Consistency and Conformity in Caries Assessment among Dental Nurses in Anguilla, British West Indies

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Purpose: In Anguilla, dental nurses are responsible for providing oral healthcare for children until they reach 18 years of age. This study determined the diagnostic conformity and consistency in caries assessment among dental nurses trained to carry out an oral health survey of 6, 12 and 15-year-old schoolchildren.

Materials and Methods: Following training in caries diagnosis using slides, extracted teeth and visual-tactile examination, three dental nurses were calibrated by a benchmark examiner (BE) using modified WHO criteria. Conformity and consistency were assessed on four different occasions – on extracted teeth (T_0) and in three different groups of children (at C_0, D_1 and D_2) for subject (SB), tooth (TH) and surface (SF) using Kappa statistics.

Results: Perfect agreement (kappa score of 1.0) was attained for all sound, decayed and filled lingual and buccal surfaces at D_1 and D_2 respectively. Levels of conformity (with and without BE) and consistency increased as the survey progressed. Accuracy level ranges for SB, TH and SF were .770-.935(T_0), .895-.951(C_0), .947-.989(D_1) and .985-.993(D_2) respectively. Kappa score of 1.0 was obtained by all three examiners for SB, TH and SF at D_2. Identical accuracy levels were attained by all examiners for TH (.985) and SF (.993) at D_2. Reliability levels for SB, TH and SF ranged from .972-.999(C_0), .977-.996(D_1) and was 1.0 at D_2.

Conclusions: Substantial and almost perfect inter and intraexaminer agreements were attained at calibration, and maintained throughout the survey. Dental nurses in Anguilla can conduct valid and reliable child oral health surveys when adequate and appropriate training is provided.

Key words: caries assessment, caries diagnosis, conformity, consistency, reliability

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The public health significance of oral health surveys in terms of over or underestimation of disease cannot be ignored especially when surface-based caries assessments are included in accuracy and reliability assessments. The accuracy of tooth-surface caries evaluation has implications for resource estimation, planning and allocation; identification of target population, appropriate intervention, and the prevention-to-treatment service ratio in oral healthcare delivery. The diagnosis of decayed at the expense of sound surfaces has significant implications for prevalence estimation. From a public health standpoint, it is better to err on the side of diagnosing more surfaces as sound since not all lesions will progress to frank cavitation especially in the face of timely and optimal fluoride exposure. The cost savings of such clinical decisions

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is desirable especially where caries prevalence is high and personnel are in short supply. The shortfall, however, should be compensated for by effective population-based oral health education and promotion programs and rigorous caries preventive intervention at the earliest opportunity.

In Anguilla (population about 9,000), children aged 18 years and under are routinely treated by the three dental nurses employed in public service either under remote supervision of the only dentist (at the Health Centre) or without supervision (in the mobile unit). Beyond this age, care is continued by the dentist as an item-based fee service. Dental nurses are responsible for the assessment and determination of the subsequent intervention (prevention and/or treatment) required for maintaining the oral health of children accessing care in the public dental service. Clinical management decisions are based on independent judgement at the time of examination.

As heads of the oral health team, dentists have traditionally been survey examiners with clinicians being trained and calibrated by epidemiologists. The trend of using government dentists as survey examiners has been maintained in non-established market economy (non-EME) countries despite the acute shortage of dentists in these countries. In view of the short supply of dentists and considering the importance of oral health surveys in oral healthcare delivery, dental nurses in Anguilla were requested to take on additional responsibilities of conducting oral health surveys. The dual responsibilities of oral healthcare delivery and oral health survey examination, involve caries diagnosis and clinical management. It is therefore appropriate to determine the conformity of caries diagnosis of these dental nurses with that of the dentist and among themselves as well as their diagnostic consistency. The conformity of caries diagnosis to the benchmark examiner (BE) and consistency between examiners were therefore assessed prior to the survey.

It is expected that diagnostic decision-making would be influenced by the differences in professional training and experience of dental nurses. The duties and responsibilities are identical and shared, whatever the type, method, location and time of professional training as well as practice experience was different for each dental nurse. The dental assistants (recorders) were trained on-the-job independently at various times and for varying durations by different dental nurses and dentists. Diagnostic accuracy and reliability are also influenced by caries prevalence. The caries prevalence in Anguilla is 56.4% and mean DMFT scores at age 6, 12 and 15 years are 0.16 ± 2.41, 2.29 ± 2.71 and 3.29 ± 2.86 respectively (Adewakun, 1997). The prevalence of Early Childhood Caries for children aged 6 years is 50% (Adewakun and Beltran, 2003).

