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Review Article

Critical Analysis of AAP 1999 and 2017 the World Workshop Classification Systems: An Insight

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Abstract

The subject of classification is taken into account to be monotonous by the majority. Classification systems help to assemble similar disease phenotypes in more homogeneous syndromes. Over the years, various researchers have done extensive work in the development of classification of periodontal diseases. Though we have made great strides towards the understanding of periodontitis in general, the bitter truth is that we have not hit the bull's eye on the true nature of etiopathogenesis. Until then any classification based on infectious etiology would be a misfit. A classification that is easy to understand and based on treatment needs would be more apt at this juncture. This article is aimed at discussing the American Academy of Periodontology 1999 and present 2017 the World Workshop Classification Systems to know and simplified the modifications.

Keywords: Classification; periodontal disease; gingivitis; periimplant mucositis.

INTRODUCTION

Over the years, discernment of the nature of periodontal diseases was achieved successfully thanks to extensive research during this field. Regardless of this, foregoing discussion continues about classification systems. Classification of periodontal diseases may be a subject of inevitable controversy. When an attempt is made to group the entire agglomeration of periodontal diseases into a precise and universally accepted classification system, one realizes that is extremely difficult and complex to deal with. Despite this no win situation, in the past century, experts have worked towards periodically developing a new classification system for periodontal diseases or to enhance an existing one.

Need for a classification system

The concept of classification systems is taken into account as uninteresting by many, but it provides us with a framework to return to a diagnosis. The intricacy of periodontal diseases are often understood by classifying various diseases. Its goals are [1]:

[1] To provide a foundation to study the etiology, susceptibility traits, pathogenesis, and treatment of diseases in an organized manner.

[2] To give clinicians a way to organize the health care needs of their patients.

[3] Assemble similar disease phenotypes in more homogeneous syndromes.

Discussion of the 1999 American Academy of Periodontology classification system

Several classification systems are proposed within the literature to facilitate categorization, but they have limitations. The subsequent list highlights some queries raised regarding the presently accepted and widely used AAP 1999 classification system. Analysis of this earlier classification put forth certain questions in our mind and prompted us to format and present a new and practical classification.

1) Does the prevailing periodontal disease classification system meet the ideal requirements of a classification system [2]?

The present classification does not meet the ideal requirements and therefore the reasons are explained later during this commentary.

2) Is there a true need for ideal classification of periodontal diseases [3]?

An ideal classification system should help in diagnosis, prognosis, treatment planning and organizing

health care needs during a simplified and orderly fashion.

3) Are we in synchrony with classifications from other dental specialties that serve as therapeutic guides?

G.V. Black's classification of dental caries clearly indicates the location of dental caries and acts as a therapeutic guide for clinicians to plan a possible treatment plan. This is often not the case with the present periodontal classification system.

4) Has the present etiology-based classification helped us in better treatment planning [4]?

Our understanding of periodontal disease is not complete enough to base our classification on etiology [4]. Treatment planning to date is based on the nonspecific plaque hypothesis.

5) Within the ambit of the prevailing classification, is it possible to diagnose the disease with certainty and place the patients in at least one of the disease categories without overlap?

The strict criteria put forward by the 1999 AAP classification makes it difficult to categorize without overlapping. To diagnose a case of aggressive periodontitis, the person should be systemically healthy. However, placing all patients with aggressive periodontitis under this clause is extremely challenging, as there exists a grey area in declaring a person as systemically healthy because many forms of systemic diseases exist in subclinical form [5].

6) Are we able to diagnose and place aggressive and chronic periodontitis disease categories within the limits of the prevailing classification?

No. The present classification system depends upon assessing the rate of progression spread over multiple appointments in order to diagnose aggressive periodontitis. Further, determining the rate of progression of the disease at any given point of time is prone to erroneous data, as evidence shows that periodontitis progresses with periods of quiescence and exacerbation because of various factors that influence how rapidly periodontal tissues are destroyed [6].

7) Can gingival diseases modified by medications be included as plaque-induced gingival diseases?

