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Restorative material and other tooth-specific variables associated with the decision to repair or replace defective restorations: findings from The Dental PBRN

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Abstract

Objectives—Using data from dentists participating in The Dental Practice-Based Research Network (DPBRN), the study had 2 main objectives: (1) to identify and quantify the types of restorative materials in the existing failed restorations; and (2) to identify and quantify the materials used to repair or replace those failed restorations.

Methods—This cross-sectional study used a consecutive patient/restoration recruitment design. Practitioner-investigators recorded data on consecutive restorations in permanent teeth that needed repair or replacement. Data included the primary reason for repair or replacement, tooth surface(s) involved, restorative materials used, and patient demographics.

Results—Data for 9,875 restorations were collected from 7,502 patients in 197 practices for which 75% of restorations were replaced and 25% repaired. Most of the restorations that were either repaired or replaced were amalgam (56%) for which most (56%) of the material used was direct tooth-colored. The restorative material was 5 times more likely to be changed when the original restoration was amalgam (OR=5.2, p<.001). The likelihood of changing an amalgam restoration differed as a function of the tooth type (OR=3.0, p<.001), arch (OR=6.6, p<.001); and number of surfaces in the original restoration (OR=12.2, p<.001).

Conclusion—The probability of changing from amalgam to another restorative material differed with several characteristics of the original restoration. The change was most likely to take place

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[5]The DPBRN Collaborative Group includes practitioner-investigators, faculty investigators and staff investigators who contributed to this DPBRN activity. A list is at www.dpbrn.org/users/publications/Default.aspx.

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when (1) the treatment was a replacement; (2) the tooth was not a molar; (3) the tooth was in the maxillary arch; and (4) the original restoration involved a single surface.

Keywords

practice-based research; repair; replacement; decision; defective; restorations

Introduction

Replacement of existing restorations still occupies most of general practitioners' treatment time[1-4]. The reasons restorations are replaced may vary according to the material in the existing restoration, as well as to other tooth-specific factors[5-7]. Identifying the materials and tooth-specific variables that can influence a dentist's decision to repair or replace restorations can be valuable when planning new strategies for minimally invasive dentistry. Furthermore, it can provide a new insight to clinicians when considering repair versus replacement of existing restorations. Therefore, using data from dentists participating in The Dental Practice-Based Research Network (DPBRN), the study had 2 main objectives: (1) to identify and quantify the types of restorative materials in the existing failed restorations; and (2) to identify and quantify the materials used to repair or replace those failed restorations. Additionally, the study sought to identify the restorative material and other tooth-specific characteristics associated with the decision to repair or replace the existing restoration by testing the following hypotheses: (1) Dentists are more likely to change restorative materials when the material of the original restoration is amalgam; (2) Restorations that are replaced are more likely to involve a change of restorative material than restorations that are repaired; (3) The likelihood of changing from amalgam restoration differs as a function of other tooth-specific variables, such as tooth type and number of surfaces in the original restoration.

Materials and Methods

Selection and recruitment process

This cross-sectional study included 197 practitioner-investigators participating in the DPBRN were enrolled in this study and recorded data on consecutive defective restorations that needed repair or replacement on permanent teeth. The DPBRN comprises outpatient dental practices mainly 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 Center for Health Research, Portland, Oregon; and SK (Scandinavia): Denmark, Norway, and Sweden. Practice structures differed by DPBRN region. Dentists from the AL/MS and FL/GA regions were primarily in independent or small group practices, MN and PDA dentists were primarily in large group practices, and SK dentists were in public or private health care settings. This study was approved by the respective Institutional Review Boards of the participating regions. DPBRN practitioner-investigators were recruited through continuing education courses and/or mass mailings to licensed dentists within the participating regions. As part of the eligibility criteria, all dentists completed (1) a DPBRN Enrollment Questionnaire describing their demographic and practice characteristics and certain personal characteristics, (2) an Assessment of Caries Diagnosis and Caries Treatment Questionnaire, (3) training in human subjects protection, and (4) a DPBRN orientation session with the regional coordinator. Copies of the questionnaires and summary data for dentists' demographic and practice characteristics are available at http://www.dpbrn.org/users/publications/Default.aspx. Results from previous studies confirm that dentists in practice-based research networks have much in common with dentists at large[8,9].

