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Risky business

Utilizing the 2017 AAP/EFP World Workshop to categorize risk of disease progression for periodontal patients

A PEER-REVIEWED ARTICLE | by Mia L. Geisinger, DDS, MS

ABSTRACT

If dental health-care professionals treat all patients with standardized treatments, we assume that every patient is the "average patient." We often see patients who are outliers and do not respond as expected to treatment. The 2017 AAP/EFP World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions (2017 WWDC) includes individualized risk assessment in periodontal diagnosis. This risk assessment can allow dental health-care professionals to deliver personalized periodontal care. This course will address how to incorporate the periodontal disease classification into real-world dental practice and will include a step-by-step approach to case assessment to create diagnostic calibration of the dental team using the 2017 WWDC system to identify disease severity and risk of future disease progression.

EDUCATIONAL OBJECTIVES

Upon completion of this course, the dental professional should be able to:

1. Critically evaluate the current diagnostic system for periodontitis based upon the 2017 AAP/EFP WWDC
2. Recognize the distinct definitions of periodontal "stage" and "grade" and their impact on patient care
3. Evaluate patients' risk factors to allow personalization of periodontal care in patients with various periodontal diagnoses
4. Effectively stratify patients and identify therapeutic needs based upon accurate diagnoses and risk assessment

Periodontal diseases are common oral inflammatory conditions caused by dysbiotic microbiota and host immune response. In 2017, updated diagnostic criteria were developed in the American Academy of Periodontology (AAP)/European Federation of Periodontology (EFP) World Workshop for the Classification of Periodontal and Peri-implant Diseases and Conditions (2017 WWDC).

Criteria were defined for the diagnosis of periodontal diseases and conditions including periodontal health, dental biofilm-induced gingivitis, nondental-biofilm-induced gingivitis, necrotizing periodontal diseases, periodontal manifestations of systemic disease, periodontitis, and peri-implantitis.[1-3] This classification represents significant changes from the previous system, which was first published in 1999 (figure 1) and later updated in 2015.[4,5] In the current diagnostic system for periodontitis, the periodontal disease severity, extent, and disease progression are further classified based upon a framework consisting of one stage and grade per patient. This system is designed

to create a multidimensional system that not only determines current disease presentation, but also aims to assess risk based upon disease progression history and risk factors.[6]

The 2017 WWDC staging and grading system differs from previous classification systems in that the periodontitis diagnosis does not solely focus on current disease severity and extent, but also captures the anticipated future risk for continued disease progression and expected treatment outcomes. Periodontal diagnoses require a thorough and accurate periodontal exam and collection of clinical data, including clinical attachment loss (CAL), probing depth (PD), radiographic bone levels, patterns of bone loss, furcation involvement, tooth mobility, tooth loss due to periodontitis, systemic conditions, and case complexity factors.[7]

After collecting and analyzing these findings, clinicians can use them to assign the stage and grade for a patient, which will then inform individualized treatment plan development. This updated classification system is designed to highlight individuals who are more likely to require advanced treatments and/or adjunctive therapies to best control chronic periodontal disease.

Summary of current diagnostic system for periodontitis

Establishing an accurate clinical diagnosis allows for more comprehensive classification of periodontal conditions and accounts for the oral implications and potential systemic interrelationships of periodontitis. The current classification system incorporates current scientific evidence, but it is also designed to be adapted as new research emerges, allowing a more flexible diagnostic system.[2] In the 2017 WWDC, staging and grading categories are used to classify and define periodontitis diagnosis.[2] Staging is assigned as Stages I through IV based upon severity (clinical attachment loss, alveolar bone loss, and periodontitis-associated tooth loss) and complexity of case management.[2]

1999 Classification	2017 Classification
—	Periodontal health and gingival health
Gingival diseases	Gingival diseases
Chronic periodontitis	Periodontitis
Aggressive periodontitis	
Periodontitis as manifestation of systemic diseases	Periodontitis as manifestation of systemic diseases
Necrotizing periodontal diseases	Necrotizing periodontal diseases
Abscesses of the periodontium	Other conditions affecting the periodontium
Periodontal-endodontic lesions	
Developmental or acquired deformities and conditions	

FIGURE 1. Changes between the previous (1999) and current (2017) classification system for periodontitis diagnosis

Stage is also further modified by extent (localized or generalized) and pattern of disease presentation (molar-incisor pattern).[2] Grading of periodontitis is established using direct or indirect evidence of disease progression and is assigned in Grades A (slow disease progression), B (moderate disease progression), and C (rapid disease progression). In the grading system, risk factor analysis is used as a grade modifier and can worsen the assigned grade, but does not improve the grade.[2] This classification system represents steps toward more robust utilization of precision medicine concepts within the diagnosis and management of periodontitis. It is important to note that due to the inherent risk assessment within the updated classification system, only one stage and grade are reported for an individual patient, e.g., "Stage III, Grade B Generalized Periodontitis."