Gingival diseases modified by medications have been included under the category "dental plaque induced gingival diseases," which is completely misleading as they are not dependent on dental plaque for their manifestation [7].

8) Is it vindicated to incorporate a gingival disease modified by medication category and simultaneously omit a parallel category on periodontal disease modified by medications?

In many instances, drug-induced gingival overgrowth is accompanied by combined pockets and attachment loss. In such cases two different diagnoses are often made: a) drug-influenced gingival enlargement; b) chronic/aggressive periodontitis. An easy provision to incorporate periodontal disease modified by medication could solve the confusion of two probable diagnoses.

9) The 1999 AAP classification has meticulously tried to segregate each disease under a different category, but lists periodontal abscess as a separate entity. Is that this justified?

Periodontal abscesses share their etiology with periodontal pockets and are merely an exaggerated clinical manifestation. Nowhere, within the field of medicine is an abscess classified as a disease. It probably got carved out as a separate entity because it required a different treatment regime [8].

10) Was there a necessity to separately categorize diabetes mellitus-associated gingivitis and exclude the parallel periodontitis category?

The reason cited for this was "diabetes mellitus associated chronic periodontitis" and "diabetes mellitus-associated aggressive periodontitis" would unnecessarily complicate matters and could not be justified by supporting data [9]. This reason seems unacceptable. First, the classification by itself is very exhaustive in its current form and an addition of one more subcategory for "diabetes-associated periodontitis" would not have really mattered. Secondly, in 1993 Loe had labelled periodontal disease as the sixth complication of diabetes, hence is logical to think that diabetes mellitus influences gingivitis and periodontitis in equal measures [10].

11) Is there a separate category called 'smoking associated gingivitis or periodontitis'?

There is no category for smoking-associated gingivitis or periodontitis albeit many cross-sectional and longitudinal studies indicate a robust relationship between smoking and increased risk of periodontal breakdown [11].

12) Can we comfortably diagnose, without disjointedness, a case of plaque-induced gingival inflammation superimposed on a reduced but healthy periodontium without an iota of doubt on whether it is periodontitis or gingivitis, within the framework of the AAP 1999 classification?

An interesting diagnostic dilemma arises when gingival inflammation occurs in a successfully treated periodontitis patient during the maintenance phase of therapy. The inflammation can be interpreted either as periodontitis or gingivitis, because at any given point of time the clinician cannot construe whether the attachment loss is progressive or stable. This compels the clinician to inevitably rely on longitudinal records of periodontal status, including clinical attachment levels, making the diagnosis impractical [12].

13) Does the existing classification include the peri-implant diseases?

In spite of rapid advancement within the field of implantology, there is no provision within the present classification for the diseases around implants, leaving a big void [5].

14) Is it clinically and practically relevant to classify 'classical gingival recession' within the scenarios mentioned below under different categories?

First scenario: "A treated periodontitis case currently showing reduced periodontal supports (recession)." If it is superimposed by gingival inflammation without evidence of further attachment loss, it should be diagnosed as gingivitis; otherwise it should be diagnosed as periodontitis [13].

Second scenario: Toothbrush trauma resulting leading to recession is assessed under non-plaque-induced traumatic lesion physical injury [14].

Third scenario: Predisposition to gingival recession because of anatomical variation (proclination) is classified under mucogingival deformities and conditions. Any soft tissue recession occurs only after some form of osseous dehiscence. Whether, this condition should be classified as a disease or only as a morphological variation of healthy periodontium is irrelevant and this induces confusion [15].

15) Is there a real need to overtly emphasize the term 'aggressive periodontitis,' especially when there have been a lot of concerns raised ever since the term was coined?

Aggressive periodontitis are often considered as merely a severe form of the same disease. There is considerable literature to show that both chronic and aggressive periodontitis have similarities within the following aspects clinical presentation, microbiology, immunopathogenesis, mechanism of bone loss and histopathology. If a specific therapeutic regime is developed for aggressive periodontitis, then the use of the term is justifiable [16].

16) Does the present classification system consider the multifactorial character of periodontal disease?

All the risk factors are not considered, e.g., smoking and diabetes [9].