This study used a consecutive patient/restoration recruitment design and every patient who received a repair or replacement of a restoration on a permanent tooth was asked to participate. Patients who returned for additional appointments while data collection was still ongoing were not eligible for further data collection. Only restorations eligible during the first appointment were enrolled. The practitioner could enroll up to 4 restorations per patient and continued to collect data until information on 50 restorations had been collected. The number of lesions/patient was restricted in order to limit the size of clustering at the patient-level, thus increasing the precision and generalizability of the study. Patient recruitment varied from practice to practice, and on average the recruitment took about 5 months. A consecutive patient/restoration log form was used to record information on eligible restorations whether or not the patient participated in the study. All the data collection forms used for this study are available at http://www.DentalPBRN.org/users/publications/Supplement.aspx.

Variable selection

Restoration replacement was characterized as the entire removal of the existing defective/failed restoration and any adjacent pathologically altered or discolored tooth tissue that was esthetically or functionally unacceptable. Repair was characterized as the removal of part of the existing restoration and any adjacent pathologically altered as well as discolored tooth tissue that was esthetically unacceptable followed by placement of restorative material in the prepared site. Repair also included light grinding and polishing, removal of overhangs, polishing discolored tooth-colored restorations, or sealing margins.

Practitioner-investigators collected data for each enrolled restoration that needed repair or replacement on permanent tooth surfaces. Data collected included: (1) the main reason for repair or replacement of the restoration (previously reported)[10]; (2) tooth type and tooth surfaces being restored; and (3) the restorative materials used for the old and the new restoration. Dentists diagnosed the need to repair or replace the existing restoration based on the diagnostic methods they typically use in their practice, which consist mainly of visual-tactile in association with radiographic examinations.

Restorative materials were classified as amalgam, direct or indirect resin-based composite (RBC or IRBC), conventional or resin-modified glass-ionomer (GI/RMGI), ceramic or porcelain, cast gold or other metallic-based material, combined metal-ceramic material, and temporary restorative materials. When multiple materials were reported, the material most likely to fail was used for classification. Information about gender, age, race, ethnicity, and insurance coverage of enrolled patients was also recorded.

The Data Collection Form was pre-tested by sixteen DPBRN practitioner-investigators. Pre-testing consisted of assessing the feasibility of the form in the flow of a busy practice environment, as well as the comprehension and intuitiveness of the classification criteria. The pre-testing phase for each of these groups met a test-retest reliability of kappa > 0.70 or ICC > 0.70.

Statistical analysis

A binary logistic model, with Generalized Estimating Equations to adjust for clustering within dental practices and restorations within patients, was used to examine dentist, patient, and restoration variables as predictors of the decision to repair or replace the restoration. The GENLIN procedure within SPSS 19 was used with an exchangeable correlation matrix structure.

Hypothesis 1: Dentists are more likely to change restorative materials when the material of the original restoration is amalgam.

Hypothesis 2: Restorations that are replaced are more likely to involve a change of restorative material than restorations that are repaired.

Hypotheses 3: The likelihood of changing from an amalgam restoration differs as a function of other tooth-specific variables, such as tooth type (molar, premolar, anterior), and the number of surfaces in the original restoration.

For data analysis, the original and treatment materials were combined into three major categories: 1) amalgam; 2) direct tooth-colored restorations (resin-based composite [RBC], compomer, and glass ionomer); and 3) indirect restorations (indirect RBC, ceramic, gold or metallic, and porcelain fused to metal). The dependent variable for this study was “material change” coded as the same material used in treatment as in the original restoration (no change) = 0, a different material was used in treatment (change) = 1. For example, if the original material was amalgam and an indirect restoration material was used in the treatment visit, it was classified as a change and coded 1; whereas, if an indirect restoration material was used for both the original restoration and during the treatment visit, it was classified as no change and coded 0.

