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Evidence-practice gap in treatment decisions about defective composite and amalgam restorations among Brazilian dentists

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Aim: Better understanding of dentists' decision-making about defective restorations is needed to close the evidence-practice gap (EPG). This study aimed to quantify the EPG about defective restorations and identify dentist factors associated with this EPG. **Methods:** 216 dentists from São Paulo State, Brazil, completed a questionnaire about three clinical case scenarios involving defective composite restorations with cementum-dentin margins (case 1) and enamel margins (case 2), and an amalgam (case 3) restoration. Dentists were asked what treatment, if any, they would recommend, including preventive treatment, polishing, re-surfacing, or repairing the restoration, or replacing the entire restoration. Replacing the entire restoration in any of these three scenarios was classified as inconsistent with the evidence, comprising an EPG. Bivariate analyses using Chi-square, ANOVA, or multiple comparison tests were performed ($p<.05$). **Results:** for defective composite restorations, 49% and 55% of dentists chose to replace the entire restoration for cases 1 and 2, respectively. Twenty-nine percent of dentists chose to replace the entire amalgam restoration. Dentists were significantly more likely to choose to replace the defective amalgam restoration than the composite restoration with a defect at the cementum-dentin margins or the enamel margins (both at $p < .001$). Female dentists were more likely to choose a conservative treatment than male dentists for cases 1 ($p=.034$) and 2 ($p=.009$). Dentists with a higher percentage of patients interested in individualized caries prevention were also more conservative in case 1 ($p=.045$). **Conclusion:** a substantial EPG regarding treatment decisions for defective restorations exists, especially for composite restorations. This study adds to the international evidence that an EPG exists in this clinical area and that global strategies need to be developed to close the gap.

Keywords: Dental caries. Practice patterns, dentists'. Dental restoration repair.

Introduction

Although clinical research is designed to benefit clinical practice, systematic reviews have demonstrated across a wide range of health care fields that it is common for there to be a substantial gap between what clinical evidence says should be occurring and what is actually done in everyday clinical practice[1]. This gap is referred to as the "evidence-practice gap (EPG)"[2]. In dental care, operative dentistry procedures comprise a large percentage of the care provided, so closing the EPG in this area presumably has substantial potential to improve patient outcomes and reduce costs.

One component of operative dentistry, the treatment of defective dental restorations, is particularly salient with regard to the EPG. Defective dental restorations are very common in dental practice[3]. Contemporary recommendations for decision-making about deteriorating restorations have suggested monitoring, refurbishment, and repair as the first choice, and considering replacement only when less invasive approaches are not appropriate[4].

Studies have shown that most dentists choose repair as a treatment decision for defective restorations. Almost all German dentists reported performing repairs, especially when treating defective composite restorations[5]. More than 80% of Swiss dentists reported repair of composite, ceramic, or crown restorations; over half of them repair metal and amalgam restorations[6]. Most (87%) Greek dentists reported repairing defective restorations[7]. On average, about 72% of dentists reported performing repairs, according to a recent systematic review and meta-analysis[8], which also observed that higher percentages of repairs were reported in more-recent studies.

Engaging clinicians in research networks can be a means to move evidence into routine practice[9]. Responding to hypothetical clinical case scenarios as part of a large questionnaire study, 65% of dentists in the United States and Scandinavia Dental Practice-Based Research Network (DPBRN) chose to replace a composite restoration with a defective margin on dentin and 35% chose to replace an amalgam restoration[10]. A total of 52% of Japanese dentists chose to replace a composite restoration with a defective margin on dentin[11]. Replacing the entire restoration in these scenarios is inconsistent with the current evidence, constituting an EPG.

There is a scarcity of recent studies from Brazil about the existence of an EPG regarding treatment decisions for defective restorations. In an investigation of the adherence of treatment decisions to the International Caries Consensus Collaboration recommendations, a majority (69%) of dentists and students chose only to polish amalgam restorations that had no compelling need for replacement[12]. Therefore, our objective for the current study is to quantify the EPG about defective restorations and identify dentist factors associated with this EPG among Brazilian dentists.