17) Can all patients be classified with precision as to whether they have either localized or generalized periodontitis?

No. The terms localized and generalized were introduced by the consensus group at the AAP 1999 classification workshop, where it was decided to use 30% involvement as the cut-off point. But it was purely an arbitrary decision and was never based on any data. The point is - does having two names in any way benefit or alter the treatment plan? Or does it create confusion? Armitage explains it well "A situation where the 30% cut-off is rigidly used on a classic case of localized aggressive periodontitis, in which all the incisors and first molars were affected (a total of 12 teeth), and if the particular individual has only 28 teeth present, the calculation of 12/28 becomes 42.9%. So would this classic case of localized periodontitis become generalized periodontitis [17]?" Any cut-off value can only cause contradiction and confusion. Instead, it is better to mention the teeth or areas affected by periodontitis, and simply refer it as periodontitis.

The need for a new classification

Unfortunately, 1999 classification [9] of periodontal disease and conditions had some drawbacks regards overlapping nature of criteria of disease, also created some confusion among clinicians to diagnosis the case properly. Another drawback, it did not elaborate the effect of risk factors (e.g. Smoking, Diabetes etc.). Peri-implant health/Conditions were not included in the 1999 classification as Periodontal disease and Peri-implant diseases shared almost same microbial profile. The classification did not give clue regards correct treatment plan as it depended on correct diagnosis of the disease. All these difficulties led to improvement of 1999 classification which was co-sponsored by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP). An organizing committee from AAP and EFP published 19 review papers and 4 Conesus reports which covered relevant areas in periodontology and Implantology, including the untouched areas of 1999 classification of periodontal disease.

The AAP released two documents entitled, "Three Steps to Staging and Grading a Patient" and "Staging and Grading Periodontitis". A quick outline of the three steps are [18]:

Step 1: Initial Case Overview to Assess Disease recommends conducting a screening consisting of full-mouth radiographs and probing depths and noting missing teeth. Based on the findings from Step 1, a determination of mild-moderate periodontitis, which is considered Stage I or Stage II, can be made. Severe or very severe periodontitis is considered to be Stage III or Stage IV.

Step 2: Establishing a stage focuses on considerations of clinical attachment loss (CAL), radiographic bone loss (RBL), tooth loss due to periodontitis, and case complexity. For mild to moderate periodontitis, CAL is that the central focus, unlike the more advanced stages (Stages III and IV) where RBL and case complexity factors are taken into account.

Step 3: Establishing a grade focuses on assessing risk factors, systemic considerations, rate of disease progression, and outcomes of non-surgical periodontal therapy.

Staging of Periodontitis

Four stages have been developed to differentiate between severity, complexity and extent, and distribution of periodontitis. The stages, consisting of Stage I-IV are determined by several variables and range from the least severe Stage I to most severe Stage IV, as presented in (Table 1).

Narrative descriptions of the stages are below:

Stage I (mild disease): CAL = 1-2 mm, probing depth ≤4 mm, radiographic evidence of horizontal bone loss ≤15 per cent, and will require non-surgical treatment. No post-treatment tooth loss is expected, indicating the case has a good prognosis going into maintenance care.

Stage II (moderate disease): CAL = 3-4 mm, probing depth ≤5 mm, radiographic evidence of horizontal bone loss between 15 and 33 per cent and will require non-surgical and surgical treatment. No post-treatment tooth loss is expected, indicating the case has a good prognosis going into maintenance.

Stage III (severe disease): CAL ≥ 5mm, probing depth ≥6 mm, radiographic evidence of horizontal and/or vertical bone loss beyond 33 per cent and may have furcation involvement of Class II or III. This will require surgical and possibly regenerative treatments. The overall case has a fair prognosis going into maintenance.

Stage IV (very severe disease): Includes all of Stage III features. Less than 20 teeth may be present and there is the potential for loss of five or more teeth. Advanced surgical treatment and/or regenerative therapy may be required, including augmentation treatment to facilitate implant therapy. Very complex implant and/or restorative treatment may be needed. The patient will often require multi-specialty treatment. The overall case has a questionable prognosis going into maintenance.