The independent variables were coded as follows: Material: amalgam =1, direct tooth-colored restorations and indirect restorations=0; Treatment: repair=1, replacement=0; Tooth: molar=1, pre-molar and anterior=0; Arch: maxillary=1, mandibular=0; Surfaces: 1=1, 2=2, 3+=3.

The first step in the analysis consisted of testing hypothesis 1, which involved the main effect of amalgam as the original restoration material (model = “amalgam”). The second step involved testing hypothesis 2, which was tested by the material × treatment interaction term (model = “amalgam” + “treatment” + “amalgam × treatment”), where treatment meant repair or replacement. The third hypothesis was tested one variable at a time and was supported when the interaction term involving that variable and amalgam was statistically significant. Certain variables – namely, patient variables (age, gender, race, insurance status), dentist variables (SK region, gender, years since dental school graduation) and restoration variables (treatment, tooth site, arch, number of surfaces on the original restoration, secondary caries, the dentist placed the original restoration) were included as control variables if that variable was not being specifically tested in that particular model as part of the hypothesis test. Each hypothesized significant interaction term was interpreted by testing the amalgam variable at each level of the tested variable.

Results

The 197 participating dentists returned data on a total of 9,875 restorations collected from 7,502 patients. Three hundred ninety-one of the restorations resulted in a temporary restoration or the dentist did not specify the treatment. Complete data were not available for an additional 563 restorations; therefore, all subsequent analyses involved 8,921 restorations with complete data from 6,759 patients. Seventy-five percent (n=6,657) of restorations were replaced and 25% (n=2,264) repaired.

Practice and patient characteristics are presented in Table 1. Patients were treated in 197 practices distributed across the DPBRN regions as AL/MS=39, FL/GA=44, PDA=40, MN=36, SK=38. One hundred thirty-eight (70%) providers were male and 59 (30%) were female. Mean number of years since dental school graduation was 21.6 (SD=10.5). The average percent of time spent performing non-implant restorations was 55.8 (SD=19.9). Regarding patient characteristics, 57% were female and 43% were males, and 21% had dental insurance. Patient race was White, 89%; Black or African American, 6%; American

Indian or Alaskan native, 1%; Asian, 2%; Native Hawaiian or other Pacific Islander, < 1%; and Other, 1%.

The overall percent distribution of the restorative material for the restorations that were repaired or replaced was: 56% (4,999) were amalgam restorations, 37% (3,296) were direct tooth-colored restorations, and 7% (626) were indirect restorations. The distribution of the restorative materials used to repair or replace the failed restorations was 29% (2,559) amalgam, 56% (5,000) direct tooth-colored, and 15% (1,362) indirect restorations. Figure 1 presents the percentages for the replacement material used for each of the original materials. The frequencies for the original restoration material cross-tabulated with the treatment material are presented in Table 2.

Table 3 shows the percent distribution of the restorative material used in the repair and replacement of restorations in the USA regions and SK regions according to the material in the original restoration. For the SK region, with the exception of the indirect restorative material, the majority of the restorations were either repaired or replaced with direct tooth-colored restorations. The number of indirect restorations had a 3-fold increase after the treatment. The SK variable was statistically significant in testing for a difference in the probability of changing the restoration material (OR = 1.98, p .001 in the test of hypothesis 1) suggesting that SK dentists were more likely than US dentists to change an amalgam material. Exploratory analyses were performed removing SK data from our models with no change found in the interpretation of any of the findings reported below.

Testing study hypotheses

Regression coefficients tested in hypotheses 1-3 are shown in Table 4.

Hypothesis1: Original material—For repair or replacement of the restorations, the restoration material was 5 times more likely to be changed when the original material was amalgam (OR=5.2, p<.001) than when the original material was a direct tooth-colored or indirect material.

