

The 2018 AAP/EFP Classification of Periodontal & Peri-implant Diseases



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Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Conflict of Interest Disclosure Statement

- Dr. Lavigne is a member of the dentalcare.com Advisory Board.

Introduction

The 2018 AAP/EFP Classification of Periodontal & Peri-implant Diseases is a free dental continuing education course that covers a wide range of topics relevant to the oral healthcare professional community.

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Overview

The purpose of this course is to provide a succinct and easy guide to help both clinicians and students understand and implement this (2018) classification system of periodontal and peri-implant diseases and conditions in their practices.

The American Academy of Periodontology and the European Federation of Periodontology held a World Workshop in 2017 to develop a new classification of periodontal disease to replace the almost 20-year old classification system (1999)¹. The results of their efforts were unveiled in June of 2018 during the Europerio Conference held in Amsterdam, and concomitantly published in both the *Journal of Periodontology*² and the *Journal of Clinical Periodontology*.³ Since its adoption, clinicians and educators worldwide have sought to improve understanding of the new classification system and its clinical implementation.

Learning Objectives

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

- Describe the rationale for the new 2018 classification of periodontal and peri-implant diseases.
- Identify the key dynamics that formed the basis of the new classification system.
- Describe the 4 major components of the new classification system.
- Explain the concept and criteria for Staging and Grading of periodontitis.
- Describe the steps for determining a periodontal diagnosis.
- Discuss how this new classification system fits in with Precision Medicine.

Glossary

dysbiosis – “Dysbiosis is any perturbation of the normal microbiome content that could disrupt the symbiotic relationship between the host and associated microbes, a disruption that could result in diseases.”⁴

grading of periodontitis – “Allows for rate of progression to be considered based on availability of direct or indirect evidence of periodontal disease progression (e.g., radiographs) and then modified by the presence of risk factors.”⁵

Human Microbiome Project – A project of the US NIH that began in 2007 and is still ongoing that has become an international initiative to better understand the extent of the human microbiome and its significance in health and disease.

metagenomics – The study of the structure and function of nucleotide sequences isolated directly from an environmental sample, especially of a community of microorganisms.

microbiomics – The scientific study of the microbiome.

peri-implant mucositis – “The main characteristic of peri-implant mucositis is bleeding on gentle probing. An increase in

probing depth is often observed due to swelling or decrease in probing resistance. There is strong evidence that plaque is the etiological factor.”⁶

peri-implantitis – “A plaque-associated pathological condition occurring in tissues around dental implants, characterized by inflammation in the peri-implant mucosa and subsequent progressive loss of supporting bone.”⁶

periodontal health – “A state free from inflammatory periodontal disease that allows an individual to function normally and avoid consequences (mental and physical) due to current or past disease.”⁷

precision medicine – “Focuses on identifying which treatment approaches will be the most effective for which patients based on genetic, environmental, and lifestyle factors.”⁸

staging of periodontitis – “Relies on the standard dimensions of severity and extent of periodontitis at presentation but introduces the dimension of complexity of managing the individual patient.”⁵

symbiosis – “Interaction between two different organisms living in close physical association, typically to the advantage of both.”⁸

World Health Organization Definition of Health – “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”¹⁰

Introduction

Clinicians and students worldwide have looked upon the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) as the world leaders in the classification of periodontal diseases for several decades. Given that the last published classification of periodontal disease prior to 2018 was in 1999,¹ their decision in 2015 to commence planning a new World Workshop to modernize the classification based on more current research findings was determined to be warranted. There are numerous reasons why an international periodontal

classification system is required, all of which are important. A classification system provides an international language for both research and communication in order to facilitate population surveys of disease prevalence, natural history, etiology and pathogenesis. Additionally, a standardized case definition of periodontal disease is critical to allowing more homogeneity in research protocols such as determination of the effectiveness of treatment modalities as well as in oral-systemic research in order to provide more consistent evidence to determine the nature of these relationships. A common system also enables diagnosis, risk assessment, and prognostication in order to educate and communicate with patients, and most importantly, to ensure implementation of appropriate treatment.

After 2 years of intensive planning, the World Workshop was held in Chicago November 9–11, 2017.^{2,3} Nineteen review papers and 4 Consensus Reports were commissioned by the AAP/EFP organizing committee with a focus on not only updating/revision of the 1999 classification, but to also include peri-implant diseases and conditions.^{2,3} These workgroups were also asked to establish both case definitions and diagnostic criteria to assist clinicians with the use of the new system. The 4 Working Groups commissioned with the creation of the Consensus Reports were divided as follows:

- **Working Group #1:** Periodontal Health and Gingival Diseases and Conditions on an Intact and a Reduced Periodontium
- **Working Group # 2:** Periodontitis
- **Working Group # 3:** Periodontal Manifestations of Systemic Diseases and Developmental and Acquired Conditions
- **Working Group #4:** Peri-implant Diseases and Conditions

This classification system is based on these 4 categories encompassing the most current literature available. In particular, the creation of the new system was driven by a focus on the findings from the Human Microbiome Project; the World Health Organization’s definition of Health; new discoveries on Inflammation; and on the concept of Precision/Personalized Medicine.

A major change from the 1999 Classification was required as advances in scientific research provided new evidence from multiple sources such as basic science investigations, population studies and prospective studies that evaluated both environmental and systemic risk factors. The first major change was to address some of the unresolved issues with the previous classification. The previous classification did not identify parameters for gingival health or gingivitis in an intact or reduced periodontium. This led to a lack of clarity regarding classification of diagnosis given the presence of gingival inflammation at one or more sites and a patient-level definition of gingivitis. Thus, a definition for periodontal health was included in this classification, which serves as a treatment endpoint goal and a benchmark for contrast with disease processes. In this classification, bleeding on probing was identified as the primary parameter to set thresholds for gingivitis.^{2,3,11,12} The new classification also differentiates gingival health and gingival inflammation occurring on an intact periodontium from that found on a reduced periodontium, which could be present on either a stable periodontitis patient or a non-periodontitis patient, in whom attachment was not lost due to inflammatory periodontitis.^{2,3} It is well-established that gingivitis is reversible and therefore that a gingivitis patient can revert to a state of health. In a patient who has lost attachment due to inflammatory periodontitis, they always remain at an increased risk of further attachment loss and therefore, despite successful therapy, a periodontitis patient remains one for life and requires lifelong supportive care.^{2,3} Introduction and incorporation of a system of staging and grading based on medical systems for symptomatology and risk stratification, such as those for hypertension and/or oncology, is another major change in this classification of periodontitis. Lastly, the inclusion of a classification for peri-implant health and diseases was a *de novo* addition to the new classification system.

