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Clinical Research

Methods Used by Dental Practice-based Research Network (DPBRN) Dentists to Diagnose Dental Caries

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Clinical Relevance

Dentists' use of specific diagnostic methods vary substantially. Overall, the dental explorer and radiographs are still the main diagnostic methods to diagnose dental caries.

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ABSTRACT

Objectives: To (1) identify the methods that dentists in The Dental Practice-Based Research Network (DPBRN) use to diagnose dental caries; (2) quantify their frequency of use and (3) test the hypothesis that certain dentist and dental practice characteristics are significantly associated with their use. Methods: A questionnaire about methods used for caries diagnosis was sent to DPBRN dentists who reported doing some restorative dentistry; 522 dentists participated. Questions included the use of dental radiographs, the dental explorer, laser fluorescence, air-drying and fiber-optic devices and magnification as used when diagnosing primary, secondary/recurrent or non-specific caries lesions. Variations on the frequency of their use were tested using multivariate analysis and

Bonferroni tests. Results: Overall, the dental explorer was the instrument most commonly used to detect primary occlusal caries and caries at the margins of existing restorations. In contrast, laser fluorescence was rarely used to help diagnose occlusal primary caries. For proximal caries, radiographs were used to help diagnose 75%-100% of lesions by 96% of the DPBRN dentists. Dentists who use radiographs most often to assess proximal surfaces of posterior teeth were significantly more likely to also report providing a higher percentage of patients with individualized caries prevention (p=.040) and seeing a higher percentage of pediatric patients (p=.001). Conclusion: The use of specific diagnostic methods varied substantially. The dental explorer and radiographs are still the most commonly used diagnostic methods.

INTRODUCTION

Research has shown that significant inconsistencies exist in the diagnosis of caries.[1-2] These inconsistencies are partly related to the marked variation among dentists when diagnosing dental caries and the lack of sensitive and specific methods to detect and quantify carious lesions.[3] Previous reports indicate sensitivity values ranging from 0.77 to 1.00 and specificity values ranging from 0.45 to 0.93.[4]

An inaccurate diagnosis will result in either overtreatment, with placement of unnecessary restorations, or under-treatment, which will potentially miss the benefit of non-invasive types of treatment at an earlier stage of caries development.[1] Either circumstance will directly or indirectly impact patients' oral health status and the short- and long-term cost of care. Identifying the methods being used for caries diagnosis and the factors associated with their use is important to understanding the current status of caries diagnosis in non-academic daily clinical practice. This information should be invaluable for developing consistent criteria for caries diagnosis and targeting dentists who could enhance their diagnostic accuracy.

The Dental Practice-Based Research Network (DPBRN) has a valuable mix of dental practices and diverse treatment philosophies, dental care reimbursement models and patient populations that present an advantageous opportunity to investigate variation in how dentists diagnose dental caries. Dentists in The DPBRN have much in common with dentists at-large,[5] while simultaneously offering substantial diversity in the characteristics of its dentists, their practices and their patients.[6] The DPBRN mainly comprises dentist practitioner-investigators from five regions: AL/MS (Alabama/Mississippi, USA), FL/GA (Florida/Georgia, USA), MN (dentists employed by HealthPartners and private practitioners in Minnesota, USA), PDA (Permanente Dental Associates in cooperation with Kaiser Permanente Center for Health Research in Oregon and Washington, USA) and SK (Denmark, Norway and Sweden).[7] This study investigated the methods that DPBRN dentists use to diagnose dental caries. The specific aims include: (1) identifying the methods that dentists in DPBRN use to diagnosis dental caries; (2) quantifying their frequency of use and (3) testing the hypothesis that certain dentist and dental practice characteristics are significantly associated with their use.