Hypothesis 2: Treatment—The likelihood of changing an amalgam restoration differed as a function of whether the treatment was repair or replacement, as indicated by the significant amalgam × treatment interaction effect (p<.001). When the restoration was repaired, the material was nearly 2 times more likely to be changed when the original material was amalgam (OR=1.9, p<.001) than when the original material was a direct tooth-colored or indirect material; whereas when the restoration was replaced, the material was nearly 8 times more likely to be changed when the original material was amalgam (OR=7.8, p<.001) compared to the other materials.

Hypothesis 3: Tooth-specific variables—The likelihood of changing an amalgam restoration differed as a function of the tooth type, as indicated by the significant amalgam × tooth type interaction effect (p <.001). For restorations that were either repaired or replaced, if the restoration was in a molar tooth, the material was 3 times more likely to be changed when the original material was amalgam (OR=3.0, p<.001) than when the original material was a direct tooth-colored or indirect material; whereas when the restoration was in a premolar tooth, the material was more than 4 times more likely to be changed when the original material was amalgam (OR=4.5, p<.001) compared to the other materials. Furthermore, when the restoration was in an anterior tooth, the material was more than 137 times more likely to be changed when the original material was amalgam (OR=137.2, p<. 001). See Table 5. The likelihood of changing an amalgam restoration also differed as a function of the arch, as indicated by the significant amalgam × arch interaction effect (p<.

001). When the restoration was in the maxillary arch, the material was more than 6 times more likely to be changed when the original material was amalgam (OR=6.6, p<.001) than when the original material had been a direct tooth-colored or indirect material; whereas when the restoration was in the mandibular arch, the material was 4 times more likely to be changed when the original material was amalgam (OR=4.1, p<.001) compared to the other materials. See Table 6. Finally, the likelihood of changing an amalgam restoration differed as a function of the number of surfaces in the original restoration, as indicated by the significant amalgam × tooth interaction effect (p<.001). When the restoration involved a single surface, the material was 12 times more likely to be changed when the original material was amalgam (OR=12.2, p<.001) than if the original material was a direct tooth-colored or indirect material. When the restoration involved two surfaces, the material was 7 times more likely to be changed when the original material was amalgam (OR=7.0, p<.001) compared to the other materials, whereas, when the restoration involved three or more surfaces, the material was more than 3 times more likely to be changed when the original material was amalgam (OR=3.4, p<.001). See Table 7.

Discussion

The longevity of dental restorations is dependent on many factors, including those related to materials, the dentist who placed the restoration, and the patient. The longevity of amalgam restorations has been the main proof of the success of this restorative material, as evidenced by numerous studies[3,11-15]. However, despite the fact that studies have discussed its safety as a restorative material[16-19] amalgam restorations are being replaced, and most likely it is because of its inferior esthetic appearance, alleged adverse health effects, and environmental concerns[20-23]. Consistent with the fact that the use of amalgam as a restorative material is decreasing in general dental practice[11,24,25], amalgam was not the main restorative material used when repair or replacement of restorations took place in the current study. In fact, when repairing and replacing existing restorations, clinicians were significantly more likely to change the restorative material when the material in the original restoration was amalgam. Amalgam has actually been banned from certain countries in Europe, in particular in the Scandinavia region. Indeed, the current study showed that for participants from the Scandinavian region, almost all of the restorations that were either repaired or replaced used direct tooth-colored restorative materials.

Restorations that were replaced were more likely to involve a change of restorative material than restorations that were repaired. When the original material was amalgam and the restoration was repaired, it was then acceptable to some dentists in the US regions to repair existing amalgam restorations using amalgam as the restorative material. Previous studies have shown that repair is an effective treatment alternative to amalgam restorations that were originally considered defective[26-28]. Laboratory studies have also attested to the success of the amalgam repair[29-31]. The replacement of defective restorations will lead to loss of healthy tooth structure[32-34] and weakening of the tooth, creating an increased risk of cusp fracture. Additionally, it may increase significantly the number of surfaces involved in the restoration. In fact, the results of the current study showed that when the replacement of an existing restoration took place and it had an increase in the number of surfaces involved, dentists opted for an indirect restoration, as evidenced by the 3-fold increase of the number of indirect restorations after treatment.