The aims of this study therefore were to determine the validity and reliability of caries assessments among dental nurses; and to determine if the levels attained were comparable to those reported for dentists.

MATERIALS AND METHODS

Training

Six weeks prior to the survey, the protocol outlining the purpose and significance of the exercise as well as the respective roles, duties and responsibilities of the examiners and recorders were sent to the dental nurses through the Chief Dental Officer (CDO). Diagnostic guidelines, scoring criteria, examination procedure, tooth eruption sequence, tooth numbering system and color-coded sample survey forms were also included. The CDO obtained the necessary authorization and approvals. Dental nurses were responsible for disseminating pertinent information to all the schools and obtaining written informed consent from parents and guardians of the children. Dental nurses and assistants operating as examiner-recorder pairs (ERP) were requested to review the diagnostic and scoring criteria. Following this, each ERP assessed a minimum of twenty randomly selected patients aged 9, 14 and 17 years during the acclimation period in the absence of, and without the supervision of the BE.

The BE, who is a dentist, was calibrated nine months before the survey using the same diagnostic criteria on a similar age-group in another Caribbean country. To maintain the gold standard, the BE was re-calibrated two weeks prior to the survey using randomly selected standard slides of teeth with various carious lesions.

The four-day training exercise was conducted by the BE in the week preceding the survey and included tooth morphology, WHO/FDI numbering system, identification of carious lesions and the evaluation of caries status. The diagnostic principles underlying the modified WHO assessment criteria were explained to the examiners and recorders simultaneously. The assignment of each tooth and surface to one of six mutually exclusive caries status cate-

gories based on a hierarchical system was emphasized.

Thirty standard calibration slides pre-selected from those used to re-calibrate the BE were used in training. Subsequently, the primary, mixed and permanent dentition of ten children aged 5, 10 and 16 years were assessed twice by each examiner under the supervision of the BE. Discussions and debriefing sessions were conducted with the ERP in order to clarify the interpretation and application of diagnostic and scoring criteria. Although every diagnosis of a non-cavitated or hypoplastic lesion was cross-checked by the BE during training, these aspects were excluded from the calibration exercise due to the relative unfamiliarity with these lesions. The ERP were each assigned a code which was retained for the duration of the survey.

Examination Procedure

The children lay supine on long tables covered with crepe sheeting. A visual-tactile examination of all teeth was conducted using natural light and without drying. The examination environment, procedure and sequence employed during training and calibration was maintained throughout the survey. Face masks, disposable latex gloves and pre-packed sterile examination sets were used for each child.

Diagnostic and Scoring Criteria

Caries was diagnosed at the level of dentin using the modified WHO assessment criteria (Beltran et al, 1997). Assessment was based on a hierarchical principle that assigned each tooth (and surface) to one of six mutually exclusive categories – sound, decayed, restored, missing due to caries, missing due to other reasons or absent (unerupted). The rule of thumb was to record a tooth as sound when the caries status was doubtful. Decay was the overriding diagnosis when present with any other lesion on a tooth or surface. For each child, diagnostic consistency and conformity were assessed for sound, decayed and restored teeth and surfaces.

Calibration

Calibration was conducted two days before the survey using two methods. (1) T_0 – extracted teeth embedded in four plaster casts labeled A to D, each consisting of 20 primary and permanent teeth of varying caries status arranged in random order. These were independently assessed once by each examiner and compared with the pre-coded standard for each cast by the BE. (2) C_0 – twenty children aged 7, 11 and 14 years with various carious lesions were examined twice by each ERP in random order. Each child was assigned an identification number and examined in cycles. Both the ERP and the BE were blind to the selection process and examination sequence. Color-coded forms used by each examiner were collected by an independent non-participant observer (NPO) as each child emerged from the examination area.