Material and Methods

Study design and ethical aspects

This cross-sectional study was based on a questionnaire evaluating the treatment preferences of dentists regarding defective restorations. The research was approved

by an Ethical Review Board (protocol number 78/11). It was undertaken with each subject's understanding and written consent and according to the World Medical Association Declaration of Helsinki principles.

Participants

Participating dentists were from Araraquara, a municipality with 233,744 inhabitants, located in the Central Region of São Paulo State, Brazil. At the time of study planning (2011), 722 dentists from Araraquara were registered at the Regional Council of Dentistry. For data collection (2014-2015), we updated the list of dentists by consulting internet sources, and we mailed paper questionnaires to 801 dentists. The following strategies were used to increase response rate: pre-paid return envelope, questionnaires sent to work address; a second copy of the questionnaire to non-respondents; pre-contact by telephone; a collection of completed questionnaires at work address[13]. Inclusion criteria were dentists who currently practice in Araraquara and treat dental caries.

Measures

Dentists completed an enrollment/demographic questionnaire that provided demographic data and information about their clinical training and individual practices (see Table 1). Using the same questionnaire completed by American and Japanese DPBRN dentists (10,11), dentists were presented with three clinical case scenarios that included high-resolution photographs of a defective restoration. The first clinical case scenario had a defective composite restoration with cementum-dentin margins and a description of a patient who had been a regular dental patient and had existing dental restorations. A second case had a defective composite restoration with enamel margins and a description of a patient at low caries risk. A third case had a defective amalgam restoration and a description of the same patient at low caries risk. Respondents were asked to recommend a treatment for each case scenario. Treatment choices were as follows: a) No treatment today, follow the patient regularly, b) Instruct patient in plaque removal for the affected area, c) Use of in-office fluoride, d) Use of a prescription fluoride, e) Recommend a non-prescription fluoride, f) Use sealant or unfilled resin over the tooth, g) Use of chlorhexidine rinse, h) Polish, re-surface, or repair restoration, i) Replace entire restoration. Scenarios, photographs, and response codes for the possible treatments are shown in Table 2.

Table 1. Dentist and practice characteristics

Characteristic	Percentage (n) or Mean (SD)
Age of dentist	42.2 (12.0)
Gender (female)	61% (n=131)
Type of practice	
Private practice	56% (n=121)
Private/public hybrid	20% (n=44)
Public health	22% (n=47)
Other	2% (n=4)

Continue

Continuation	
Years since dental school graduation	19.7 (SD=11.7)
Type of dental school graduation	
Public institution	76% (n=165)
Private institution	24% (n=51)
Specialization	
Did not complete specialization training	38% (n=82)
Specialization training	62% (n=134)
Post-graduate degree	
No advanced degree	69% (n=149)
Master's degree	7% (n=14)
Doctorate	24% (n=53)
Percent of patients by age cohort	
Pediatric patients (missing=2)	23% (SD=26)
Adults (19-44 years) (missing=2)	34% (SD=18)
Adults (45-64 years) (missing=2)	30% (SD=17)
Adults (65 years and older) (missing=2)	13% (SD=11)
Percent of patients for which a dental explorer is used to diagnose an occlusal caries lesion.	79% (SD=32)
Assess caries risk for individual patients (missing=9)	36% (n=75)
Percent of patients interested in a caries prevention regimen (missing=1)	44% (SD=26)
Percent of patients who receive a caries risk prevention regimen (missing=2)	56% (SD=35)

Note: 216 dentists completed at least one of the three clinical scenarios.

