Flowcharts for Easy Periodontal Diagnosis Based on the 2018 New Periodontal Classification

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Focused Clinical Question: How can a clinician simply and quickly perform a periodontal screening and make a proper periodontal diagnosis using the 2018 proposed new periodontal classification?

Summary: The 2018 periodontal classification has been released, however, it is challenging for clinicians especially for the dental students to apply the published information in practice. A diagnostic flowchart was created for three of the most common periodontal conditions: health, gingivitis, and periodontitis. Additionally, flowcharts were proposed for the diagnosis of periodontitis severity and risk of progression by staging and grading. Probing depth was the first clinical parameter to categorize the type of diseases. Subsequently, bleeding on probing, radiographic bone loss/clinical attachment loss, and history of periodontal treatment were further added for making a proper diagnosis. Three clinical cases were given to demonstrate the use of the simplified proposed flowcharts.

Conclusions: The proposed diagnostic flowcharts are the user-friendly tool to assist clinicians to perform an initial screening and diagnosis based on the 2018 newly proposed periodontal disease classification. *Clin Adv Periodontics* 2020;10:155–160.

Key Words: Classification; gingivitis; periodontal diseases; periodontitis.

Background

The periodontal and peri-implant diseases and conditions classification aids clinicians to diagnose and properly treat patients. The 1999 periodontal classification[1] has been used widely for almost 20 years. During this period, advanced technologies and emerging evidence provided a better understanding of periodontal and peri-implant diseases, leading to an update in classification in the 2017 World Workshop.

The details of the new classification are thoroughly explained in the consensus report.[2–4] However, it is challenging for clinicians to adopt this 2018 newly developed classification. Not only because it is new but also because it comprises a lot of detailed information, it is challenging to make a prompt diagnosis. Many clinicians expressed difficulty in applying these new periodontitis diagnosis in their daily practice. There was an attempt to develop a clinical guideline.[5] However, it is complex for a periodontal screening. The aim of this article was to propose user-friendly flowcharts for easy periodontal diagnosis based on the criteria proposed in the 2018 periodontal classification. The goal of these flowcharts was designed for quick initial screening to make proper

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diagnosis for three most commonly found periodontal conditions; health, gingivitis, and periodontitis, and to differentiate the types of periodontitis diagnosis by using staging and grading system.