METHODS AND MATERIALS

This study queried dentists' participating in The DPBRN, which comprises outpatient dental practices that have affiliated to investigate research questions and share experiences and expertise (n=1,166). Participants in The DPBRN were recruited through mass mailings to licensed dentists from the participating regions. As part of enrollment in The DPBRN, all practitioner-investigators completed an Enrollment Questionnaire about their practice characteristics and themselves. An "Assessment of Caries Diagnosis and Caries Treatment" (Caries Questionnaire) questionnaire was sent to DPBRN dentists who reported on the Enrollment Questionnaire that they perform at least some restorative dentistry (n=901). A pilot study documented comprehension and item test-retest reliability across 15 days using a sample of 35 network dentists. All items in the final version met a test-retest reliability cutoff of kappa >0.7. Practitioner-investigators were asked to return the questionnaire within three weeks. A reminder letter was sent after the third week, if the questionnaire had not been returned. After an additional three weeks, a second reminder was sent. Both of these questionnaires are available at http://www.dpbrn.org/users/publications/Supplement.aspx.

The Caries Questionnaire contained clinical photographs and had a range of questions, including caries-related diagnostic and clinical decision-making processes, caries risk assessment and the use of prevention techniques. Five hundred and thirty-two participating DPBRN dentists returned the questionnaire, which represents an overall return rate of 59%. There were no participation differences by gender, area of specialty or years since dental school graduation. Ten surveys were completed by dentists whose practices were outside the designated regions and were not included in this study; therefore, the authors reported data from 522 dentists.

Measures

Table 1 presents the wording for the series of questions about the methods used to diagnose dental caries. Questions specifically investigated the use of radiographs for proximal and occlusal lesions, the dental

Table 1: *Questions Used to Assess the Methods Used by DPBRN Dentists to Diagnose Dental Caries*

Instructions. These questions have to do with methods that you may use to diagnose dental caries. Please circle the one number that best corresponds to your answer. Patients can vary substantially from one practice to the next, but we are interested in the patients in YOUR practice.

1. When you examine patients to determine if they have a caries lesion on a proximal (mesial or distal) surface, on a posterior tooth, on what percent of these patients do you use radiographs to help diagnose the lesion?
2. When you examine patients to determine if they have a caries lesion on the occlusal surface, on what percent of these patients do you use radiographs to help diagnose the lesion?
3. When you examine patients to determine if they have a primary occlusal caries lesion, on what percent of these patients do you use a dental explorer to help diagnose the lesion?
4. When you examine patients to determine if they have a caries lesion at the margin of an existing restoration (recurrent/secondary caries) on what percent of these patients do you use a dental explorer to help diagnose the lesion?
5. When you examine patients to determine if they have a primary caries lesion on the occlusal surface, on what percent of these patients do you use laser fluorescence (for example, Diagnodent)?
6. When you examine patients to determine if they have a primary caries lesion, on what percent of these patients do you use air-drying to help diagnose the lesion?**
7. When you examine patients to determine if they have a caries lesion on a proximal (mesial or distal) surface of an anterior tooth, on what percent of these patients do you use fiber optic transillumination to help diagnose the lesion?
8. When you examine patients to determine if they have a caries lesion, on what percent of these patients do you use some sort of magnification to help diagnose the lesion?

***Respondents who reported using air-drying were also asked: Approximately how long do you dry the tooth surface? The response choices were: 1-2 seconds, 3-4 seconds, 5 seconds, more than 5 seconds*

Participants had the following answering choices:

1 – Never or 0%

2 – 1% to 24%

3 – 25% to 49%

4 – 50% to 74%

5 – 75% to 99%

6 – Every time or 100%

Note: The percentages for each method used were recoded to the categories' median to maintain the interval nature of the data so that parametric statistics could be used: 0% = 0, 1%-24% = 12.5, 25%-49% = 37, 50%-74% = 62, 75%-99% = 87, 100% = 100.

explorer for the detection of primary occlusal caries and secondary/recurrent caries at the margins of existing restorations, air-drying for primary caries on unspecified locations, laser fluorescence for primary caries on occlusal surfaces and fiber optic transillumination for proximal lesions in anterior teeth. Additionally, when responses to the use of air-drying were positive, respondents were prompted to report on the length of time used for the air-drying procedure. The response choices were 0% and 1-24%, 25-49%, 50-74%, 75-99%, 100%.

