A NEW CLASSIFICATION SCHEME FOR PERIODONTAL AND PERI-IMPLANT DISEASES AND CONDITIONS – INTRODUCTION AND KEY CHANGES FROM THE 1999 CLASSIFICATION

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Running Head: Classification of periodontal and peri-implant diseases and conditions.

Key words: Periodontal diseases, Gingivitis, periodontitis, peri-implant mucositis, peri-implantitis, classification.

Figures: 0, Tables: 5, References: 31, Words: 1,688

Sources of Funding: The workshop was planned and conducted jointly by the American Academy of Periodontology and the European Federation of Periodontology and supported through an educational grant from the American Academy of Periodontology Foundation and sponsorship from Colgate, Johnson & Johnson Consumer Inc., Geistlich Biomaterials, SUNSTAR, and Procter & Gamble Professional Oral Health.

Declaration of conflict of interest: The authors filed detailed disclosure of potential conflicts of interest relevant to the workshop topics, and these are kept on file.

ABSTRACT

A classification scheme for periodontal and peri-implant diseases and conditions is necessary for clinicians to properly diagnose and treat patients as well as for scientists to investigate etiology, pathogenesis, natural history and treatment of the diseases and conditions. This paper summarizes the proceedings of the World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions. The workshop was co-sponsored by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) and included expert participants from

all over the world. Planning for the conference, which was held in Chicago on November 9-11, 2017, began in early 2015.

An organizing committee from the AAP and EFP commissioned 19 review papers and 4 consensus reports covering relevant areas in periodontology and implant dentistry. The authors were charged with updating the 1999 classification of periodontal diseases and conditions[1] and developing a similar scheme for peri-implant diseases and conditions. Reviewers and workgroups were also asked to establish pertinent case definitions and to provide diagnostic criteria to aid clinicians in the use of the new classification. All findings and recommendations of the workshop were agreed to by consensus.

This introductory paper presents an overview for the new classification of periodontal and peri-implant diseases and conditions, along with a condensed scheme for each of four workgroup sections, but readers are directed to the pertinent consensus reports and review papers for a thorough discussion of the rationale, criteria and interpretation of the proposed classification. Changes to the 1999 classification are highlighted and discussed. Although the intent of the Workshop was to base classification on the strongest available scientific evidence, lower level evidence and expert opinion were inevitably used whenever sufficient research data were unavailable.

The scope of this workshop was to align and update the classification scheme to the current understanding of periodontal and peri-implant diseases and conditions. This introductory overview presents the schematic tables for the new classification of periodontal and peri-implant diseases and

conditions and briefly highlights changes made to the 1999 classification.[1] It cannot present the wealth of information included in the reviews, case definition papers and consensus reports that has guided the development of the new classification and reference to the consensus and case definition papers is necessary to provide a thorough understanding of its use for either case management or scientific investigation. Therefore, it is strongly recommended that the reader use this overview as an introduction to these subjects. **Accessing this publication online will allow the reader to use the links in this overview and the tables to view directly the source papers (Table 1).**

INSERT Table 1 here

PERIODONTAL HEALTH, GINGIVITIS, AND GINGIVAL CONDITIONS [2-6]

The workshop addressed unresolved issues with the previous classification by identifying the difference between presence of gingival inflammation at one or more sites and the definition of a gingivitis case. It agreed that bleeding on probing should be the primary parameter to set thresholds for gingivitis.[2, 5] The workshop also characterized periodontal health and gingival inflammation in a reduced periodontium after completion of successful treatment of a periodontitis patient. Specific definitions were agreed to with regard to cases of gingival health or inflammation after completion of periodontitis treatment based on BOP and depth of the residual sulcus/pocket. This distinction was made to emphasize the need for a more comprehensive maintenance and surveillance of the successfully treated periodontitis patient. It was accepted that a patient with gingivitis can revert to a state of health, but a periodontitis patient remains a periodontitis patient for life, even following

successful therapy, and requires life-long supportive care to prevent recurrence of disease.[6] The workshop also re-organized the broad spectrum of non-plaque induced gingival diseases and conditions based on primary etiology (Table 2).[4]

INSERT TABLE 2 HERE

A NEW CLASSIFICATION OF PERIODONTITIS

The 1989 workshop recognized that periodontitis had several distinct clinical presentations, different ages of onset and rates of progression.[7, 8] Based on these variables the workshop categorized periodontitis as prepubertal, juvenile (localized and generalized), adult and rapidly progressive. The 1993 European Workshop determined that the classification should be simplified and proposed grouping of periodontitis into two major headings: adult and early onset periodontitis.[9] The 1996 workshop participants determined that there was insufficient new evidence to change the classification.[10] Major changes were made in the 1999 classification of periodontitis,[11-13] which has been in use for the last 19 years. Periodontitis was reclassified as chronic, aggressive (localized and generalized), necrotizing and as a manifestation of systemic disease.