Key Dynamics Embracing Precision Medicine

The key dynamics driving the creation of the new periodontal disease classification

encompassed findings from the Human Microbiome project and the concept of Precision Medicine. In 2007, the US National Institutes of Health (NIH) began a massive project that grew into an international initiative that is still underway. *"The Human Microbiome Project."*¹³ These efforts are helping scientists and clinicians better understand how the human microbiome and their interactions with the human immune system either protect or harm the host. This information presents a more realistic view of the various microbiomes found in the human body and is helping clinicians understand how best to focus their efforts when treating their patients.

Findings from this project have revealed how important our microbiome is for our existence as humans and that microbes far outnumber human cells by more than ten-fold! The human microbiome is comprised of a "core" and a "variable" part.¹⁴ The core is shared among all humans, while the variable microbiome is exclusive to each individual based on their phenotype, genotype, and unique lifestyle.¹⁴ The differences in species and strains of this variable portion of the microbiome among individuals, may be as unique as their fingerprint! This also holds true for the oral microbiome.

Microbes do not typically occur in nature as a pure culture of a single species, but exist in a community of microbes, which are referred to collectively as a Microbiome. In the human host, the microbiome exists in several anatomical niches, each with their own exclusive microbiome and metagenome i.e., hair, skin, gastrointestinal tract, urogenital tract, vagina, nasal and paranasal sinuses, and the oral cavity. In ideal conditions, these microbiome niches represent species-balanced communities that have a symbiotic relationship in health. In the case of the oral microbiome, this symbiotic relationship plays a critical role in physiologic, metabolic, and immunological functions such as food digestion, energy generation and maintaining balance in pro-inflammatory and anti-inflammatory processes.¹⁵ This homeostasis is possible due to the presence of both commensal (beneficial) species as well as those capable of disease

initiation (pathobionts). Although each of these microbial inhabitants residing within a unique ecosystem are geared towards symbiotic interactions within that particular ecosystem, if this balanced state is disrupted and disease-producing pathobionts begin to overpower the beneficial species, a state of dysbiosis ensues leading to initial gingivitis. More recent theories have speculated that this imbalance occurs when the innate immune system by initiating the inflammatory response in its attempts to maintain homeostasis, fails when it is overpowered by certain keystone pathogens that further lead to this state of dysbiosis resulting ultimately in periodontitis.¹⁶ This new flipped hypothesis now questions whether it's the microbes themselves or the inflammation that causes the dysbiosis.

The actual state of dysbiosis however, explains how oral diseases occur, more specifically this shift is most readily apparent in the microbial shift from gingivitis to periodontitis. The oral cavity houses the second largest number of microbiota next to the GI tract. Thus, the project has now developed organ-specific microbial databases for both the Human Intestinal Tract *and* eHomid (expanded Human Oral Microbiome Database). To date, almost 800 specific oral species have been added to the oral microbiome database but well over 1,000 are thought to exist.

This understanding has created a major paradigm shift in identifying the primary etiology of periodontal diseases. What is now considered to be old knowledge is that specific virulent periodontal pathogens cause periodontal tissue breakdown (mainly Gram-negative anaerobic bacteria). The problem with this theory is that no specific bacteria have ever been shown to be solely causative of periodontal disease. Thus, the new prevailing theory is that dependent upon the microbe-host environment, disease severity will vary. Periodontal breakdown in susceptible individuals creates an environment suitable for particular microbes, which then flourish. Certain keystone pathogens may be considered bridging organisms and may facilitate the transfer from symbiosis to dysbiosis in a susceptible host. Certain microbes may be

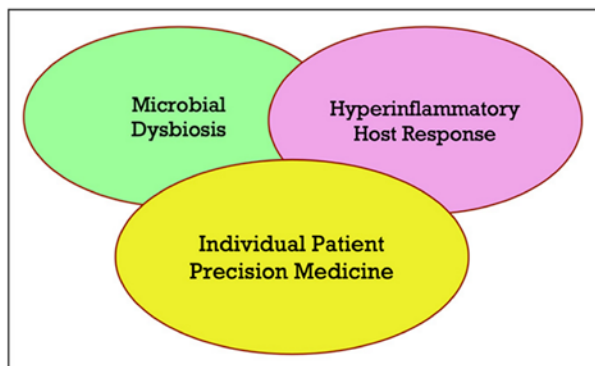
found intraorally in health and maintain this healthy state, however interference with this symbiotic state leads to dysbiosis resulting in periodontal disease. It has also become clear with these new findings that rather than the old concept that all bacteria are bad, the main goal of oral hygiene should focus more on the maintenance of symbiosis rather than elimination of all oral microbes.

With this major shift in the understanding of the underlying causes of disease, an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment, and lifestyle for each person, has been created called "Precision Medicine," previously known as personalized medicine. The major premise of precision medicine is a focus on identifying which treatment approaches will be the most effective for which patients based on genetic, environmental, and lifestyle factors. This is in contrast to the "one size fits all" approach that has dominated mainstream medicine and dentistry for decades.

Commercialization of the human microbiome as a drug therapy has already begun. In 2013, patients infected with *C. difficile* were successfully treated by duodenal infusion of the fecal microbiota of a healthy individual!⁸ The ability to use patients' genetic and other molecular information as part of routine medical and perhaps dental care may soon be a reality. With these new discoveries in metagenomics and microbiomics, there will be improved ability to predict which treatments will work best for specific patients. Additionally, there will be better understanding of the underlying mechanisms by which various diseases occur leading to improved approaches to preventing, diagnosing, and treating a wide range of diseases.