Setting the stage

Staging of periodontitis utilizes a multidimensional approach to classify and communicate disease severity and case management complexity. Staging is meant to accomplish the following: 1) classification of disease severity and extent of an individual patient based on the currently measurable extent of tissue destruction associated with inflammatory periodontitis, and 2) assessment of specific factors that may determine complexity of controlling current disease and management of long-term function, esthetics, and phonetics with regard to the patient's dentition.[2]

Inherent to the staging is the understanding that staging represents a continuum of disease with patients proceeding from Stage I to Stage IV if effective treatment is not rendered to arrest and/or repair diseased tissues. When assigning a stage, practitioners should use the interdental site with the most advanced attachment loss and use CAL as the primary determinant of disease severity. Only one stage is assigned to each patient. However, due to the practical limitations of assessing gingival overgrowth (or negative recession), interproximal radiographic bone loss (RBL) in comparison to root length may be used as a secondary measure in cases where CAL cannot be accurately recorded.

It should be noted that CAL is preferred as a primary measure when

	PERIODONTITIS	STAGE I	STAGE II	STAGE III	STAGE IV
Severity	Interdental CAL (at site of greatest loss)	1-2mm	3-4mm	25mm	25mm
	RBL (radiographic bone loss)	Coronal third (< 15%)	Coronal third (15%-33%)	Extending to middle third of root and beyond	Extending to middle third of root and beyond
	Tooth loss (due to periodontitis)	No tooth loss	No tooth loss	≤ 4 teeth	≥ 5 teeth
Complexity	Local	Maximum probing depth 4mm Mostly horizontal bone loss	Maximum probing depth 5mm Mostly horizontal bone loss	In addition to stage II complexity: · Probing depth ≥ 6mm · Vertical bone loss 3mm or less · Furtication involvement Class II or III · Moderate ridge defects	In addition to stage III complexity · Masticatory dysfunction · Secondary occlusal trauma (Grade ≥ 2) · Severe ridge defects · Bite collapse, drifting or flaring · Less than 20 teeth (10 occlusal pairs)
Extent and distribution	Add to stage as descriptor	For each stage, describe extent as: Localized (< 30% of teeth involved); Generalized; or molar/incisor pattern			

TABLE 1. Diagnostic criteria used to establish severity and extent of periodontitis and identify the periodontitis stage

available, as early signs of bone loss may not be noted radiographically.[2,5] Each stage of periodontitis severity presents with a distinct clinical presentation and case management complexity (table 1). This allows for a communication strategy between dental health-care practitioners and patients who are seeking periodontal care. Further, unless periodontal regeneration is undertaken to address Stage III-defining vertical bone loss and/or furcation involvement, successful periodontal treatment does not result in regression to a lower stage than the original stage presentation. Stage also captures extent of disease, which is defined as localized if <30% of teeth demonstrate periodontitis-related attachment loss and generalized if >30% of teeth are involved. Additionally, distribution limited to the incisors and first molars can be classified as molar-incisor pattern.

Making the grade

Grading is aimed at estimating future risk of disease progression, responsiveness to standard therapeutic strategies, and assessing potential bidirectional health impacts of periodontitis on systemic disease. In each stage of severity, subjects may present with a range of rates of disease progression and systemic risk factors that may influence future disease progression and responses to therapy. These variances in disease progression and responsiveness to standard therapies can inform treatment planning and allow for the use of more targeted advanced therapies aimed at individuals at the highest risk. Further, recognized risk factors, such as tobacco use and suboptimal glycemic control in patients with diabetes mellitus, can significantly impact the rate of progression of periodontitis, thus resulting in a more rapid progression through the staging continuum of disease.