Survey (D_1 and D_2)

Two groups each comprising twenty-three children respectively aged 6, 12 and 15 years were randomly selected for examination by the non-participant observer (NPO). The first group was examined at the end of the first week of the survey (D_1), and the second group was examined at the end of the second week (D_2). All children were examined once by the BE and once by each ERP on the same day after the survey. The duplicate examination form was collected by the NPO after each examination, matched with the original survey form, coded and stapled in batches of seven i.e. survey and duplicate for each examiner and one BE form. A total of 466 examinations were conducted based on the total number of times the children were examined – T_0 (4), C_0 (140), D_1 (161) and D_2 (161).

Analysis of Data

The caries status recorded for each tooth type (primary and secondary) and each surface by each ERP and the BE for each child at T_0, C_0, D_1 and D_2 were statistically analyzed using SPSS statistical software. Diagnostic conformity (with and without the BE) and consistency determined at T_0, C_0, D_1 and D_2 were determined at the level of subject (SB), tooth (TH) and surface (SF). Interexaminer and intraexaminer agreement for sound, decayed and filled teeth and surfaces were generated for both calibration methods and for each survey phase.

Table 1 Diagnostic conformity with BE for subject, tooth and surfaces

Survey Phase	Examiners	Kappa scores (asymptomatic Standard Error)		
		SB	TH	SF
T_0	1	.906 (.021)	.836 (.071)	.935 (.026)
	2	.847 (.026)	.770 (.083)	.881 (.035)
	3	.880 (.023)	.839 (.070)	.911 (.031)
C_0	1	.948	.919 (.018)	.946
	2	.943 (.005)	.895 (.020)	.943 (.008)
	3	.951	.926 (.017)	.941
D_1	1	.986 (.003)	.964 (.014)	.977 (.007)
	2	.989 (.003)	.976 (.012)	.981 (.007)
	3	.979 (.004)	.947 (.018)	.968 (.009)
D_2	1	.993		
	2	.993 (.002)	.985 (.008)	.993 (.002)
	3	.992		

RESULTS

Nomenclature

The calibration methods are T_0, and C_0. Survey phases are D_1 and D_2. Assessed elements are SB, TH and SF.

Diagnostic Conformity

Based on WHO criteria for agreement levels (Eklund et al, 1993), diagnostic conformity (with and without the BE) for all examiners was substantial at T_0 and almost perfect at C_0, D_1 and D_2 and improved as the survey progressed (Tables 1 and 2). Diagnostic accuracy was lowest for TH (.895-.964) at all survey phases (Tables 1 and 3). Identical levels of accuracy and almost perfect agreement were obtained by all examiners for all sound, decayed and filled TH (.985), SF (.993), all mesial (.992) and occlusal SF's (.984) at D_2 and all buccal SF's (.985) at D_1 (Tables 1 and 2). A Kappa score of 1.0 was obtained by all examiners for all sound, decayed, and filled lingual and buccal SF at D_1 and D_2 respectively (Table 2). Perfect agreement also occurred between two examiners and the BE for distal SF's at T_0, D_1, and D_2, between one examiner and the BE for all buccal and lingual SF's at T_0, and all distal SF's at C_0 (Table 2).

Diagnostic accuracy was highest and most consistent for distal surfaces with perfect agreement occurring between at least one examiner and the BE in every survey phase (Table 2). For SF, diagnostic conformity (with and without BE) was highest at T_0 and increased as the survey progressed while that for SB was highest at C_0 and D_1 (Tables 1 and 3). Marginally higher levels of conformity were obtained for SB, TH and SF at D_1 and D_2 without the BE (Tables 3 and 4). This trend and pattern of distribution was also maintained for individual SF. At D_2, perfect agreement (1.0) between all examiners was obtained for all sound, decayed and filled TH and between two examiners for SF (.999) at D_2 (Table 3). Identical and perfect agreement was obtained for all sound, decayed and filled mesial, occlusal, buccal and lingual SF at D_2 and for buccal and lingual SF at D_1 (Table 4).