Statistical Analyses

The percentages for each caries diagnostic method were coded to the categories' median to maintain the interval nature of the data, so that parametric statistics could be used: 0%=0%, 1-24%=12.5%, 25-49%=37%, 50-74%=62%, 75-99%=87%, 100%=100%. Descriptive statistics for each of the diagnostic methods were calculated.

The general linear model was used to test for differences across DPBRN regions on the use of each diagnostic method. Other practice characteristics tested as independent variables in each model include type of practice, the gender of the dentist, percentage of pediatric patients, years since dental school graduation, whether caries risk was assessed, percentage of patients who received individualized caries prevention and percentage of patient contact time spent performing non-implant restorative procedures. "Type of practice" was categorized for each dentist as being in either: (1) a solo or small group private practice (SGP); (2) a large group practice (LGP) or (3) a public health practice (PHP). "Small" practices were defined as those with three or fewer dentists. Public health practices were defined as those that receive the majority of their funding from public sources.

Other dichotomous variables were coded as follows: dentist gender, male = 0 and female = 1; performing caries risk assessment = 0 and not performing caries risk assessment = 1. Multivariate pairwise comparisons using a Bonferroni correction were used to interpret regional differences.

Observations for some dentists may lack independence, because some network dentists practice within the same office, and this may influence their responses or practice patterns. However, data that could account for this possibility were not available for the statistical analysis.

Table 2: *Summary of Dentists' and Practice Characteristics*

Practice Variable	Total % (n)	AL/MS 57% (298)	FL/GA 19% (98)	MN 5% (28)	PDA 10% (51)	SK 9% (47)
Practice type						
Solo or small group practice	81% (422)	99% (296)	98% (96)	11% (3)	0% (0)	57% (27)
Large group practice	14% (98)	0% (0)	0% (0)	89% (25)	100% (51)	0 (0%)
Public health practice	5% (51)	1% (2)	2% (2)	0% (0)	0% (0)	43% (20)
Gender (male)	81% (425)	86% (255)	86% (84)	68% (19)	82% (42)	53% (25)
Percent of pediatric patients	25% (SD=23)	25% (SD=21)	23% (SD=23)	23% (SD=19)	18% (SD=18)	31% (SD=33)
Years since dental school graduation (mean)	23 (SD=11)	24 (SD=11)	25 (SD=10)	19 (SD=9)	18 (SD=10)	22 (SD=12)
Caries risk assessed	70% (363)	65% (194)	56% (55)	79% (22)	98% (50)	89% (42)
Individualized caries prevention	52% (SD=34)	46% (SD=32)	53% (SD=35)	62% (SD=29)	71% (SD=29)	58% (SD=34)
Time spent in non-implant restorative services	60% (SD=19)	61% (SD=20)	59% (SD=19)	66% (SD=15)	59% (SD=14)	52% (SD=22)

Table 3: *Frequency of Use for Each of the Caries Diagnostic Methods by DPBRN Dentists*

		Range (Min-Max)	Not used at all % (n)	Used on all patients % (n)	% Patients Mean (SD)
Radiograph (n=522)	proximal	12-100%	0% (n=0)	50% (n=262)	92% (12)
Radiograph (n=521)*	occlusal	0-100%	1% (n=1)	14% (n=71)	56% (33)
Dental explorer (n=522)	occlusal lesion	0-100%	<1% (n=2)	61% (n=317)	88% (23)
Dental explorer on the margin* of an existing restoration (n=520)		0-100%	2% (n=9)	63% (n=328)	91% (16)
Laser fluorescence (n=521)*	occlusal	0-100%	86% (n=450)	1% (n=4)	7% (21)
Air Drying (n=521)*		0-100%	4% (n=19)	32% (n=168)	70% (32)
Drying time in seconds (n=488)*		0-5+	----	----	1.2 (1.3)
Fiber optic (n=520)*		0-100%	35% (n=180)	2% (n=9)	21% (27)
Magnification (n=521)*		0-100%	21% (n=110)	40% (n=205)	57% (43)

