

Purpose and problems of periodontal disease classification

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There has been a debate on the diagnosis and classification of periodontal diseases since dentists first became interested in periodontology. In this respect, periodontology is not unique; comparable discussions can be encountered in many fields of medicine, especially in complex diseases. Diagnosis is defined as the act of identifying a disease from its signs and symptoms, whereas classification is defined as the act or method of distribution into groups. The present article deals with the periodontal condition which is clinically characterized by three symptoms: loss of connective tissue attachment, loss of alveolar bone support, and inflamed pathological pockets. On the basis of these three symptoms one diagnostic name for this condition would be appropriate, e.g. destructive periodontal disease. However, if age, distribution of lesions, degree of gingival inflammation, putative rate of breakdown, response to therapy, etc., are also taken into account, numerous diagnostic names are needed. In order to be able to communicate about patients, clinicians have always felt the need for diagnostic names and classifications for these diseases, preferably on the basis of putative etiologic factors. At present, controversies about definitions of diseases continues, not only in the periodontal field but also in medicine.

An interesting contribution to the discussion on disease terminology is a paper by Scadding (31) entitled: 'Essentialism and nominalism in medicine: logic of diagnosis in disease terminology'. In this paper the clear distinction between these two types of definitions is highlighted. The essentialistic idea implies the real existence of a disease. *Essentialist* definitions typically start 'X is ...', implying *a priori* the existence of something that can be identified as X. Thus the doctor's skills consist in identifying the causal disease and then prescribing the appropriate treatment. In relation to this, Scadding states:

'The essentialist's hankering after a unified concept of diseases as a class of agents causing illness, is mistaken and misleading for several good reasons: many diseases remain of unknown cause; known causes are of diverse types; causation may be complex, with interplay of several factors, intrinsic; and, more generally, an effect – the disease – should not be confused with its own cause'.

The counterpart of essentialism is *nominalism*, which implies that a disease name is just a name given to a group of subjects who share a group of well-defined signs and symptoms. Scadding supports the nominalistic concept and states: 'The names of diseases are a convenient way of stating briefly the endpoint of a diagnostic process that progresses from assessment of symptoms and signs towards knowledge of causation'. Ideally, a nominalistic disease definition describes a set of criteria that are fulfilled by all persons said to have the disease, but not fulfilled by persons that are considered free from the disease (40). This set of criteria is dependent on the level of knowledge of a given disease. For example, if the etiology is known, e.g. cholera, then the key criterion for the disease is the presence of *Vibrio cholerae*. However, for many diseases the etiology is complex or not known, and consequently a large number of diseases are defined as syndromes. A syndrome constitutes a distinct group of symptoms and signs which together form a characteristic clinical picture or entity. In this respect periodontitis is a good example of a syndromically defined disease (10, 36).

Need for classification

Syndromic classification(s) are needed to cluster similar disease phenotypes in more homogeneous

syndromes. This is the prerequisite to establish etiology and susceptibility traits, and thus separate truly different forms of disease or conversely link different different phenotypic variations to the same underlying disease (35).

As mentioned above, the names of a disease are a convenient way of stating briefly the endpoint of a diagnostic process that progresses from the assessment of symptoms and signs towards knowledge of causation (31). In other words, in order to obtain more knowledge about the causation of periodontal diseases the various forms of the disease have to be classified. The term 'periodontal disease' has referred for some time to all diseases which affect one or more tissues from the periodontium (2). However, in 1964 Sherp (32) noted:

'Discussions of periodontal disease commonly begin with the tacit assumption that all participants are considering the same entity. Since the variations of periodontal diseases are almost limitless, depending on one's taste for subclassification, this unqualified usage often leads to fruitless semantic misunderstandings. What is usually meant is the most common form of periodontal disease – a chronic, slowly progressive and destructive inflammatory process affecting one or more of the supporting tissues of the teeth – the gingival tissue, the periodontal membrane, and the alveolar bone'.

This statement, made 40 years ago, is still valid today; it also highlights one of the most frequent premises in periodontal diagnosis: the assumptions concerning previous disease progression. In this respect, age has always been an important parameter in periodontal diagnosis.