Because each individual harbors a unique microbiome that plays a key role in the etiology of disease within the body, disease may manifest and progress differently among different individuals, making precision medicine imperative for optimal health care. With this new knowledge, the focus of the new periodontal disease classification became one

that is more biologically based, embracing the concept of Precision Medicine; one that encompasses both Microbial Dysbiosis and a Hyperinflammatory Host Response.



With this model in mind, the concept of creating more individualized patient case definitions came to fruition. Using the medical model of staging and grading, the authors of the new classification were able to combine some of the factors typically used in disease determination such as severity, extent, rate of progression, risk factors, etc. to create a method of more specifically defining individual cases. This system will be discussed in further depth under 5(b) Periodontitis.

The 4 Major Components of the New Classification System

The 4 working group categories previously identified in the course introduction became the foundation for the new classification. Table 1 below illustrates the more detailed components of the new classification.

Periodontal Health, Gingivitis and Gingival Conditions

Based on the World Health Organization's definition that "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."⁶

Working group 1 defined periodontal health as a "State free from inflammatory periodontal disease that allows an individual to function normally and avoid consequence (mental or physical) due to current or past disease."⁷

This state of periodontal health should be determined by the clinical absence of disease associated with gingivitis, periodontitis or other periodontal conditions. The absence of disease may include those successfully treated who were previously diagnosed with gingivitis, periodontitis or other periodontal conditions who are able to maintain a state free from inflammation.⁷ However,

Table 1. The Components of the New Periodontal Disease Classification.

Periodontal Health, Gingivitis & Gingival Conditions	Periodontitis	Other Conditions Affecting the Periodontium	Peri-implant Disease & Conditions
1. Periodontal Health & Gingival Health	1. Necrotizing Periodontal Diseases	1. Systemic diseases or conditions affecting periodontal supporting structures	1. Peri-implant Health
2. Gingivitis Biofilm Induced	2. Periodontitis as a Manifestation of Systemic Diseases	2. Periodontal abscesses & endodontic-periodontal lesions	2. Peri-implant Mucositis
3. Gingival Diseases Non-biofilm Induced	3. Periodontitis	3. Mucogingival deformities & conditions	3. Peri-implantitis
		4. Traumatic occlusal forces	
		5. Tooth and prostheses-related factors	4. Peri-implant hard & soft tissue deficiencies

Adapted from Caton et al.²

it is important to recognize that the stable periodontitis patient is at higher risk for recurrent disease than those patients with previous gingivitis or those continuously healthy. From a Precision Medicine standpoint, these patients require ongoing surveillance and individual risk assessment for optimal patient management.⁷ It is important to recognize that clinical periodontal health encompasses the physiological state of homeostasis, both immunologically and microbiologically.

A case definition of patients who fall into the category of **Periodontal Health** is as follows: (see Table 2)

Gingivitis Biofilm Induced

Cases of dental plaque-induced gingivitis whether they occur on an intact periodontium

or a reduced periodontium, regardless of cause, are patients with signs of gingival inflammation as measured by bleeding on probing (BOP). The same three categories described for Periodontal Health in Table 2 are applied in Table 3 more specifically defining biofilm-induced gingivitis.

Please note from the above table that for stable periodontitis patients with a reduced periodontium, if they have BOP in periodontal pockets that are either equal to or deeper than 4mm, they would automatically revert back to being an active periodontitis case and would not be classified as gingivitis on a reduced periodontium. However, as long as pocket depths of 4mm do not display signs of inflammation (BOP), then the case would remain as gingivitis.

Table 2. Periodontal Health.

Clinical Gingival Health on an Intact Periodontium	Clinical Gingival Health on a Reduced Periodontium: Stable Periodontitis Patient	Clinical Gingival Health on a Reduced Periodontium: Non-periodontitis Patient (i.e., recession; crown lengthening, etc.)
Bleeding on Probing <10% Pocket Probing depths ≤3mm Probing Attachment Loss - No Radiological Bone Loss - No	Bleeding on Probing <10% Pocket Probing depths ≤4mm (no site ≥4mm with BOP) Probing Attachment Loss - Yes Radiological Bone Loss - Yes	Bleeding on Probing <10% Pocket Probing depths ≤3mm Probing Attachment Loss - Yes Radiological Bone Loss - Possible

Chapple et al. 2018.⁷

Table 3. Biofilm-induced Gingivitis.

Intact Periodontium	Reduced Periodontium: Stable Periodontitis Patient	Reduced Periodontium: Non-periodontitis Patient (i.e., recession; crown lengthening, etc.)
Bleeding on Probing ≥10% Pocket Probing depths ≤3mm Probing Attachment Loss - No Radiological Bone Loss - No	Bleeding on Probing ≥10% Pocket Probing depths ≤3mm Probing Attachment Loss - Yes Radiological Bone Loss - Yes	Bleeding on Probing ≥10% Pocket Probing depths ≤3mm Probing Attachment Loss - Yes Radiological Bone Loss - Possible

Localized gingivitis is >10% and <30% BOP/Generalized Gingivitis is >30% BOP. Adapted from Chapple et al. 2018.⁷

There are three distinct categories of Biofilm-induced gingivitis:⁷

1. Associated with biofilm alone
2. Gingivitis Mediated by either Systemic Risk Factors or Local Risk Factors
 - a. Systemic Risk Factors (modifying factors)
 - Smoking
 - Hyperglycemia
 - Nutritional factors
 - Pharmacological factors
 - Sex steroids hormones (Puberty, menstrual cycle, pregnancy, oral contraceptives)
 - Hematological conditions

- b. Local Risk Factors (predisposing factors)
 - Dental plaque biofilm retaining factors
 - Oral dryness

3. Drug-influenced gingival enlargement

Gingival Diseases Non-biofilm Induced

It is well recognized that there are numerous oral conditions that are interrelated with systemic health. Some conditions may be further exacerbated by local factors such as plaque or oral dryness, however are not caused by plaque biofilm and usually do not resolve following plaque removal. These conditions may be manifestations of systemic conditions or they may be localized to the oral cavity.⁷

Table 4. Gingival Diseases Non-dental Plaque-induced.