**These numbers do not equal to 522 as some dentists left some of the questions unanswered.*

RESULTS

Table 2 shows the distribution of practice characteristics for the participating dental offices. Table 3 summarizes the frequency of use of the diagnostic methods. Table 4 shows the parameter estimates for practice characteristics associated with the frequency of use of each diagnostic method ($p<0.10$).

Practice Characteristics and Use of Diagnostic Tools

Radiographs

Proximal Surface of a Posterior Tooth

Dentists who provide a higher percentage of patients with individualized caries prevention ($p=0.040$) and see a higher percentage of pediatric patients ($p=0.001$) would use radiographs to assess the proximal surfaces of posterior teeth on a greater percentage of patients. There was also a trend for a positive association

between the number of years since dental school graduation and the greater use of radiographs to assess proximal surfaces of posterior teeth (p=0.068) (Table 4).

Table 4: *Practice Characteristics Associated with Each Diagnostic Method*

	B	SE	p
Radiograph for proximal caries			
Years since dental school graduation	-.082	.047	.068
Individualized caries prevention	.030	.015	.040
Percent of pediatric patients	-.785	.228	.001
Radiograph for occlusal lesions[a]			
Explorer on occlusal lesions			
Private practice	13.352	5.640	.018
Caries risk assessment	4.820	2.337	.040
Explorer on the margin of an existing restoration			
Private practice	7.692	4.198	.068
Caries risk assessment	3.067	1.678	.068
Use of laser fluorescence on occlusal surfaces			
Percent of non-implant restorative work	1.900	.484	< .001
Year since graduation from dental school	-.158	.092	.088
Air drying when diagnosing occlusal caries			
Individualized caries prevention	.209	.045	<.001
Fiber optic transillumination for proximal caries			
Individualized caries prevention	.141	.039	<.001
Use of Magnification			
Gender	-13.414	5.136	.009
Percentage of pediatric patients	-4.104	.886	<.001

This table provides parameter estimates for practice characteristics associated with the frequency of use of each diagnostic method where significance was <.10 and are adjusted for regional differences. Regional differences are reported in the results section text for each diagnostic method.
[a]None of the practice characteristics were associated with the use of radiographs for occlusal lesions.
Private practice variable was coded as SGP = 2, PHS or LGP = 1
Caries risk assessment yes = 1, no = 2
B = unstandardized regression coefficient
ZE = standard error (of the estimate)

Dentists in the AL/MS (93%), FL/GA (95%), MN (88%) and PDA (95%) regions would use radiographs to assess proximal surfaces of posterior teeth on a significantly greater percentage of patients than dentists in the SK region (76%, all at p<0.001). Dentists in the FL/GA (p=0.050) and PDA (p=0.028) regions would also use radiographs to assess proximal surfaces of posterior teeth more often than dentists from the MN region.

Occlusal Surface

None of the practice variables were significant predictors of using radiographs to assess occlusal caries (Table 4). However, regional differences were found in which dentists in the FL/GA (63%, p=0.033) and PDA (69%, p=0.013) regions would use radiographs to assess the proximal surfaces of posterior teeth on a significantly greater percentage of their patients than dentists in the SK region (45%).

Use of Explorers

Occlusal Surface

Dentists in a SGP practice model (90% vs 80%) (p=0.018) and those who perform caries risk assessment (94% vs 87%) (p=0.04) use the explorer on occlusal lesions on a greater percentage of patients than dentists using a non-SGP practice model or who do not use caries risk assessment.

