three “Study A” Restorations, with the Number of Restorations in “Study B” that had these same Characteristics

	Q27 type	Q28 type	Q29 type
tooth	anterior	anterior or posterior	posterior
material before treatment	composite	composite	amalgam
main reason for treatment	secondary/recurrent caries	restoration margins are discolored, degraded, or ditched	secondary/recurrent caries, entire restoration is discolored, restoration margins are discolored, margins are degraded or ditched
number of restorations with these characteristics in Study B	609	312	2,557

Table 3

Mean (S.D.) Percentage of Repairs Done in Actual Clinical Treatment in Study B by the Number of Repairs Recommended by the Practitioners in the Study A Questionnaire

# of Repairs (f or h) Recommended in Study A	N Dentists Study A	N Restorations Study B	Mean (S.D.) % of Repairs Done in Study B *
0	72	1270	24.7 ^a (24.3)
1	72	1279	24.5 ^a (22.6)
2	38	736	30.9 ^{ab} (20.6)
3	11	193	39.8 ^b (20.0)

* means in a column with the same superscript are not significantly different, $p>0.05$. S.D.: standard deviation

Table 4

Mean (S.D.) Percentages of Repairs Done in Actual Clinical Treatment in Study B and by the Type of Restoration in Study A

Study A Scenario	n	Mean (S.D.) % of Repairs Done in Study B *
<u>Composite restoration with dentinal caries</u>		
dentist chose to repair	41	40.3 (31.6) ^a
dentist chose to replace	68	26.0 (30.1) ^b
<u>Composite restoration with enamel stain</u>		
dentist chose to repair	60	45.9 (43.0) ^a
dentist chose to replace	23	30.1 (35.5) ^a
<u>Amalgam restoration with discolored tooth</u>		
dentist chose to repair	35	29.9 (23.8) ^a
dentist chose to replace	47	14.3 (22.0) ^b

* means in a cell with the same superscript are not significantly different, $p > 0.05$. S.D.: standard deviation