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Periodontitis Classifications — Up to Date: A Narrative Review”

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ABSTRACT

Classification systems translate heterogeneous clinical observations into reproducible categories that guide diagnosis, research, prognosis, and treatment. Periodontal classification has evolved from simple, age-based and descriptive systems to multidimensional frameworks integrating severity, extent, complexity, and risk modifiers. The 2017 World Workshop (published 2018) replaced the chronic/aggressive dichotomy with a unified entity “periodontitis” and introduced **staging (I–IV)** and **grading (A–C)** to support precision management. It also established definitions for **necrotizing periodontitis** and **periodontitis as a manifestation of systemic disease**. This review critically analyzes the historical development of periodontal classification, the structure and rationale of the 2018 AAP/EFP classification, evidence for its validity and reproducibility, strengths and limitations, and emerging digital and AI-based applications. Drawing upon PubMed-indexed studies, consensus documents, and contemporary critiques, it provides a comprehensive synthesis of how the classification supports individualized care, identifies its practical challenges, and highlights opportunities for refinement through biomarker discovery, AI integration, and epidemiological harmonization.

INTRODUCTION

Classifying disease is foundational to clinical medicine, enabling clinicians to communicate consistently, standardize case definitions for research, and guide therapy. **Periodontitis** is a chronic, microbially-associated, host-mediated inflammatory disease that leads to loss of periodontal attachment and alveolar bone, ultimately resulting in tooth loss and systemic sequelae[1].

Over the decades, multiple periodontal classification systems have been proposed, each reflecting prevailing scientific understanding and clinical needs. However, inconsistencies in terminology, diagnostic thresholds, and etiopathogenic interpretation created confusion. The most consequential advance came from the **2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions**, which produced the **AAP/EFP 2018 classification**[2]. This modern framework unified disease entities, introduced prognostic staging and grading, and aligned classification with risk assessment principles[3].

This review synthesizes the **historical evolution**, the **structure of the 2018 framework**, its **strengths, limitations, validation evidence**, and **future directions** involving AI and biomarkers, based on leading PubMed-indexed literature and consensus documents from top periodontal journals.

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Historical Evolution of Periodontal Classification
The evolution of periodontal classification reflects advances in pathogenesis and diagnostic precision. Early schemes (1970s–1980s) primarily described clinical phenotype and age of onset, dividing cases into entities such as "juvenile," "rapidly progressive," and "adult" periodontitis[4].

In **1989**, the AAP consolidated earlier systems, introducing categories like adult periodontitis, early-onset periodontitis, and rapidly progressive periodontitis[5]. While widely adopted, this classification relied heavily on age and rate of progression, resulting in overlapping categories and poor reproducibility[6].

The **1999 AAP International Workshop** improved terminology, defining chronic and aggressive periodontitis as distinct diseases[7]. This version served the research community for nearly two decades but faced persistent ambiguity regarding whether the two forms represented separate diseases or phenotypic variations of one spectrum[8].

Ultimately, accumulating genetic, microbiological, and immunological evidence demonstrated overlapping features between chronic and aggressive forms[9], paving the way for a unified model.

2017 World Workshop / 2018 AAP–EFP Classification — Structure and Rationale
The **2017 World Workshop** co-organized by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) produced a landmark classification published in **2018**[10].

1. Unified Concept of "Periodontitis"
Evidence indicated no clear biological distinction between "chronic" and "aggressive" forms. Consequently, both were merged into a single entity, periodontitis, recognizing phenotypic variability driven by host and environmental modifiers[11].

2. Multidimensional Staging and Grading
- **Staging (I–IV):** Quantifies severity (based on clinical attachment loss [CAL], radiographic bone loss, and tooth loss) and treatment complexity (e.g., furcation involvement, ridge defects, masticatory dysfunction)[12].
- **Grading (A–C):** Reflects the rate of progression, systemic impact, and anticipated response to therapy, incorporating risk factors such as smoking and diabetes[13].

3. Refined Definitions for Related Conditions
The framework also established clear diagnostic criteria for **necrotizing periodontal diseases**, **periodontitis as a manifestation of systemic disease**, and **peri-implant conditions**[14]. It additionally defined periodontal health and reduced but stable periodontium as measurable clinical endpoints.

Critical Analysis — Strengths of the 2018 Classification

1. Conceptual Clarity
The unification of periodontitis removes artificial boundaries between chronic and aggressive forms, reflecting the continuum of host–microbe interactions[15]. This enhances diagnostic clarity and aligns with modern pathobiological evidence.