Category	Conditions
Genetic/Developmental Disorders	Hereditary gingival fibromatosis
Specific Infections	<p>Bacterial Origin:</p> <ul style="list-style-type: none"> ✓ <i>Neisseria gonorrhoeae</i> ✓ <i>Treponema pallidum</i> ✓ <i>Mycobacterial tuberculosis</i> ✓ Streptococcal gingivitis <p>Viral Origin:</p> <ul style="list-style-type: none"> ✓ Coxsackie virus (Hand-foot-and-mouth disease) ✓ Herpes simplex I & II (Primary or recurrent) ✓ Varicella zoster (Chicken Pox & Shingles) ✓ Molluscum contagiosum ✓ Human papilloma virus (squamous cell papilloma; condyloma acuminatum; verruca vulgaris; focal epithelial dysplasia) <p>Fungal Origin:</p> <ul style="list-style-type: none"> ✓ Candidosis ✓ Other mycoses (e.g., histoplasmosis, aspergillosis)
Inflammatory & Immune Conditions	<p>Hypersensitivity reactions:</p> <ul style="list-style-type: none"> ✓ Contact allergy ✓ Plasma cell gingivitis ✓ Erythema multiforme

Table 4. Continued.

<p>Inflammatory & Immune Conditions</p>	<p>Autoimmune diseases (skin & mucous membranes)</p> <ul style="list-style-type: none"> ✓ Pemphigus vulgaris ✓ Pemphigoid ✓ Lichen planus ✓ Lupus erythematosus <ul style="list-style-type: none"> ● Systemic lupus erythematosis ● Discoid lupus erythematosis <p>Granulomatous Inflammatory Lesions (orofacial granulomatoses)</p> <ul style="list-style-type: none"> ✓ Crohn's disease ✓ Sarcoidosis
<p>Reactive Processes</p>	<p>Epulides</p> <ul style="list-style-type: none"> ✓ Fibrous epulis ✓ Calcifying fibroblastic granuloma ✓ Vascular epulis (pyogenic granuloma) ✓ Peripheral giant cell granuloma
<p>Neoplasms</p>	<p>Premalignancy</p> <ul style="list-style-type: none"> ✓ Leukoplakia ✓ Erythroplakia <p>Malignancy</p> <ul style="list-style-type: none"> ✓ Squamous cell carcinoma ✓ Leukemic cell infiltration ✓ Lymphoma <ul style="list-style-type: none"> ● Hodgkin ● Non-Hodgkin
<p>Endocrine, Nutritional & Metabolic Diseases</p>	<p>Vitamin Deficiencies</p> <ul style="list-style-type: none"> ✓ Vitamin C deficiency (Scurvey)
<p>Traumatic Lesions</p>	<p>Physical</p> <ul style="list-style-type: none"> ✓ Frictional Keratosis ✓ Mechanically-induced gingival ulceration ✓ Factitious injury (self-harm) <p>Chemical</p> <ul style="list-style-type: none"> ✓ Toxic burn <p>Thermal</p> <ul style="list-style-type: none"> ✓ Burns to gingiva
<p>Gingival Pigmentation</p>	<p>Melanoplakia</p> <ul style="list-style-type: none"> ✓ Smoker's melanosis ✓ Drug-induced pigmentation (antimalarials, minocycline) ✓ Amalgam tattoo

Periodontitis: Concept & Criteria for Staging and Grading

Some of the more major changes in the new classification scheme occur in the classification of periodontitis. The three main categories for periodontitis now are:

1. Necrotizing Periodontal Diseases
2. Periodontitis Associated with Systemic Diseases
3. Periodontitis



Image Courtesy of Dr. C. Cobb.

Table 5. Periodontitis.

Periodontitis		
Necrotizing Periodontal Diseases	Periodontitis as a Manifestation of Systemic Diseases	Periodontitis

It is noted that the category of Aggressive Periodontitis no longer exists. The workshop 2 authors determined that there is currently insufficient evidence to consider aggressive periodontitis and chronic periodontitis as two pathophysiologically distinct diseases.¹⁷ Thus, both chronic and aggressive periodontitis from the 1999 classification have now been included under the umbrella of "Periodontitis."

Sufficient evidence however was found to consider necrotizing periodontitis as a separate entity.¹⁷ Additionally, there was sufficient evidence for periodontitis observed in the presence of systemic diseases that severely impair the host response, to be considered separately under the umbrella of Periodontal Manifestations of Systemic diseases.

Necrotizing Periodontal Diseases

Patients falling under this category present with three typical clinical features: necrosis of the papilla, bleeding; and pain. This condition is associated with an impairment of the host immune response.¹⁷ Table 6 illustrates the key features of this classification.

Table 6. Classification of Necrotizing Periodontal Diseases.

Patient Category of Necrotizing Periodontal Disease	Patients	Predisposing Conditions	Clinical Condition
Severely & Chronically Compromised	Adult	- HIV+/AIDS with CD4 counts <200 & detectable viral load - Other severe systemic conditions that cause immunosuppression	Necrotizing Gingivitis (NG) Necrotizing Periodontitis (NP) Necrotizing Stomatitis (NS)
	Child	- Severe malnourishments - Extreme living conditions - Severe viral infections	Noma Possible progression
Temporarily or Moderately Compromised	Gingivitis Patient	- Uncontrolled factors: stress, nutrition, smoking, habits - Previous NPD (residual craters)	Generalized NG Possible progression to NP
		Local Factors: root proximity, tooth malposition	Localized NG Possible progression to NP
	Periodontitis Patient	Common Predisposing Factors	NG infrequent Progression NP infrequent progression

Adapted from Papapanou et al. 2018.¹⁷

Periodontitis Associated with Systemic Diseases

This category is primarily comprised of uncommon systemic diseases, such as Papillon-Lefevre syndrome, leukocyte adhesion deficiency, etc., that alter the host response enough to have a major effect on the course of periodontal disease. The primary diagnosis for such periodontal conditions should be classified under the systemic disease based on the World Health Organization's International Classification of Disease (ICD).⁵ Interestingly, there was not sufficient evidence to include periodontitis observed in the poorly controlled diabetic patient for inclusion in this category. Rather, since diabetes is recognized as being one of two currently identified evidence-based risk factors for periodontal disease, its presence is captured in the "Grading" of Periodontitis cases. In the new Classification, you will find periodontal manifestations of systemic diseases and conditions under the 3rd classification category entitled "Other Conditions Affecting the Periodontium."