Direct tooth-colored material was the main choice of material to repair or replace failed restorations by practicing dentists. Resin-based composite (RBC) materials rely on mechanical bonding and they can be placed in small surface areas; therefore, they were probably an appealing option for the repair treatment of defective or failed restorations. Additionally, numerous *in vitro* studies have reported acceptable bonding strength forces for

the repair of RBC materials[35-41]. Clinical studies have also confirmed the long-term success of restorations that have been repaired with RBC materials[42-44]. Direct tooth-colored material was also the main choice for the replacement of failed restorations. Previous studies have confirmed that the use of RBC restorations has increased in the last several years[45-49]. It is possible that patients' expectations for a more-esthetic appearance than that of the existing amalgam material may have influenced the clinician's decision to replace the existing restoration with a tooth-colored material. Studies have confirmed the decline of amalgam as a restorative material in recent years[11,50,51].

The likelihood of changing from amalgam when repair or replacement was done differed significantly as a function of tooth-specific variables, such as tooth type, arch location, and the number of surfaces in the original restoration. Premolar and anterior teeth were most likely to receive a change in restorative material when the original restoration was amalgam. Anterior teeth are located in an esthetic zone and premolar teeth are also positioned in a more-esthetic zone when compared to molar teeth; therefore, it would be expected that those teeth would receive a tooth-colored restoration if the restoration had to be replaced. Because molar teeth receive most of the biting forces[52] and amalgam materials have performed well in this area, dentists may not have been as likely to change the restorative material when the restoration was in a molar tooth. Also related to the same line of thought, when the number of surfaces in the original restoration was smaller, particularly if the tooth involved one surface and had an amalgam, the restoration was more likely to be changed with a direct tooth-colored material. Occlusal forces may not have been as critical to the decision if the tooth had involved two or less surfaces. Indeed, the study showed a gradual decrease in the tendency to change the restorative material from amalgam to direct tooth-colored materials as the number of surfaces in the original restoration increased. Regarding the arch location, it is unclear why dentists were more likely to change the restorative material when the original restoration was an amalgam and the tooth was located in the maxillary arch. Even though some studies discussed that tooth type and arch location had significant differences in bond strength - with lower bond strength forces on maxillary molar teeth than on mandibular molar teeth[53,54] - there have been no clinical studies to substantiate those findings.

In summary, the results of the study showed that amalgam material was not being frequently used in the repair or replacement of defective or failed restorations. Practitioners clearly were more likely to use direct tooth-colored materials to repair or replace existing restorations.

Conclusion

The probability of changing from amalgam to another restorative material differed for most characteristics of the original restoration in which the repair or replacement took place. The change was most likely to take place when (1) the treatment was a replacement; (2) the tooth was not a molar; (3) the tooth was in the maxillary arch; and (4) the original restoration involved a single surface.

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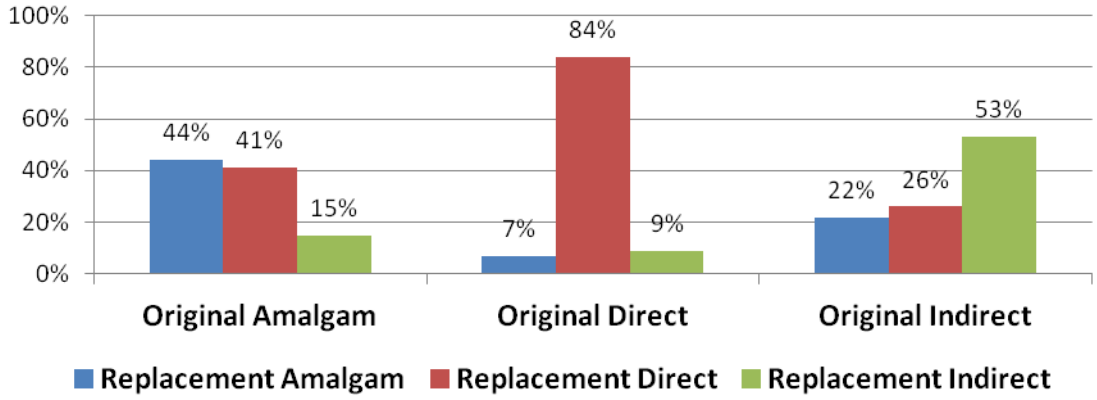