Table 2. Treatment choices for clinical cases scenarios

	No treatment	Prevention	Repair	Replacement
Preliminary patient description. 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 regularly for the past 6 years.				
Case scenario 1 (cementum-dentin margins). The patient 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. [Reprinted from Ericson et al., 2003 with permission]*				
	----	9% (n=19)	41% (n=88)	50% (n=108)[a]

Continue

Continuation

Case scenario 2 (enamel margins). Now imagine the patient has no other dental restorations than the one shown, no dental caries, and is not missing any teeth. Indicate what treatment you would provide to the restoration. [Reprinted from Mjör and Toffenetti, 2000, with permission]**				
	3% (n=7)	13% (n=28)	28% (n=61)	55% (n=119)[a]
Case scenario 3 (amalgam restoration). The same patient has no other dental restorations than the one shown, no dental caries, and is not missing any teeth. Indicate what treatment you would provide to the restoration. Courtesy of Dr. Ivar Mjör.				
	27% (n=57)	7% (n=14)	38% (n=80)	29% (n=61)[b]
Treatment choices: a) No treatment today, follow the patient regularly, b) instruct patient in plaque removal for the affected area, c) In-office fluoride, d) Prescription fluoride, e) Recommend non-prescription fluoride, f) Use sealant or unfilled resin over tooth, g) Chlorhexidine treatment, h) Polish, re-surface, or repair restoration, but not replace, i) Replace entire restoration. Responses were grouped as follows: No treatment category (a,b), Prevention (c-g), Repair (h), Replace (i).				

[a] Case scenarios 1 and 2 were completed by 215 dentists.
[b] Case scenario 3 was completed by 212 dentists.
*Ericson D, Kidd E, McComb D, Mjör I, Noack MJ. Minimally Invasive Dentistry - concepts and techniques in cariology. Oral Health Prev Dent. 2003;1(1):59–72.
**Mjör IA, Toffenetti F. Secondary caries: a literature review with case reports. Quintessence Int. 2000 Mar;31(3):165–79

Statistical analysis

First, descriptive statistics were calculated for all study variables. Responses to the clinical case scenarios comprised the main outcome of interest and were grouped as follows: **1- No treatment category**: a) No treatment today, follow the patient regularly; b) Instruct patient in plaque removal for the affected area); **2- Prevention**: c) Use of in-office fluoride; d) Use of a prescription fluoride; e) Recommend a non-prescription fluoride; f) Use sealant or unfilled resin over the tooth; g) Use of chlorhexidine rinse; **3- Repair**: h) Polish, re-surface, or repair restoration; **4- Replace**: i) Replace entire restoration. The treatment assignment that was considered the most aggressive code when multiple codes were indicated (i.e., no treatment < prevention, repair < replace) was coded as the primary treatment choice. Replacing the entire restoration in any of these three scenarios was classified as inconsistent with the evidence, comprising an EPG.

To examine differences in treatment choices across the three clinical case scenarios, Friedman's test for ordinal data was performed. Associations between treatment

decisions and dentist and practice variables were tested by bivariate analysis using chi-square tests when explanatory variables were categorical and ANOVA and multiple comparison tests when explanatory variables were continuous. Exploratory multivariate models using Generalized Linear Modeling were used to test for associations between treatment decisions and dentist and practice variables.

Results

Sample characteristics

A total of 216 dentists completed at least one of the three clinical scenarios on the questionnaire. The mean age for participating dentists was 42.2 years. As shown in Table 1, most dentists were female (61%), worked exclusively in private practice (56%), received their dental school training from a public dental school (76%), had some specialization (62%) and no post-graduate degree (69%), and treated patients between 19-64 years of age. On average, they had 19.7 years since dental school graduation.

Regarding their practices, as shown in Table 1, only 36% reported assessing caries risk, 44% of their patients were interested in a caries prevention regimen, and 56% of their patients received a caries risk prevention regimen.

Differences between clinical case scenarios

The Wilcoxon Signed Rank test indicated a significant difference across the three scenarios (X^2 (2) = 56.436, p =< .001). The mean ranks for each case were as follows: Clinical Scenario 1 (cementum-dentin margins) = 2.18), Clinical Scenario 2 (enamel margins) = 2.16, and Clinical Scenario 3 (amalgam restoration) = 1.66. The Wilcoxon Signed Rank test indicated that scenario 1 and 2 did not differ (Z = -.400, p = .842), however scenario 3 differed significantly from scenario 1 (differ (Z = -7.260, p < .001) and scenario 2 (Z = -6.449, p < .001).

