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Techniques and materials used by general dentists during endodontic treatment procedures

Findings from The National Dental Practice-Based Research Network

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ABSTRACT

Background. Little is known about which materials and techniques general dentists (GDs) use during endodontic procedures. The objectives were to quantify GDs' use of specific endodontic tools, quantify inappropriate use, and ascertain whether inappropriate use is associated with GDs' practice characteristics.

Methods. GDs in The National Dental Practice-Based Research Network reported in a questionnaire materials and techniques they use during endodontic procedures.

Results. Among eligible GDs, 1,490 (87%) participated. Most (93%; n = 1,383) used sodium hypochlorite to irrigate. The most commonly used sealers were zinc oxide eugenol (43%) and resin (40%), followed by calcium hydroxide (26%). Most (62%; n = 920) used a compaction obturation technique; 36% (n = 534) used a carrier-based method. Most (96%; n = 1,423) used gutta-percha as a filler; 5% used paste fillers. Few used irrigants (n = 46), techniques (n = 49), or fillers (n = 10) that investigators classified as inappropriate.

Conclusions. GDs use a broad range of endodontic techniques and materials, often adapting to newer technologies as they become available. Few GDs use tools that the investigators classified as inappropriate.

Practical Implications. GDs use many types of endodontic techniques and materials, but only a small percentage of them are inappropriate.

Key Words. Dentistry; endodontic materials; endodontic procedures; general dentist; paste obturation; practice-based research.

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The tools available for endodontic treatment continue to evolve and improve, offering clinicians an increasing range of treatment options. Only limited evidence is available regarding how general dentists (GDs) have adapted to these changes, such as whether they have adopted newer technologies and maintain endodontic practice consistent with the latest scientific evidence. Such studies are rare and are generally at a low level of evidence.

Savani and colleagues[1] surveyed 2,000 GDs, finding that most had adopted the more-recent endodontic technologies, such as nickel-titanium (NiTi) rotary instruments, and that more-recent graduates were more likely to have adopted newer technologies. A limitation of the study was a low response rate: 479 responded (24%).

Some endodontic materials and techniques have substantial evidence of effectiveness and, therefore, are appropriate for routine use. We consider others inappropriate, such as irrigants that are not antimicrobial, because early infections may not be clinically apparent. Single-cone techniques lack sufficient research regarding long-term success and, therefore, are controversial.[2-5] Paste fillers are considered inappropriate because of

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difficulties in controlling placement in canals and because many contain formaldehyde.[6]

Gutta-percha has stood the test of time, most often paired with a zinc oxide eugenol (ZOE)–based sealer. Gutta-percha on rigid carriers has become popular, with results from even the earliest studies showing a seal equivalent to that of conventional gutta-percha compacted either with heat or at ambient temperature.[7] We consider single-cone techniques inappropriate because they may not obturate the canal adequately. Paste fillers have fallen from favor mostly because of the difficulty in controlling the material and the inclusion of harmful ingredients.[8-12] Use of paraformaldehyde-containing sealers to obturate canals has never been taught in any US dental school.[13] Results from Newton and coworkers' classic long-term study[6] showed effects of this material in primates; they found that periapical inflammation predominated, whereas the untreated controls showed no inflammation. The objectives of our study were to quantify GDs' use of specific endodontic materials (types of instrumentation files, irrigation solutions, sealers, and fillers) and obturation techniques, identify and quantify inappropriate use, and ascertain whether inappropriate use is associated with dentists' practice characteristics.

METHODS

The National Dental Practice-Based Research Network is a consortium of dentists and dental organizations focused on improving the scientific basis for clinical decision making.[14] Its mission is to improve oral health by conducting dental practice-based research and by serving dental professionals through education and collegiality. It is committed to maximizing the practicality of conducting research about clinical practice across geographically dispersed regions and diverse practice types. Many details about the network are available at its Web site: www.nationaldentalpbrn.org. This study was approved by the respective institutional review boards of each of the network's regions.

