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Periodontal Diagnosis Affected by Variation in Terminology

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Abstract

Background—The randomized case presentation (RCP) study is designed to assess the degree of diagnostic accuracy for described periodontal cases. This is to lay the basis for practitioner calibration in the Practitioners Engaged in Applied Research and Learning (PEARL) Network for future clinical studies.

Methods—The RCP consisted of 10 case scenarios ranging from periodontal health to gingivitis and mild, moderate, and severe periodontitis. Respondents were asked to diagnose the described cases. Survey diagnoses were compared to two existing classifications of periodontal disease status. The RCP was administered via a proprietary electronic data capture system maintained by the PEARL Data Coordinating Center. Standard analytic techniques, including frequency counts and cross-tabulations, were used for categorical data with mean and standard deviation and median values reported for continuous data elements.

Results—Demonstrable variations in periodontal assessment for health, gingivitis, and mild, moderate, and severe periodontitis were found among the 130 PEARL general practitioners who participated in the RCP survey. The highest agreement for diagnosis among dentists was for

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severe periodontitis (88%) and the lowest for gingivitis (55%). The highest percentage of variation was found in cases with health and gingivitis.

Conclusions—There was variation among PEARL practitioners in periodontal diagnosis that may affect treatment outcomes. Our findings add clinical support to recent publications suggesting a need for standardization of terminology in periodontitis diagnosis.

Keywords

Dental dictionary; dental records; dental research; *International Classification of Disease Codes*; periodontal diseases; terminology

The Practitioners Engaged in Applied Research and Learning (PEARL) Network is a practice-based research network (PBRN) supported by the National Institute of Dental and Craniofacial Research and the National Institutes of Health (NIDCR/NIH). PEARL Network dentists are termed practitioner-investigators (P-Is), who conduct practice-based research pertaining to clinical issues of everyday practice for the purpose of improving patient care. Currently, the PEARL Network has a registry of >300 P-Is throughout the continental United States. The clinical portfolio of studies includes surveys, observational, retrospective, prospective, randomized clinical studies (RCSs), randomized case presentations (RCPs), and randomized clinical trials, depending on the stage of clinical development of a product and if it were to undergo regulatory approval. RCSs are reserved for standard of care studies. The PEARL Network findings contribute to the concept of evidence-based dentistry related to treatment outcomes.[1–3] The survey is, to the best of the authors' knowledge, the first periodontal disease-related study conducted in a PBRN.

Savage et al.[4] suggests evidence of variation in the diagnosis of periodontitis and lack of consensus definitions of periodontal disease states. Treatment of periodontitis may be instrumental in reducing adverse health outcomes.[5] Periodontal diseases are common, with literature reporting prevalence as high as 90%,[6] and are a significant cause of tooth loss.[7–11] The variation in definitions of periodontal diseases may have an impact on the reported prevalence of periodontitis in the US population.[12,13] There are numerous sources suggesting criteria for defining a diagnosis of periodontitis.[14–24] Differences in periodontitis definitions and lack of commonality may impact periodontal research, including determining the prevalence and extent of periodontitis.[25] A problem in periodontitis diagnosis is the lack of a single consensus document which contains all the information needed to form a diagnosis. Hence, a "gold standard" for diagnosis of periodontitis is lacking. There are >15 definitions for periodontitis in the literature.[4] The current article considers definitions used to define the most common forms of periodontitis from: 1) the American Academy of Periodontology (AAP) position paper and parameters of care[10] (Table 1),[21–23] 2) the periodontal treatment protocol[10] (Table 1),[19] 3) the Centers for Disease Control (CDC)-AAP case definitions for surveillance of periodontitis (Table 2),[15] and 4) the criteria for randomized case presentation (RCP) (Table 3).[10]

The historical reason for this variation of a periodontal diagnosis is based on the coding of dental procedures for reimbursement purposes. The delivery of dental care is translated from treatment to procedure codes. The Health Insurance Portability and Accountability Act of

1996 (HIPAA)[26] set into law the use of procedure codes exemplified by *Current Dental Terminology* (CDT) published by the American Dental Association.[27] HIPAA legislation excluded dentistry from the requirement to document diagnosis codes[26,28] but mandated the use of diagnosis codes in medicine. Every oral health diagnosis for a hospital or medical encounter is made using the International Classification of Disease (ICD), which is mandated for use in medicine in the United States (Table 4). The codes originate from the World Health Organization, and ICD-9-CM (which will be soon replaced by ICD-10) is published by the Center for Medicaid and Medicare Services.[29–32] Dentistry currently has a disconnect between procedure codes (CDT) and diagnosis codes (ICD), which only confounds the issue of terminology.

