Shades of Gray

Periodontal disease classification isn’t as easy as black and white

by Dr. Rachel A. Schallhorn

In 2017, the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) held the World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. The goal was to develop an evidence-based update to account for what the specialty had learned about periodontitis and implant-related conditions since the existing periodontal disease classifications had been published in 1999.

While the revised classification system is a significant advance for the profession, determining the stage and grade of periodontal disease is still not always a black-and-white situation. More often than not, clinicians must still rely on experience and judgment when assessing a “gray” situation for which the correct assessment is not immediately or intuitively obvious. This article is intended to provide insight on how to navigate some of the many shades of gray likely to be encountered when classifying periodontal disease.
Key definitions

According to the updated classifications, a patient has periodontitis if:

- Interdental clinical attachment loss (CAL) is detectable in two or more nonadjacent teeth.
- Buccal or lingual CAL ≥ 3 mm with pocketing > 3 mm is detectable in two or more teeth.
- The observed CAL cannot be ascribed to trauma-induced gingival recession, dental caries extending to the cervical area, endodontic lesions draining through the periodontium, or tooth fractures.

The new classification of periodontitis is based on a two-vector system defined by stage and grade, inspired by a scheme used in oncology.

Stage classifies the severity and extent of current tissue loss, including tooth loss due to periodontitis. As seen in Table 1, this classification incorporates an assessment of the level of complexity of management of the patient’s condition.

According to the revised ground rules for assessing the stage of periodontal disease:

- The stage is defined on the basis of the most severe finding and on the patient level, not the individual tooth level.
- The stage is assigned before treatment and cannot revert after therapy, but may advance over time if the periodontal conditions deteriorate significantly.
- Disease severity, case complexity and periodontitis-associated tooth loss are “alternative paths” that guide the selection of the appropriate stage.
- Selection of the appropriate stage requires more than “checking off” individual boxes; it is a deliberate process that necessitates a holistic evaluation of multiple findings.

### Table 1

<table>
<thead>
<tr>
<th>Periodontitis Stage</th>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
<th>Stage IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Severity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interdental CAL at site of greatest loss</td>
<td>1–2 mm</td>
<td>3–4 mm</td>
<td>≥ 5 mm</td>
<td>≥ 5 mm</td>
</tr>
<tr>
<td>Radiographic bone loss</td>
<td>Coronal third (&lt; 15%)</td>
<td>Coronal third (15–33%)</td>
<td>Extending to mid-third of root and beyond</td>
<td>Extending to mid-third of root and beyond</td>
</tr>
<tr>
<td>Tooth loss</td>
<td>No tooth loss due to periodontitis</td>
<td>Loss of four or fewer teeth due to periodontitis</td>
<td>Loss of five or more teeth due to periodontitis</td>
<td></td>
</tr>
<tr>
<td><strong>Complexity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>Maximum probing depth ≥ 4 mm</td>
<td>Maximum probing depth ≥ 5 mm</td>
<td>In addition to Stage II complexity: • Probing depth ≥ 6 mm • Vertical bone loss ≥ 3 mm • Furcation involvement Class II or III • Moderate ridge defect</td>
<td>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)</td>
</tr>
<tr>
<td>Mostly horizontal bone loss</td>
<td>Mostly horizontal bone loss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Extent and distribution</strong></td>
<td>Add to stage as descriptor</td>
<td>For each stage, describe extent as localized (less than 30% of teeth involved), generalized, or molar/incisor pattern.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As seen in Table 2, a patient’s grade incorporates four additional biological dimensions of periodontal disease:

- The history-based periodontitis progression.
- The risk of further periodontitis progression.
- Any anticipated treatment outcomes.
- The risk that the disease or its treatment may negatively affect the general health of the patient.

According to the revised ground rules for assessing a patient’s grade:

- The grade is primarily defined on the basis of observed or inferred rate of periodontitis progression.
- The grade is heavily influenced by the presence or control of risk factors that influence further progression and treatment outcomes.
- The grade may revert to a lower level after therapy, if the risk profile of the patient improves significantly and sustainably.
- When unsure, the clinician should assign Grade B (moderate rate of progression) and modify accordingly when the elements of the risk profile become clearer.

The case summaries on the pages that follow illustrate how to classify periodontal disease when dealing with "the gray zones."