Dentists in the AL/MS (93%), FL/GA (89%) and PDA (91%) regions would use the explorer on occlusal surfaces significantly more often on patients than dentists in the SK region (69%), p<0.001. Dentists in the AL/MS (p<0.001), FL/GA (p=0.015) and PDA (p<0.001) regions would use the explorer on occlusal surfaces significantly more often than dentists in the MN region (88%).

Margin of an Existing Restoration

There was a trend for dentists in a SGP practice model (92% vs 87%) and those who did not perform caries risk assessment (94% vs 87%) to use the explorer on the margin of an existing restoration on a greater percentage of their patients than their respective comparison groups (both at p=0.07). Dentists in the AL/MS (93%, p=0.031) region would use the explorer on the margin of an existing restoration significantly more often than dentists from the SK region (84%).

Other Methods (Table 4)

Laser fluorescence on occlusal surfaces was used most often by dentists who spent the highest percentage of their patient care time performing restorative procedures (p<0.001). There was a trend for dentists with the least number of years since dental school graduation (p=0.088) to use laser fluorescence more often than dentists with longer tenure. Dentists in the FL/GA (13%, p=0.025) region use laser fluorescence significantly more often than dentists in the AL/MS region (6%).

There was a positive association between the percentage of patients who receive individualized caries prevention and the use of air-drying to help detect a cari-

ous lesion (<0.001). Dentists in the PDA (60%) region would be less likely to use air-drying when diagnosing a caries lesion than dentists in the SK region (84%, p=0.004). Time of air-drying presented no significant associations.

There was a positive association between the percentage of patients who receive individualized caries prevention and the use of fiber-optic transillumination on proximal lesions (p<0.001), with no significant regional differences.

Male dentists (61% vs 40% for females) and practices with a lower percentage of pediatric patients (p<0.001) were more likely to use magnification when examining a carious lesion. Dentists in the FL/GA (79%, p=0.009), MN (73%, p=0.001) and PDA (67%, p=0.004) regions use magnification for caries detection more often than dentists from the SK region (31%). Dentists in the FL/GA (p<0.001) and MN (p=0.013) regions also use magnification more often than dentists in the AL/MS region (49%).

DISCUSSION

The accurate diagnosis of the presence of disease is paramount for appropriate care. Even though several methods have been described for the diagnosis of dental caries, no consistent criteria are available.[8] The diagnosis of occlusal caries is highly subjective, with considerable variation in the ability and experience among clinicians to appropriately diagnose and treat occlusal caries.[9-10] Reviews of the literature point to methodological difficulties in drawing valid comparisons between studies due to incompatible criteria and simulations.[11-12] It has also been concluded that no caries diagnostic method fulfills all of the ideal criteria for accurate measurements needed to plan appropriate care.[11-13]

In the current study, dentists would use the dental explorer, a tactile tool, as the main instrument for the detection of occlusal and recurrent dental caries. The low specificity (approximately 40%) reported for this diagnostic tool, when used as the only diagnostic method, is of concern.[14-19] Dentists tend to over-diagnose caries if a sharp instrument is used and it sticks in any deep pit and fissure without true evidence of caries. A "sticking" probe is not necessarily indicative of decay and may result from local anatomic features. Additionally, applying pressure with a sharp explorer has been called into question, particularly in Europe and Scandinavia, because of documented damage to surface integrity and possible implantation of organisms, both of which may increase lesion susceptibility.[20-21] Although this last issue is somewhat contentious, the evidence suggests that an explorer should be used lightly or not at all on occlusal surfaces. As shown in the current study, some dentists from the SK region do not use a dental explorer for the detection of occlusal dental caries.

The use of magnification to assist visual examination was consistently used by almost half of the dentists in the study in the regions of the United States. The visual examination for evaluating carious lesions has been described and, in certain studies, the results have been validated *in vitro* by sectioning the teeth after the lesions had been visually scored;[22] the histological features are considered to be the "gold standard."[23] The visual method for evaluating dental caries has low sensitivity and high specificity in diagnosing occlusal caries.[24-26] Conversely, some dentists from the SK region do not use magnification for dental caries detection.