To determine extent and distribution of periodontitis, the per cent of "teeth" affected by periodontitis is assessed. This provides information about what percentage teeth are suffering from periodontitis, which is expressed as localized or generalized. It does not give information about the per cent of teeth with slight, moderate, or severe destruction. Distribution refers to affected teeth, such as first molars and/or incisors (e.g., Stage III periodontitis with a generalized molar distribution).

Grading of Periodontitis

The three levels of periodontitis grading consider the overall health status of the patient and risk factors, such as smoking and metabolic control of diabetes, and indicates low risk of progression (Grade A), moderate risk of progression (Grade B), and high risk of progression (Grade C). Grading of periodontitis is also based on evaluating the rate of progression of disease and expected response to treatment (Table 2).

Narrative descriptions of the grades are below:

Grade A (slow progression): No bone loss or CAL over five years, no smoking, no diabetes, heavy biofilm but no tissue destruction.

Grade B (moderate progression): Less than 2 mm bone loss or CAL over five years, half pack or less per day smoking, HbA1c less than 7 per cent, biofilm commensurate with destruction.

Grade C (rapid progression): Greater than 2 mm of bone loss or CAL over five years, half pack or more per day smoking, HbA1c 7 per cent or higher, tissue destruction exceeds amount of biofilm.

Staging and grading provide a structure for treatment planning and for monitoring a patient's response to therapy. Thus, the new classification system can be used to develop a well-rounded treatment strategy based on a patient's specific needs, resulting in a personalized approach to patient care. Forms of periodontal disease are now mainly defined together of three distinct forms, which include periodontitis (formerly aggressive and chronic), necrotizing periodontitis, and periodontitis as a manifestation of systemic conditions.

Periodontal and Peri-Implant Diseases and Conditions

Periodontal diseases and conditions can be broken down into three main categories:

1. **Periodontal health and gingival diseases**

I. Periodontal and gingival health
II. Gingivitis caused by biofilm (bacteria)
III. Gingivitis not caused by biofilm

2. **Periodontitis**

I. Necrotizing diseases
II. Periodontitis as a manifestation of systemic disease
III. Periodontitis

3. **Other conditions affecting the periodontium**

I. Systemic diseases affecting the periodontium
II. Periodontal abscess or periodontal/endodontic lesions
III. Mucogingival deformities and conditions
IV. Traumatic occlusal forces
V. Tooth- and prosthesis-related factors

In addition, the workshop proceedings also included, for the first time, a new classification for peri-implant diseases and conditions. Implant dentistry has become a main component of patient treatment planning and care since 1999 [19].

Peri-implant diseases and conditions can be broken down into four major categories:

I. **Peri-implant health:** Identified by the absence of visible inflammation and bleeding on probing.
II. **Peri-implant mucositis:** Characterized by bleeding on probing and visual signs of inflammation without pathologic bone loss. It is a plaque-associated condition occurring in the soft-tissues around dental implants.
III. **Peri-implantitis:** Peri-implantitis is indicated by inflammation of mucosal tissue and subsequent progressive loss of supporting bone [20].
IV. **Peri-implant soft- and hard-tissue deficiencies:** Hard- and soft-tissue implant site deficiencies (associated with healing after tooth loss, extraction trauma, endodontic infections, injury, and other causes) are also included within the implant condition classification [21].

Benefits of the Proposed New Classification

This classification aims to bring a transparent understanding of periodontal disease to the patient, general dentist, periodontist and insurance agencies, and to facilitate the course of treatment required.

1. The proposed classification system helps to make a clinical diagnosis for a patient with any periodontal condition. There is no overlap among the disease categories.
2. Patients will benefit from the proposed new classification, as they will understand the root cause for the periodontal status.
3. A general dentist will find the new simple classification handy when it involves devising a treatment protocol, as there is no overlapping of disease categories. This distinguishing feature of the proposed classification outlines the framework for easier treatment planning.
4. As dental insurance is gaining prominence worldwide, a transparent and simplified classification will aid to a great extent in risk profiling of the patient for the settlement of claims.
5. The proposed classification encompasses the risk elements associated with periodontitis that were hitherto not included within the 1999 AAP classification.
6. This classification has a provision to incorporate peri-implant conditions.
7. The necessity for multiple visits to assess the disease progression to arrive at a diagnosis is no longer required.