Since the 1999 workshop, substantial new information has emerged from population studies, basic science investigations and the evidence from prospective studies evaluating environmental and systemic risk factors. The analysis of this evidence has prompted the 2017 workshop to develop a new classification framework for periodontitis.[14]

In the last 30 years, the classification of periodontitis has been repeatedly modified in an attempt to align it with emerging scientific evidence. The workshop agreed that, consistent with current knowledge on pathophysiology, three forms of periodontitis can be identified: *necrotizing periodontitis*,[15] *periodontitis as a manifestation of systemic disease*,[16] and the forms of the disease previously recognized as "chronic" or "aggressive", now grouped under a single category "Periodontitis".[14, 17-20] In revising the classification, the workshop agreed on a classification framework for periodontitis further characterized based on a multidimensional staging and grading system that should be adapted over time as new evidence emerges.[20]

Staging is largely dependent upon the severity of disease at presentation as well as on the complexity of disease management, while **grading** provides supplemental information about biological features of the disease, including a history based analysis of the rate of disease progression, assessment of the risk for further progression, anticipated poor outcomes of treatment, and assessment of the risk that the disease or its treatment may negatively affect the general health of the patient.[14, 20] Staging involves four categories (Stages 1-4) and is determined after considering several variables including clinical attachment loss, amount and percentage of bone loss, probing depth, presence and extent of angular bony defects and furcation involvement, tooth mobility and tooth loss due to periodontitis. Grading includes three levels (Grade A – low risk, Grade B – moderate risk, Grade C – high risk for progression) and encompasses, in addition to aspects related to periodontitis progression, general health status, and other exposures such as smoking or level of metabolic control in diabetes. Thus, grading allows the clinician to incorporate individual patient factors into the diagnosis, which are crucial to comprehensive case management (Table 3). For a complete description of the new classification scheme for periodontitis, the reader is directed to the consensus report on periodontitis[14] and the case definition paper on periodontitis.[20]

SYSTEMIC DISEASES ASSOCIATED WITH LOSS OF PERIODONTAL SUPPORTING TISSUES[16, 21]

The new classification of periodontal diseases and conditions also includes systemic diseases and conditions that affect the periodontal supporting tissues.[16] It is recognized that there are rare systemic disorders, such as Papillon Lefevre Syndrome, that generally result in the early presentation of severe periodontitis. Such conditions are grouped as "Periodontitis as a Manifestation of Systemic Disease", and classification should be based on the primary systemic disease.[16] Other systemic conditions, such as neoplastic diseases, may affect the periodontal apparatus independent of dental plaque biofilm-induced periodontitis,[21] and such clinical findings should also be classified based on the primary systemic disease and be grouped as "Systemic Diseases or Conditions Affecting the Periodontal Supporting Tissues". There are, however, common systemic diseases, such as uncontrolled diabetes mellitus, with variable effects that modify the course of periodontitis. These appear to be part of the multi-factorial nature of complex diseases such as periodontitis and are included in the new clinical classification of periodontitis as a descriptor in the staging and grading process.[20] Although common modifiers of periodontitis may substantially alter disease occurrence, severity, and response to treatment, current evidence does not support a unique pathophysiology in patients with diabetes and periodontitis.[22]

INSERT TABLE 3 HERE

CHANGES IN THE CLASSIFICATION OF PERIODONTAL DEVELOPMENTAL AND ACQUIRED DEFORMITIES AND CONDITIONS [21, 23-25]

MUCOGINGIVAL CONDITIONS

The new case definitions related to treatment of gingival recession are based on interproximal loss of clinical attachment and also incorporates the assessment of the exposed root and cementoenamel junction.[23] The consensus report presents a new classification of gingival recession that combines clinical parameters including the **gingival phenotype** as well as characteristics of the exposed root surface.[21] In the consensus report the term **periodontal biotype** was replaced by **periodontal phenotype** (Table 4).[21]

OCCLUSAL TRAUMA AND TRAUMATIC OCCLUSAL FORCES

Traumatic occlusal force, replacing the term **excessive occlusal force**, is the force that exceeds the adaptive capacity of the periodontium and/or the teeth. Traumatic occlusal forces can result in occlusal trauma (the lesion) and excessive wear or fracture of the teeth.[21] There is lack of evidence from human studies implicating occlusal trauma in the progression of attachment loss in periodontitis (Table 4).[24]