The magnitude of variation in diagnostic conformity was derived by calculating the difference between the Kappa scores of the most and least accurate examiner for each calibration method, each survey phase and across the assessed elements in Tables 1 to 4. That for consistency was determined

Table 2 Diagnostic conformity with BE for individual tooth surfaces

Survey Phase	Examiners	Kappa Scores (Asymptomatic standard Error)				
		mesial	occlusal	Distal	Buccal	lingual
T_0	1	.907 (.065)	.926 (.051)	.902 (.068)	1.0	1.0
	2	.863 (.077)	.857 (.069)	1.0	.796 (.114)	.658 (.318)
	3	.907 (.065)	.888 (.063)	1.0	.858 (.098)	.658 (.318)
C_0	1	.961 (.016)	.930 (.018)	1.0	.893 (.025)	.953 (.017)
	2	.980 (.011)	.921 (.019)	.974 (.013)	.914 (.023)	.932 (.021)
	3	.967 (.015)	.944 (.016)	.932 (.020)	.921 (.022)	.940 (.020)
D_1	1	.955 (.026)	.961 (.016)	1.0		
	2	.956 (.025)	.973 (.013)	1.0	.985 (.015)	1.0
	3	.955 (.026)	.948 (.018)	.974 (.018)		
D_2	1			1.0		
	2	.992 (.008)	.984 (.009)	1.0	1.0	.991 (.009)
	3			.992 (.008)		

Table 3 Diagnostic conformity (without BE) among the dental nurses for subject, tooth and surfaces

Survey Phase	Examiner pairs	Kappa scores (asymptomatic Standard Error)		
		SB	TH	SF
T_0	1–2	.848 (.026)	.736 (.089)	.881 (.035)
	1–3	.856 (.025)	.742 (.086)	.888 (.035)
	2–3	.915 (.020)	.871 (.062)	.945 (.025)
C_0	1–2	.945 (.005)	.912 (.018)	.938 (.009)
	1–3	.952 (.005)	.927 (.017)	.936 (.009)
	2–3	.962 (.004)	.951 (.014)	.952 (.007)
D_1	1–2	.995 (.002)	.988 (.008)	.991 (.005)
	1–3	.988 (.003)	.971 (.013)	.982 (.006)
	2–3	.989 (.003)	.971 (.013)	.982 (.082)
D_2	1–2	.999		1.0
	1–3	.998 (.001)	1.0	.999 (.001)
	2–3	.999		.999 (.001)

by comparing the least and most reliable across the survey phases and for the assessed elements. The magnitude of variation was highest between the two calibration methods and least between D_1 and D_2 (Table 5). The magnitude of variation was greatest for TH and least for SF. The least variation in diagnostic conformity with the BE occurred for TH between C_0 and D_1, while that without the BE occurred for SF and SB between C_0 and D_1, and between D_1 and D_2 respectively (calculation derived from Tables 1 and 3). Magnitude of variation for consistency was much lower than that for conformity.

Table 4 Diagnostic conformity (without BE) among the dental nurses at individual surfaces level

Survey phase	Examiner pair	Kappa Score (asymptomatic Standard Error)				
		mesial	occlusal	Distal	buccal	lingual
T_0	1–2	.952 (.047)	.860 (.068)	.902 (.068)	.858 (.098)	.658 (.318)
	1–3	1.0	.818 (.079)		.796 (.114)	.658 (.318)
	2–3	.952 (.047)	.894 (.060)	1.0	.925 (.075)	1.0
C_0	1–2	.953 (.017)	.919 (.019)	.974 (.013)	.909 (.024)	.939 (.020)
	1–3	.953 (.018)	.933 (.017)	.932 (.020)	.929 (.021)	.934 (.021)
	2–3	.960 (.016)	.969 (.012)		.966 (.015)	.926 (.022)
D_1	1–2	.969	.987 (.009)	1.0		
	1–3	.968 (.022)	.975 (.013)	.974 (.018)	1.0	1.0
	2–3	.969	.974 (.013)			
D_2	1–2			1.0		
	1–3	1.0	1.0	.992 (.008)	1.0	1.0
	2–3					

Table 5 Variation in degree of conformity across survey phases (with and without BE)

Survey Phase	Assessed elements					
	SB		TH		SF	
	w/Pl.	w/out Pl.	w/Pl.	w/out Pl.	w/Pl.	w/out Pl.
T_0	.026	.067	.169	.165	.054	.064
C_0	.008	.017	.031	.039	.005	.016
D_1	.010	.007	.029	.017	.009	.009
D_2	.001	.001	0	0	0	.001

Diagnostic Consistency

In contrast to the trend for accuracy, the ranges for reliability levels were slightly narrower at C_0 than at D_1 with perfect reliability for all examiners and assessed elements at D_2 (Tables 6 and 7). The margin of variation for diagnostic consistency was much lower than that for diagnostic conformity; however, the trend and pattern of distribution were similar.