Decision Process

The proposed flowcharts aimed to help clinicians distinguish and diagnose three common periodontal conditions. The diagnosis is not only for a new case, but also for cases that have been treated. In previous patients treated for periodontitis, once periodontal stability is achieved, health or gingivitis can exist even on a reduced periodontium with clinical attachment loss (AL). When signs of active periodontitis remain after treatment, a diagnosis of recurrent periodontitis can be made due to the unsuccessful treatment.
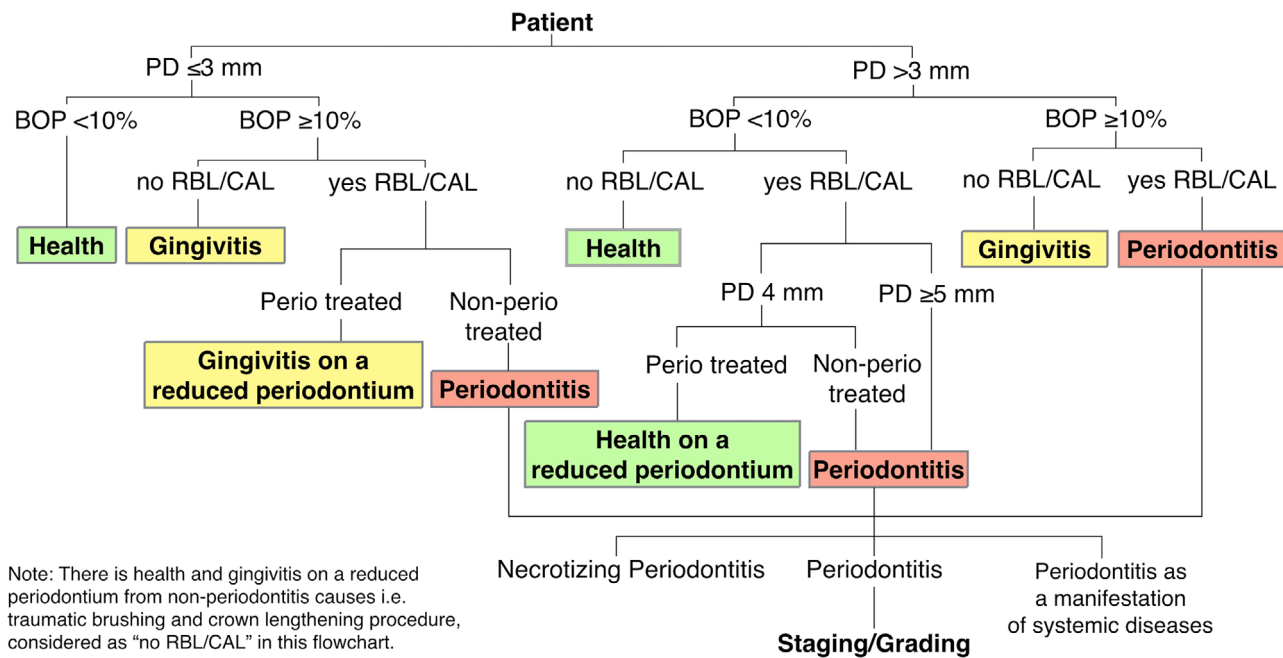
Figure 1 shows the proposed periodontal diagnosis flowchart. Probing depth (PD) is the first clinical parameter used to categorize the patient. The patient will be classified based on the maximum PD (e.g., ≤3 mm or >3 mm) then full-mouth BOP percentage (e.g., <10% or ≥10%) will be used to determine gingival inflammation. If PD is ≤3 mm with full-mouth BOP <10%, the patient will be diagnosed with "periodontal health." If PD is ≤3 mm and full-mouth BOP is ≥10%, then the detection of radiographic bone loss (RBL) or clinical AL will be needed. In a case without RBL or clinical AL, the patient will be diagnosed with "gingivitis." While in a case with RBL and clinical AL, history of periodontal treatment is needed for the diagnosis. If the patient has been previously

FIGURE 1 The quick and simple periodontal diagnostic flowchart. BOP = full-mouth BOP; AL = clinical attachment loss; PD = probing depth; RBL = radiographic bone loss.

treated for periodontal disease, the diagnosis is "gingivitis on a reduced periodontium in a stable-periodontitis patient." In a case with no treatment, the diagnosis is then "periodontitis."

The similar process is also applied if the maximum PD is >3 mm. When PD is >3 mm and BOP <10% without RBL or clinical AL, the diagnosis is "periodontal health." In a case with RBL/clinical AL and BOP <10%, PD = 4 mm with a history of periodontal treatment, the diagnosis is "health on a reduced periodontium in a stable-periodontitis patient." Usually, PD = 4 mm can still present in a periodontitis case that has been successfully treated.[2] In a case with PD = 4 mm without history of periodontal treatment or PD ≥5 mm, the diagnosis is "periodontitis." However, when PD is ≥5 mm and even with BOP <10%, the case is still diagnosed as "periodontitis." In cases with PD >3 mm and BOP ≥10%, "gingivitis" will be assigned if there is no RBL/clinical AL, while "periodontitis" will be assigned in cases with RBL/clinical AL.

Once a case is diagnosed with "periodontitis," a complete periodontal examination including full-mouth periodontal charting and radiographs as well as thorough history taking will be performed. The diagnosis can be confirmed with the case definition which is either 1) interdental clinical AL detectable at ≥2 non-adjacent teeth or 2) buccal, or oral clinical AL ≥3 mm with pocketing >3 mm detectable at ≥2 adjacent teeth. The observed clinical AL cannot be affected from non-periodontal causes.[4] A specific form of periodontitis; periodontitis, necrotizing periodontitis, or periodontitis as a manifestation of systemic disease will then be identified. If the case has neither the characteristics of necrotizing periodontitis nor a rare

systemic disease with a second manifestation of severe periodontitis, it will be diagnosed as "periodontitis."