The AAP classification system describes eight categories of disease,[17] which differs from the ICD-9-CM coding system that has nine categories, and only three categories overlap: "gingivitis, chronic periodontitis (CP), and aggressive periodontitis"[33] (Table 4). The noted differences between the AAP and the ICD systems include different terminology to describe oral health, as well as definitions that incorporate certain risk factors. For example, the ICD system uses the risk factor "accretions on teeth" (calculus), and the AAP system uses the risk factor "periodontitis as a manifestation of systemic diseases" (medical health conditions). Table 4 is a review of the discrepancies between the systems. The primary aim of this RCP study is to assess the practitioners' diagnosis of health; gingivitis; and mild, moderate, and severe periodontitis. The study is designed to assess the degree of diagnostic accuracy for described periodontal cases. This was to lay the basis for practitioner calibration in the network for future clinical studies.

MATERIALS AND METHODS

An RCP series that included 10 different periodontal cases (see supplementary Appendix 1 in the online *Journal of Periodontology*) was created to assess the general practitioner's periodontal diagnosis acumen in describing a case study. Upon accessing the protocol in a web-based proprietary electronic data capture system, maintained by the EMMES Corporation (Rockville, Maryland), a randomly selected order and sequence of five scenarios was pulled from a preloaded randomization table and assigned to the user. The order and sequence informed the system of the five scenarios to be presented, and the order in which to present them. There was no opportunity for users to access scenarios to which they were not randomized. The PEARL Network developed the cases based on the literature[10] (Table 3) in consultation with Board-certified periodontists and reviewed by the NIDCR/NIH appointed Protocol Review Committee. Standard information for each case included probing depth (PD), bleeding on probing (BOP), bone loss, furcation involvement, mobility, clinical attachment loss (AL), and presence of inflammation. For each case, the participant was asked to select the diagnosis from periodontal health; gingivitis; mild, moderate, and severe periodontitis; or referral to a specialist for the diagnosis. For the purpose of the RCP study, the terms early, mild, and slight periodontitis are used interchangeably to describe the least severe form of periodontitis. Additionally, survey questions were developed to ascertain the information used to form a diagnosis and recommended treatment. Criteria used in diagnosis included: 1) probing results; 2) gingival inflammation; and 3) presence of calculus or plaque. Options for treatment

recommendations included: 1) oral hygiene instruction; 2) scaling; 3) full-mouth polishing; 4) mouth rinses; 5) root planing; 6) antibiotics; 7) surgery; 8) occlusal adjustment; or 9) host response modification. The survey was administered via a proprietary electronic data capture system†† maintained by PEARL's Data Coordinating Center. Descriptive statistics are presented, including frequencies and percentages for categorical variables and mean, median, standard deviation (SD), and minimum and maximum for continuous variables. The authors of the present study define PD and AL for the comparison criteria (Table 1) as applied to the RCP for the worst site. The classification system described by Armitage correlates more specifically with AL as 1 to 2 mm for slight periodontitis and 3 to 4 mm for moderate periodontitis.[17] The study used the comparison criteria (Table 1) to diagnose the RCP outcomes. The issue of classification and periodontal terminology was noted in the analysis phase of the study. Tables 1, 2, and 3 describe some of the most common terms of periodontal disease available to clinicians. CDC/AAP definitions[15] were not used in private practice as they were developed for epidemiologic studies. It should also be noted that the AAP diagnosis from the parameters of care[22,23] and position statement[21] does not distinguish between mild and moderate periodontitis (Table 1). In addition, CDC/AAP definitions are too new to have been used in this study. This study follows PEARL standard operating procedures and is conducted in accordance with good clinical practice guidelines and Institutional Review Board approval by the New York University School of Medicine.

RESULTS

A total of 132 PEARL practitioners participated in the study survey. Two of the practitioners were excluded from analyses because they were not general dentists. Data were reported on the responses of 130 general dentists. Demographics of the PEARL Network (Table 5) demonstrate a representative distribution of dentists in age, sex, race, ethnicity, practice location, and number of active patients. The average age of a PEARL P-I in the study was 53 years. When excluding referral to a specialist for diagnosis, the distribution of responses (Table 6) for the 10 patient case scenarios was Case A (65), Case B (64), Case C (66), Case D (66), Case E (63), Case F (57), Case G (61), Case H (52), Case I (52), and Case J (54). Table 7 describes the correct diagnosis based on the criteria (Table 1) to interpret each case. Using Case A as an example, 57% assigned a diagnosis of health in agreement with the AAP definition (Tables 6 and 7). Dentists exhibited variation in agreement with an interpretation of the RCP ranging from 55% for Case B "gingivitis" to 88% for Case I "severe periodontitis" (Table 6). The diagnosis appears to be dependent on the definition applied (respondents did not apply the same definitions to survey cases illustrating the variation of terminology affecting periodontal diagnosis and is further mentioned in the discussion section).