DISCUSSION

The World Health Organization has established criteria for ranking interexaminer and intraexaminer agreement, based on the Kappa score which is a function of both overall agreement and the distribution of the characteristic (Eklund et al, 1993). The results of this study show almost perfect agreement in caries diagnoses between dental nurses and the BE (dentist) as well as between themselves. This finding is consistent with reports of previous studies conducted in established market economy countries. Generally, studies have reported high and comparable levels of diagnostic consistency and conformity between dental hygienists and therapists on the one hand, and dentists on the other (Beltran et al, 1997; Kwan and Prendergast, 1998; Disney et al, 1992; Mauriello et al, 1990; Kwan et al, 1996). Agreement levels for surveys using professionals complementary to dentist

Table 6 Diagnostic consistency of the dental nurses for subject, tooth and surfaces

Survey phase	Examiners	Kappa Score (Asymptomatic Standard Error)		
		SB	TH	SF
C_0	1	.998 (.001)	.996 (.004)	.999 (.001)
	2	.984 (.003)	.972 (.011)	.982 (.005)
	3	.987 (.003)	.979 (.009)	.983 (.004)
D_1	1	.994 (.002)	.994 (.006)	.989 (.005)
	2	.996 (.002)		.988 (.005)
	3	.991 (.002)	.977 (.012)	.986 (.006)
D_2	1			
	2	1.0	1.0	1.0
	3			

Table 7 Diagnostic consistency of the dental nurses at individual surfaces

Survey phase	Examiners	Kappa Score				
		mesial	occlusal	Distal	Buccal	Lingual
C_0	1	1.0	1.0	1.0	.994 (.006)	1.0
	2	.987 (.009)	.978 (.010)	.987 (.009)	.979 (.012)	.979 (.012)
	3	.993 (.007)	.982 (.009)	.994 (.006)	.980 (.012)	.967 (.015)
D_1	1	.984 (.016)	.994 (.006)	.974 (.019)	.986 (.014)	1.0
	2	.985 (.015)	.993 (.007)	.987 (.013)	.985 (.015)	.984 (.016)
	3	1.0	.981 (.011)	.962 (.022)	1.0	1.0
D_2	1					
	2	1.0	1.0	1.0	1.0	1.0
	3					

as examiners are yet to be reported in non-established or developing market economy countries. A survey of preschool children in the US Virgin Islands (a non-established market economy country), reported comparable levels of agreement between dentists and hygienists, however, much lower agreement levels were recorded between dentists and dental nurses (Katz et al, 1992). One US study reported poor accuracy for a dental hygienist (Hawley et al, 1999). Between 85% to 100% intraexaminer agreement between a registered nurse and a dental hygienist as well as high Kappa scores (0.7 – 0.93) have also been documented in the US (Beltran et al, 1997). A UK study found no differences in performance between dentist and auxiliaries (hygienists and therapists) jointly trained and calibrated to screen 5-year-old children (Kwan and Prendergast, 1998). The benefits of reduced time and costs were highlighted when dental auxiliaries screened US children for caries without any loss of precision (Disney et al, 1992). Good and comparable agreement between screener-hygienist and dentist-examiner was reported in a US prevalence study (Mauriello et al, 1990).

The accurate estimation of caries prevalence and severity has significant implications for human, material and financial resource allocation, type and extent of caries-preventive intervention, and oral

health policy formulation. Reliability assessments are integral to the accurate interpretation and valid comparison of survey results and should therefore be routinely documented. In countries and communities with a high caries prevalence and severity, it is important that the maximum number of true positives and minimum number of false negative cases in a randomly selected and representative population are correctly diagnosed.

Surveys are not an end in themselves but part of a process involved in achieving the dual public health goals of reducing the proportion of population requiring treatment as well as the amount of disease to be treated in these populations. The achievement of these goals depends to a large extent on the accurate and reliable assessment of caries status and the correct and timely identification of persons with, and at risk of developing caries. While the objective of epidemiology is not to provide treatment, it nevertheless supports the delivery of care by helping to increase efficiency and effectiveness.