The second flowchart is proposed to identify the severity of periodontitis using the staging system[4] (**Fig. 2**). First, tooth loss from periodontitis, including teeth planned for extraction due to periodontitis as part of active therapy (e.g., hygienic phase)[6] will need to be recorded. If tooth loss existed then the case is either stage III or IV. The differentiation of stage III or IV is based on the number of teeth lost and masticatory dysfunction. If the patient has tooth loss due to periodontitis of ≥5 teeth and/or <20 remaining teeth and/or need a rehabilitation because of masticatory dysfunction, periodontitis stage IV will be assigned. If there are <4 teeth lost due to periodontitis and no other masticatory dysfunction, then stage III is the diagnosis.

If the patient does not have any tooth loss or has tooth loss from reasons other than periodontitis or unknown cause of tooth loss, a combination of clinical AL, PD, and RBL will be used to classify the patient. If the patient presents with clinical AL ≥5 mm and/or PD ≥6 mm and/or vertical bone loss ≥3 mm and/or furcation involvement grade 2 or 3, the case is either stage III or IV. As previously discussed, masticatory dysfunction and/or number of the remaining teeth will then be used to determine the stage. If clinical AL is <5 mm and/or PD <6 mm, stage I or II is assigned, based on clinical AL, the maximum PD, and the amount of bone loss.

Finally, a periodontitis grade can be determined using the third flowchart (**Fig. 3**). Grade B is usually the default for most periodontitis cases and a clinician will consider if it should be adjusted to grade A or grade C. A primary criteria for grade identification is the evidence of disease
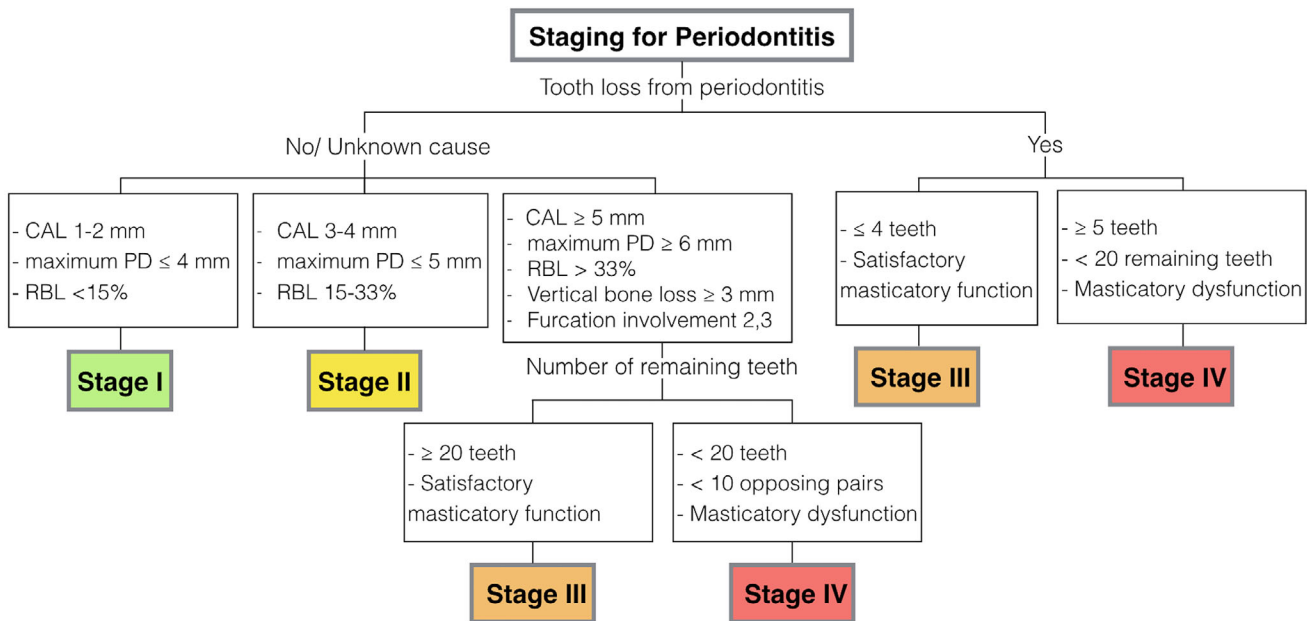
Staging for Periodontitis