Given the in-depth nature and extensive list of conditions and categories for this portion of the classification, it has not been included in this course. For further information regarding this category, reading of the "Periodontal manifestations of systemic diseases and developmental and acquired conditions: Consensus Report of Workgroup 3 of the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions" by Jepsen et al.¹⁸ is highly recommended.

Periodontitis

The new classification of periodontitis is modelled after the oncology system of staging and grading enabling a more multi-dimensional approach that incorporates not only severity of disease but rate of progression, the multifactorial etiology of the disease, its level of complexity for disease management and identification of risk for future disease recurrence or progression. This approach individualizes the diagnosis and case definition thus aligning it with the principles of personalized or precision medicine.⁶

The key elements necessary for classifying periodontal disease are:

Severity: Degree of periodontal breakdown

Complexity of Management: Type of bone loss (horizontal/vertical), probing depths, presence of furcations, tooth mobility, number of missing teeth, occlusal/functional aspects.

Extent: Number and distribution of teeth with detectable breakdown.

Rate of Progression: Rapidity of breakdown (direct or indirect observation).

Risk Factors: Smoking, Diabetes, overall compliance, general health.

Staging and Grading encompasses all of these necessary key elements. Staging includes classification of severity and extent of current tissue loss, including tooth loss (due to periodontitis), while incorporating the level of complexity in the long-term management of both function and esthetics. Grading on the other hand, incorporates the following biological dimensions: *periodontitis progression based on history; risk for further periodontitis progression; anticipated inferior treatment outcomes; and risk that the disease or treatment may negatively impact the patient's general health.*⁵ Tables 7 and 8 summarize the essential components for determining the stage and grade of the periodontitis case.

Requirements of a Periodontitis Case

In order for an individual to be diagnosed as a periodontitis case, there are three essential requirements:¹²

1. Detectable clinical attachment loss (CAL) at two (2) non-adjacent teeth.
2. Identification of the form of periodontitis i.e., necrotizing periodontitis, periodontitis as a manifestation of systemic disease, or periodontitis.
3. Description of the case characteristics and aggressiveness of the disease by Stage and Grade.

Steps for Determining a Diagnosis of Periodontitis

A simple 4-step process has been suggested by Kornman and Papapanou¹⁷ to assist clinicians in developing a diagnosis for each individual case using the new classification.

Table 7. Overview of Staging (Severity).





Stage	Description	Description
I	<ul style="list-style-type: none"> ✓ Very incipient ✓ CAL & BL limited to most coronal part of root ✓ No periodontal pockets ✓ No tooth loss from periodontitis 	<p style="text-align: center;">Mild</p> 
II	<ul style="list-style-type: none"> ✓ Periodontal destruction in coronal third of root ✓ Presence of moderate pockets (<5mm) ✓ No tooth loss from periodontitis 	<p style="text-align: center;">Moderate</p> 
III	<ul style="list-style-type: none"> ✓ Advanced periodontitis ✓ Destruction of periodontal tissues beyond half the tooth length ✓ Limited tooth loss has occurred & furcations and infra-bony pockets common ✓ Treatment more complex & usually entails surgical intervention 	<p style="text-align: center;">Severe</p> 
IV	<ul style="list-style-type: none"> ✓ Advanced periodontitis ✓ Destruction of periodontal tissues beyond half the tooth length ✓ Limited tooth loss has occurred & furcations and infra-bony pockets common ✓ Treatment more complex & usually entails surgical intervention 	<p style="text-align: center;">Very Severe</p> 

Table 8. Overview of Grading (Rate of Progression & Risk Factors).

Grade	Description
A	Rate of progression low No risk factors
B	Expected progression
C	Evident risk factors & high risk of progression

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Table 9. Periodontitis Stages.

Periodontal Stage		Stage I	Stage II	Stage III	Stage IV
Severity	Interdental CAL at site of greatest loss	1-2mm	3-4mm	≥5mm	≥5mm
	Radiographic Bone Loss	Coronal third (<15%)	Coronal third (15%-33%)	Extending to mid-third of root and beyond	Extending to mid-third of root and beyond
	Tooth Loss	No tooth loss due to Periodontitis	No tooth loss due to Periodontitis	Tooth loss due to Periodontitis of ≤4 teeth	Tooth loss due to Periodontitis of ≥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 Furcation involvement Class II or III Moderate ridge defect	In addition to Stage III complexity: Need for complex rehabilitation due to: Masticatory dysfunction Secondary occlusal trauma (tooth mobility degree ≥2) Severe ridge defect Bite collapse, drifting, flaring Less than 20 remaining teeth (10 opposing pairs)
Extent and distribution	Add to Stage as Descriptor	For each stage, describe extent as localized (<30% teeth involved), generalized, or molar/incisor pattern			

Adapted from Tonetti et al.⁵

Table 10. Periodontitis Grade.