Table 8 suggests that dentists are more likely to refer to a specialist for the more severe cases. PEARL P-Is responded to cases by referring to a specialist for diagnosis 0% and 1% for mild periodontitis (Cases C and D, respectively), 0%, 8%, and 6% for moderate periodontitis (Cases E, F, and G, respectively), and 15%, 19%, and 21% for severe periodontitis (Cases H, I, and J, respectively).

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DISCUSSION

The authors have identified disparate classifications described in Tables 1 and 2 to illustrate the issues of varying definitions of periodontitis and terminology. The first classification comes from the AAP Parameters of Care,[21–23] the second was used to support clinical outcomes for a marketed oral care product for the treatment of CP,[19] and the third definition[15] was developed for epidemiologic research. Table 3 shows the criteria used for the RCP development.

The findings suggest that the lack of consensus in the definitions of periodontitis may have contributed to the variation in diagnosis by the practitioners. Individual clinical outcome parameters, such as PD, BOP, AL, and others, provide the basis to assess classification systems for oral health and periodontitis, and they provide the basis to improve diagnosis accuracy. One common element to link the systems should be primarily directed toward measuring disease outcomes that can be translated and interpreted by multiple users to improve health. A consensus for periodontal terminology may benefit the use of electronic health records by establishing a foundation for studies and the future of evidence-based dentistry.

From Tables 6 and 7, it was concluded that a periodontal diagnosis is dependent on the benchmark reference used by a practitioner and his or her interpretation of the reference. The present study suggests that the lack of consensus criteria (Table 1) that precisely describes a specific periodontal diagnosis may have contributed to the variation in diagnosis. Based on the authors' observations, it is recommended that future studies take into consideration the variation in periodontal diagnosis including the terminology used by clinicians to describe periodontitis when conducting comparative effectiveness research with the objective of identifying the most beneficial treatments for a specific periodontal diagnosis. Ideally, dentistry would have a consensus of terminology with precise correlation of clinical conditions for a specific periodontal diagnosis.

Table 8 suggests that severity of periodontitis is a criterion used by dentists to refer, which is consistent with Cobb et al.[34] However, presenting the information in this manner implies that severity of periodontitis is the sole criterion. This may or may not be true and warrants further study. This issue is important because other factors such as risk and other criteria have been suggested for referral.[35]

Although the present study showed that practitioners' agreement of a periodontal diagnosis was good only for severe periodontitis, this could mean that some patients with periodontitis of less severity are not accurately diagnosed and, as a consequence, are over- or undertreated.

The RCP is designed for internet-based delivery and is not without limitations. Based on the progression of chronic adult periodontitis, the RCP describes periodontal health; gingivitis; mild, moderate, and severe periodontitis. In some instances, the RCP describes clinical cases that require clear interpretation of terminology. The survey is intended to focus on clinical information used by practitioners to establish the diagnosis. Further, the survey instrument allows providers to select "refer to a specialist" rather than require a diagnosis.

The study identifies multiple terms currently used to describe periodontal disease. Tables 1 through 3 describe the commonly accepted definitions, and Table 4 describes two periodontal disease classification systems, which were developed for different purposes, but neither of which is aimed at disease status. Variation in terminology supports the gross description of a condition rather than applying a classification that can monitor disease progress positively or negatively. This masks the fundamental issue described in this article; that is, the lack of an agreed-upon system of terminology to measure disease status and improve diagnosis. Future studies should take into consideration the systems of classification that exist in dentistry and consider the variation in definitions to improve dentists' patient-centered diagnosis of periodontitis. This variation becomes important when conducting comparative effectiveness research with the objective of identifying the most beneficial treatments.