Tooth loss from periodontitis

No/ Unknown cause

- CAL 1-2 mm
- maximum PD ≤ 4 mm
- RBL <15%

→ **Stage I**

- CAL 3-4 mm
- maximum PD ≤ 5 mm
- RBL 15-33%

→ **Stage II**

- CAL ≥ 5 mm
- maximum PD ≥ 6 mm
- RBL > 33%
- Vertical bone loss ≥ 3 mm
- Furcation involvement 2,3

Number of remaining teeth

- ≥ 20 teeth
- Satisfactory masticatory function

→ **Stage III**

- < 20 teeth
- < 10 opposing pairs
- Masticatory dysfunction

→ **Stage IV**

Yes

- ≤ 4 teeth
- Satisfactory masticatory function

→ **Stage III**

- ≥ 5 teeth
- < 20 remaining teeth
- Masticatory dysfunction

→ **Stage IV**

FIGURE 2 Staging for periodontitis. One stage should be assigned per patient, based on the worst tooth. AL= clinical attachment loss; PD= probing depth; RBL= radiographic bone loss.
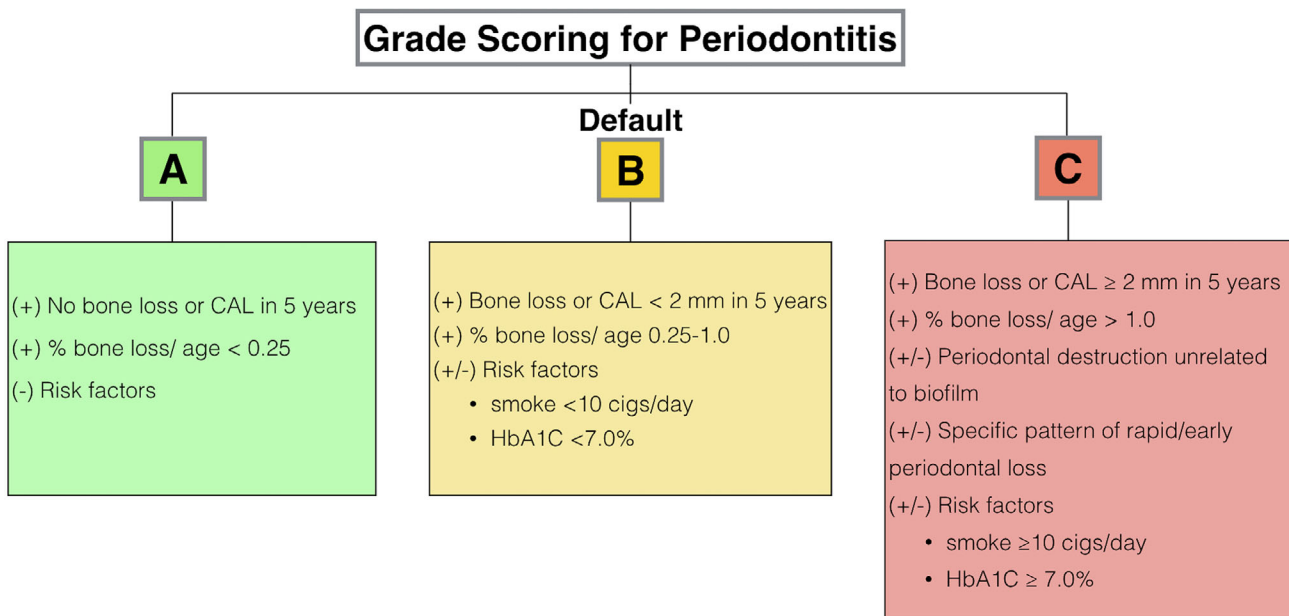
Grade Scoring for Periodontitis