Previous classifications

Almost all ancient medical works refer to the various diseases of the teeth and their supporting tissues but without using any particular terminology. The first specific name for periodontal disease was introduced by Fauchard in 1723 using the term 'scurvy of the gums' (15). Ever since, researchers have introduced names for diseases of the periodontium on the basis of etiologic factors, pathologic changes or clinical manifestations.

Gottlieb is generally considered to be the first author who clearly distinguished various forms of periodontal disease. In the 1920s he classified perio-

dontal disease into four types (16–18): *Schmutz-Pyorrhöe*, *alveolar atrophy* or *diffuse atrophy*, *Paradental-Pyorrhöe*, and *occlusal trauma*. *Schmutz-Pyorrhöe* was thought to be the result of the accumulation of deposits on the teeth and was characterized by inflammation, shallow pockets, and resorption of the alveolar crest. Alveolar atrophy or diffuse atrophy was described as a noninflammatory disease exhibiting loosening of teeth, elongation, and wandering of teeth in individuals who were generally free of carious lesions and dental deposits. In this disease, manifesting pockets are formed only in later stages. *Paradental-Pyorrhöe* was characterized by irregularly distributed pockets varying from shallow to extremely deep. This form of disease may have started as *Schmutz-Pyorrhöe* or as diffuse atrophy. The fourth type was occlusal trauma, a form of physical overload which was believed to result in resorption of the alveolar bone and loosening of teeth.

More or less at the same time, McCall & Box (24) introduced the term *periodontitis* to denote those inflammatory diseases in which all three components of the periodontium, i.e. the gingiva, bone, and periodontal ligament, were affected. This is in contrast to the lesions of occlusal traumatism and atrophic lesions, in which only the bone and periodontal ligament may be involved. Periodontitis was subclassified, on the basis of presumed etiologic factors, into *Simplex periodontitis*, considered to be the result from local bacterial factors, and *Complex periodontitis*, a result of systemic etiologic factors.

Becks (11) made a distinction between *paradentitis*, a disease which 'originates from the gum tissue in the form of gingivitis' and *genuine paradentosis*, which 'originates in the bony alveolus, perhaps in the form of an osteopathy'. Orban & Weinmann (25) adopted this nomenclature using the anglicized term *periodontosis* to designate this 'noninflammatory disease'. Periodontosis was considered a separate disease entity, distinctly different from periodontitis, which was considered the sequela of gingivitis of the deeper periodontal structures, and therefore of inflammatory origin. It is remarkable that in relation to the issue of degenerative disease it is not mentioned specifically that this was a disease entity particular to young subjects (23).

During the 1950s and 1960s the importance of dental plaque as the major etiologic factor for periodontal diseases became more and more evident. The ultimate proof of the association between plaque and gingival inflammation was shown by Löe and coworkers in their experimental gingivitis

studies (22, 34). The influence of this way of thinking was clearly evident during the 1966 Workshop in Periodontics when the entity periodontosis was revisited (13). In the committee report it was concluded:

‘Evidence to support the conventional concept of periodontosis is unsubstantiated. It was the consensus of the section that the term periodontosis is ambiguous and that the term should be eliminated from periodontal nomenclature. Nevertheless, the committee is aware that some evidence exists to indicate that a clinical entity different from adult periodontitis may occur in adolescents and young adults’.

Therefore it is not surprising that soon after the Workshop a study was published by Butler (12) introducing the name *juvenile periodontitis* instead of periodontosis when describing the periodontal condition of young individuals with severe periodontal bone loss. According to Butler there was no proof of any degenerative process, as the suffix ‘osis’ would imply.

Numerous classifications have since been published. Page & Schroeder (28) defined periodontitis as an inflammatory disease of the periodontium characterized by the presence of periodontal pocket(s) and active bone resorption with acute inflammation. They suggested at least four distinctly different forms of periodontitis in humans: *prepubertal*, *juvenile*, *rapidly progressive*, *adult periodontitis*, and *acute necrotizing ulcerative gingivo-periodontitis* (ANUG/P). In this classification, with the exception of ANUG/P, the age of onset is of decisive importance. This item is adopted in almost all subsequent classifications. In 1986 the American Academy of Periodontology (AAP) adopted the following classification (3):

- I Juvenile periodontitis
 - A Prepubertal periodontitis
 - B Localized juvenile periodontitis
 - C Generalized juvenile periodontitis
- II Adult periodontitis
- III Necrotizing ulcerative gingivo-periodontitis
- IV Refractory periodontitis.