PROSTHESIS AND TOOTH RELATED FACTORS

The section on prostheses related factors was expanded in the new classification. The term **biologic width** was replaced by **supracrestal attached tissues**.[21] Clinical procedures involved in the fabrication of indirect restorations was added because of new data indicating that these procedures may cause recession and loss of clinical attachment (Table 4).[25]

INSERT TABLE 4 HERE

A NEW CLASSIFICATION FOR PERI-IMPLANT DISEASES AND CONDITIONS [26]

A new classification for peri-implant health,[27] peri-implant mucositis[28] and peri-implantitis[29] was developed by the workshop. An effort was made to review all aspects of peri-implant health, diseases and relevant aspects of implant site conditions and deformities in order to achieve a consensus for this classification that could be accepted worldwide. Case definitions were developed for use by clinicians for individual case management and also appropriate for population studies.[26, 30]

PERI-IMPLANT HEALTH

Peri-implant health was defined both clinically and histologically.[27] Clinically, peri-implant health is characterized by an absence of visual signs of inflammation and bleeding on probing. Peri-implant health can exist around implants with normal or reduced bone support. It is not possible to define a range of probing depths compatible with peri-implant health.[26, 30]

PERI-IMPLANT MUCOSITIS

Peri-implant mucositis is characterized by bleeding on probing and visual signs of inflammation.[28] While there is strong evidence that peri-implant mucositis is caused by plaque, there is very limited evidence for non-plaque induced peri-implant mucositis. Peri-implant mucositis can be reversed with measures aimed at eliminating the plaque.

PERI-IMPLANTITIS

Peri-implantitis was defined as a plaque-associated pathological condition occurring in the tissue around dental implants, characterized by inflammation in the peri-implant mucosa and subsequent progressive loss of supporting bone.[29] Peri-implant mucositis is assumed to precede peri-implantitis. Peri-implantitis is associated with poor plaque control and with patients with a history of severe periodontitis. The onset of peri-implantitis may occur early following implant placement as indicated by radiographic data. Peri-implantitis, in the absence of treatment, seems to progress in a non-linear and accelerating pattern.[29]

HARD AND SOFT TISSUE IMPLANT SITE DEFICIENCIES

Normal healing following tooth loss leads to diminished dimensions of the alveolar process/ridge that result in both hard and soft tissue deficiencies. Larger ridge deficiencies can occur at sites associated with severe loss of periodontal support, extraction trauma, endodontic infections, root fractures, thin buccal bone plates, poor tooth position, injury and pneumatization of the maxillary sinuses. Other

factors affecting the ridge can be associated with medications and systemic diseases reducing the amount of naturally formed bone, tooth agenesis and pressure from prostheses.[31]

INSERT TABLE 5 HERE

CONCLUSION

This overview introduces an updated classification of periodontal diseases and conditions and a new classification of peri-implant diseases and conditions. The publication as a whole represents the work of the worldwide community of scholars and clinicians in periodontology and implant dentistry. This paper presents an abbreviated overview of the outcome of the consensus workshop, and the reader is encouraged to review the entire publication to receive comprehensive information about the rationale, criteria and implementation of the new classifications.