	DISEASE PROGRESSION		GRADE A SLOW RATE	GRADE B MODERATE RATE	GRADE C RAPID RATE
Primary Criteria	Direct Evidence of Disease Progression	Radiographic Bone Loss or Progressive Clinical Attachement Loss	No Loss over 5 years	< 2mm Loss over 5 years	
	Indirect Evidence of Disease Progression	% Alveolar Bone Loss/Age	< 0.25	0.25–1.0	> 1.0
		Case Phenotype	Heavy biofilm deposits with low levels of desctruction	Destruction commensurate with biofilm deposits	Destruction exceeds expectations given biofilm deposits; specific clinical patters suggest periods of reapid progression and/or early onset of disease
Grade Modifiers	Risk Factors	Smoking	Non-smoker	< 10 cigarettes per day	≥ 10 cigarettes per day
		Diabetes Mellitus	Normoglycemic/No diabetes diagnosis	HbA1c < 7.0% in patients with diabetes	HbA1c ≥ 7.0% in patients with diabetes

TABLE 2. Diagnostic criteria used to establish history and/or risk of periodontitis disease progression and identify the periodontitis grade

The current system is designed so that as the scientific knowledge base grows, if emerging risk factors, such as obesity, genetic polymorphisms, rheumatoid arthritis, or nutritional factors, amass adequate levels of data to allow them to be utilized in patient risk assessment, they can be added as grade modifiers. The primary criterion for grade assignment is direct or indirect evidence of disease progression at the worst intraoral site and, similar to assignment of stage, only one grade is assigned per patient.

In cases where direct evidence (e.g., longitudinal observation) over at least a five-year period is available, the rate of disease progression can be calculated over that time period. However, in clinical practice, such direct evidence of disease progression is rarely available. In these instances, utilization of indirect evidence of disease progression, which assesses rapidity of disease progression based upon alveolar bone loss or CAL compared to the patient's age, can serve as a surrogate measure to determine disease progression rate.[8-11] In this system, grade modifiers may result in a worsening grade, but do not improve the grade that is assigned based upon primary criteria (rate of disease progression) (table 2).

Utilizing the 2017 AAP/EFP WWDC to identify high-risk patients

Because the current classification system utilizes a progressive system for both stage and grade assignment, it is logical that a higher stage and/or grade represents a higher disease severity and risk for patients. Patients with a high stage will demonstrate an increased likelihood of requiring surgical therapy and multidisciplinary treatment to address their periodontal conditions. Patients who have been assigned Grade C represent individuals with an elevated risk of future disease progression and an enhanced probability of bidirectional interactions between periodontal condition and systemic health conditions. For such high-risk patients, adjunctive treatment therapies, such as systemic and local antibiotic use, and surgical and regenerative outcomes may be particularly beneficial.[12,13]

Further, in patients with Stage IV periodontitis, the incorporation of multidisciplinary care into the overall treatment plan is imperative to the establishment and long-term maintenance of health.[13] Additionally, individuals with an initial diagnosis of Stage III or IV and/or Grade C show more rapid disease progression and increased periodontitis-related tooth loss overall and even more so with irregular maintenance intervals.[14,15] Given these findings, proper identification of individuals with an enhanced risk profile is critical to appropriate treatment planning.

A step-by-step approach to periodontal diagnoses

This approach follows the guide for implementation that was presented and initiated by Kornman and Papapanou, utilizing a four-step process to diagnose periodontitis with the 2017 WWDC.[16]

STEP 1: SCREENING AND CASE OVERVIEW

In the first step, findings should be collected to allow for initial screening to identify cases of periodontitis