The current study did not address the issue of whether an individual dentist reported using more than one method to assess caries diagnosis. It is possible that the same individuals who reported that they would use the explorer in 100% of the cases could also always use magnification, and vice-versa. The authors of the current study explored whether certain pairs of diagnostic techniques were used more often by certain dentists than others. However, when they calculated correlations between the frequencies of use for each of the caries diagnostic techniques, the correlations were small, ranging from r=0.15 for radiographs and explorer on an occlusal lesion, to r=0.02 for occlusal explorer and magnification. Apart from numerous possible combinations of the data, some studies reported on the use of combined methods to improve the accuracy of the diagnosis of caries. This approach also seems to be controversial. While the combined three methods (for example, visual examination, radiographic examination and laser fluorescence) has been reported to improve accuracy and provide the best treatment plan for occlusal surfaces,[27] others have indicated that a combination of diagnostic methods (ca bitewing radiographs, electric conductance, quantitative light fluorescence and DIAGNOdent) only slightly improved the correct diagnosis when compared to visual examination alone. Of more concern was the fact that the combined methods resulted in decreased specificity, thus leading examiners to elect for more invasive treatments.[28]

The use of radiographs for caries detection has a long history, and it is still a widely used diagnostic method.[13,29] In the current study, radiographs have been consistently and widely used for the diagnosis of proximal dental caries and used less often for the diagnosis of occlusal dental caries. It is accepted that occlusal lesions are initiated on the fissure walls and can therefore be obscured by sound superficial tissue.[30] This seems to be a known concept among the respondents, and it may explain the tendency for a lower frequency of the use of radiographs as a diagnostic method for occlusal caries. Dental radiographs have been reported to be inadequate for detecting caries in

the occlusal surface until the lesion is well advanced through the enamel and into the dentin.[30] False positives can also occur with radiographic diagnosis, and specificities of 66% to 98% have been recorded *in vitro*.[31-32] However, studies have reported high sensitivity values for radiographs when diagnosing proximal dental caries.[14,33-37] More importantly, radiographs can be a reliable way to monitor the remineralization process of proximal dental caries if fluoride therapy or other remineralization treatment is used. The current study has shown that 96% of the respondents would use radiographs for the diagnosis of proximal lesions in more than 75% of the cases. With the exception of SK, the use of radiographs was reported in more than 75% of the cases by the vast majority (>90%) of all respondents from US regions.

The current study did not investigate all diagnostic methods available for the detection of proximal lesions in posterior teeth and, therefore, it is unclear whether respondents make use of other diagnostic methods in those cases. Improved methods for the diagnosis of proximal lesions have been reported with the use of tooth separation and impression techniques.[38-39] These methods accurately identify the presence of cavitation on the surface and thus allow for a more accurate decision regarding treatment.

Fiber-optic transillumination (FOTI) has been evaluated in a number of studies for the detection of posterior proximal caries lesions reporting low to good sensitivity and good specificity.[35,40-43] One *in vitro* study suggested that a combination of FOTI and visual examination is valid for determining occlusal lesion depth.[44] As the buccal-lingual distance of anterior teeth is, in general, smaller than in posterior teeth, clinicians may rely more on visual inspection for examination in this area. This may explain the low frequency of use of FOTI found in the current study. Yet, 10% of the respondents reported using it in more than 50% of the cases.

Even though advances in technology have made other assisting diagnostic methods available, such as FOTI and DIAGNOdent, this study shows that dentists participating in The DPBRN do not frequently use these methods. Various levels of sensitivity have been reported for DIAGNOdent[34,45-50] and FOTI[44,51-53] for the diagnosis of occlusal and proximal dental caries. The strength of the evidence, however, is low, as the available literature is insufficient to support generalizable estimates of the sensitivity and specificity studies of these diagnostic methods. Again, there was no attempt to investigate whether clinicians are using FOTI and DIAGNOdent as a secondary method in combination with the more traditional methods. From the lower frequencies reported, the authors of the current study speculate that this is the case.