Periodontitis Grade			Grade A Slow rate of progression	Grade B Moderate rate of progression	Grade C Rapid rate of progression
Primary Criteria	Direct Evidence of Progression	Longitudinal data (Radiographic bone loss or CAL)	Evidence of no loss over 5 years	<2mm over 5 years	≥2mm over 5 years
		% Bone Loss	<0.25	0.25 - 1.0	>1.0
	Indirect Evidence of Progression	Case Phenotype	Heavy biofilm deposits with low levels of destruction	Destruction commensurate with biofilm deposits	Destruction exceeds expectation given biofilm deposits; specific clinical patterns suggestive of periods of rapid progression and/or early-onset disease (e.g., molar/incisor pattern; lack of expected response to standard bacterial control therapies)
Grade Modifiers	Risk Factors	Smoking	Non-smoker	Smoker <10 cigarettes/day	Smoker ≥10 cigarettes/day
		Diabetes	Normoglycemic/no diagnosis of diabetes	HbA1c <7.0%	HbA1c ≥7.0% in patients with diabetes

Adapted from Tonetti et al.⁵

Steps for Determining a Diagnosis of Periodontitis

A simple 4-step process has been suggested by Kornman and Papapanou¹⁹ to assist clinicians in developing a diagnosis for each individual case using the new classification.

Step 1 - Case Overview

- Examine full mouth radiographs
- Examine full mouth probing depths
- Document number of missing teeth

*This will help to first determine whether the case is: **Mild/Moderate** or **Severe/Very Severe***

Step 2 - Determine Stage

- Determine maximum Clinical Attachment Loss (CAL) or Radiographic Bone Loss (RBL)

- Confirm pattern of bone loss (horizontal or vertical)
- Determine number of missing teeth due to periodontitis
- Determine complexity of case (i.e., probing depths, furcations, occlusion/function, need for extensive rehabilitation, etc.)
- Decision made using Table 9

Step 3 - Determine Grade

- Always start with the default Grade of B
- Consider history/rate of progression/age
- Response to previous therapy (Plaque control/SRP)
- Medical history/systemic conditions
- Risk factors
- Adjust default Grade using Table 10

Stage 1 Grade B

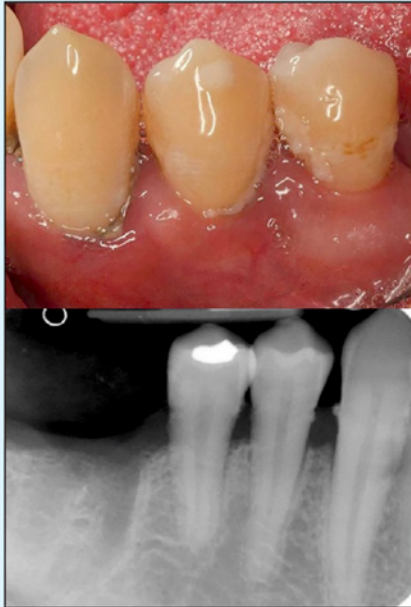


Image Courtesy of Dr. C. Cobb

Staging

PD = \leq 4 mm
BOP = Yes
RBL < 15% & generally horizontal
CAL 1-2 mm
Biofilm = Slight-Heavy

Grading

No tooth loss due to periodontitis
Moderate Rate of Progression
Non-Smoker
Non-Diabetic

Stage 2 Grade B



Image Courtesy of Dr. C. Cobb

Staging

PD \leq 5 mm
BOP = Yes
RBL = 15% - 33% / mostly horizontal
CAL 3-4 mm
Biofilm = Slight-Heavy

Grading

No tooth loss due to periodontitis
Moderate Rate of Progression
Smoker <10 cigs per day
If Diabetic HbA1c <7.0%

Stage 3 Grade B



Image Courtesy of Dr. C. Cobb

Staging

PD = \leq 4 mm
BOP = Yes
RBL < 15% & generally horizontal
CAL 1-2 mm
Biofilm = Slight-Heavy

Grading

No tooth loss due to periodontitis
Moderate Rate of Progression
Non-Smoker
Non-Diabetic

Stage 4 Grade C



Image Courtesy of Dr. C. Cobb

Staging

PD \geq 6 mm
BOP = Yes
RBL = Horizontal \geq 50% / Vertical \geq 3 mm
CAL \geq 5 mm
Biofilm = Slight-Heavy

Grading

Tooth loss due to periodontitis \geq 5 teeth
Furcation Involvement = Class II or III
Moderate ridge defect
Need for complex rehabilitation
Bone loss exceeds expectations given biofilm
Rapid Rate of Progression
Smoker >10 cigs per day
If Diabetic HbA1c >7.0%

Please note: These examples do not include categorization of the extent of disease, thus keep in mind that localized would be any case that had less than 30% of teeth involved, while generalized would be more than 30% of teeth involved.

Other Conditions Affecting the Periodontium

Table 11. Other Conditions Affecting the Periodontium

1. Systemic diseases or conditions affecting periodontal supporting structures
2. Periodontal abscesses and endodontic-periodontal lesions
3. Mucogingival deformities and conditions
4. Traumatic occlusal forces
5. Tooth and prostheses-related factors

In addition to the major categories of gingivitis and periodontitis included in the new classification, it was recognized that there are also a variety of diseases and conditions that can negatively affect the integrity of the periodontium that can result in periodontal disease. These conditions include: (i) periodontal manifestations of systemic diseases and conditions; (ii) mucogingival conditions around natural teeth; (iii) traumatic occlusal forces and occlusal trauma; and (iv) dental and tooth related factors.

As indicated in the periodontitis category, periodontal manifestations of systemic disease are primarily comprised of uncommon systemic diseases such as Papillon-Lefevre syndrome, leukocyte adhesion deficiency, etc. that alter the host response enough to have a major effect on the course of periodontal disease. The primary diagnosis for such periodontal conditions should be classified under the specific systemic disease they fall under on the world Health Organization's International Classification of Disease (ICD).⁵

Although substantial evidence has accumulated since the 1999 classification in support of the role of periodontal disease in increasing the overall systemic inflammatory burden and thus the individual's susceptibility to diseases such as coronary artery disease, stroke and Type II diabetes, there is little direct interventional evidence that periodontal therapy improves overall health.¹⁸ The only exception is Type II Diabetes, where demonstrable effects have been shown in reducing a patient's HbA1c levels by controlling oral inflammation due to

periodontitis.²⁰ Since diabetes is recognized as being one of only two currently identified risk factors for periodontal disease, its presence is captured in the "Grading" of Periodontitis cases. In the new Classification, you will find "periodontal manifestations of systemic diseases and conditions" under the 3rd classification category entitled "Other Conditions Affecting the Periodontium."