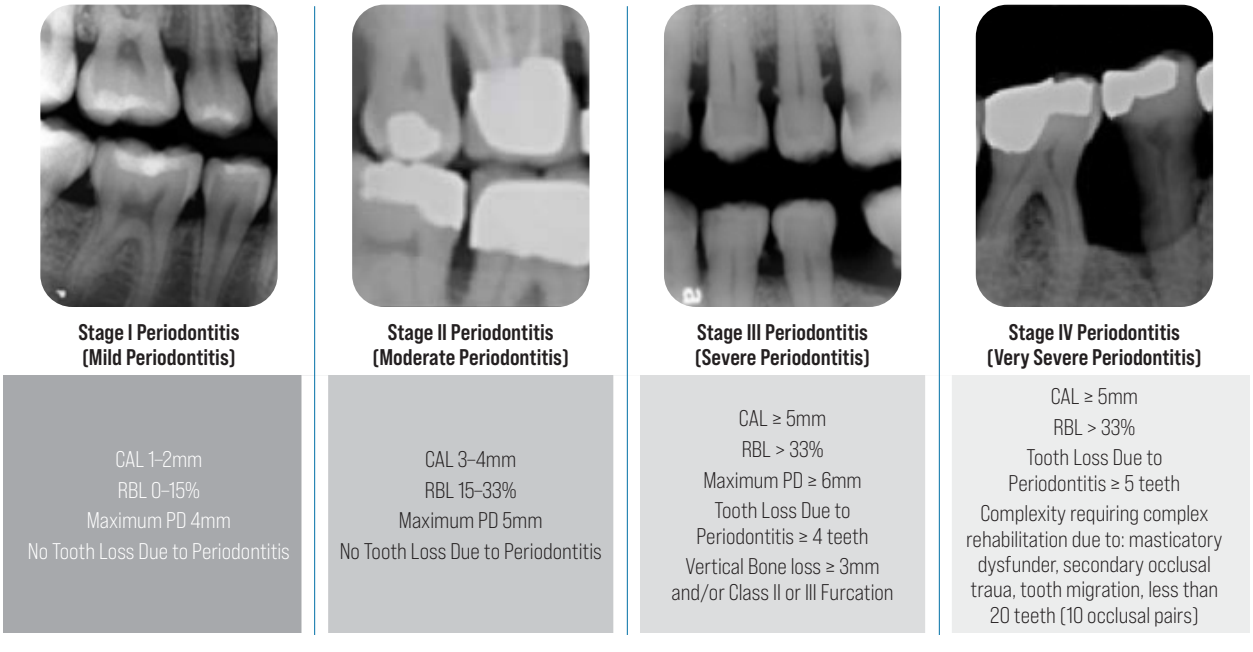

FIGURE 2. An overview of the clinical presentation for periodontitis Stages I-IV in the 2017 AAP/EFP WWDC

(as opposed to health or gingivitis) and determination of whether the case is mild/moderate (Stage I/II) or severe/very severe (Stage III/IV). Clinicians will then review diagnostic full-mouth radiographs, including vertical bitewing radiographs, and full-mouth probing depths, and document the number of missing teeth. Evaluation of these initial findings will allow evaluation of attachment levels and the most severe site of attachment loss in the mouth. If alveolar bone loss and/or attachment loss has occurred due to inflammatory periodontitis, practitioners can then determine if tooth loss or alveolar bone loss is within or beyond the middle third of the tooth, and this case would be identified as Stage III/IV.

STEP 2: DETERMINATION OF STAGE

Practitioners should identify the interdental site with maximum clinical attachment loss (CAL) or alveolar bone loss (ABL) and the pattern of bone loss (horizontal bone loss or vertical defects >3 mm) throughout the mouth. Clinicians should also assess the number of teeth that were lost due to periodontitis, including teeth that are deemed by the practitioner to be periodontally hopeless. Next, case complexity and the potential need for multidisciplinary rehabilitation should be determined. Case complexity factors include: maximum probing depths, furcation involvement, occlusal trauma, masticatory dysfunction, etc. Determination of extent of disease is based upon the number of teeth involved. Cases that have <30% of teeth involved are deemed localized, and cases with >30% of teeth involved are considered generalized. Further, a distribution at only molar/incisor teeth would be noted in relation to the assigned stage. Assignment of stage is based upon the categories in Table 1. An overview of stages is presented in Figure 2.

STEP 3: DETERMINATION OF GRADE

Initial grade assignment should start with a default Grade B. If direct evidence of disease progression over a five-year period exists, that evidence can be used to determine the rate of disease progression. Practically, however, such evidence of disease progression is not often available. In such instances, alveolar bone loss/age can be used to assess the rapidity of disease progression. When assessing bone loss/age, the most severe site of interproximal alveolar bone loss is used in the assessment. For example, in a 70-year-old patient in whom the most severe site of bone loss is 50%, bone loss/age would be calculated as follows:

[Bone loss]/[Age] = [50]/[70]=0.714

In addition, grade modifiers, including smoking and diabetic glycemic control, can be used to increase, but not decrease, the assigned grade based upon primary criteria (direct or indirect evidence of disease progression). Determination of grade is based upon the categories in Table 2.

STEP 4: DEVELOPMENT OF TREATMENT PLAN

Practitioners should then use both the stage and grade assigned to the case to determine the treatment plan, including standard periodontal therapies and/or the use of adjunctive therapies. The next part of this course will focus on utilization of the 2017 WWDC as a tool to inform risk assessment and treatment choices.