Figure 1. Restoration material (%) used by orginal material

Table 1
Dentists', practices', and patients' characteristics

Variable	Mean (SD) or % (n)
Dentists'and practices' characteristics (n=197)	
Gender (male)	70% (138)
Years since dental school graduation	21.7 (SD=10.5)
Full-time (32+ hours per week in patient care)	86% (162)
Dental chairs per office	4.0 (SD=2.3)
Practice type	
- Solo or small group private practice	58% (114)
- Large group practice	37% (72)
- Public health service	6% (11)
Percent of revenue derived from dental insurance	58% (SD=32)
Percent of time spent on non-implant restorative care	56% (SD=20)
Patients'characteristics (n=6,744)	
Gender (female)	57% (3,862)
Age	51.4 (SD=16.0)
Hispanic ethnicity (missing=109)	12% (762)
Race (missing=97)	
- White	90% (6,003)
- Black or African American	6% (412)
- Asian or Pacific Islander	1% (86)
- American Indian or Alaskan native	<1% (60)
- Other	1% (101)
Number of restorations done during the visit	
- Single restoration	76% (5,105)
- Two restorations	18% (1,228)
- Three restorations	5% (311)
- Four restorations	2% (115)
Dental insurance or any third party coverage	21% (1,438)

Table 2

Percent distribution of the restorative material used in the new treatment according to the material in the original restoration

Treatment material	Amalgam % (n)	Direct tooth-colored % (n)	Indirect % (n)	Total
Replacement				
Original Amalgam	39% (1,545)	43% (1,730)	18% (724)	3,999
Original Direct tooth-colored	8% (192)	79% (1,823)	12% (282)	2,297
Original Indirect	2% (6)	8% (28)	91% (327)	361
Total	1,743	3,581	1,333	6,657
Repair				
Original Amalgam	64% (643)	34% (336)	2% (21)	1,000
Original Direct tooth-colored	4% (44)	95% (950)	<1% (5)	999
Original Indirect	49% (129)	50% (133)	1% (3)	265
Total	816	1,419	29	2,264

Table 3

Percent distribution of the restorative material used in the repair and replacement of restorations in the USA regions and SK regions according to the material in the original restoration

Treatment material	Amalgam % (n)	Direct tooth-colored % (n)	Indirect % (n)	Total
USA				
Original Amalgam	52% (2,180)	32% (1,322)	16% (694)	4,196
Original Direct tooth-colored	9% (234)	81% (2,039)	10% (236)	2,509
Original Indirect	24% (135)	23% (132)	53% (296)	563
Total	2,549	3,493	1,226	7,268
SK				
Original Amalgam	1% (8)	93% (744)	6% (51)	803
Original Direct tooth-colored	< 1% (2)	93% (734)	7% (51)	787
Original Indirect	0% (0)	46% (29)	54% (34)	63
Total	10	1,507	136	1,653

Table 4

Regression coefficients tested in hypotheses 1, 2, and 3.

	B (SE)	OR (95% CI) *(a)*	p value
Amalgam*(b)*	1.7 (.1)	5.2 (4.6-5.9)	.<001
Amalgam × treatment	1.4 (.1)	4.1 (3.2-5.3)	<.001
Repair	.6 (.1)	1.8 (1.4-2.3)	<.001
Replacement	2.3 (.1)	7.8 (6.7-9.2)	<.001
Amalgam × tooth type	2.3 (.2)	9.7 (8.1-11.2)	<.001
Molar	1.1 (.1)	3.0 (2.5-3.5)	< .001
Premolar	1.5 (.1)	4.5 (3.6-5.7)	<.001
Anterior	5.0 (.4)	137.2 (62.4-301.9)	<.001
Amalgam × arch	.4 (.1)	1.6 (1.2-1.9)	<.001
Maxillary	1.9 (.2)	6.6 (5.5-8.0)	<.001
Mandibular	1.4 (.1)	4.1 (3.4-4.8)	<.001
Amalgam × surfaces	-.7 (.1)	0.5 (0.4-0.6)	<.001
Single surface	2.5 (.2)	12.2 (8.5-17.7)	<.001
2 surfaces	1.9 (.1)	7.0 (5.4-9.0)	<.001
3+ surfaces	1.2 (.1)	3.4 (2.9-4.0)	<.001