Enrollment questionnaire. As part of the network enrollment process, practitioners complete an enrollment questionnaire that describes characteristics about themselves, their practices, and their patient populations. The full questionnaire is publicly available.[15]

Questionnaire on endodontic care practices. After confirming on the questionnaire itself that the GD was still a GD and that he or she performed at least 1 endodontic procedure each month, respondents were asked about categories of instrumentation, irrigation, sealer choice, obturation technique, and obturation material. Each topic had specified categories, as well as an *other* category in which practitioners could describe items not listed; there were no limits to the number of responses allowed. Instrumentation preferences were categorized into NiTi hand files, engine-driven NiTi files of any rotary pattern, stainless steel hand files, and rotary files of any type. Irrigation agents included normal saline, sodium hypochlorite, local anesthetic solution, hydrogen peroxide, and chlorhexidine. Sealer preference categories were ZOE, epoxy resin, calcium hydroxide, and glass ionomer. Obturation technique choices were lateral and vertical compaction, continuous wave, thermoplasticized injection, carrier-based (gutta-percha) techniques, thermomechanical compaction with rotary instruments, and paste. Obturation material options were gutta-percha (Resilon, a filled aliphatic polyester-with-resin sealer; Resilon Research, LLC), resin-coated gutta-percha, endodontic paste, and apical barrier (for example, MTA, Dentsply International).

Administration of questionnaire on endodontic care practices. By January 31, 2014, more than 5,000 people had completed an enrollment questionnaire; 1,876 were invited to participate in the questionnaire because they met these 4 criteria: GD; currently practicing and seeing patients; reported performing at least some endodontic procedures; and selected the *limited* or *full* participation levels, as compared with the *information only* level of participation in the network. We mailed preprinted invitation letters to eligible practitioners, inviting them to participate and informing them they would receive an e-mail with a link to the electronic version of the questionnaire with the option for a paper version.

We asked practitioners to complete the questionnaire within 2 weeks. We sent reminder letters after the second and fourth weeks, if needed. After 6 weeks, we sent e-mail and postal reminders. After 8 weeks, each practitioner was sent a final postal questionnaire. If we did not receive a response within 2 weeks, a regional coordinator followed up these dentists. Data collection was closed 12 weeks after the original e-mail invitation. We remunerated practitioners or their business entities $50 for completing the questionnaire if they confirmed at the end of the survey that they would like remuneration (84% of respondents requested remuneration). We collected data from February 2014 to July 2014.

To document the reliability of these questionnaire items, 43 respondents completed the same questionnaire twice online. The mean (standard deviation) time between test and retest was 15.5 (3.0) days. We quantified the agreement between time 1 and time 2 by using a mean weighted κ score, which was 0.62, with an interquartile range of 0.46 to 0.79. Table 1 shows the characteristics of GDs and their practices.

Statistical methods. We ascertained the overall frequency of types of instruments, solutions, obturation techniques, sealers, and fillers used for performing endodontic procedures (Table 2). We reviewed all items specified in the *other* option and grouped them into existing types or defined new ones. We then categorized these types of instruments, solutions, obturation

ABBREVIATION KEY. **GD:** General dentist. **NiTi:** Nickel-titanium. **ZOE:** Zinc oxide eugenol.

TABLE 1

Characteristics of participating general dentists and their practices.