Caries lesions occur in a variety of anatomic locations and have unique aspects of configuration and rate of progression. These differences make it unlikely that a single diagnostic method will have the adequate sensitivity and specificity to detect caries at all sites. Reports in the literature have concluded that conventional visual, tactile and radiographic examinations used as individual diagnostic methods provide less than ideal diagnostic sensitivity.[14-17,54]

Many of the Alabama dentists were part of a preexisting dental network that was not formed specifically for The DBPRN, and this may partially explain their participation rates in this study. Additionally, the study sample is not a random sample of general dentists in the United States. Consequently, the extent to which these findings generalize to this population cannot be stated with certainty. Based on comparisons to dentists who responded to the 2004 ADA Survey of Dental Practice, DPBRN dentists have much in common with dentists at-large.[5-6] The only key characteristic with a statistically significant difference seems to be that DPBRN dentists tend to have a more recent year of graduation from dental school than dentists at-large. DPBRN dentists certainly represent a substantial diversity with regard to practice settings, patient populations, rural-urban area of residence and geographic locations.

Substantial differences exist among dentists regarding the clinical decision-making process, which is partially due to the lack of sensitivity and specificity provided by some caries diagnostic methods. Variation of the diagnostic methods among the different DPBRN regions is probably related to the type of participating practices. AL/MS and FL/GA participants are generally solo practitioners in fee-for-service, self-pay or private insurance-based practices. PDA and MN comprise dentists working in large group practices; SK practitioners are mostly in public health practices; and the MN region mainly comprises large group practices with a few solo private practice practitioners. Since public health practices and some large group practices employ the practitioners, it may be that these organizations are able to use standardized training and diagnostic tools. HP Dental Group, for example, has its own guidelines for caries risk assessment (caries guideline), which has specific instructions on the assessment of caries risk and protocols for radiographic and clinical diagnosis of dental caries. In fact, MN and SK were regions that reported the least percentage of clinicians using an explorer in all cases. These were the regions that were more aligned with the current scientific evidence on the validity of using an explorer to detect occlusal caries.

An International Consensus Report conducted 20 years ago concluded that "research emphasis should be placed on the development of improved and standardized methods for caries diagnosis."[54] Today's status of caries diagnosis in dental private offices still calls for evidence-based and standardized protocols.

Unfortunately, the status of caries diagnosis has not changed significantly during the past several decades. A systemic review completed recently corroborates this conclusion (Ewoldsen & Koka).[55] Without proper protocol and consistent criteria for caries diagnosis, the cost of dental treatment could be significantly affected (Shugars & Bader).[56] Establishing accurate methods and criteria for caries diagnosis is fundamental to determining normative treatment needs, reducing dental over-treatment (Bader & Shugars)[57] and, consequently, reducing the cost of care.

CONCLUSIONS

There is considerable variation in the methods used for diagnosing caries across the DPBRN regions.

1. AL/MS reported the highest frequency of use of the dental explorer in 100% of the cases and MN reported the lowest.
2. The use of radiographs to diagnose proximal caries for all patients ranged from 63% in FL/GA to 21% in SK. Dentists who provide a higher percentage of patients with individualized caries prevention and who see a higher percentage of pediatric patients are more likely to use radiographs to assess the proximal surfaces of posterior teeth.
3. Laser fluorescence on occlusal surfaces was used most often by practices that perform the highest percentage of restorative procedures. There was a trend for dentists with the least number of years since dental school graduation to use laser fluorescence more often than dentists with longer tenure.

Overall, the dental explorer and radiographs are still the main diagnostic methods for the diagnosis of dental caries.

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