The degree of diagnostic accuracy and reliability depends on the level at which caries is diagnosed, the manner in which diagnostic and scoring criteria are interpreted by examiners, the manner and extent of participation in the training process by recorders, and the accuracy of data recorded at the time of examination. The level of interest, perceived importance of the exercise by both examiners and recorders, and the extent of their involvement in the proposed intervention can also influence the diagnostic accuracy and reliability. Furthermore, accuracy and reliability are influenced by overarching treatment philosophy, training method, experience, practice activity and clinical preferences developed by individual examiners over time.

This study analyzed interexaminer and intraexaminer agreement for subject, tooth and surfaces. Analysis of agreement at the SF level is important because the misdiagnosis of several surfaces may not alter the caries status of a single tooth (unless the surfaces are all sound, all decayed or all filled) or an individual subject (unless the teeth are all sound, all decayed or all filled). The misdiagnosis of a single tooth, however, can alter the caries status of a single subject and thereby the prevalence and severity of the entire population if the error is consistent. This point is illustrated by the consistent and almost perfect agreement levels obtained for surfaces in all the survey phases. Although almost perfect agreement was obtained for the other assessed elements, the ranges of agreement were less consistent and narrower for TH and narrowest for SB. For individual surfaces, the range of agreement for occlusal surfaces was slightly lower at C_0 compared with the other surfaces and the lowest agreement was recorded for occlusal surfaces at D_2. The degree of conformity (with and without BE) and consistency followed a pattern in which SF, TH and SB followed a descending order of agreement. It is suggested that this pattern partly reflects the prevalence of carious lesions in individual tooth surfaces. The perfect agreement obtained for the lingual, buccal and distal lesions also reflect the relatively low prevalence of carious lesions on the respective surfaces. The agreement levels were consistent and the ranges between each examiner and the BE in each phase were similar for the different elements assessed. This suggests a common perception and understanding of the diagnostic criteria and their application by the dental nurses.

The T_0 (extracted teeth) method of the calibration was introduced in order to provide an indication of conformity for professionals complementary to dentistry who are not usually involved in oral health surveys. Dental nurses in Anguilla had an appreciation of the significance of accurate interpretation of the diagnostic and scoring criteria. Overall, the high levels of reliability and strong agreement are attributed to the pre-survey exposure of both examiners and recorders to the diagnostic and scoring criteria. It is suggested that the population size, the fact that the dental nurses work in close proximity and routinely examine primary school children as part of their responsibilities also contributed to the high levels of agreement. Familiarity with the process may also have contributed to the consistently high levels of accuracy and reliability. In addition, the involvement of both examiners and recorders in all aspects of the survey (planning to execution) played a significant role in achieving high levels of reliability and agreement.

The practice experience, type, time and duration of professional training received by dental nurses did not appear to influence diagnostic conformity and consistency. The recorders were accurate and consistent in spite of the considerable variation in type, duration, time and amount of on-the-job training received from various dental professionals. The levels reported in this study were attributed to the training approach rather than independent clinical judgment or training institution attended by the dental nurses. It is possible for dental nurses to at-

tain high levels of agreement and reliability provided training is all-inclusive, of a realistic duration and both examiners and recorders are involved in all aspects of the survey, i.e. planning, organization, co-ordination and implementation. In this survey, all three nurses in Anguilla were examiners; in larger countries with more dental nurses, the training period should be used to determine not only the ERP that conform most but also those who conform most to the BE. It is recommended that if agreement levels remain low at calibration, the areas of discrepancy should be reviewed and a recalibration conducted until substantial or almost perfect agreement levels are attained and reproduced.

This is the first study documenting levels of diagnostic accuracy and reliability among dental nurses in a Caribbean country. Consistent with several reports (Beltran et al, 1997; Kwan and Prendergast, 1998; Disney et al, 1992; Mauriello et al, 1990; Kwan et al, 1996), this study suggests that the use of dental nurses is cost-effective, reliable and valid. Non-established or developing market economy countries with similar oral healthcare delivery systems should consider adopting this approach when conducting surveys. It is hoped that such government dental departments will be encouraged to employ more dental nurses or equivalent designations to conduct both child and adult oral health surveys since they are responsible for the routine examination and care of children with primary, mixed and permanent dentition. It is further suggested that the legislation and job descriptions should be revised so as to provide the formal ambit within which surveys can be conducted.