In an attempt to detect groups and individuals at high risk for periodontal disease, Johnson et al. (20) presented a more extensive classification:

- I *Childhood periodontitis* including specific syndromes such as Papillon-Levèfre
- II *Juvenile periodontitis*: localized; generalized
- III *Post-juvenile periodontitis*

IV *Adult onset periodontitis*: slowly progressive; rapidly progressive

V *Periodontitis* associated with systemic diseases such as diabetes, scurvy, immunodeficiencies (including AIDS), immunosuppressive states, blood dyscrasias

VI *Traumatic periodontitis*, e.g. gingival recession and loss of attachment as a result of abrasion during oral hygiene practice (toothbrushing, wood sticks, charcoal, brick dust; trauma from occlusion)

VII *Iatrogenic periodontitis*, due to inappropriate restorations or inappropriate instrumentation of the gingival crevice.

At the same time a new classification was proposed by Suzuki (33). Suzuki stated that ‘Additional clinical observations in our laboratories during investigation on the mode of inheritance of juvenile and rapidly progressive periodontitis have suggested that further qualifications can be made’. Based on factors such as age, microbial deposits, and the autologous mixed lymphocyte reaction, rapidly progressive periodontitis, as introduced by Page & Schroeder (28), can be subdivided into *type A* and *type B*. In addition, the term postjuvenile periodontitis delineated a slow-progression-type of juvenile periodontitis.

One year later it was stated in the 1989 World Workshop in Clinical Periodontics that ‘although the AAP classification was adopted, legitimizing the idea that different forms of periodontal diseases exist, more recently acquired data mandate modification and revision’ (4). The following classification was recommended:

- I Adult periodontitis
- II Early onset periodontitis
 - A Prepubertal periodontitis
 - 1 Generalized
 - 2 Localized
 - B Juvenile periodontitis
 - 1 Generalized
 - 2 Localized
 - C Rapidly progressive periodontitis
- III Periodontitis associated with systemic diseases
- IV Necrotizing ulcerative periodontitis
- V Refractory periodontitis.

Volume 2 of Periodontology 2000, issued in 1993, was dedicated to the classification and epidemiology of periodontal diseases. In the contribution of Ranney (30) four major disease categories were proposed, i.e. adult periodontitis, early onset periodontitis, necrotizing ulcerative periodontitis, and periodontal abscess including a large number of subcategories mainly based on systemic factors. Also in 1993, the

first European Workshop on Periodontology was organized. In session I the following position papers were presented. Papapanou: epidemiology and natural history of periodontal disease (29), Claffey: Gold Standard – Clinical and radiographical assessment of disease activity (14), Tonetti: Etiology and pathogenesis (35) and Johnson: Risk factors and diagnostic tests for destructive periodontitis (19). On the basis of these comprehensive reviews a consensus report was produced (9) that included the following statement regarding the classification of periodontal diseases:

‘There is insufficient knowledge to separate truly different diseases (disease heterogeneity) from differences in the presentation/severity of the same disease (phenotypic variation). Because of this, existing classifications are unsatisfactory. Disadvantages of present classifications (e.g. AAP 1989) include 1. extensive overlap between the different diagnostic categories, 2. need for assumptions concerning previous disease progression, 3. the necessity for detailed information on the quality of treatment provided previously and the patient response to this therapy, and 4. the apparent lack of a consistent basis for classification. Ideally classifications should be based on etiologic and host response factors. In order to deal with the present confusion, a simple classification distinguishing between 1. Early onset periodontitis, 2. Adult periodontitis, 3. Necrotizing periodontitis, might be preferable. Provided that the relevant information is available, as many as possible additional secondary descriptors should be used to further define the clinical situation. These include distribution within the dentition, rate of progression, response to treatment, relation to systemic diseases, microbiological characteristics, ethnic group and other factors’.