### Periodontitis Grade

<table>
<thead>
<tr>
<th>Primary Criteria</th>
<th>Direct evidence of progression</th>
<th>Indirect evidence of progression</th>
<th>Case phenotype</th>
<th>Grade A: Slow rate of progression</th>
<th>Grade B: Moderate rate of progression</th>
<th>Grade C: Rapid rate of progression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal data (radiographic bone loss or CAL)</td>
<td>Evidence of no loss over 5 years</td>
<td>&lt;0.25%</td>
<td>Heavy biofilm deposits with low levels of destruction</td>
<td>&lt;2 mm over 5 years</td>
<td>&lt;0.25–1.0%</td>
<td>&gt;1.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade Modifiers</th>
<th>Systematic Impact Risk</th>
<th>Biomarkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk factors</td>
<td>Inflammatory burden</td>
<td>Indicators of CAL/bone loss</td>
</tr>
<tr>
<td>Smoking</td>
<td>High-sensitivity CRP (hsCRP)</td>
<td>Saliva, gingival crevicular fluid, serum</td>
</tr>
<tr>
<td>Nonsmoker</td>
<td>&lt;1mg/L</td>
<td>?</td>
</tr>
<tr>
<td>Smokes &lt;10 cigarettes/day</td>
<td>1–3mg/L</td>
<td>?</td>
</tr>
<tr>
<td>HbA1c &lt; 7.0% in patients with diabetes</td>
<td>&gt;3mg/L</td>
<td>?</td>
</tr>
<tr>
<td>HbA1c ≥ 7.0% in patients with diabetes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Conclusion

Periodontics, like life, would be much simpler if it involved binary black-and-white choices rather than a seemingly infinite number of shades of gray. Used properly and consistently, the updated Classification of Periodontal and Peri-Implant Diseases and Conditions can serve as a significantly enhanced complement to the periodontist’s judgment in providing best possible patient care when dealing with complex periodontal cases.
Case 1: Periodontitis involving a single tooth

A 60-year-old patient presents with an isolated deep probing depth at tooth #31 distal. The patient is systemically healthy with no current or past smoking history. Her dental history indicates third-molars extraction at age 42 and regular dental care that included prophylaxis every 6–12 months. Key periodontal and radiographic measurements were as follows:

Periodontal parameters
- Bleeding on probing (BoP): Localized to #31 distal.
- PD range: Generally 2–3 mm
- Localized 9–11 mm PD at #31 distal (Fig. 1).
- CAL range: 0–9 mm.
- Furcation involvement: Class I (#31 buccal).

Radiographic parameters
- Vertical bone loss extending to and beyond the mid-third of the root at #31 distal (Figs. 2 and 3).
- Generally intact bone support.

Staging assessment
- Severity: CAL range of 0–9 mm and radiographic bone loss extending beyond the mid-third of the root indicates Stage III or IV periodontitis.
- Complexity: PD ≥ 6 mm; vertical bone loss ≥ 3 mm.
- Extent and distribution: localized (< 30% of teeth).

Grading assessment
- Primary criteria: Destruction is commensurate with the biofilm deposits indicating Grade B.
- Grade modifiers: Done.

When reviewing the key definitions for periodontitis, one of the requirements for a diagnosis of periodontitis is “interdental clinical attachment loss at two or more nonadjacent teeth.” It is thus fair to question whether it’s appropriate to make a single-tooth diagnosis of periodontitis in this patient. In my view, the “two or more teeth” requirement was developed to prevent overdiagnosis. Given the severity of the complexity factors for this patient, as well as the complex surgical treatment required to address the osseous defect, a diagnosis of localized Stage III, Grade B periodontitis was deemed justifiable.

The initial etiology of this case merits highlighting: This defect likely did not start as periodontitis; it developed into frank periodontitis over time. Case management was localized but complex, requiring regenerative periodontal therapy.

Fig. 1: Clinical photo demonstrates the 9mm PD at tooth #31 distal.

Fig. 2: Periapical radiograph shows severe vertical bone loss at #31 distal.

Fig. 3: Surgical photograph shows a deep osseous defect at #31 distal.
Case 2: Interpreting risk after periodontal treatment

A 14-year-old patient presented with swollen gums. She had been receiving regular dental care, including prophylaxis every six months, since age 5, but had recently developed severe gingival inflammation and had undergone scaling/root planing at her general dentist’s office.

She was systemically healthy, but as an adoptee had no known family medical history. Her periodontal and radiographic measurements were as follows:

**Periodontal parameters**
- BoP: 50% of sites.
- PD range: 2–3mm generally; 4–7mm at teeth #7–10.
- CAL range: 0–2mm.
- Furcation involvement: none.
- Mobility: none.
- Altered passive eruption in maxilla (Fig. 4).

**Radiographic parameters**
- Generally intact bone support (Figs. 5a–5f).
- Bone loss within coronal third (#7 and #10).

**Staging assessment**
- Severity: CAL range of 0–2mm suggests Stage I; bone loss within coronal third (#7 and #10) suggests Stage I; lack of tooth loss suggested Stage I or II.
- Complexity: PD range of 4–7mm at teeth #7–10 suggests Stage III.

**Grading assessment**
- Primary criteria: High percentage of bone loss for age suggests Grade C. The fact that destruction exceeded expectation based upon the patient’s history and clinical appearance also suggests Grade C.

Taking into consideration the patient’s clinical and radiograph appearance as well as her history of regular dental care, she was diagnosed with **Stage I, Grade C periodontitis**. With incipient disease in a very young person, the driving force is the grade.

Considering the patient’s high-grade periodontitis and recent history of nonsurgical periodontal therapy, surgical periodontal treatment was recommended (Fig. 6). Surgery involved root surface debridement as well as gingival and osseous recontouring. The patient healed well and without complication after surgery (Fig. 7). After active treatment,
she was maintained on a three-month periodontal maintenance recall interval.