Default

A

(+) No bone loss or CAL in 5 years

(+) % bone loss/ age < 0.25

(-) Risk factors

B

(+) Bone loss or CAL < 2 mm in 5 years

(+) % bone loss/ age 0.25-1.0

(+/-) Risk factors
- smoke <10 cigs/day
- HbA1C <7.0%

C

(+) Bone loss or CAL ≥ 2 mm in 5 years

(+) % bone loss/ age > 1.0

(+/-) Periodontal destruction unrelated to biofilm

(+/-) Specific pattern of rapid/early periodontal loss

(+/-) Risk factors
- smoke ≥10 cigs/day
- HbA1C ≥ 7.0%

FIGURE 3 Grade scoring for periodontitis. (+)= primary criteria, (+/−)= criteria that may or may not present, (−)= criteria that must not present.

progression, either the direct evidence from longitudinal data (>5 years) of RBL or clinical AL, or the indirect evidence from a calculation of percentage of bone loss per age. Other information such as a specific pattern of periodontal destruction, the response of standard bacterial control treatment can also be considered, however, this information may not be available in every case. If there is an evidence of rapid progression or inconsistency of biofilm and periodontal destruction, grade C is assigned. However, if there is no evidence of periodontal disease progression or percentage of bone loss per age <0.25, grade A is assigned. The presence or control of risk factors

can also modify the grade assignments. For example, if the patient is a heavy smoker or has uncontrolled diabetes, periodontitis grade B can be modified to grade C.

Clinical Scenarios

A 27-year-old female presented with periodontal condition shown in Figure 4. Generalized PD ranged from 2 to 4 mm with full-mouth BOP 45%, however, there was no RBL/clinical AL. Based upon our flowchart (Fig. 1), the patient was placed in the PD ≥4 mm category, with BOP >10%, and no RBL/AL; the diagnosis was "gingivitis."
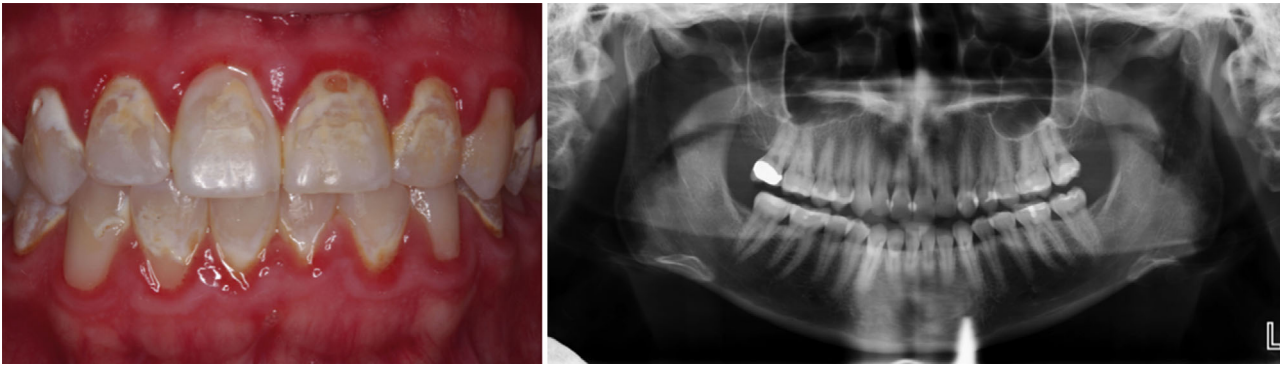
FIGURE 4 Gingivitis. A 27-year-old female with PD of 2 to 4 mm, BOP ≥10%, and no RBL/AL.