Although, in my opinion, the conclusion ‘there is insufficient knowledge to separate truly different diseases (disease heterogeneity) from differences in the presentation/severity of the same disease (phenotypic variation)’ from the European Workshop on Periodontology in 1993 (9) still holds true today, it was concluded in the 1996 World Workshop in Periodontics that there was a clear need for a revised classification system for periodontal diseases (5). This resulted in a new classification which was agreed upon at the International Workshop for a Classification of Periodontal Diseases and Conditions in 1999 (6). This classification included many disease categories

and subcategories and was certainly an improvement with regard to the category gingival diseases. However, a number of subcategories present in the majority of the previous classifications were eliminated, i.e. prepubertal periodontitis, juvenile periodontitis, postjuvenile periodontitis, rapidly progressive periodontitis, early onset periodontitis and refractory periodontitis. Amongst others it was argued that:

‘in case of early onset periodontitis (prepubertal periodontitis, juvenile periodontitis, postjuvenile periodontitis and rapidly progressive periodontitis), one must have temporal knowledge of when the disease started. In addition, there is considerable uncertainty about arbitrarily setting an upper age limit for patients with so-called early onset periodontitis. For example, how does one classify the type of periodontal disease in a 21-year old patient with the classical incisor-first molar pattern of Localized Juvenile Periodontitis (LJP)? Since the patient is not a juvenile, should the age of the patient be ignored and the disease classified as LJP anyway?’

On the basis of this and other arguments the workshop participants decided that it was wise to discard classification terminologies that were age-dependent or required knowledge of rates of progression (6). Therefore it was proposed to re-name the disease formerly considered under the umbrella early onset periodontitis and other forms of rapidly progressive disease by *aggressive periodontitis*. Although not clearly stated, it can be concluded from the report that the term aggressive periodontitis is only applicable for patients with severe periodontal breakdown. However, it can be argued that this new classification does not solve the problems because it is not clear how severe a case must be in order to be classified as aggressive periodontitis, and knowledge about the rate of progression is still needed. In the same Workshop, *adult periodontitis* was re-named *chronic periodontitis* on the basis of the assumption that slowly progressive disease can be present at any age, i.e. in adults as well as in adolescents. But again it can be argued that for this classification, knowledge about the rate of progression is still needed.

The problems related to the prediction of the rate of progression in the future or assumptions on the rate of progression in the past are clearly illustrated by the study of Albandar et al. (1). In this longitudinal study, young individuals, mean age at baseline

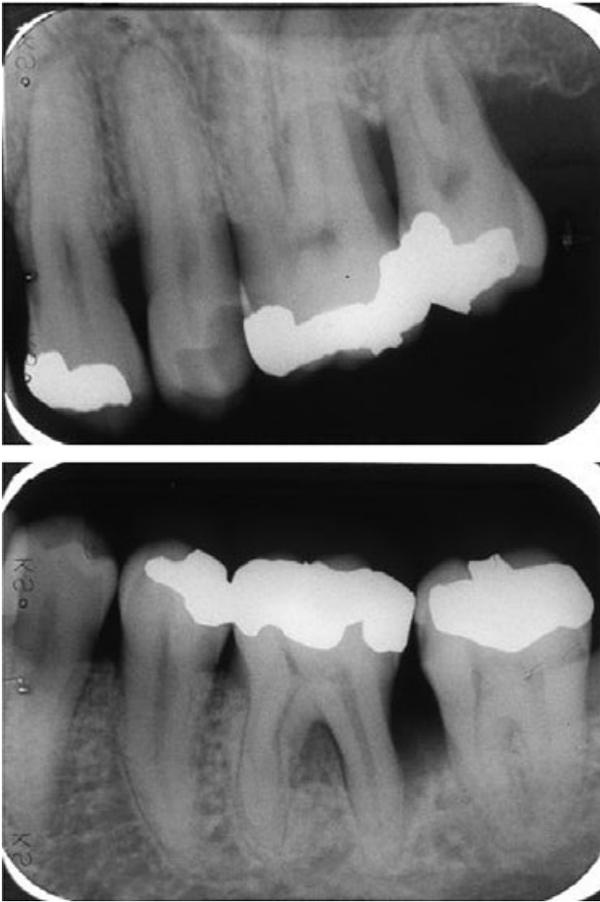


Fig. 1. Radiographs of a 50-year-old male patient when he was referred to the Department of Periodontology at ACTA.