Personalized periodontal care based upon individualized diagnosis

A shortcoming of previous periodontal disease classification systems was that they did not include an assessment of risk factors associated with disease progression and response to therapy. It has been estimated that up to 25% of patients with periodontitis do not respond to standard periodontal therapy as expected.[17] Much of this discrepancy between expected and actual response to therapy can be attributed to individual patient- and site-specific risk factors.

The 2017 WWDC captures a component of risk assessment within the diagnostic framework that can inform treatment for patients. For example, individuals with initial periodontitis diagnoses with increased stage and grade have been shown to demonstrate increased tooth loss with poor compliance to maintenance protocols and higher rates of peri-implantitis when implants are placed for tooth replacement.[14,15,18,19] It is well established that host response and susceptibility to etiologic factors result in considerable variability in the pathophysiology and disease progression of periodontitis and the response of individual patients to standard therapies.[20,21]

In general, stage does not improve over time (with certain specific exceptions for individuals treated with periodontal regeneration), but grade can improve if grade modifiers are altered or disease is arrested and calculated bone loss/age decreases below threshold levels. It has been recommended that patients who have completed active periodontal treatment for periodontitis should be periodically assessed and new diagnoses assigned, if appropriate, to monitor disease severity and progression.[6] Given these and other findings, practitioners should apply the 2017 WWDC when they develop periodontal treatment plans and during ongoing periodontal maintenance to personalize care based upon individual patients' known disease severity and risk factors.

Active therapies

Treatment of periodontitis is most frequently phased to allow for initial

control of etiologic factors, repair, regeneration, and/or removal of hard and soft tissues damaged by disease progression, and maintenance of treatment results. Because periodontitis is a chronic disease that is initiated by dysbiotic biofilm with tissue destruction occurring due to host immune-inflammatory dysfunction, reassessment throughout these phases of treatment and treatment to acceptable end-points with ongoing maintenance are ideal to arrest and control disease. It has also been established that systemic conditions can impact outcomes seen after both surgical and nonsurgical periodontal therapies.[22-26] In implementing personalized periodontal care, clinicians should use a treat-to-target approach. With such an approach, therapies are strategically employed to achieve optimal clinical measures and oral hygiene outcomes.[27,28]

Phase I therapy for periodontitis focuses on control of etiologic factors. This phase includes behavior modification for improved oral home care, tobacco cessation, modification of systemic risk factors, and nonsurgical periodontal therapy, including scaling and root planing (SRP), occlusal adjustment, and closure of open contacts. Reevaluation of the outcomes of Phase I therapy is generally performed four to six weeks after the completion of active Phase I therapy. Outcomes after Phase I therapy differ based upon initial disease severity, systemic considerations, and the practitioner's ability to identify and remove etiologic factors.[29]

Adjunctive treatments

Adjunctive therapies may improve the effectiveness of periodontal therapy, particularly for high-risk individuals.[30,31] Traditional treatments have focused on the removal of dysbiotic biofilm and creating intraoral conditions to reduce biofilm accumulation, but emerging treatments have focused on enhancement of healing and modulation of the host immune-inflammatory response. These strategies may be particularly effective when targeted at individuals who demonstrate more severe disease presentations (Stages III and IV) or more rapdily progressive forms of periodontal disease (Grade C).

Laser and photodynamic therapy

Both laser treatment and photodynamic therapy have been proposed as adjunctive treatments that may increase the effectiveness of SRP. Laser-assisted new attachment procedure (LANAP) using an Nd:YAG laser in conjunction with meticulous SRP and occlusal adjustment has demonstrated a reduction in both PD and CAL and has histologic evidence of regeneration.[32,33] Limited evidence is available to demonstrate enhanced improvements in clinical indices after the use of LANAP or other adjunctive laser protocols compared to standard periodontal therapies including periodontal surgery and SRP alone.[34-36]

Additionally, much attention has been paid to photodynamic therapy (PDT), which is a noninvasive treatment approach that incorporates singlet oxygen and free radicals produced by a light-excited photosensitizer agent that may produce bactericidal effects.[37] The adjunctive use of PDT with SRP therapy has demonstrated clinical and microbiological improvements in mild to moderate periodontal disease but not in severe disease.[38] Such adjunctive therapies for nonsurgical therapy have the potential to eliminate the need for surgical treatment in some patients with initial diagnoses of Stage II or Stage III periodontitis and may be advantageous in individuals with increased grade and therefore higher risk for future disease progression.