CHARACTERISTIC	NO. OF PARTICIPANTS*	PERCENTAGE OF PARTICIPANTS
Practitioner		
Sex		
Male	1,142	77
Female	339	23
Race and ethnicity†		
White	1,170	79
Black	70	5
Asian	145	10
Other	9	1
Hispanic or Latino	78	5
Age, y		
< 35	160	11
35-44	332	22
45-54	310	21
55-64	525	35
≥ 65	157	11
Years since dental school graduation		
< 10	278	19
10-19	298	20
20-29	341	23
≥ 30	570	38
Additional formal training after dental school		
None	874	59
Any	616	41
Membership in dental organizations		
None	186	12
Any	1,304	88
Practice		
Practice type		
Owner of a private practice	1,097	74
Associate in a small group private practice	175	12
Member of large staff-model group practice‡	101	7
Public, community, or publicly funded clinic	63	4
Federal, academic, or other managed care facility	49	3
Endodontist in same location		
No	1,444	97
Yes	46	3
Rural		
No	1,231	83
Yes	256	17
Practice at more than 1 location		
No	1,257	84
Yes	232	16
Region of United States where practice is located§		
Western	173	12
Midwest	139	9
Southwest	255	17
South Central	356	24
South Atlantic	252	17
Northeast	315	21
Patient		
Percentage of patients with private insurance		
< 40%	205	14
40%-79%	876	60
≥ 80%	378	26
Percentage of patients who come in regularly		
< 50%	269	18
50%-79%	875	60
≥ 80%	320	22
Clinical		
Number of endodontic procedures dentist performs each month		
1-5	535	36
6-10	438	29
> 10	517	35
Always use dental dams when performing endodontic procedures		
No	793	53
Yes	697	47

* Not all categories add up to 1,490 because of missing data for some characteristics.
† Although race and Hispanic or Latino ethnicity are separate questions in the enrollment questionnaire, some Hispanic or Latino participants did not provide a race or indicated "Hispanic or Latino" as their race. Therefore, we combined race and ethnicity for this analysis.
‡ Either HealthPartners Dental Group in greater Minneapolis, MN, or Permanente Dental Associates in greater Portland, OR.
§ Reported on the enrollment questionnaire as the state, then subsequently categorized into 1 of the 6 regions of the network.

techniques, sealers, and fillers as appropriate or inappropriate on the basis of assessments by the 3 endodontists (P.D.E., G.J.R., and A.S.L.) of the current state of scientific evidence. We compared characteristics of practitioners working appropriately by using χ^2 tests for bivariate analyses. If numbers were sufficient, we used logistic regression to ascertain independent associations of practitioner characteristics and whether practitioners consistently (that is, always) used dental dams when

TABLE 2

Frequency of inappropriate* materials and methods participating general dentists (n = 1,490†) reported using when performing endodontic therapies.

MATERIAL OR METHOD	NO. OF PARTICIPANTS	PERCENTAGE OF PARTICIPANTS‡
Endodontic Instrument (n = 1,489)		
Rotary endodontic instruments	958	64
Engine-driven nickel-titanium	768	52
Standard nickel-titanium hand K files	738	50
Stainless steel hand K files	675	45
Other	85	6
Solution for Canal Irrigation (n = 1,490)		
Appropriate		
Sodium hypochlorite	1,383	93
Chlorhexidine	381	26
Hydrogen peroxide	130	9
QMix	58	4
Inappropriate if not with the solutions above§		
Local anesthetic	326	22
Ethylenediaminetetraacetic acid	215	14
Normal saline	117	8
Other	42	3
Overall inappropriate¶	46	3
Sealer (n = 1,472)		
Zinc oxide eugenol	633	43
Epoxy resin	590	40
Calcium hydroxide	384	26
Glass ionomer	85	6
Other	23	2
Obturation Technique (n = 1,490)		
Appropriate		
Lateral condensation and vertical compaction	920	62
Carrier-based techniques (gutta-percha)	534	36
Continuous wave technique	233	16
Thermoplasticized injection technique	79	5
Thermomechanical compaction with rotary	33	2
Other	9	1
Inappropriate		
Paste fillers	68	5
Single cone	44	3
Overall inappropriate¶	49	3
Filler Material (n = 1,489)		
Appropriate		
Gutta-percha	1,423	96
Resin-coated gutta-percha cones	86	6
Apical barrier material	74	5
Resin root-filling materials	69	5
Other	8	1
Inappropriate		
Paste fillers	74	5
Single cone	6	0
Overall inappropriate¶	10	1