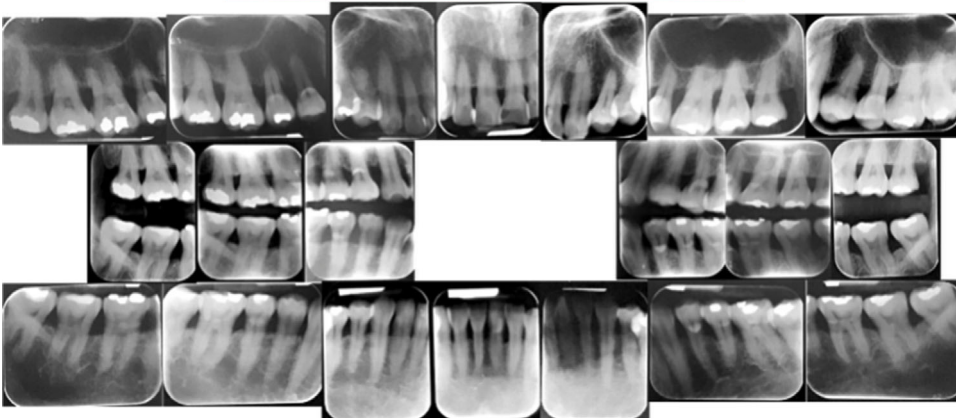**FIGURE 5** Health on a reduced periodontium. A 45-year-old female with history of periodontal treatment. PD of 2 to 4 mm, BOP <10%, with RBL/CAL.

Figure 5 demonstrated another case of a woman (aged 45-years) who presented for periodontal maintenance. Overall PD was 2 to 4 mm with full-mouth BOP 8%. From the flowchart (Fig. 1), the patient was placed in the PD >3 mm category with BOP ≤10%. RBL/clinical AL could be identified. With the maximum PD of 4 mm and a history of periodontal treatment, the patient was diagnosed as "periodontal health on a reduced periodontium in a stable-periodontitis patient."

The third case was a 50-year-old male (Fig. 6) with a history of smoking 5 cigarettes/day for 20 years. PD was 2 to 5 mm on anterior teeth and 2 to 8 mm on posterior teeth with full-mouth BOP 84%. RBL presented and the upper left first molar was extracted due to dental caries. Using the diagnostic flowchart (Fig. 1), the patient was placed in the PD >3 mm category. With BOP ≥10% and

the presence of RBL/clinical AL, the patient was diagnosed with "periodontitis." A comprehensive periodontal examination was performed, revealing Grade 1 and 2 furcation involvement on upper molars. The diagnosis of "periodontitis" was made, considering clinical presentation and patient's medical history. Staging and grading of periodontitis was determined using the flowchart (Figs. 2 and 3) as "stage III grade B." Due to no tooth loss from periodontitis, the left side of the flowchart (Fig. 2) was to be followed. Based on clinical and radiographic findings, and ≥20 remaining teeth, the patient was diagnosed as stage III. Being a smoker with 0.25% to 1.0% bone loss/age, the grading score would be grade B (Fig. 3). However, if patient smoked ≥10 cigarettes/d, then grading could be modified to "C."

All patients provided verbal informed consent.

FIGURE 6 Generalized periodontitis. Stage III grade B. A 50-year-old male who is a light smoker. PD ≥4 mm, BOP≥10%, with severe RBL and furcation involvement grade 1 and 2. History of tooth loss from dental caries but still have ≥20 remaining teeth.

Discussion

Periodontal classification is a tool for clinicians to identify diseased status so the proper treatment can be provided. The classification has been updated in the 2017 World Workshop and the consensus was released in 2018. Because it is new and there are many factors to consider, it soon becomes a challenge for clinicians especially dental students to apply this new classification in their practice. Hence, a simple, quick decision flowchart was developed to overcome this issue.