Future Challenges in the Implementation of 2017 Classification System in our Clinical Practice

In 2017, the World Workshop Classification system was developed. Thereafter, the British Society of Periodontology convened an implementation group to develop guidance on how the new classification system should be implemented in clinical practice (Table 3).

1) Why was the classification system updated and why did the British Society of Periodontology then release an updated version (implementation guide)?

The 2017 World Workshop Classification system for periodontal and peri-implant diseases and conditions was updated in order to accommodate advances in scientific knowledge, including our understanding of periodontal and peri-implant diseases and conditions that has evolved since the 1999 International Classification of Periodontal Diseases [9]. The European Federation of Periodontology (EFP) and American Academy of Periodontology (AAP) management committees were involved in updating the classification system [22].

The British Society of Periodontology (BSP) convened an implementation group to develop guidance on how the new classification system should be implemented in clinical practice. They felt the complexity of the proposed system rendered its adoption in UK general practice unlikely. A particular focus was to describe how the new classification system integrates with established diagnostic parameters and pathways, such as the basic periodontal examination (BPE).

2) Why have chronic and aggressive periodontitis been removed from the classification?

The distinction between chronic and aggressive periodontitis has been removed on the basis that there was little evidence from biological studies that chronic and aggressive periodontitis were separate entities, rather than variations along a spectrum of the same disease process [23].

3) How do we determine the extent of the periodontitis?

Bone loss assessed by radiographs is a key component of the updated classification system. The extent of the radiographic bone loss is used to describe if the condition is localised (up to 30% of teeth with radiographic bone loss), generalised (more than 30% of teeth with radiographic bone loss) or of a molar/incisor pattern (first molars and incisors with evidence of bone loss).

4) How do we assess the stage and grade?

The stage is related to the severity of the periodontitis, which is also associated with the complexity of overall patient management.

To determine the stage, the BSP implementation group proposed a simplified staging grid based on radiographic bone loss alone. This is based on percentage bone loss in relation to the root length, which is an intuitive measure already used by many practitioners. The bone loss is taken as the worst value at any site in the mouth, where it is clear that the bone loss has arisen due to periodontitis. For some

patients, in particular for those with early stage periodontitis, the availability of radiographs may be limited to bitewings in the posterior regions and no radiographs may be available for the anterior sextants. In such cases, and when peri-apical or panoramic radiographs are not indicated for clinical reasons, the clinician should use bitewings or clinical attachment loss (CAL) measured from the cement-enamel junction to estimate percentage of bone loss.

The BSP implementation group felt that the ratio of percentage of bone loss/age was the most pragmatic way of determining this. Grade A is assigned if the maximum amount of radiographic bone loss in percentage terms is less than half the patient's age in years (for example, less than 25% in a 50-year-old). Grade C is assigned if the maximum amount of bone loss in percentage terms exceeds the patient's age in years (for example, more than 20% in an 18-year-old or more than 60% in a 59-year-old). Grade B is assigned otherwise.

5) Why do we need to determine the stage and grade if we treat pockets and bleeding, not bone loss?

Stage and grade are a reflection of historical disease experience, but this is just as important to determine, especially in patients who have received periodontal therapy in the past. Even a successfully treated periodontitis patient remains a periodontitis patient for life because the disease may progress at any time if periodontal maintenance is sub-optimal and risk factors are not controlled. Therefore, assigning the severity and rate of progression of periodontitis is important.

6) What do we do if you don't have radiographs?

Without radiographs, we are unable to determine the extent, stage or grade of periodontitis. It is important that the appropriate radiographs are taken at the initial assessment appointment. This may include horizontal bitewings, vertical bitewings, periapical radiographs and/or a dental panoramic radiograph. Without this, the treatment plan cannot be formulated and only a provisional diagnosis can be made.

7) Which risk factors have been included in the updated classification system?