Local and systemic antimicrobials

Dysbiotic biofilm is well established as the primary etiologic factor for periodontitis, and it has been estimated that biofilm contributes to approximately 20% of the risk for development of periodontitis.[39] Local and systemic antibiotic protocols, primarily amoxicillin and metronidazole, have been used in individuals as an adjunct to SRP and have demonstrated greater improvements in CAL and PD when compared to SRP alone.[40-42] Such adjunctive use of systemic antibiotic protocols has been applied clinically for cases considered more aggressive and therefore may have particular benefit in individuals in whom primary criteria for disease progression results in an assignment of Grade C at diagnosis.

Local antimicrobial delivery in the treatment of periodontal diseases has been shown to be effective in the reduction of PD and clinical attachment gain when applied with scaling and root planing.[27,42] Greater improvement in PD and CAL has been seen in patients with periodontitis, particularly in smokers, when adjunctive local delivery antimicrobials are combined with nonsurgical periodontal therapy, compared to SRP alone or SRP and systemic antibiotics.[43]

Subantimicrobial dose doxycycline (SDD) delivered as a 20 mg, twice daily tablet has proven to aid in the reduction of PD and clinical attachment gain over a three-to-nine-month period when added to nonsurgical and/or maintenance treatments, although equivocal data exists about the clinical significance of the benefits.[44] Further, patients with particular risk factors and/or hyperinflammatory conditions may demonstrate enhanced benefit from SDD. For example, the application of SDD as an adjunct to standard periodontal therapy in smokers who are undergoing SRP or periodontal

maintenance may mitigate some of the adverse clinical response to therapy associated with smoking and result in improved outcomes for those patients.[45]

Systemic anti-inflammatory medications

Another strategy for enhancing outcomes of periodontal treatment can include the delivery of systemic anti-inflammatory medications. For individuals with grade modifiers such as dysglycemia or smoking, much of the enhanced risk of disease progression is associated with a hyperinflammatory state. In such patients, promoting resolution of inflammation with lipid mediators has been proposed to manage disease. The use of low-dose aspirin (81-325 mg, once daily) with or without the use of polyunsaturated fatty acids (Ω-3 PUFA) may prove to have an adjunctive benefit with nonsurgical periodontal therapy for such patients.[46-48]

Recommendations for the use of either systemic or local antimicrobial therapy should be tailored to individual patient needs, and cost-effectiveness of treatment should be considered. Delivery of personalized recommendations for adjunctive therapies may be improved by the 2017 WWDC, particularly for those patients who are initially diagnosed with higher stages and grades of periodontitis.

Periodontal maintenance protocols

After successful active periodontal therapy, it is essential that a periodontal maintenance schedule be established to optimally maintain patients' clinical gains. Studies have shown that tooth loss in periodontal patients is related to the frequency and quality of their maintenance care.[42,49] Further, recent investigations have demonstrated that when strict adherence to recommended periodontal maintenance protocols is not achieved, those patients with more severe initial disease presentations, i.e., increased diagnostic stage and grade, demonstrate more clinical attachment loss and tooth loss as well as an increased incidence of peri-implantitis.[14,15,18] Overall, patients who are seen at regular maintenance intervals experience less attachment loss and lose fewer teeth and have overall lower oral healthcare costs than those who are seen more infrequently, and this appears to be even more impactful for those with more severe initial periodontitis diagnoses.[14,15,18,50]

It is generally accepted that intervals for periodontal maintenance should range between two to six months, depending upon the patient's disease presentation and history, current oral hygiene levels, patient risk factors for disease progression, treatment modalities performed, clinical findings, and the overall prognosis of the teeth. Shorter intervals decrease the likelihood of disease progression.[51] Continued evaluation of periodontal conditions and subgingival debridement at PD ≥4 mm results in better maintenance of attachment levels and is more effective than supragingival plaque control alone.[42] Further, in well-maintained patients with low levels of clinical inflammation, sites with shallow PD without bleeding on probing (BOP) have a high likelihood of stability over time.[52]

Conclusion

Roughly 42% of US adults over the age of 30 have periodontitis, and the severity and disease progression vary based upon initial presentation and patient-related risk factors.[53] In 2017, an updated classification system for periodontitis diagnosis was introduced. Proper periodontitis diagnosis using this system allows clinicians to provide more impactful and targeted care to their patients. The combination of assessment of disease severity and risk of disease progression inherent in the current staging and grading diagnostic system allows practitioners to identify individuals who may benefit from enhanced treatment protocols, including surgical interventions, adjunctive antimicrobial and anti-inflammatory therapies, and enhanced periodontal maintenance visits. Further, this system accounts for systemic risks, such as smoking and diabetes mellitus, which can be impactful on disease progression and encourages interprofessional management of these conditions for optimal oral and overall health.