Five years after treatment, the patient underwent comprehensive periodontal evaluation, and the following, significantly improved, periodontal and radiographic measures were recorded:

**Periodontal parameters**
- BoP: < 10% of sites.
- PD range: 2–3mm.
- CAL range: 0–1mm.
- Furcation involvement: none.
- Mobility: none.
- No bone loss in the previous 5 years.

**Radiographic parameters**
- Stable alveolar bone levels

While the periodontal treatment had clearly been successful both clinically and aesthetically (Fig. 8), several questions suggested themselves:
- How should risk be assessed?
- Can grade be modified in this case?
  - Soft-tissue defects (altered passive eruption) have been addressed.
  - The patient has been stable for 5 years.
  - Note: While the grade can be modified over time, the stage cannot.
- What are the implications of changing the grade?
  - How do a patient’s age and history of periodontitis affect risk for future disease development and progression?

While grade can be modified after successful periodontal therapy, this particular patient’s young age at the time of initial presentation was a significant factor in this case.

Based upon her history of severe inflammation and disease development at a young age despite regular dental care, her risk for future disease recurrence and progression remains high. The patient’s diagnosis was maintained at a **Stage 1, Grade C periodontitis**.

Fig. 5a–5f: Radiographs demonstrate generally intact bone support; however, horizontal bone loss within the coronal third of the root is evident at teeth #7 and 10.

Fig. 6a–6b: Surgical photos demonstrate calculus on root surfaces.

Fig. 7: Surgical photo after root surface debridement and osseous recontouring.

Fig. 8: Clinical appearance 5 years after completion of active periodontal treatment.
Case 3: Periodontally hopeless teeth

A 35-year-old patient presented with severe inflammation and probing depths ranging 4–12 mm with tooth mobility at several sites (Fig. 9). Radiographically severe bone loss was evident with vertical defect formation at several sites, bone loss to apex #24, and narrow, tapered root form, especially at maxillary premolars (Fig. 9). She had received no regular dental care for 10 years, and had been smoking less than half a pack of cigarettes daily for the past eight years. Aside from her smoking habit, she was systemically healthy. Her periodontal and radiographic measurements were as follows:

**Periodontal parameters**
- BoP: 89% of sites.
- PD range: 4–12 mm.
- CAL range: 3–14 mm.
- Furcation involvement: Class I–II (molars).
- Mobility:
  - Grade 1: #7, 10, 11, 20, 21, 22.
  - Grade 2: #12, 13, 25.
  - Grade 3: #24.

**Radiographic parameters**
- Generalized horizontal bone loss extending to mid-third of root and beyond (Fig. 10).
- Vertical bone loss around multiple teeth (Fig. 10).
- Bone loss to the apex of tooth #24 (Fig. 11).
- Tapered root form and severe alveolar bone loss of teeth #12–13.

**Staging assessment**
Severity: The CAL range of 3–14 mm suggested Stage III or IV. The generalized horizontal bone loss extending to mid-third of root and beyond also suggested Stage III or IV. Tooth loss due to periodontitis: to be determined.

**Grading assessment**
- Primary criteria: The high percentage of bone loss for age of > 1.0 suggested Grade C. The fact that destruction was not commensurate with the biofilm deposits also suggested Grade C.
- Grade modifiers: The fact that she smoked fewer than 10 cigarettes daily suggested Grade B.

On the basis of the above, the patient was diagnosed with Stage III, Grade C periodontitis.

According to the classification system, the measurements and bone loss severity and pattern indicate either Stage III or IV periodontitis. The delineating factor between Stage III and IV periodontitis, in this case, is the number of teeth lost due to periodontitis, which includes teeth that are periodontally “hopeless” upon initial presentation. In such a case, an individual
practitioner’s clinical judgment is important to consider, particularly with regard to teeth #12 and #13. While one clinician may recommend extraction and prosthetic replacement, another may recommend regenerative periodontal therapy.

In addition, the distinction must be made between tooth loss due to periodontitis and treatment plan–based tooth loss. For this discussion, the treatment plan for the patient’s mandibular incisor region can be highlighted. While teeth #24 and #25 were deemed periodontally hopeless due to the extent of bone loss and tooth mobility, teeth #23 and #26 were not considered periodontally hopeless. Considering the prosthetic treatment plan, options may include the following: a single implant with a cantilevered crown at the #24–25 site; a tooth-supported FPD utilizing teeth #23 and #26 as abutments; and extraction of teeth #23 and #26 (in addition to extraction of teeth #24 and #25) with placement of an implant-supported fixed partial denture with implants at sites #23 and #26. It is critical to note that extraction of teeth #23–26 should be considered tooth loss due not to periodontitis, but to extraction as a means of facilitating prosthetic treatment. In other words, this was a matter of “treatment plan-based tooth loss.”

It is also important to stress that the updated classification system is meant to supplement, rather than replace, the clinician’s judgment, experience and skill. The judgment of the clinician is particularly crucial in taking into account such factors as the patient’s commitment to compliance and anticipated response to treatment.