Diabetes and smoking (including previous smoking) were chosen to be documented as part of the diagnostic statement in the new classification system. They can also be objectively measured and modified.

8) How often do we need to update the diagnostic statement?

The diagnostic statement should be reflected upon and revised if relevant at every new assessment. Patients cannot regress to a lower stage of periodontitis due to treatment, but if they remain untreated this may increase and need to be updated if further radiographic bone loss is detected at a future assessment. Grading may also change in the long-term. The current disease status is important to determine at each assessment as this is likely to change with treatment.

9) Is there a simple way of remembering the updated classification for the periodontitis component?

These six steps may also be useful to remember and include as a template in our clinical notes:

1) Determine type of periodontal disease – is the bone loss due to periodontitis?
2) Disease extent – localised (up to 30% of teeth), generalised (more than 30% of teeth) or molar/incisor pattern.
3) Stage – how severe is the bone loss? Stage I (early/mild), Stage II (coronal third of root), stage III (mid third of root), stage IV (apical third of root).
4) Grade – how susceptible is my patient? Is the maximum amount of bone loss more than my patient's age (grade C), is the bone loss less than half the patient's age (grade A)? Anything else is grade B.
5) Current disease status – Stable = health/successfully treated patient, disease remission = recurrent gingival inflammation (BOP ≥10%) at sites with PPD ≤3mm and no PPD >4mm, unstable = recurrent periodontitis with bleeding sites ≥4mm or any PPD ≥5 mm.
6) Lifestyle risk factor profile – smoking, diabetes.

Table-1: Staging Periodontitis

	Periodontitis	Stage I	Stage II	Stage III	Stage IV
Severity	Interdental CAL (at site of greatest loss)	1-2mm	3-4mm	≥ 5mm	≥ 5mm
	RBL (radiographic bone loss)	Coronal third (<15%)	Coronal third (15%-33%)	Extending to middle third of root and beyond	Extending to middle third of root and beyond
	Tooth loss (due to periodontitis)	No tooth loss	No tooth loss	≤ 4 teeth	≥ 5 teeth
Complexity	Local	Maximum probing depth ≤ 4mm	Maximum probing depth ≤ 5mm	In addition to Stage II complexity:	In addition to Stage III complexity: Need complex

		Mostly horizontal bone loss	Mostly horizontal bone loss	Probing depths ≥ 6mm Vertical bone loss ≥ 3mm Furcation involvement Class II or III Moderate ridge defects	rehabilitation due to: Masticatory dysfunction Secondary occlusal trauma (tooth mobility degree ≥2) Severe ridge defects Bite collapse, drifting, flaring <20 remaining teeth (10 opposing pairs)
Extent and Distribution	Add to stage as descriptor	For each stage, describe extent as: Localized (<30% of teeth involved); Generalized; or Molar/incisor pattern			