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Mia L. Geisinger, DDS, MS, is a professor and director of advanced education in periodontology at the University of Alabama at Birmingham (UAB). Dr. Geisinger received her BS in biology from Duke University, her DDS from Columbia University School of Dental Medicine, and her MS and Certificate in Periodontology and Implantology from the University of Texas Health Science Center at San Antonio. Dr. Geisinger is a diplomate in the American Board of Periodontology. She has served as the president of the American Academy of Periodontology Foundation, as the chair of the American Dental Association's Council on Scientific Affairs, as a member of the Board of Directors of the American Dental Association Science and Research Institute, and on multiple national and regional organized dentistry committees. She currently serves as the president-elect of the American Academy of Periodontology. She has authored over 75 peer-reviewed publications and she lectures nationally and internationally on topics in periodontology and oral health care.

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1. The system and criteria for diagnosis of periodontitis was updated at a world workshop conducted in 2017. The previous system of diagnosis was first published in 1989.

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

2. Which of the following is not a change between the previous diagnosis system and the 2017 WWDC?

A. Chronic and aggressive periodontitis are eliminated in the updated 2017 WWDC.

B. Periodontal health was added to the 2017 WWDC.

C. The 2017 WWDC includes diagnostic criteria for peri-implant health and disease.

D. The 2017 WWDC includes necrotizing periodontal diseases where the earlier classification system did not.

3. Which of the following is not a data point used in the determination of periodontitis stage?

A. Clinical attachment loss (CAL) at the worst site in the mouth

B. Radiographic alveolar bone levels

C. All tooth loss

D. Patterns of bone loss

4. Extent of periodontitis is classified as "localized" in which of the following conditions?

A. <10% of sites demonstrate periodontitis-related attachment loss

B. <10% of teeth demonstrate periodontitis-related attachment loss

C. <30% of sites demonstrate periodontitis-related attachment loss

D. <30% of teeth demonstrate periodontitis-related attachment loss

5. The updated 2017 WWDC diagnostic system is multidimensional and involves assigning both a stage and grade for periodontitis cases. Individuals may have more than one stage or grade assigned.

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

6. If possible, interproximal radiographic bone loss should be used to determine stage. When not available, interproximal clinical attachment loss may be used as a secondary measure.

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

7. Which of the following would not result in automatic assignment of Stage III or IV in a periodontitis case?

A. Maximum probing depth of 5 mm

B. Any tooth loss due to periodontitis

C. Furcation involvement of Class II or Class III

D. Vertical bone loss with a depth >3 mm

8. Grading is assigned based upon direct and/or indirect evidence of disease progression as the primary criteria. Assigned grade determined with primary criteria can be improved or worsened by grade modifiers.

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

9. Which of the following does not place a patient into the Grade C category?

A. Direct evidence of progression of alveolar bone loss or clinical attachment loss of ³1 mm over a five-year period

B. Indirect evidence of progression of bone loss/age of >1.0

C. Smoker >10 cigarettes/day

D. HbA1c >7% in patients with diabetes mellitus

10. Order the following steps for periodontitis screening and stage/grade assignment according to the framework created by Kornman and Papapanou: I. Screening and case overview II. Determination of grade III. Determination of stage IV. Development of treatment plan

A. I, II, III, IV

B. I, IV, III, II

C. I, III, II, IV

D. I, III, IV, II

11. When performing initial screening to assess a periodontitis case, what are the goals of such an assessment?

A. Differentiate between health, gingivitis, and periodontitis

B. Determination of mild/moderate (Stage I/II) or severe/very severe disease (Stage III, IV)

C. Understand if surgical treatment will be necessary

D. A and B

12. Assignment of Stage IV periodontitis can be determined by significant case complexity and the need for complex rehabilitation. In these cases, patients may share characteristics with Stage III cases, but may also present with masticatory dysfunction, secondary occlusal trauma with tooth mobility degree >2, severe ridge defects, bite collapse, and/or less than 20 remaining teeth (10 opposing pairs).

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

13. Initial grade is assumed to be ___ as a default and evidence is sought to definitively assign a different grade based upon primary criteria and grade modifiers.