16 years, were reexamined 6 years later. On the basis of the baseline measurements the individuals were classified into localized juvenile periodontitis, generalized juvenile periodontitis, incidental attachment loss, and no-periodontitis group. The results showed low correlations between baseline disease classifications and the classifications at the 6-year follow-up examination. In addition, the cross-sectional classifications were not predictive of the rate of progression of periodontal disease in these subjects. Sometimes retrospective documentation of cases gives interesting information. Figure 1 shows radiographs of a 50-year-old patient when he was referred to the Department of Periodontology at ACTA. Bitewing radiographs could be retrieved from his dentist when the patient was 45 (Fig. 2) and 49 years old (Fig. 3). It was obvious that most of the breakdown had occurred in 1 year. The medical history revealed no particular problems. This case clearly illustrates that without documentation, assumptions on the rate of previous disease progression are made blindly, although in general, periodontitis is a slowly pro-

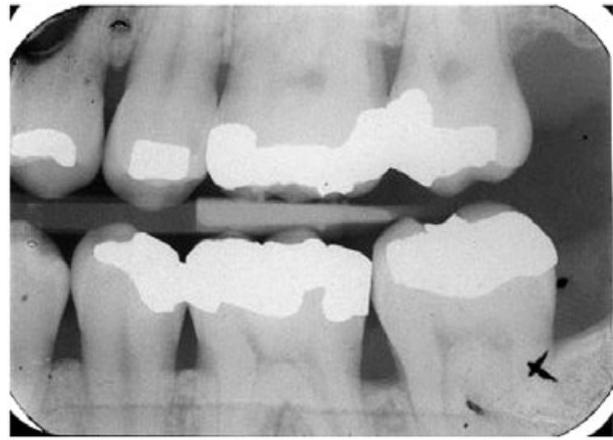


Fig. 2. Bitewing radiographs from the same patient as in Fig. 1 when he was 45 years old.

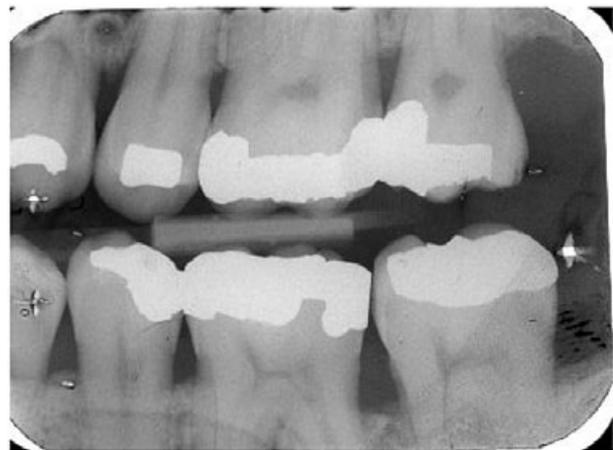


Fig. 3. Bitewing radiographs from the same patient as in Fig. 1 when he was 49 years old.

gressive disease whose pace may vary between individuals as well as during life. In a review on classification of periodontal diseases in 2002, Armitage (7) stated that if a classification is based on the extent and severity of the disease, age, and rate of progression, this would represent a return to the domination of the 'Clinical Characteristics' paradigm that reigned from approximately 1870 to 1920, when we knew little about the nature of periodontal diseases. The 1999 classification is based on the 'Infection/Host Response' paradigm that started to be the dominant paradigm in the 1970s. According to Armitage, the 1999 classification is even more firmly based on the Infection/Host Response paradigm. However, it can be argued that, at present, regardless of the enormous increase in knowledge of periodontal diseases, we still know too little to diagnose and classify the periodontal disease of a patient on an etiologic basis.

Essentialistic or nominalistic disease classification

As Sherp (32) noted in 1964:

'Discussions of periodontal disease commonly begin with the tacit assumption that all participants are considering the same entity. In order to be able to discuss cases between colleagues it is for clinicians of paramount importance to be able to give a diagnostic name to a patient with periodontitis. One obvious problem is that one of the most important components of periodontitis is expressed in all patients in the same way, i.e. the amount of loss of attachment. This can be illustrated by the example that 2 mm loss of attachment mesial of all first molars in an 8-year child is a severe problem suggestive for an individual that is highly susceptible to periodontal disease, whereas the same condition in a 60 years old subject may suggest that the individual is rather resistant to periodontal disease'.