Clinical case scenario 1

For the first clinical case scenario that involved a defective composite restoration with cementum-dentin margins (Table 2), no dentists chose the "no treatment" option, 9% (n=19) selected various methods of prevention, 41% (n=88) chose to polish, re-surface, or repair the restoration, and 50% (n=108) elected to replace the entire restoration.

For this case (Table 3), female dentists were significantly more likely to choose a more-conservative treatment than male dentists (p = .034). In addition, dentists who chose to replace the entire restoration had a significantly lower percentage (p = .045) of patients interested in individualized caries prevention (39%) than dentists who chose to polish, re-surface, or repair (48%).

Table 3. Clinical case scenario #1 - defective composite restoration with cementum-dentin margins

Variable	No Treatment n=0	Prevention 9% (n=19)	Repair 41% (n=88)	Replace 50% (n=108)	P-value
	Percent or mean (SD)	Percent or mean (SD)	Percent or mean (SD)	Percent or mean (SD)	
Gender of dentist					
Male (n=85)	---	7% (n=6)	32% (n=27)	61% (n=52)	.034
Female (n=130)	---	10% (n=13)	47% (n=61)	43% (n=56)	
Years since graduation		21.2 (10.6)	19.7 (11.6)	19.4 (12.1)	.828
Type of School graduation					
Public (n=165)	---	10% (n=16)	37% (n=61)	53% (n=88)	.097
Private (n=50)	---	6% (n=3)	54% (n=27)	40% (n=20)	
Specialization					
Yes (n=134)	---	10% (n=8)	47% (n=38)	43% (n=35)	.276
No (n=81)	---	8% (n=11)	37% (n=50)	55% (n=73)	
Post-graduate degree					
Yes (n=53)	---	9% (n=5)	42% (n=22)	49% (n=26)	.974
No (n=162)	---	9% (n=14)	41% (n=66)	51% (n=82)	
Practice model					
Private practice exclusively (n=120)	---	7% (n=8)	47% (n=56)	47% (n=56)	.115
Public health with some private practice (n=95)	---	12% (n=11)	34% (n=32)	55% (n=52)	
Primarily pediatric patients [a]					
Yes (n=25)		20% (n=5)	36% (n=9)	44% (n=11)	.118
No (n=188)		7% (n=14)	42% (n=79)	51% (n=97)	
Assess Patient's Caries Risk [b]					
Yes (n=75)		11% (n=8)	41% (n=31)	48% (n=36)	.802
No (n=131)		8% (n=11)	40% (n=52)	52% (n=68)	
Use of explorer to examine caries at the margin of an existing restoration		78% (33.4)	81% (31)	77% (32)	.728
Percent of patients interested in Individualized Caries Prevention [c]		44% (19)	48% (27)*	39% (24)*	.045
Percent of patients receiving Individualized Caries Prevention [d]		63% (36)	56% (34)	53% (35)	.514

Two hundred and fifteen dentists completed clinical case scenario 1.
[a] Two dentists did not indicate the percentage of their patients that are pediatric.
[b] Nine dentists did not indicate whether or not they assess caries risk.
[c] One dentist did not indicate the percentage of their patients that were interested Individualized Caries Preventions.
[d] Two dentists did not indicate the percentage of their patients that were interested Individualized Caries Preventions.
* Indicates percentages were different at $p < .05$.

Clinical case scenario 2

For the second clinical case scenario that involved a defective composite restoration with enamel margins (Table 2), the "no treatment" option was chosen by 3% (n=7) of the dentists, 13% (n=28) selected various methods of prevention, 28% (n=61) chose

to polish, re-surface, or repair the restoration, and 55% (n=119) elected to replace the entire restoration. For this case (Table 4), female dentists were significantly more likely to choose a more-conservative treatment than male dentists (p = .009).