CONCLUSIONS

Substantial and almost perfect agreement levels of conformity (with and without BE) and consistency were attained and maintained by the dental nurses in spite of the differences in method, location and time of professional training as well as practice experience. The agreement levels reported in this study are attributed to the training process and approach rather than the experience of the dental nurses. It is possible for professionals complementary to dentistry in countries with developing and non-established market economy countries to attain high levels of accuracy and reliability in caries diagnoses provided training is all-inclusive, of a realistic duration and both examiners and recorders are involved in all aspects of the survey. It is recommended that examiners should be allowed to select recorders that they feel most comfortable to work with rather than pre-assigning examiner-recorder pairs based on experience, qualifications and type of training. Dental nurses in Anguilla can be employed as examiners in future national child oral health surveys following the provision of adequate and appropriate training and calibration.

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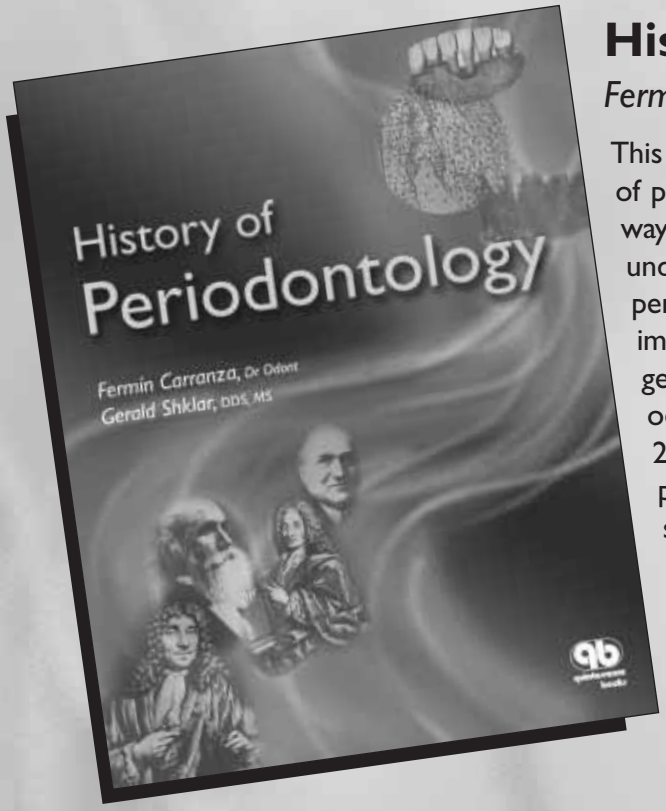

History of Periodontology

Fermín Carranza and Gerald Shklar

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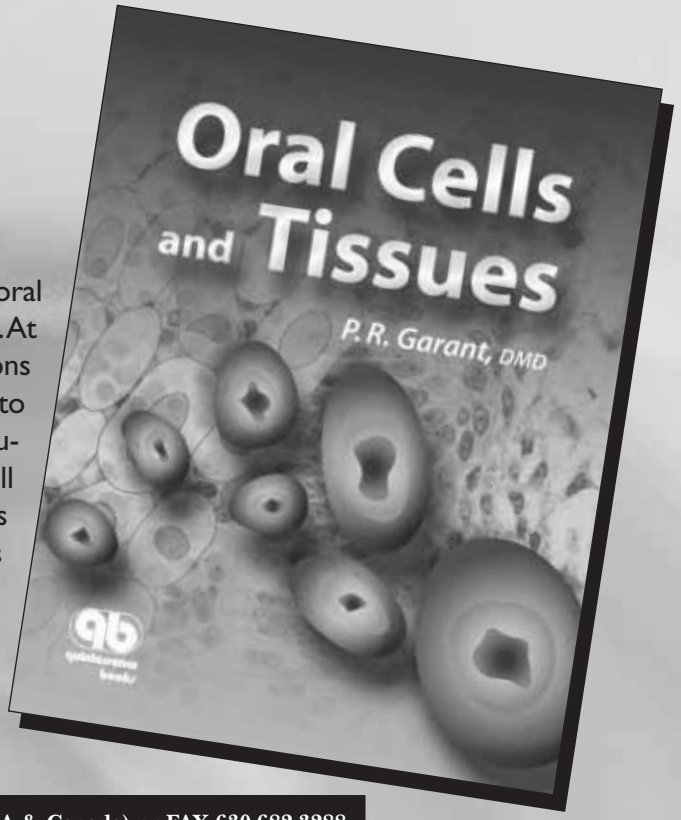

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