CONCLUSIONS

Further study is needed to better comprehend the relationship among the variables that make up a diagnosis of periodontitis. In the current study, the poorest agreement was found when distinguishing health and gingivitis and the best for severe periodontitis. The PEARL Network findings of a 33 percentage point difference in diagnosis supports the literature's call for standardized terminology for diagnosing dental diseases.[4,32] A consensus of standardized terms related to periodontal health states, risk assessment, and diagnosis codes may improve the practitioner's ability to diagnose periodontitis and may provide cost savings to the patient and the nation. If a patient is treated for periodontitis when he or she merely has gingivitis, this may have significant costs associated with it. Alternatively, if a patient is treated for gingivitis when he or she has periodontitis, this may be associated with adverse oral health outcomes. Consensus of standardized terminology to increase diagnosis accuracy may have potential health benefits and potential cost savings.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Criteria Used to Define the Most Common Forms of Periodontal Diseases

	PD	BOP	Radiographic Bone Loss	Mobility	Furcations	AL
AAP position paper and parameters of care[21–23]						
Health		No	No loss			No loss
Gingivitis		Yes	No loss			No loss
Slight periodontitis*	<6 mm	Yes	May be observed	May exist	If present, up to Grade I	<4 mm
Moderate periodontitis†	<6 mm	Yes	May be observed	May exist	If present, up to Grade I	<4 mm
Severe periodontitis	>6 mm	Yes	Apparent	May exist	If present, > Grade I	>4 mm
Periodontal treatment protocol[19]						
Health	≤3 mm	No	None	None	None	None
Gingivitis	≤4 mm	Yes	None	None	None	None
Slight periodontitis	4 to 5 mm	Yes	≤10%	None	≤ Grade I	1 to 2 mm
Moderate periodontitis	5 to 6 mm	Yes	≤33%	≤ Grade II	≤ Grade II	3 to 4 mm
Severe periodontitis	≥6 mm	Yes	≥33%	≤ Grade III	≤ Grade IV	≥5 mm

*Slight as used here is synonymous with mild.

†AAP definition of moderate periodontitis includes slight-to-moderate periodontitis.

Table 2

CDC/AAP Case Definitions for Surveillance of Periodontitis[15]

Case Type	Definition
No or mild* periodontitis	Neither moderate nor severe periodontitis
Moderate periodontitis	≥2 interproximal sites with AL ≥4 mm (not on same tooth); OR ≥2 interproximal sites with PD ≥5 mm (not on same tooth)
Severe periodontitis	≥2 interproximal sites with AL ≥6 mm (not on same tooth); OR ≥1 interproximal sites with PD ≥5 mm

*"Mild" synonymous with "slight."

Table 3

Criteria for Randomized Case Presentation[10]

Case Type	Definition
No periodontitis	None of the following criteria are met
Mild* periodontitis	≥1 teeth with ≥3 mm PD or ≥1 posterior teeth with grade I furcation involvement
Moderate periodontitis	≥1 teeth with PD≥5 mm or ≥2 teeth having PD≥4 mm or ≥1 posterior teeth with grade I furcation involvement and accompanied with PD ≥3 mm
Advanced* periodontitis	≥2 teeth having PD≥5 mm or ≥4 teeth having PD≥4 mm or ≥1 posterior teeth with grade II furcation involvement

*"Mild" synonymous with "slight," and "advanced" synonymous with "severe."

Table 4

Classification Systems for Periodontal Diseases

AAP Classification[17,21–23]	ICD-9-CM[29,31]	Summary of the Inconsistencies in Terminology
Gingival diseases Defined as "inflammation of the gingiva in the absence of clinical attachment loss."	**Acute gingivitis (523.0)** 523.00 Acute gingivitis, plaque induced acute gingivitis NOS 523.01 Acute gingivitis, non-plaque induced	Differences in terminology include the use of acute and chronic in the ICD-9-CM codes. Gingival disease may include gingivitis.
Dental plaque induced Gingivitis associated with dental plaque only Gingival diseases modified by systemic factors Gingival diseases modified by medications Gingival diseases modified by malnutrition	**Chronic gingivitis (523.1)** Gingivitis (chronic): desquamative hyperplastic simple marginal ulcerative 523.10 Chronic gingivitis, plaque induced; chronic gingivitis NOS; gingivitis NOS 523.11 Chronic gingivitis, non-plaque induced; gingival recession; gingival recession (postinfective) (postoperative)	
Non-plaque induced	**Gingival recession (523.2)** 523.20 Gingival recession, unspecified 523.21 Gingival recession, minimal 523.22 Gingival recession, moderate 523.23 Gingival recession, severe 523.24 Gingival recession, localized 523.25 Gingival recession, generalized	
Chronic periodontitis Severity categories: Slight Moderate Severe	**Chronic periodontitis (523.4)** 523.40 Chronic periodontitis, unspecified 523.41 Chronic periodontitis, localized 523.42 Chronic periodontitis, generalized	Difference in terminology includes the lack of the ability to rank severity of disease in ICD-9-CM, and AAP definitions lack location in terms of localized and generalized. ICD-9-CM Coordination and Maintenance Committee Meeting September 14, 2011, addressed this issue.[33]
Aggressive periodontitis	**Aggressive and acute periodontitis (523.3)** Aggressive and acute periodontitis Acute: pericementitis, pericoronitis 523.30 Aggressive periodontitis, unspecified 523.31 Aggressive periodontitis, localized Periodontal abscess 523.32 Aggressive periodontitis, generalized 523.33 Acute periodontitis	AAP lacks the location option for where disease is present in this condition.
Periodontitis as a manifestation of systemic diseases	—	ICD-9-CM does not currently list this option.
Necrotizing periodontal diseases	—	ICD-9-CM does not currently list this option.
Abscesses of the periodontium	—	ICD-9-CM does not currently list this option.
Periodontitis associated with endodontic lesions	—	ICD-9-CM does not currently list this option.
Developmental or acquired deformities and conditions		ICD-9-CM does not currently list this option.
—	**Periodontosis (523.5)**	The AAP does not currently use this term to describe periodontal disease.
—	**Accretions on teeth (523.6)**	The AAP does not currently list this as a diagnosis.
—	**Other specified periodontal diseases (523.8)**	The AAP does not have this option.
—	**Unspecified gingival and periodontal disease (523.9)**	The AAP does not have this option.