A. Grade A

B. Grade B

C. Grade C

D. No grade

14. In a 60-year-old patient for whom the most severe site of attachment loss is 40%, the calculated bone loss/age for indirect evidence of disease progression would be:

A. 0.33 B. 0.67 C. 1.0 D. 1.5

15. In a nonsmoking, normoglycemic patient without diabetes in whom indirect evidence of disease progression aligned with a grade assignment of Grade B, how would grade modifier impact grade assignment?

A. Grade modifiers would improve the grade assigned to Grade A.

B. Grade modifiers would worsen the grade assigned to Grade

C. C. Grade modifiers are also aligned with Grade B, so no change in grade would be made.

D. Grade modifiers would not be used to determine the grade because grade modifiers can increase but not decrease the grade assigned using primary criteria of disease progression.

16. Staging allows for assessment of current disease severity, and treatment planning is solely based upon the initial assigned stage. Grading is a unique part of the current diagnostic classification system as it uses history of disease progression and risk factors (e.g., grade modifiers) to assess the risk of future disease progression and potential response to therapy.

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

17. It has been estimated that up to ___% of patients with periodontitis do not respond to standard periodontal therapy as expected.

A. 0 B. 25 C. 33 D. 50

18. Individuals with initial periodontitis diagnoses with increased stage and grade demonstrate similar tooth loss with poor compliance to maintenance protocols when compared to individuals with less severe stage and grade periodontitis initial diagnoses. Individuals with initial periodontitis diagnoses with increased stage and grade have similar rates of peri-implantitis compared to individuals with less severe stage and grade periodontitis diagnoses when implants are placed for tooth replacement.

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

19. A grade assigned at baseline can improve in all of the following cases except:

A. A patient who smoked <10 cigarettes/day quits smoking and demonstrates indirect evidence of disease progression (bone loss/age) = 0.5

B. A patient quits smoking when a grade modifier of smoking resulted in increased grade.

C. A patient improves glycemic control to <7%, when a grade modifier of HbA1c >7% resulted in increased grade.

D. Periodontitis is treated and arrested and the patient presents with no disease progression over a five-year period.

20. Dysbiotic biofilm is well established as the primary etiologic factor for periodontitis, and it has been estimated that biofilm contributes to approximately ___% of the risk for development of periodontitis.

A. 10 B. 20 C. 30 D. 50

21. Studies have demonstrated clinical and microbiological benefits that support the adjunctive use of systemic antibiotic delivery with nonsurgical periodontal therapy compared to SRP alone. The benefit of systemic antibiotic therapy may be particularly impactful in patients with more severe initial grade at diagnosis.

A. Both statements are true.

B. The first statement is true; the second statement is false.

C. The first statement is false; the second statement is true.

D. Both statements are false.

22. The use of subantimicrobial dose doxycycline (SDD) as an adjunct to standard periodontal therapy in patients who smoke and are undergoing nonsurgical periodontal therapy and/or periodontal maintenance results in ___ compared with individuals who do not receive adjunctive SDD.

A. Similar outcomes

B. Improved outcomes

C. Worsened outcomes

D. More antibiotic resistance

23. For individuals with grade modifiers such as dysglycemia or smoking, much of the enhanced risk of disease progression is associated with:

A. More dysbiotic biofilm

B. Poor vascularization

C. Hyperinflammatory state

D. Decreased cellular turnover

24. Patients who are seen at regular periodontal maintenance intervals experience ___ attachment loss and lose ___ teeth than those with intermittent compliance or noncompliance to maintenance intervals.

A. Less, fewer C. Less, more

B. Greater, more D. Greater, fewer

25. Compliance with periodontal maintenance protocols has been associated with ___ oral health-care costs compared to patients who are seen more infrequently.

A. Higher C. Lower

B. Similar D. Free

26. Periodontal maintenance intervals are generally set between ___ months.

A. 1-3 B. 1-6 C. 2-6 D. 2-12

27. Which of the following is generally not considered when determining periodontal maintenance intervals?

A. Initial stage and grade at diagnosis

B. Oral hygiene levels

C. Overall tooth prognosis

D. Number of teeth remaining

28. Shorter periodontal maintenance intervals ___ the likelihood of periodontal disease progression.

A. Increase

B. Do not influence

C. Decrease

D. May have a variable impact on

29. Regular periodontal examinations during periodontal maintenance allow for subgingival debridement at PD ≥___ to improve outcomes.

A. 2 mm B. 3 mm C. 4 mm D. 5 mm

30. Approximately ___% of US adults over the age of 30 have periodontitis.

A. 19 B. 27 C. 36 D. 42

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5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

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