Table 4. Clinical case scenario #2 - defective composite restoration with enamel margins

Variable	No Treatment 3% (n=7)	Prevention 13% (n=28)	Repair 28% (n=61)	Replace 55% (n=119)	P-value
Gender of dentist					
Male (n=85)	7% (n=6)	7% (n=6)	25% (n=21)	61% (n=52)	.009
Female (n=130)	41% (n=1)	17% (n=22)	31% (n=40)	52% (n=67)	
Years since graduation	21.2 (10.6)	19.7 (11.6)	18.1 (12.1)	20.5 (11.4)	.603
Type of school graduation					
Public (n=165)	4% (n=6)	14% (n=23)	29% (n=47)	54% (n=89)	.794
Private (n=50)	2% (n=1)	10% (n=5)	28% (n=14)	60% (n=30)	
Specialization					
Yes (n=134)	2% (n=3)	13% (n=18)	25% (n=33)	60% (n=80)	.246
No (n=81)	5% (n=4)	12% (n=10)	35% (n=28)	48% (n=39)	
Post-graduate degree					
Yes (n=53)	2% (n=1)	13% (n=7)	30% (n=16)	55% (n=29)	.920
No (n=162)	4% (n=6)	13% (n=21)	28% (n=45)	56% (n=90)	
Practice model					
Private practice exclusively (n=120)	3% (n=4)	13% (n=15)	25% (n=30)	59% (n=71)	.601
Public health with some private practice (n=95)	3% (n=3)	14% (n=13)	33% (n=31)	51% (n=48)	
Primarily pediatric patients (50% or greater) [a]					
Yes (n=25)	0% (n=0)	24% (n=6)	32% (n=53)	44% (n=11)	.200
No (n=188)	4% (n=7)	11% (n=22)	28% (n=8)	57% (n=108)	
Assess Patient´s Caries Risk [b]					
Yes (n=75)	0% (n=0)	17% (n=13)	29% (n=22)	53% (n=40)	.202
No (n=131)	4% (n=5)	11% (n=14)	28% (n=37)	57% (n=75)	
Use of explorer to examine caries at the margin of an existing restoration	89% (24)	83% (27)	76% (34)	77% (32)	.655
Percent of patients interested in Individualized Caries Prevention [c]	36% (20)	41% (28)	44% (26)	44% (26)	.828
Percent of patients receiving Individualized Caries Prevention [d]	31% (32)	53% (36)	55% (34)	58% (35)	.240

Two hundred and fifteen dentists completed clinical case scenario 2.
[a] Two dentists did not indicate the percentage of their patients that are pediatric.
[b] Nine dentists did not indicate whether or not they assess caries risk.
[c] One dentist did not indicate the percentage of their patients that were interested Individualized Caries Preventions.
[d] Two dentists did not indicate the percentage of their patients that were interested Individualized Caries Preventions.

Clinical case scenario 3

For the third clinical case scenario that involved a defective amalgam restoration (Table 2), the "no treatment" option was chosen by 27% (n=57) of the dentists, 7% (n=14) selected various methods of prevention, 38% (n=80) chose to polish, re-sur-

face, or repair the restoration, and 29% (n=61) elected to replace the entire restoration. For this case (Table 5), the type of dental school attended was significantly associated with the treatment recommendation (p=.021): dentists who attended a private dental school were more likely than public dental school graduates to polish, re-surface, or repair the restoration as compared to public school graduates. Also, dentists with a specialization were significantly more likely (p=.019) to replace the defective restoration as compared to those without a specialization, who were more likely to polish, re-surface, or repair the restoration (Table 5).