NOS = not otherwise specified.

Table 5

Demographics of the PEARL Network Survey Participants (N = 130)

Respondent Characteristic	Number (%)	Mean (SD)	Median (Min to Max)
Age*		53 (8.7)	54 (32 to 75)
Sex			
Male	90 (69)		
Female	40 (31)		
Race			
White	99 (76)		
Asian	17 (13)		
Black/African American	8 (6)		
Other	6 (5)		
Ethnicity			
Hispanic/Latino	10 (8)		
Not Hispanic/Latino	114 (88)		
Missing	6 (5)		
Practice location			
Suburban	72 (55)		
Urban	42 (32)		
Rural	16 (12)		
Number of active patients†			
<1,000	22 (17)		
1,000 to 1,500	30 (23)		
1,500 to 2,000	27 (21)		
>2,000	50 (39)		
Years in practice		21 (8.5)	23 (1 to 38)

*Age is missing for 10 respondents (n = 120).

†Number of active patients is missing for one respondent (n = 129).

Table 6

Case Diagnosis Selected by Practitioners

Case	n	Health (%)	Gingivitis (%)	Mild Periodontitis (%)	Moderate Periodontitis (%)	Severe Periodontitis (%)
A	65	37 (57)	22 (34)	6 (9)	0	0
B	64	6 (9)	35 (55)	21 (33)	2 (3)	0
C	66	3 (5)	16 (24)	40 (61)	7 (11)	0
D	66	2 (3)	5 (8)	46 (70)	12 (18)	1 (2)
E	63	1 (2)	1 (2)	23 (37)	37 (59)	1 (2)
F	57	3 (5)	0	17 (30)	35 (61)	2 (4)
G	61	1 (2)	0	10 (16)	43 (70)	7 (11)
H	52	0	0	0	15 (29)	37 (71)
I	52	0	0	0	6 (12)	46 (88)
J	54	0	0	0	7 (13)	47 (87)

P-I responses are listed by the case. n = number of respondents excluding referrals to specialists.

Table 7

Case Diagnosis per Classification System

Case[10]	AAP Parameters of Care and Position Paper[21–23]	Periodontal Treatment Protocol[19]
A	Health	Gingivitis
B	Gingivitis	Slight
C	Slight/moderate	Slight
D	Slight/moderate	Slight
E	Slight/moderate	Moderate
F	Slight/moderate	Moderate
G	Slight/moderate	Moderate
H	Severe	Severe
I	Severe	Severe
J	Severe	Severe

Table 8

Dentists' Choosing to Refer Cases

Diagnosis	Case	n	Number Referring	Referral Rate (%)
Health	A	65	0	0
Gingivitis	B	64	0	0
Mild periodontitis	C	66	0	0
	D	67	1	1
Moderate periodontitis	E	63	0	0
	F	62	5	8
	G	65	4	6
Severe periodontitis	H	61	9	15
	I	64	12	19
	J	68	14	21

Diagnosis = most commonly selected among P-Is for each case; n = number of respondents including referrals to specialists; Number Referring = number of general dentists choosing to refer to specialists.