Peri-implant Diseases and Conditions

The 4th and last category in the new Classification system is Peri-implant Diseases and Conditions which are broken down into 4 sections as shown in Table 12. This is the first time that an implant category has been included in a Periodontal Classification System. The first section is the inclusion of **Peri-implant Health**, representing the absence of disease, thus the absence of any signs of inflammation such as bleeding on probing, redness, swelling and suppuration. With implants, it was not possible to determine what a healthy probing depth range would be, as it is variable dependent upon the amount of tissue support. Implants with reduced bone support can still be healthy.⁶

Table 12. Peri-implant Diseases and Conditions.

1. Peri-implant Health
2. Peri-implant Mucositis
3. Peri-implantitis
4. Peri-implant Hard & Soft Tissue Deficiencies

Peri-implant Mucositis is clinically similar to gingivitis in natural teeth and is characterized by clinical signs of inflammation such as bleeding on probing, possible suppuration, redness and swelling. Typically, there may be an increase in probing depth from the original due to edema resulting from the inflammatory response. There is strong evidence that plaque biofilm is the prime etiological factor in this condition and as well, similar to natural teeth, can resolve once the burden of biofilm is controlled.⁶

Peri-implantitis is the next step that occurs if peri-implant mucositis is not arrested and



Image Courtesy of Dr. C. Cobb.

is allowed to progress resulting in loss of supportive bone. Peri-implantitis is considered to be a plaque-associated disease, thus plaque control and regular maintenance care are paramount. Risk indicators include a past history of severe periodontitis, poor plaque control, and failure to attend regular maintenance appointments after implant placement. Another factor that has been considered is poor positioning of the implant preventing good plaque removal. Increased probing depths, inflammation, possible recession and radiographic bone loss are used to diagnose this condition. Pocket depths have been noted to be correlated with bone loss and thus are used to determine the severity of



Image Courtesy of Dr. C. Cobb.

the disease. If bone loss becomes extensive, mobility of the implant will occur.

Hard and Soft Tissue Deficiencies refer to the diminished dimensions of both the alveolar process or ridge following tooth loss as well as the amount of keratinized soft tissue.

Conclusion

This course has provided the learner with insight into the rationale and complexity involved in the development of the 2018 periodontal disease classification system that was created by representatives from around the world who are experts in the discipline of periodontology. This system was well thought out, using the most current literature and aligning it with new developments in the human microbiome as well as the new paradigm of Precision Medicine. This new classification has a built-in plan for periodic revision and once the concept of staging and grading are learned, arriving at a diagnosis can be relatively simple. One thing that should be kept in mind is that when assessing the stage and grade, it is not necessary to fill every single cell in the grid. As well, there is built in flexibility that enables one to revise the initial diagnosis once response to individual treatment based on patient adherence to biofilm and risk factor control is assessed.

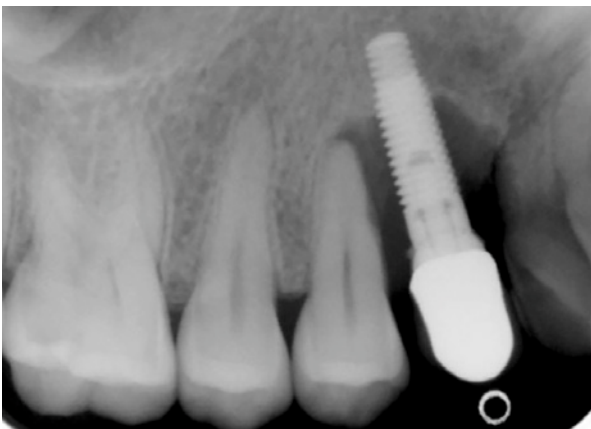


Image Courtesy of Dr. C. Cobb.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/ce-courses/ce610/test

- 1. An International classification system for periodontal disease is required for all of the following reasons EXCEPT _____.**
 - A. to facilitate population surveys of disease prevalence, etiology and natural history
 - B. to enable dental boards to create specific fee guides for treatment
 - C. to provide an international language for research and communication
 - D. to enable diagnosis and prognostication in order to educate patients
- 2. The new classification system differentiates gingival health and gingival inflammation occurring _____.**
 - A. in anterior and posterior regions of the mouth
 - B. on attached gingiva and alveolar mucosa
 - C. on intact periodontium, reduced periodontium & stable periodontitis patients
 - D. on all mucosal surfaces of the mouth
- 3. The term “Dysbiosis” refers to _____.**
 - A. a disruption in symbiosis of microbiome content that could lead to disease
 - B. the state of balance of microbes in the oral cavity
 - C. a state of imbalance of microbes only in the gut
 - D. the over 1,000 microbes occurring in the oral cavity
- 4. The focus of “Precision Medicine” is to determine which treatment approaches will be most effective for patients based on their _____.**
 - A. genetic factors alone
 - B. environmental factors alone
 - C. lifestyle factors alone
 - D. genetic, environmental and lifestyle factors together
- 5. Staging of periodontal disease includes _____.**
 - A. severity and extent of current tissue and tooth loss
 - B. direct evidence of progression
 - C. Indirect evidence of progression
 - D. presence of risk factors
- 6. The human microbiome is comprised of a “core” and a “variable” part. The core is shared among all humans, while the variable microbiome is exclusive to each individual and based on their _____.**
 - A. physical makeup
 - B. genetics alone
 - C. lifestyle choices and genetics
 - D. genotype, phenotype and unique lifestyle
- 7. The oral cavity houses the second largest number of microbiota next to the GI tract.**
 - A. True
 - B. False