PD was selected to be the first clinical parameter for this diagnostic flowchart. Although clinical AL is the main clinical parameter to diagnose periodontitis in this 2018 classification, it has been previously discussed that the challenge of routine measuring of clinical AL is not practical and often inaccurate in the daily practice due to improper identification of the cemento-enamel junction;[7] This may result in the wrong diagnosis and possibly lead to improper treatment. In addition, measuring full-mouth clinical AL in every patient is time-consuming. Comparing with clinical AL, measurement of PD is simple and easy to adopt since dentists routinely perform probing in their practice. Additionally, a walking probe can be performed in oral examination for periodontal screening within a short period of time. Generally, deep PD is more concerned by dental practitioners than clinical AL. The PD was used as an active periodontal-diseased

indicator.[8] Furthermore, deep pocket has a higher risk of disease progression when compared with a shallower pocket.[9] Thus, in practice, we proposed to use PD as an initial screening tool along with RBL, instead of clinical AL.

History of periodontal treatment has become one of the criteria used for this new classification. In a patient with no history of periodontal treatment, with full-mouth BOP <10% but PD >3 mm with RBL or clinical AL, the diagnosis will be "periodontitis." This may help clinicians with early detection and treatment of the disease. However, in a case with history of periodontal treatment, the BOP <10% and PD ≥5 mm or BOP ≥10% and PD >3 mm, the patient can be diagnosed with "recurrent periodontitis." To specify recurrent periodontitis from periodontitis may help clinicians be more aware of patient susceptibility and the case complexity.

It is important to note that in the case that "periodontitis" is diagnosed from the flowchart but with no obvious RBL/clinical AL, clinicians must confirm the diagnosis again, considering the periodontitis case definition.[4]

After excluding necrotizing periodontitis and periodontitis as a manifestation of systemic diseases on the basis of its distinct clinical presentation and associated medical history, periodontitis can be diagnosed. Staging and grading of periodontitis should be assigned to specify the disease severity and risk for future disease progression

leading to patient management and treatment plan. Criteria for staging and grading of a periodontitis patient are already elaborated in the consensus report.[4] However, clinicians remain hesitant to adopt this widely in their current practice. Hence, we proposed these flowcharts to not only allow clinicians to make a quick and proper periodontitis diagnosis but also minimize the confusion and inconsistent diagnosis.

The major benefit of the proposed flowcharts is to aid clinicians to a simple and quick screening so a correct periodontal diagnosis can be obtained. In contrast to the other decision tree,[4] the proposed flowchart provides criteria to differentiate periodontal health, gingivitis, and periodontitis according to the 2018 case definition in the same flowchart, which makes it easier to follow. Additionally, not all clinical parameters are needed to make a periodontal diagnosis in every case. In this flowchart, clinical AL measurement may be skipped in some cases or it can be done only when necessary. However, this flowchart only focuses on plaque-induced periodontal diseases. Attachment loss or bone loss from non-periodontitis causes will be considered as "no RBL/clinical AL" to avoid false positive in a diagnosis of periodontitis.

In the flowchart for periodontal stage, information of tooth loss due to periodontitis was selected as the first criteria to separate patients with severe periodontal conditions, which can be stage III or IV. Clinicians can easily further differentiate stage III to stage IV by the number of teeth lost and masticatory dysfunction. A combination of clinical AL, maximum PD, and level of bone loss of the worst affected tooth are the main criteria to categorize disease severity in case of no tooth loss or tooth loss from other causes. We proposed that these criteria used to identify disease severity and complexity should be evaluated together to diagnose periodontitis stage.

Periodontal grade is challenging to be assigned because it most likely depends on clinical experience and judgment. The proposed flowchart is in a checklist format. The primary criteria of direct or indirect evidence of progression may be the first parameter to consider. Factors that can modify the grade will be considered next. Hence, the periodontal grade flowchart provides the main criteria for grade assignment and also allows clinicians to consider other factors for possible grade modification.

Conclusions

The flowcharts were proposed to simplify the 2018 periodontal classification to a more user-friendly tool. However, it is just a guideline that certainly may possess some limitations in some cases. Therefore, judgement of clinicians is essential to make a definitive diagnosis. Clinical efficiency of the flowcharts should be evaluated in a future study.■

Acknowledgments

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