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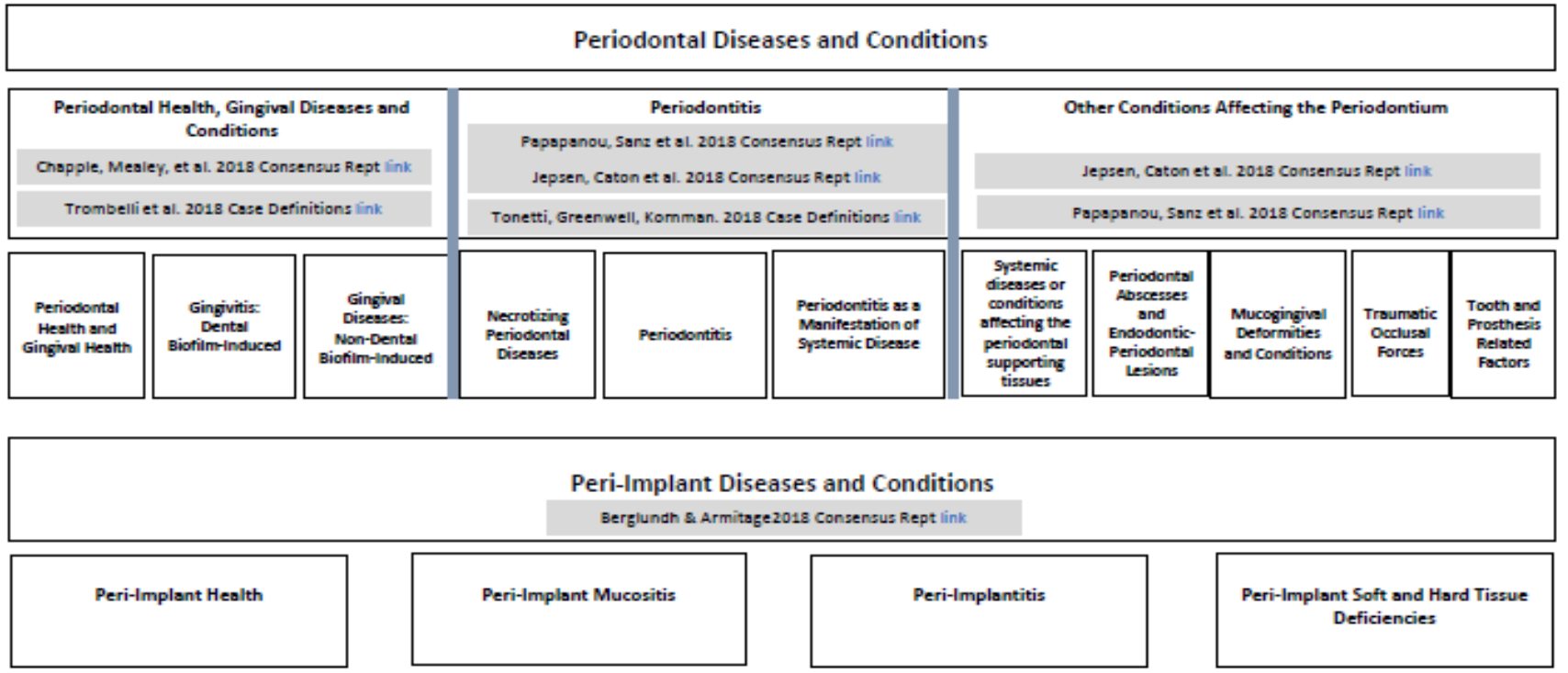
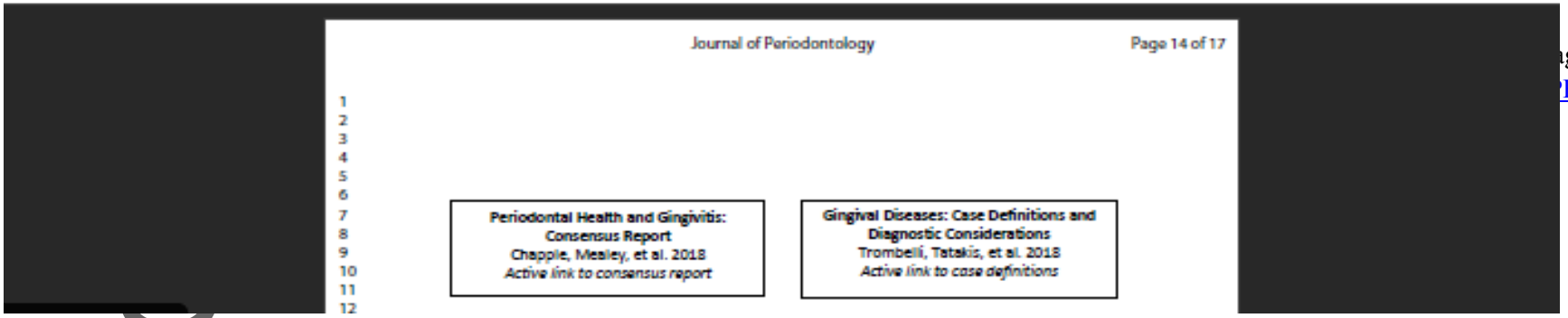
CLASSIFICATION OF PERIODONTAL AND PERI-IMPLANT DISEASES AND CONDITIONS 2017





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PERIODONTAL HEALTH, GINGIVAL DISEASES/CONDITIONS

1. **Periodontal health and gingival health**
   Lang & Bartold 2018 (link)
   a. Clinical gingival health on an intact periodontium
   b. Clinical gingival health on a reduced periodontium
      i. Stable periodontitis patient
      ii. Non-periodontitis patient

2. **Gingivitis – dental biofilm-induced**
   Murakami et al. 2018 (link)
   a. Associated with dental biofilm alone
   b. Mediated by systemic or local risk factors
   c. Drug-influenced gingival enlargement