* Inappropriate according to limited evidence or long-term study results.
† Not all categories add up to 1,490 because of missing data for some questions.
‡ Some columns add up to more than 100% because some general dentists used more than 1 material.
§ Irrigation solutions, number of listed types who did not also use an appropriate solution: ethylenediaminetetraacetic acid, 1; local anesthetic, 26; normal saline, 17.
¶ Total number in category who used an irrigation solution, technique, or filler that was inappropriate who also did not use an appropriate method or material. Three endodontist authors (P.D.E., G.J.R., and A.S.L.) determined inappropriateness.

performing endodontic procedures with use of inappropriate solutions, techniques, or fillers. We calculated odds ratios (ORs) and 95% confidence intervals (CIs) from the regression models. Because of the large overall sample size and no a priori hypothesis, we used .01 for the statistical significance level. Results and details of these associations are publicly available.[15] We performed all analyses by using software (SAS Version 9.2, SAS Institute).

RESULTS

Of the 1,876 dentists invited to participate, 160 were ineligible for 1 or more of the following reasons: no longer a GD, no longer in active practice, no longer performing any endodontic procedures, or deceased. Of the 1,716 eligible participants, 1,500 responded, for a response rate of 87% (1,500 of 1,716). Of the 1,500 respondents, 10 either only logged on or stopped the survey after the first few questions, for a participation rate of 87% (1,490 of 1,716). Those who reported that they practiced with either the HealthPartners (Minneapolis, MN) or Permanente Dental Associates (Portland, OR) groups participated at higher rates (97%) than did other participants (87% in private practice and 81% in all others [$P < .001$]) (data not shown). GDs who were members of a dental organization (for example, American Dental Association) participated at higher rates than did nonmembers (88% versus 81%; $P = .002$) (data not shown), as did those from the Western region compared

with those from other regions (93% versus 86%; $P = .009$) (data not shown). These differences remained significant in adjusted, logistic regression analysis. There were no differences in participation with regard to dentist sex, race, age, years since graduation from dental school, rural or urban practice location, and whether the GD had additional training or an endodontist was located in the same building or with regard to selected patient characteristics.

Instruments used. Most practitioners used a combination of files, often hand and rotary files (Table 2). Approximately one-third used only 1 type of instrument, one-third used 2 types, and one-third used 3 or more. Of the group that used a single instrument type, 14% (102 of 738) of those who used NiTi hand files used only this type of file. Use of only 1 type of file was 15% (114 of 768) for NiTi rotary, 10% (67 of 675) for stainless steel hand files, and 18% (171 of 958) for the broader category of any rotary file. Whether more than 1 file type was used within a single patient was not included in the survey.

The most common combination of 2 types of instruments used was stainless steel hand files and rotary instruments (n = 166; 11%). Other less frequently used instruments were Gates Glidden (n = 13), Hedstrom (n = 10), reciprocating (n = 18), sonic and ultrasonic (n = 18), and WaveOne (Dentsply International) (n = 10). None of the instruments reported is considered inappropriate.

Canal irrigants. We considered appropriate those irrigants that are good disinfectants or irrigants without disinfecting action if they were used in conjunction with broad-spectrum antimicrobials. In contrast to the wide range of instruments used, 1 solution, sodium hypochlorite, was used by most dentists (n = 1,383; 93%). GDs used chlorhexidine (n = 381; 26%), hydrogen peroxide (n = 130; 9%), QMix (Dentsply International) (n = 58; 4%), and all other effective disinfectants less commonly. Altogether, almost one-half of GDs used local anesthetic (22%), ethylenediaminetetraacetic acid (14%), or normal saline (8%). If used alone, their use would not be appropriate; however, all but 38 also used an appropriate irrigant. Five dentists used only water, and 3 reported not using any irrigant. Together with the 38, a total of 46 (3%) dentists reported using a solution (or no solution) we considered inappropriate.