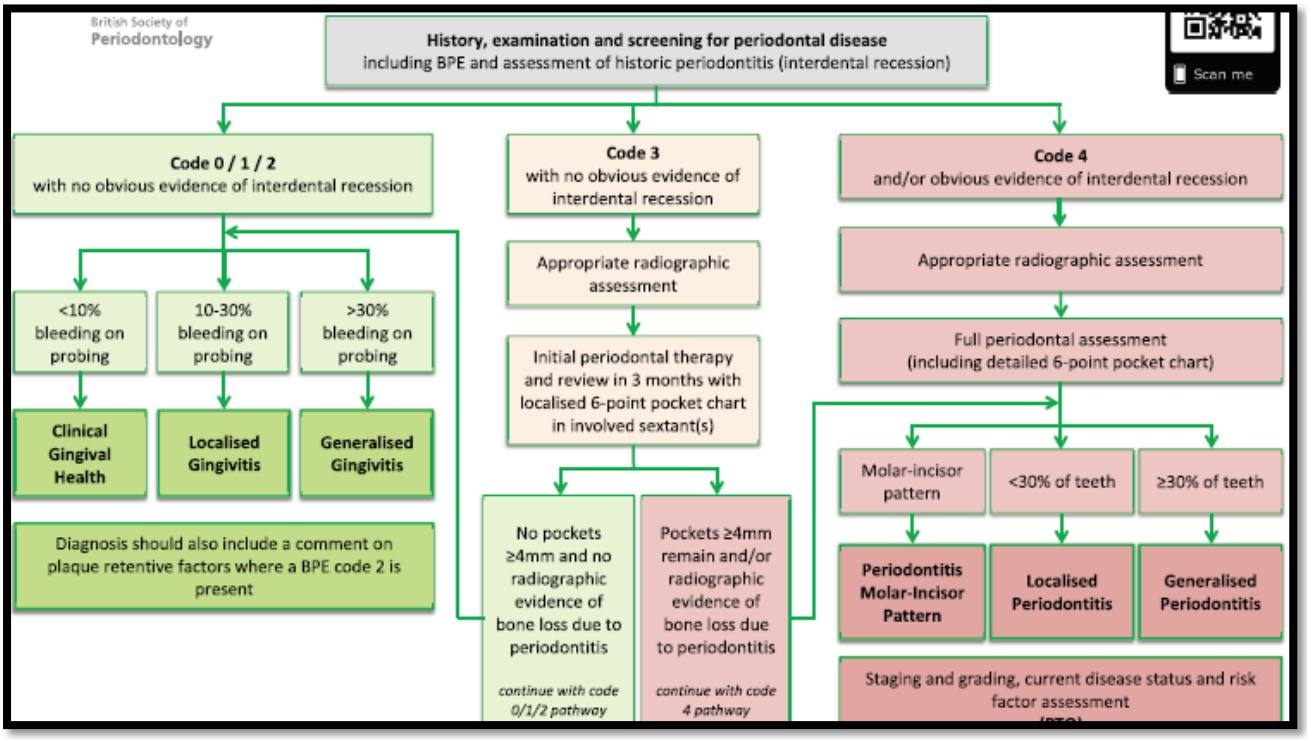
Source: American Academy of Periodontology. Available at: https://www.perio.org/sites/default/files/files/Staging%20and%20Grading%20Periodontitis.pdf

Table-2: Grading Periodontitis

	Progression		**Grade A: Slow rate**	**Grade B: Moderate rate**	**Grade C: Rapid rate**
Primary criteria Whenever available, direct evidence should be used.	Direct evidence of progression	Radiographic bone loss or CAL	No loss over 5 years	<2mm over 5 years	≥2mm over 5 years
	Indirect evidence of progression	% bone loss/age	< 0.25	0.25 to 1.0	>1.0
		Case phenotype	Heavy biofilm deposits with low levels of destruction	Destruction commensurate with biofilm deposits	Destruction exceeds expectations given biofilm deposits; specific clinical patterns suggestive of periods of rapid progression and/or early onset disease
Grade modifiers	Risk factors	Smoking	Non-smoker	<10 cigarettes/day	≥10 cigarettes/day
		Diabetes	Normoglycemic/ no diagnosis of diabetes	HbA1c < 7.0 % in patients with diabetes	HbA1c ≥ 7.0 % in patients with diabetes

Source: American Academy of Periodontology. Available https://www.perio.org/sites/default/files/files/Staging%20and%20Grading%20Periodontitis.pdf

Table-3: BSP Implementing the 2017 Classification of Periodontal Diseases to Reach a Diagnosis a Clinical Practice



CONCLUSION

The look for a perfect classification of periodontal diseases may be a add progress and therefore the finished product still looks like a mirage. The entire idea of the proposed classification is to simplify the existing classification system and eliminate unnecessary confusion. As we are yet to unravel the complete etiopathogenesis of periodontal disease, any new classification is sure to raise certain questions and controversies, which are inevitable now. With this knowledge we have aimed to classify periodontal disease in a simpler format, which is beneficial to the periodontal fraternity, general dental practitioners and therefore the patient.

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Author Contributions

Neelam Das, was contributed to update all relevant information to formulate the design, drafted the manuscript review. The author gave final approval and agrees to be accountable for all aspects of the work.

Conflicts of Interest

There are no conflicts of interest.

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