Table 5. Clinical case scenario #3 - defective amalgam restoration

Variable	No treatment 27% (n=57)	Prevention 7% (n=14)	Repair 38% (n=80)	Replace 29% (n=61)	P-value
	Percent or mean (SD)	Percent or mean (SD)	Percent or mean (SD)	Percent or mean (SD)	
Gender of dentist					
Male (n=84)	24% (n=20)	11% (n=9)	38% (n=32)	27% (n=23)	.246
Female (n=128)	29% (n=37)	4% (n=5)	38% (n=48)	30% (n=38)	
Years since graduation	19.7 (10.6)	22.1 (12.2)	17.3 (12.1)	22.3 (11.7)	.072
Type of school graduation					
Public (n=162)	30% (n=49)	7% (n=11)	32% (n=52)	31% (n=50)	.021
Private (n=50)	16% (n=8)	6% (n=3)	56% (n=28)	22% (n=11)	
Specialization					
Yes (n=133)	27% (n=36)	9% (n=12)	31% (n=41)	33% (n=44)	.019
No (n=79)	27% (n=8)	3% (n=3)	49% (n=39)	22% (n=11)	
Post-graduate degree					
Yes (n=52)	27% (n=14)	4% (n=2)	35% (n=18)	35% (n=18)	.617
No (n=160)	27% (n=43)	8% (n=12)	39% (n=62)	27% (n=43)	
Practice model					
Private practice exclusively (n=120)	25% (n=30)	8% (n=10)	43% (n=51)	24% (n=29)	.150
Public health with some private practice (n=92)	29% (n=27)	4% (n=4)	32% (n=29)	35% (n=32)	
Primarily pediatric patients (50% or greater) [a]					
Yes (n=24)	25% (n=6)	8% (n=2)	29% (n=7)	38% (n=9)	.685
No (n=187)	27% (n=51)	6% (n=12)	39% (n=73)	27% (n=52)	
Assess Patient´s Caries Risk [b]					
Yes (n=72)	28% (n=20)	8% (n=6)	32% (n=23)	32% (n=23)	.600
No (n=131)	27% (n=36)	5% (n=7)	40% (n=53)	27% (n=36)	
Use of explorer to examine caries at the margin of an existing restoration	75% (33)	86% (26)	76% (34)	83% (27)	.408
Percent of patients interested in Individualized Caries Prevention [c]	43% (26)	50% (37)	42% (25)	45% (24)	.690
Percent of patients receiving Individualized Caries Prevention [d]	53% (34)	61% (39)	53% (36)	60% (33)	.610

Two hundred twelve dentists completed clinical case scenario 3.
[a] Two dentists did not indicate the percentage of their patients that are pediatric.
[b] Nine dentists did not indicate whether or not they assess caries risk.
[c] One dentist did not indicate the percentage of their patients that were interested Individualized Caries Preventions.
[d] Two dentists did not indicate the percentage of their patients that were interested Individualized Caries Preventions.

Discussion

In this study, we assessed treatment decisions about defective restorations and quantified the EPG. Because at least some respondents recommended replacing the entire restoration for each of the three scenarios, we can state that an EPG exists for each scenario.

The results suggest that dentists are more concordant with the evidence when managing defective amalgam restorations than when managing composite restorations. A minority (29%) of dentists reported that they would replace a defective amalgam restoration, as compared to approximately half who stated that they would choose the same procedure for defective composite restorations. These results align with Gordan et al.[10] but are less conservative for composite restorations than dentists from other countries. Most German[5], Swiss[6], Japanese[11], and Norwegian[14] dentists chose to repair defective composite restorations instead of replacing them.

Amalgam has been the most-used dental material among Brazilian dentists[15,16]. As a low-cost and effective material, amalgam remains the first choice for dentists in some developing countries[17]. However, it is important to mention that measures to gradually reduce the use of mercury, including amalgam in dentistry, have been proposed globally. The Minamata Convention on Mercury is a global treaty established by The United Nations Environment Program to protect human health and the environment from the adverse effects of mercury. It proposes the adoption of some measures such as "a ban on new mercury mines, the phase-out of existing ones, the phase-out and phase-down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal once it becomes waste, sites contaminated by mercury as well as health issues." The Convention was agreed on 2013 but entered into force only in 2017[18]. Brazil signed the Minamata Convention in 2013, and since January/2019, ANVISA has prohibited the manufacturing, marketing, and use of mercury elements and unencapsulated amalgam alloy in health services[19].