- 8. A major paradigm shift has occurred recently in the etiology of periodontal disease, based on the concept(s) of _____.**
- A. metagenomics and individual lifestyle
 - B. metabiomics and symbiosis
 - C. specific bacteria have been shown to be the sole cause of periodontal disease
 - D. no specific bacteria have been shown to be the sole cause of periodontal disease
- 9. In stable periodontitis patients with a reduced periodontium, if there are no signs of inflammation and pocket depths do not exceed 4mm, the case would be classified as _____.**
- A. gingival health
 - B. gingivitis
 - C. periodontal health
 - D. periodontitis
- 10. Gingival diseases that are considered to be Non-dental Plaque-induced, include all of the following EXCEPT those _____.**
- A. of hereditary origin such as Gingival Fibromatosis
 - B. of viral or fungal origin
 - C. associated with smoking
 - D. of physical, chemical or thermal origin
- 11. Aggressive periodontitis is not included as a category in the new classification because _____.**
- A. it is now included under the category of Periodontitis as a Manifestation of Systemic Disease
 - B. there is insufficient evidence to consider it as a separate entity from chronic periodontitis
 - C. it is pathophysiologically distinct from chronic periodontitis
 - D. it is rarely seen in adults
- 12. Necrotizing periodontal diseases are characterized by _____.**
- A. possible bleeding on probing
 - B. suppuration and bone loss
 - C. presence of a high fever
 - D. bleeding, pain and necrosis of the papilla
- 13. For periodontal conditions that fall under the category of "Periodontitis as a Manifestation of Systemic Disease," their primary diagnosis should be classified under _____.**
- A. their specific systemic disease
 - B. the World Health Organization's International Classification of Disease (ICD)
 - C. periodontitis
 - D. other conditions affecting the periodontium
- 14. What are the essential requirements of a periodontitis case?**
- A. Detectable clinical attachment loss (CAL) at three (3) non-adjacent teeth and identification of the aggressiveness of the disease by Stage and Grade
 - B. Identification of the form of periodontitis i.e., necrotizing periodontitis, periodontitis as a manifestation of systemic disease, or periodontitis
 - C. Description of the form of periodontitis and the case characteristics and aggressiveness of the disease
 - D. Detectable clinical attachment loss at 2 non-adjacent teeth, identification of the form of periodontitis, description of the case characteristics, and aggressiveness of the disease by Stage and Grade

15. When classifying the stage of periodontal disease, the extent must also be identified. "Localized" is differentiated from "generalized" by LESS THAN _____.
- A. 10% of teeth involved
 - B. 20% of teeth involved
 - C. 30% of teeth involved
 - D. 40% of teeth involved
16. When Grading a Periodontitis Case and considering risk factors, a Grade B would be someone who _____.
- A. does not smoke
 - B. is normoglycemic
 - C. has an HbA1c less than 7.0%
 - D. has an HbA1c more than $\geq 7.0\%$
17. A 42-year old male patient presented himself for examination complaining of bleeding gums. While reviewing his medical history, he disclosed that he is a non-smoker but was recently diagnosed with Type 2 diabetes. He claims his last HbA1c value was 6.2%. Upon clinical examination, he had numerous 4 mm pockets and one 5mm pocket on the mesial of #15. Evidence of slight radiographic horizontal bone loss was also noted in that area. All teeth were present and biofilm was moderate. Your initial classification of his case type is _____.
- A. Stage 1 Grade B
 - B. Stage 2 Grade B
 - C. Stage 3 Grade C
 - D. Stage 4 Grade C
18. A 65-year old female patient presents for her 3-month maintenance appointment. She has been a heavy smoker for the past 40 years and is on 3 antihypertensive medications as well as Lipitor. She has lost 6 molars due to periodontal disease over the past 10 years which have been replaced with two partial dentures and has a subsequent ridge defect. She has numerous pockets that are between 5 and 7 mm with bleeding on probing and one 8 mm pocket. There is extensive radiographic bone loss around the remaining 2 molars that exceed 50% and vertical bone loss evident adjacent to a premolar. Furcation involvement on one molar is a Class III. Bleeding on probing is noted in some areas but is not as extensive as one would expect. Her plaque control is relatively good with only slight biofilm noted. You classify this case type as _____.
- A. Stage 3 Grade B
 - B. Stage 3 Grade C
 - C. Stage 4 Grade B
 - D. Stage 4 Grade C
19. Which of the following statements is true?
- A. Probing depths around implants can vary dependent upon the amount of tissue support.
 - B. Implants with reduced bone support can still be healthy.
 - C. Both A and B are true.
 - D. Neither are true.
20. Peri-implant mucositis is characterized by _____.
- A. bleeding on probing and mobility of the implant
 - B. possible suppuration and bone loss
 - C. redness and swelling
 - D. bleeding on probing, suppuration, redness and swelling

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Additional Resources

- No Additional Resources Available.

About the Author

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Salme received a diploma in Dental Hygiene (University of Toronto), a BA in Biomedical Anthropology, (Lakehead University), a Master of Science degree in Dental Hygiene (University of Missouri-Kansas-City), and a PhD (Faculty of Medicine, University of Manitoba). Salme was Coordinator, Dental Programs, Confederation College; Chair, Department of Dental Hygiene, Wichita State University and Professor & Director, School of Dental Hygiene at the University of Manitoba where she taught periodontology to both dental and dental hygiene students and medical microbiology and infectious diseases to dental hygiene students. Her research interests lie in oral/systemic medicine, periodontology and the older institutionalized adult. Salme has authored more than 25 peer-reviewed journal articles in National and International journals and 3 textbook chapters. She has delivered over 100 professional presentations in numerous countries including South Africa, Switzerland, Italy, Sweden, China, US and Australia. Salme has held numerous appointments including President, Canadian Dental Hygienists Association; Commissioner, Commission on Dental Accreditation of Canada; Chair, Canadian Foundation for Dental Hygiene Research & Education; and Councilor, Section on Dental Hygiene Education, American Dental Education Association. Salme has received Alumni of Distinction Awards from both the University of Missouri-Kansas City and the Faculty of Dentistry, University of Toronto.

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