2. Prognostically Oriented Staging and Grading
Staging captures disease severity and treatment complexity; grading incorporates systemic and behavioral risk factors, promoting individualized patient management[16].

3. Harmonization of Clinical and Research Frameworks
The AAP/EFP classification has standardized definitions that facilitate comparability across clinical trials, epidemiological studies, and public health databases[17].

4. Integration Potential with Digital and Biomarker-Based Tools
By accommodating future integration of molecular and imaging biomarkers, the system supports the movement toward **precision periodontal medicine**[18].

Critical Limitations and Practical Challenges
1. Implementation Complexity

While conceptually robust, staging and grading require calibration and clinical training for consistent application. Inter-examiner reproducibility varies widely[19].

2. Dependence on Longitudinal Data
Accurate grading ideally requires previous radiographs or documented attachment loss. When unavailable, surrogate indices such as bone loss-to-age ratio are used but may misclassify disease severity[20].

3. "Gray Zone" Diagnoses
Some cases—such as localized severe lesions with minimal complexity—do not fit neatly within existing stage/grade matrices[21].

4. Epidemiological Comparability
Historic CDC/AAP surveillance data cannot be directly reclassified under the 2018 definitions, complicating longitudinal disease burden comparisons[22].

5. Limited Validation of Prognostic Accuracy
Few prospective studies have confirmed the predictive superiority of staging/grading for tooth loss or treatment response[23].

Evidence for Reproducibility and Reliability
Studies show higher agreement among calibrated periodontists than general practitioners, particularly for **stage IV** and **grade C** assignments[24]. Digital aids and AI-assisted algorithms can improve accuracy and consistency by automating radiographic and textual data analysis[25].

Digital Tools, Imaging, and Artificial Intelligence
AI and digital dentistry have opened pathways for automated staging/grading. **Convolutional neural networks (CNNs)** quantify radiographic bone loss, while **natural language processing (NLP)** extracts periodontal data from clinical notes[26]. Decision-support apps that guide clinicians through classification steps are under pilot evaluation, showing improved accuracy and reduced cognitive load[27].

Biomarkers and Systemic Links
The inclusion of systemic modifiers—smoking and diabetes—acknowledges systemic influences on periodontal disease progression. Biomarkers such as **HbA1c**, **cotinine**, and inflammatory mediators (IL-1β, MMP-8) are potential grade modifiers but require validation[28].
Future studies may establish **salivary or genomic markers** as standard modifiers, linking periodontal classification more closely with personalized medicine[29].

Special Categories: Necrotizing and Systemic Periodontitis
The 2018 framework retained necrotizing periodontal diseases and recognized **periodontitis as a manifestation of systemic disease** (e.g., leukocyte adhesion deficiency, Papillon–Lefèvre syndrome)[30]. These entities, though rare, underscore the need for systemic evaluation in atypical cases.

Impact on Education, Guidelines, and Clinical Practice
Major societies (AAP, EFP) and global guidelines (EFP S3-level) now use the 2018 classification[31]. It underpins treatment algorithms, recall interval recommendations, and educational curricula[32]. However, successful clinical translation requires structured training and decision-support tools[33].

Research Priorities and Future Directions
Key priorities include:
- Prospective validation of the prognostic utility of stages and grades[34].
- Standardization of grading reliability across clinical settings.
- Integration of validated biomarkers and AI models[35].
- Harmonization of epidemiological data with historical schemes[36].

Continued refinement through multicenter trials and international consensus updates will ensure ongoing relevance.

Practical Recommendations for Clinicians

- Incorporate staging and grading into clinical charts and EHR templates.
- Use decision aids and validated calculators.
- Apply conservative grading in absence of longitudinal data.
- Train and calibrate clinicians through workshops/webinars.
- Utilize AI-based tools judiciously, maintaining clinician oversight.

CONCLUSION

The **2018 AAP/EFP classification** represents a paradigm shift—merging scientific insight with clinical applicability. It transforms periodontitis from a dichotomous model into a **continuum-based, prognostic, and risk-integrated framework**. However, to fully realize its potential, reproducibility, implementation, and validation challenges must be addressed through education, digital support, and research. As AI, biomarkers, and longitudinal datasets evolve, the classification will continue to mature, guiding precision care in periodontal medicine.

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