Sealers. ZOE and resin were the sealers used most frequently, at 43% (633 of 1,472) and 40% (590 of 1,472), respectively, and calcium hydroxide was used by 26% (384 of 1,472) and glass ionomer by 6% (85 of 1,472). Overall, 86% (1,261 of 1,472) used 1 sealer exclusively, and 12% (184 of 1,472) used 2 types, apparently for different indications rather than 2 types in a single tooth. Eighty percent of dentists who used ZOE (501 of 633 [79%]) or resin (501 of 633 [79%]) used only 1 type of sealer, and 58% (225 of 384) who used calcium hydroxide and 41% (35 of 85) who used glass ionomer did so. Only 4 used a formaldehyde-containing sealer (N2, or Sargenti), which widely is considered inappropriate.[6]

Obturation techniques. Gutta-percha compaction by means of lateral or vertical techniques was most common at 62%, followed by gutta-percha by any other means at 36%. Note that totals amount to more than 100% because some practitioners used more than 1 technique. Paste as a technique was used by 68 dentists. It was also an option in the material section, and 74 dentists selected it as an option in this category. Forty-four dentists used a sole single-cone and sealer technique. The endodontist authors (P.D.E., G.J.R., and A.S.L.) considered paste and single cone inappropriate.

Obturation materials. Virtually all dentists (96%) used gutta-percha. No other material was used by more than 6% of the dentists. Overall, 83% (1,239 of 1,489) only used 1 type of filler material. We noted use of inappropriate material exclusively for only 10 dentists.

Practitioner and practice characteristics and inappropriate or less-than-optimal practices. Associations with inappropriate irrigants (ethylenediaminetetraacetic acid, normal saline, local anesthetic, or water used without a broad antimicrobial) were older age, more years since receiving a dental degree, practice in a nonrural area, not having more than 1 practice location, and not consistently using a dental dam when performing endodontic procedures. Only the association with years since receiving a dental degree retained significance in adjusted analyses (OR, 1.8 per every 10 years [namely, an 80% increased odds of using an inappropriate irrigant for every 10 years since receiving a degree]; 95% CI, 1.4-2.5; $P < .001$).

Use of paste as an obturation technique or filler was associated with older age, more years since receiving a dental degree, performing more endodontic procedures, and not consistently using a dental dam when performing endodontic procedures. In adjusted analysis, years since receiving a dental degree retained significance (OR, 1.5 [50% increased odds] for every 10 years; 95% CI, 1.1-2.6; $P < .001$), and performing at least 10 endodontic procedures a month (OR, 1.7; 95% CI, 1.1-2.6; $P = .01$) were associated independently with use of paste as either an obturation technique or filler, whereas consistently using a dental dam when performing endodontic procedures was associated inversely with use of paste (OR, 0.4; 95% CI, 0.2-0.6; $P < .001$).

There were no significant differences between the practitioners who used only an inappropriate technique or filler (single cone or paste) or the practitioners who used paste and nothing else as either an obturation technique or filler versus the remaining (1,438 and 1,471, respectively) practitioners at a 1% significance level. The paste users were all male, and none had an endodontist in the same building; most were non-Hispanic white (n = 18), members of a dental organization (n = 17), and owned a private practice (n = 16).

DISCUSSION

Most GDs are using appropriate techniques and have adopted newer technologies. We found that only a small percentage of GDs are not using appropriate techniques (Table 3).

TABLE 3

Practitioner and practice characteristics according to use of inappropriate* irrigation solution and use of paste.