Figure 4 illustrates this problem. The essentialistic idea implies the real existence of a disease caused by a class of agents. However, to date, all indications have been that the causal web for periodontitis is so complex and involves so many factors in so many different constellations that a classification of periodontitis based on etiology is effectively precluded (10). Since periodontitis has to be regarded as a syndrome, present and future classifications of periodontitis have to be based on the nominalistic concept.

Classifications based on this concept should be simple to apply and not susceptible to multiple interpretations. Ideally, such a classification should

be determined on the basis of documented differences regarding the consequences of the diagnosis (10). Unfortunately, to date there is insufficient knowledge to make a classification based on this principle. However, it is most convenient if the terminology used describes the patient in such a way that all clinicians immediately have a clear image of a case. The recent classification into aggressive and chronic periodontitis (6) does not fulfill this criterion since the criteria are too indefinite. However, in a recent review Armitage (8) again discussed periodontal diagnoses and classification. In this review he accepted, in a way, the nominalistic concept by stating that a diagnosis can be phrased many different ways depending on how precise or detailed one wants to be. With regard to the distinction between aggressive and chronic periodontitis it can be argued that all forms of periodontitis are chronic in nature, with the exception of acute necrotizing periodontitis and a periodontal abscess. This would imply that there is no place for the diagnosis aggressive periodontitis, leaving the diagnosis chronic periodontitis for all cases of periodontitis, a situation which is not feasible in practice. Especially in relation to research into the etiology of the various manifestations of periodontitis, it is of utmost importance to include clear phenotypes in the study groups. For clinicians the most important characteristic of a patient is the extent and severity of the periodontal destruction in relation to age.

Classification according to the nominalistic concept

At present, the best option is to classify the periodontitis syndrome in an exhaustive but also exclusive way and use a terminology for the various classes of

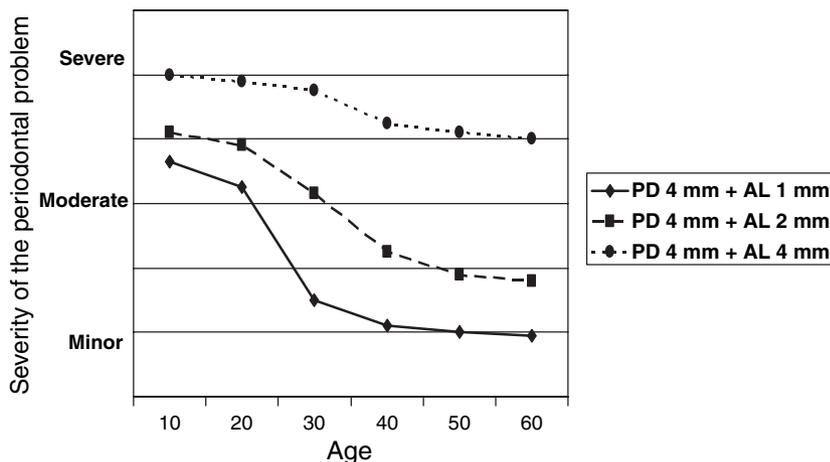


Fig. 4. Estimation of the severity of the periodontal problem in relation to age. PD = pocket depth. AL = attachment level.

Table 1. Classification based on the extent of the disease. If teeth are missing, the class description should still reflect the clinical image of the patient. Therefore it was decided for cases with ≤ 14 teeth to omit the class semi-generalized and to change the number of teeth for the generalized class to 8–14

	Permanent / mixed dentition No. of teeth present		Primary dentition
	$n \geq 14$	$n \leq 14$	
Incidental	1 tooth	1 tooth	1 tooth
Localized	2–7 teeth	2–7 teeth	2–4 teeth
Semi-generalized	8–13 teeth	–	5–9 teeth
Generalized	≥ 14 teeth	8–14 teeth	≥ 10 teeth

the disease which makes it easy to understand the case. A classification which comes closest to these principles was recently published by Van der Velden (38). This classification was based on four dimensions, i.e. extent, severity, age, and clinical characteristics. The following is a presentation of the original classification with a few additions.

- Defining when periodontitis is considered to be present. It is suggested to define periodontitis as the presence of inflamed pathological pockets ≥ 4 mm deep in conjunction with attachment loss. If present, then the next steps can be taken.
- Classification based on extent of the disease, i.e. number of affected teeth (Table 1).
- Classification based on severity of disease per tooth (Table 2). The fact that either attachment loss or bone loss can be used for the classification of severity implies that although it may be important to know the actual root length in a given patient, radiographs are not a prerequisite for the classification of severity.
- Classification based on age (Table 3).
- Classification based on clinical characteristics (Table 4).