(a) The dependent variable was “material change” and was coded as material not changed=0 and material changed=1.

(b) All non-amalgam original restoration materials (direct tooth-colored or indirect material) were the reference group.

(c) All models included certain patient characteristics (age, gender, race, insurance status), dentist characteristics (region, gender, years since dental school graduation) and restoration characteristics (treatment, tooth site, arch, number of surfaces on the original restoration, secondary caries, the dentist placed the original restoration) as control variables if not a tested variable in that model.

Table 5

Percent distribution of the restorative material used in the new treatment according to the material in the original restoration and tooth type

Treatment material	Amalgam % (n)	Direct tooth-colored % (n)	Indirect % (n)	Total
Molar				
Original Amalgam	46% (1,567)	40% (1,363)	14% (488)	3,418
Original Direct tooth-colored	14% (153)	75% (813)	11% (121)	1,087
Original Indirect	27% (6)	24% (81)	49% (162)	334
Total	1,811	2,257	771	4,839
Premolar				
Original Amalgam	41% (606)	42% (619)	17% (249)	1,474
Original Direct tooth-colored	11% (74)	79% (527)	10% (65)	666
Original Indirect	19% (29)	28% (42)	53% (65)	152
Total	709	1,188	395	2,292
Anterior				
Original Amalgam	14% (15)	79% (84)	8% (8)	107
Original Direct tooth-colored	<1% (9)	93% (1,433)	7% (101)	1,543
Original Indirect	11% (15)	27% (38)	62% (87)	140
Total	39	1,555	196	1,790

Table 6

Percent distribution of the restorative material used in the new treatment according to the material in the original restoration and arch

Treatment material	Amalgam % (n)	Direct tooth-colored % (n)	Indirect % (n)	Total
Maxillary arch				
Original Amalgam	45% (1,777)	40% (1,064)	15% (402)	2,643
Original Direct tooth-colored	6% (118)	86% (1,751)	8% (171)	2,040
Original Indirect	14% (45)	24% (74)	62% (193)	312
Total	1,340	1,002	766	4,995
Mandibular arch				
Original Amalgam	43% (1,011)	43% (1,002)	15% (343)	2,356
Original Direct tooth-colored	9% (118)	81% (1,022)	9% (116)	1,256
Original Indirect	29% (90)	28% (87)	44% (137)	314
Total	1,219	2,111	596	3,926

Table 7

Percent distribution of the restorative material used in the new treatment according to the material in the original restoration and number of surfaces involved

Treatment material	Amalgam % (n)	Direct tooth-colored % (n)	Indirect % (n)	Total
One surface				
Original Amalgam	44% (466)	55% (582)	2% (18)	1,066
Original Direct tooth-colored	6% (63)	93% (905)	1% (10)	978
Original Indirect	31% (10	50% (16)	19% (6)	32
Total	539	1,503	34	2,076
Two surfaces				
Original Amalgam	48% (951)	44% (874)	8% (162)	1,987
Original Direct tooth-colored	10% (120)	85% (991)	5% (54)	1,165
Original Indirect	20% (4)	65% (13)	15% (3)	20
Total	1,075	1,878	219	3,172
Three or more surfaces				
Original Amalgam	40% (771)	31% (610)	29% (565)	1,946
Original Direct tooth-colored	5% (53)	76% (877)	19% (223)	1,153
Original Indirect	21% (121)	23% (132)	56% (321)	574
Total	945	1,619	119	3,673