CHARACTERISTIC	CANAL IRRIGATION SOLUTION INAPPROPRIATE (n = 46)		PASTE TECHNIQUE OR FILLER (n = 104)	
	No. of Participants	Row Percentage†	No. of Participants	Row Percentage†
Practitioner				
Sex				
Male	41	4	89	8
Female	5	2	15	4
P value‡		.049		.03
Race and ethnicity§				
White	43	4	78	7
Black	2	3	7	10
Asian	0	0	10	7
Other	0	0	0	0
Hispanic or Latino	0	0	7	9
P value		.06		.7
Age, y				
< 35	0	0	4	3
35-44	5	2	17	5
45-54	7	2	15	5
55-64	22	4	42	8
≥ 65	11	7	26	17
Tr¶ *P* value		< .001		< .001
Years since dental school graduation				
< 10	1	0	7	3
10-19	4	1	17	6
20-29	9	3	19	6
≥ 30	32	6	60	11
Tr *P* value		< .001		< .001
Additional formal training after dental school				
None	24	3	65	7
Any	22	4	39	6
P value		.4		.4
Membership in dental organizations				
None	5	3	12	6
Any	41	3	92	7
P value		.7		.8
Practice				
Practice type				
Owner of a private practice	42	4	89	8
Associate in a small group private practice	0	0	9	5
Member of a large staff-model group practice#	0	0	1	1
Public, community, or publicly funded clinic	3	5	2	3
Federal, academic, or other managed care facility	1	2	3	6
P value		.02		.04

* Three endodontist authors (P.D.E., G.J.R., and A.S.L.) determined inappropriateness.
† Percentages who used inappropriate canal solution for irrigation or who used paste, respectively, are calculated from denominators in Table 1.
‡ *P* values from χ^2.
§ Although race and Hispanic or Latino ethnicity are separate questions in the enrollment questionnaire, some Hispanic or Latino participants did not provide a race or indicated "Hispanic or Latino" as their race. Therefore, we combined race and ethnicity for this analysis.
¶ *P* value from Mantel-Haenszel χ^2 trend test.
# Either HealthPartners Dental Group in greater Minneapolis, MN, or Permanente Dental Associates in greater Portland, OR.
** Reported on the enrollment questionnaire as the state, then subsequently categorized into 1 of the 6 regions of the network.

TABLE 3 (CONTINUED)

CHARACTERISTIC	CANAL IRRIGATION SOLUTION INAPPROPRIATE (n = 46)		PASTE TECHNIQUE OR FILLER (n = 104)	
	No. of Participants	Row Percentage[†]	No. of Participants	Row Percentage[†]
Endodontist in same location				
No	46	4	102	7
Yes	0	0	2	4
P value		.2		.5
Rural				
No	30	2	84	7
Yes	16	6	20	8
P value		.001		.6
Practice at more than 1 location				
No	46	4	89	7
Yes	0	0	15	6
P value		.003		.7
Region of United States where practice is located[**]				
Western	1	1	12	7
Midwest	1	1	4	3
Southwest	8	3	19	7
South Central	18	5	30	8
South Atlantic	5	2	16	6
Northeast	13	4	23	7
P value		.02		.4
Patient				
Percentage of patients with private insurance				
< 40%	9	4	10	5
40%-79%	24	3	69	8
≥ 80%	12	3	23	6
P value		.4		.2
Percentage of patients who come in regularly				
< 50%	11	4	17	6
50%-79%	30	3	60	7
≥ 80%	4	1	25	8
P value		.09		.8
Clinical				
Number of endodontic procedures dentist performs each month				
1-5	13	2	23	4
6-10	13	3	28	6
> 10	20	4	53	10
P value		.4		< .001
Always use dental dams when performing endodontic procedures				
No	35	4	78	10
Yes	11	2	26	4
P value		.002		< .001

Few used irrigant without disinfecting properties. Most use sodium hypochlorite. Inasmuch as no distinction was made for infected versus noninfected pulp status and because the survey asked this question as a general use statement, we assumed that selection of nondisinfecting irrigants was inappropriate.