Table 2. Classification based on the severity of disease per tooth. The mean estimated root length based on the literature is approximately 12 mm (21); in the case of incidental disease, the severity category at that particular tooth is mentioned

Minor	bone loss $\leq 1/3$ of the root length or attachment loss ≤ 3 mm
Moderate	bone loss $> 1/3$ and $\leq 1/2$ of the root length or attachment loss 4–5 mm
Severe	bone loss $> 1/2$ of the root length or attachment loss ≥ 6 mm

Table 3. Classification based on age. If in patients classified as adult periodontitis it can be demonstrated on the basis of documentation that they already had moderate or severe periodontitis before the age of 36 years, the disease is classified as early onset periodontitis

Early onset periodontitis	
Prepubertal periodontitis	≤ 12 years
Juvenile periodontitis	13–20 years
Postadolescent periodontitis	21–35 years
Adult periodontitis	≥ 36 years

The classification is ascertained in the following way:

- first, the severity category is determined for each tooth;
- next, the extent category is determined by counting the number of teeth with the most severe condition;
- diagnosis on the basis of clinical characteristics is added if applicable;
- diagnosis on the basis of age.

In the nomenclature, the parameters for the classification are set in the following order: extent, severity, clinical characteristics and age. Thus examples for diagnoses are: localized minor prepubertal periodontitis, localized severe juvenile periodontitis, semi-generalized minor juvenile periodontitis, generalized severe refractory post adolescent periodontitis, localized severe adult periodontitis. One could make the diagnosis even more detailed by including two levels of extent and severity when appropriate, e.g. localized severe, semi-generalized moderate adult periodontitis.

Traditionally in periodontology, a specific diagnosis has been introduced on the basis of severe cases,

Table 4. Classification based on clinical characteristics. Periodontitis associated with systemic diseases, i.e. periodontitis in subjects suffering from general diseases, or periodontitis in subjects using medication, which enhance the rate and severity of periodontal breakdown is not identified as a specific class of periodontitis. However, the association with such a condition should be added to the diagnosis.

Necrotizing periodontitis	interdental gingival necrosis, bleeding and pain
Rapidly progressive periodontitis	documented rapid breakdown (at any age), i.e. rapidly progressive periodontitis patients showing a progression of ≥ 1 mm interproximal attachment / bone loss per year at affected sites
Refractory periodontitis	documented, no or minimal pocket depth reduction at single rooted teeth after proper initial therapy and/or further attachment loss despite the proper execution of various treatment modalities

e.g. paradontosis (11), juvenile periodontitis (12), rapidly progressive periodontitis (26), and prepubertal periodontitis (27). However, in all patients the disease started initially with minor breakdown and progressed over time. It is only a matter of when the patient is first diagnosed. For example, in an epidemiologic survey carried out in Amsterdam in 15–16-year-old adolescents (39), 230 out of the 4565 subjects were diagnosed as having periodontitis. These subjects showed a pocket depth = 5 mm in conjunction with attachment loss ranging from 1 to 8 mm. However, the majority (74%) had minor loss of attachment (≤ 3 mm). Therefore it is important that it is possible with a classification system of periodontitis to make a clinical diagnosis for any patient with periodontitis. This will also help in epidemiologic studies to obtain a better insight of the periodontal problem in a given population. In addition, the use of the presented classification based on the nominalistic principle will help the clinician to get a better image of the patient population he is treating. Furthermore, the new classification may help research into the etiology of periodontitis by including the ‘same’ type of patients in the study protocols. At present, in my opinion ‘response to treatment’ is still our chief diagnostic method (37). Studying the response to treatment in well described patient populations according to the new classifica-

tion may help in the search for a better understanding of the disease.

Conclusion

In order to obtain more knowledge about the causation of periodontitis and to be able to discuss cases between colleagues, the various forms of the disease have to be classified. Since periodontitis must be regarded as a syndrome with a complex etiology, classifications of periodontitis should be based on the nominalistic concept. Classifications based on this concept should be simple to apply and not susceptible to multiple interpretations. In this paper an example of such a classification has been presented.

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