Irrespective of material used, damage to dental restorations is common and can be expected due to the oral environment's adverse conditions[20]. As a contemporary minimally invasive (MI) management, repair of restorations instead of their replacement can be a feasible and effective way of managing defective restorations[21]. Before repairing and replacing restorations within the MI concept, dentists should consider refurbishment with no new restorative material inserted, such as eliminating overhangs and discoloration, re-contouring, smoothing, or polishing the surface and sealing small gaps with sealants[22]. Repair is another essential element of MI management. It conserves tooth structure and vitality, reduces patient chairside time, alleviates dental anxiety, increases the longevity of the existing restoration, and presents reduced cost, materials, and staff time[3]. A recent systematic review demonstrated that clinical longevity of defective direct restorations treated by MI procedures, such as repair, seal, and refurbishment, is the same as replaced restorations, indicating the MI techniques should be the first choice for defective restorations[23]. Therefore, dentists should consider postponing restoration replacement until no other preventive or restorative treatment is available[21] in recovering the esthetic and function.

Our study assessed the association between treatment decisions and dentist/practice characteristics. Female dentists chose conservative treatment for composite restorations more frequently than males. Other studies have also observed a more-conservative approach to caries management[24-26] and patients' oral health care[27] among female dentists as compared to their male counterparts.

Dentists who chose to replace the entire defective composite restoration had lower percentages of patients interested in individualized caries prevention than dentists who chose to polish, re-surface, or repair. A possible reason for such a finding is that the patient's interest in preventive oral health may require a more-preventive approach during dental care[28] and the adoption of shared decision-making in a patient-centered care model[29].

Although there was an association between type of school, specialization, and treatment decision for defective amalgam restorations in the current study, this does contrast with findings from other studies. Other Brazilian studies have suggested that students from private dental schools are less-conservative in caries management than those from public schools[12,30]. These findings might be partially explained by the fact that better-prepared undergraduate students are selected by the admission process in Brazilian public dental schools[31] when compared to private dental schools. Our results have also shown that dentists who had a specialty degree were less conservative in deciding a treatment for an amalgam defective restoration. Previous DPBRN studies did not have the "specialization" as a variable, but we would speculate that participant dentists who had a specialty degree were more used to esthetic or prosthetic procedures and not as much with procedures more accepted in general dental practice. Therefore, they were more likely to replace defective amalgam restorations by other restorative materials. Studies on diagnosis and treatment decisions for carious lesions have shown that more-experienced dentists[32] and dentists with post-graduate degrees reported a more-conservative approach in caries management[33]. Future studies with a larger sample and at the national level should be designed to augment the findings of the current study.

The findings from the current study represent the treatment decisions of a sample of dentists who predominantly graduated in public schools and had specialized training. Considering the minority of Brazilian dental schools teach MI, caries lesions sealing or other essential elements of MI[34], our current findings are consistent with that circumstance.

The limitations of this study consist of a) the cross-sectional design; b) a sample with a self-selected group of dentists; and c) the assumption that dentists reported accurately what they do in their dental practices[26]. As a strength, the questionnaire was confirmed to be a viable tool to assess and compare dental practice among other populations of dentists[35].

Conclusion

A substantial EPG regarding treatment decisions for defective restorations exists, especially for composite restorations. This study adds to the international evidence that an EPG exists in this clinical area and that global strategies need to be developed to close the gap.

Data Availability

Datasets related to this article will be available upon request to the corresponding author.

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Conflict of Interest

The authors declare no conflict of interest.

Authors Contribution

EPST, JLR, GHG, SRCS, FLR, AVJ and VVG have made substantial contributions to conception and design of the study. EPST collected the data; EPST, JLR, GHG and VVG analyzed and interpreted the data. EPST, JLR, GHG, SRCS, FLR, AVJ and VVG have been involved in drafting the manuscript, revising it critically and have given final approval of the version to be submitted.

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