3. **Gingival diseases – non-dental biofilm induced**
   Holmstrup et al. 2018 (link)
   a. Genetic/developmental disorders
   b. Specific infections
   c. Inflammatory and immune conditions
   d. Reactive processes
   e. Neoplasms
   f. Endocrine, nutritional & metabolic diseases
   g. Traumatic lesions
   h. Gingival pigmentation

Periodontitis Consensus Report
Papapanou, Sanz et al. 2018
Active link to consensus report

Staging and Grading of Periodontitis: Framework and Proposal of a New Classification and Case Definition
Tonetti, Greenwell, Kornman 2018
Active link to case definitions

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1002/JPER.18-0157.

FORMS OF PERIODONTITIS

1. **Necrotizing Periodontal Diseases**

   Herrera et al. 2018 link

   a. Necrotizing Gingivitis
   b. Necrotizing Periodontitis
   c. Necrotizing Stomatitis

2. **Periodontitis as Manifestation of Systemic Diseases**

   Jepsen, Caton et al. 2018 Consensus Rept link | Albandar et al. 2018 link

   Classification of these conditions should be based on the primary systemic disease according to the International Statistical Classification of Diseases and Related Health Problems (ICD) codes

3. **Periodontitis**

   Fine et al. 2018 link | Needleman et al. 2018 link | Billings et al. 2018 link

   a. **Stages:** Based on Severity[1] and Complexity of Management[2]
      Stage I: Initial Periodontitis
      Stage II: Moderate Periodontitis
      Stage III: Severe Periodontitis with potential for additional tooth loss
      Stage IV: Severe Periodontitis with potential for loss of the dentition
   b. Extent and distribution[3]: localized; generalized; molar-incisor distribution
   c. **Grades:** Evidence or risk of rapid progression[4], anticipated treatment response[5]
      i. Grade A: Slow rate of progression
      ii. Grade B: Moderate rate of progression
      iii. Grade C: Rapid rate of progression

[1] Severity: interdental clinical attachment level (CAL) at site with greatest loss; Radiographic bone loss & tooth loss
[2] Complexity of management: Probing depths, pattern of bone loss, furcation lesions, number of remaining teeth, tooth mobility, ridge defects, masticatory dysfunction
[3] Add to Stage as descriptor: localized <30% teeth, generalized ≥ 30% teeth
[4] Risk of progression: direct evidence by PA radiographs or CAL loss, or indirect (bone loss/age ratio)
[5] Anticipated treatment response: case phenotype, smoking, hyperglycemia

Periodontal Manifestations of Systemic Diseases and Developmental and Acquired Conditions: Consensus Report
Jepsen, Caton et al. 2018
Active link to consensus report

PERIODONTAL MANIFESTATIONS OF SYSTEMIC DISEASES AND DEVELOPMENTAL AND ACQUIRED CONDITIONS

1. **Systemic diseases or conditions affecting the periodontal supporting tissues**

   Albandar et al. 2018 link

2. **Other Periodontal Conditions**

   Papapanou, Sanz et al. 2018 link Herrera et al. 2018 link

   a. Periodontal Abscesses
   b. Endodontic-Periodontal Lesions

3. **Mucogingival deformities and conditions around teeth**

   Cortellini & Bissada 2018 link

   a. Gingival phenotype
   b. Gingival/soft tissue recession
   c. Lack of gingiva
   d. Decreased vestibular depth
   e. Aberrant frenum/muscle position
   f. Gingival excess
   g. Abnormal color
   h. Condition of the exposed root surface

4. **Traumatic occlusal forces**

   Fan & Caton 2018 link

   a. Primary occlusal trauma
   b. Secondary occlusal trauma
   c. Orthodontic forces

5. **Prostheses and tooth-related factors that modify or predispose to plaque-induced gingival diseases/periodontitis**

   Ercoli & Caton 2018 link

   a. Localized tooth-related factors
   b. Localized dental prostheses-related factors

Peri-implant Diseases and Conditions Consensus Report
Berglundh, Armitage et al. 2018
Active link to consensus report

PERI-IMPLANT DISEASES AND CONDITIONS

1. **Peri-implant health**

   Araujo & Lindhe 2018 link

2. **Peri-implant mucositis**

   Heitz-Mayfield & Salvi 2018 link

3. **Peri-implantitis**

   Schwarz et al. 2018 link

4. **Peri-implant soft and hard tissue deficiencies**

   Hammerle & Tarnow 2018 link

Renvert et al., 2018 Case Definitions link