Carrier-based obturators were popular, with 36% of respondents using them at least sometimes. Gound

and colleagues[16] noted that dental students' abilities at placing single-cone materials, although faster, were less likely to achieve target length and density than were multicone techniques. However, Hale and colleagues[17] compared lateral condensation with carriers placed by dental students and found no significant difference at 2 years. Reports of results from seasoned practitioners are lacking. Investigators have debated the differences widely, but most now agree that these techniques produce similar outcomes.

We classified paste fillers as inappropriate because of clinical observations of high retreatment rates for such materials and because paste fillers are difficult to control.[18] Use of formaldehyde, added to some paste fillers, is considered inappropriate in all settings.[19,20] Kulild and Karabucak[21] specifically recommend against using paste fillers, citing control difficulties, shrinkage, toxicity, voids, and resorbability problems.

This study has certain limitations, and conclusions made from it should take these into account. The main limitation is that it relies on questionnaire information rather than direct observation of procedures. In addition, although the response rate was good, nonresponders might have reported different behavior. Furthermore, although network practitioners have much in common with dentists at large,[22,23] their endodontic procedures may not be representative of those of dentists at large. In addition, network members are not recruited randomly, so factors associated with network participation (for example, an interest in clinical research) may make network dentists unrepresentative of dentists at large. Although we cannot assert that network dentists are entirely representative, we can state that they have much in common with dentists at large, while also offering substantial diversity in these characteristics. This assertion is warranted because substantial percentages of network GDs are represented in the various response categories of the characteristics listed in Table 1; findings from several network studies document that network GDs report patterns of diagnosis and treatment that are similar to patterns determined from nonnetwork GDs[24,25]; and because of the similarity of network dentists to nonnetwork dentists according to the best available national source, the American Dental Association 2010 Survey of Dental Practice.[26,27]

Our κ values (median, 0.60; interquartile range, 0.46-0.79) are what generally are regarded as moderate. One factor that may have distorted our κ estimates is the prevalence bias, which occurs when dichotomous variables are measuring something highly prevalent (or, conversely, rare). Consequently, chance agreement is high, and κ values are lower. Two of our lowest κ values illustrate this: use of saline solution for irrigation had a κ value of 0.283, and 39 of 43 (91%) participants were in agreement, and use of apical barrier material for final obturation had a κ value of 0.289, with again 39 of 43 (91%) participants in agreement.

Although the number of practitioners using inappropriate techniques or materials was small, the possibility of changing behavior exists. Koch and colleagues[28] noted high levels of success in changing behavior with education. They surveyed nearly 100 GDs in each of 2 counties in Sweden. All participants reported high levels of dental dam usage for endodontics, with more than 90% reporting always or general use, indicating a high level of compliance with their school training. One group underwent continuing education in endodontics, but the second group did not. With a response rate of 87%, they found that the education intervention resulted in 77% adoption of new technology (rotary NiTi) versus only 6% for the comparison group. Also, 79% of the intervention group performed treatment in 1 session compared with 32% for the others, after learning of the more-modern philosophy recommended by the educators. These results are in agreement with those of Savani's group,[1] in which more than 5 hours of endodontic continuing education was associated significantly with rotary instrument use, as were more sophisticated irrigation devices, molar treatment, retreatments, and electronic apex locators.

CONCLUSIONS

This study's results shed light on use preferences for various endodontic materials and techniques by GDs in the network. The use of techniques and materials deemed inappropriate was limited, and we noted certain characteristics of those practitioners. We also note the potential possibility for educational intervention. ■

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A Web site devoted to details about the nation's network is located at http://NationalDentalPBRN.org. The National Dental Practice-Based

Research Network Collaborative Group includes practitioners, faculty, and staff investigators who contributed to this activity. A list of these people is available at http://nationaldentalpbrn.org/tyfoon/site/fckeditor/file/Iso%20techs%20Collaborative%20Group.pdf.

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