PERIODONTAL HEALTH: DETERMINANTS AND INDICATORS. A REVIEW

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ABSTRACT

Defining periodontal health is very important in establishing a common reference point for evaluating periodontal disease and determining significant treatment outcomes. Health can be evaluated both histologically and clinically and should be considered in the context of a preventive starting point and a therapeutic end point. Periodontal health should not only be considered in the context of bacterial plaque / bacteria levels and control but should embrace a holistic analysis and assessment of all factors responsible for disease onset, as well as the restoration and maintenance of health. The term impeccable clinical health is a rare but realistic entity, resulting in no loss of attachment, no bleeding at probing (BoP), no probing depth >3 mm, and no redness, clinical oedema or purulent discharge. We must recognize that this condition is associated with immune physiological surveillance, rather than with pathological inflammation.

Keywords: periodontal health, inflammation, bleeding on probing

Introduction

"Health is the complete physical, mental and social well-being and not just the absence of disease or infirmity" [1]. According to this definition of the World Health Organization, periodontal health should be defined as a periodontal condition free of inflammatory periodontal phenomena of the disease, which allows a person to function normally and not suffer consequences (mental or physical) as a result of disease of the past.

However, while this definition is holistic and based on patient outcomes, it appears to be an impractical and limiting definition for the clinical management of periodontal disease. Therefore, a more practical definition of periodontal health would be a condition without inflammatory periodontal disease. This, in turn, means that the absence of inflammation associated with gingivitis or periodontitis, clinically evaluated, is a prerequisite for defining periodontal health.

It is debatable whether certain modified morphological conditions resulting from previous exposure to disease processes (e.g., gingival recession, loss of attachment, and bone loss) can be redefined as healthy new conditions in the absence of clinical signs and symptoms of inflammation.

Interestingly, there are almost no studies or reports that attempt to define periodontal health [2]. Defining periodontal health is very important in establishing a common reference point for evaluating periodontal disease and determining significant treatment outcomes. Health can be evaluated both histologically and clinically and should be considered in the context of a preventive starting point and a therapeutic end point.
Thus, periodontal health may exist before the onset of the disease, but, conversely, periodontal health may be restored to anatomically reduced periodontal.

Determinants of clinical periodontal health

Periodontal diseases can no longer be considered as simple bacterial infections. Rather, these are complex diseases of a multifactorial nature, which involve a complicated interaction between the subgingival microbiota, the host's immune and inflammatory responses, and environmental factors [3]. Thus, periodontal health should not only be considered in the context of bacterial plaque / bacteria levels and control but should embrace a holistic analysis and assessment of all factors responsible for disease onset, as well as the restoration and maintenance of health [4].

The determinants of periodontal health fall into 3 major categories, namely microbiological, host-related and environmental (Table 1).

The relevance of recognizing important determinants of periodontal health and disease as predisposing factors and controllable and uncontrollable modifiers cannot be underestimated, and their assessment for each patient is crucial in achieving and maintaining clinical periodontal health. In this context, predisposing factors are defined as any agent or condition that contributes to dental plaque accumulation (eg, tooth anatomy, tooth position, dental restorations). Modifying factors are defined as any agent or condition that modifies how an individual responds to the accumulation of the subgingival plaque (eg, smoking, systemic conditions, medications). The threshold(s) to be established when these factors are controlled or not fully controlled awaits further elaboration, but it is reasonable to expect more factors to be determined controllable (eg, elimination of overhanging restorations, smoking cessation, control diabetes) while others cannot be controlled (eg, genetic predisposition, immune status, use of critical drugs).

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The bacterial composition of the subgingival biofilm associated with gingivitis and periodontitis results from the dynamic interactions with its microenvironment. In general, the microbial composition is a collection of commensal organisms that coexist in relative harmony. However, if the environment changes, either as a result of inflammation in the gingival tissues or other processes that are not yet identified within the biofilm, a state of dysbiosis can lead to overgrowth of more virulent components of the biofilm, with exacerbation of periodontal inflammation [5]. Thus, gingivitis may be considered a relatively nonspecific inflammatory response to the non-specific (indigenous) subgingival microbiota. With the resulting inflammation and the development of periodontitis, there is a change in the microbial composition and several presumed pathogens appear, which leads to marked deterioration of the tissues. Thus, in order for periodontal health to be achieved or maintained, the composition of the subgingival microbiota must be redirected to one compatible with gingival health [6].

Good oral hygiene has always been considered as a support for periodontal health [7]. It is usually achieved through a combination of good personal oral hygiene and regular professional care [8]. It should be remembered that the bacterial plaque is responsible for only 20% of the direct risk of periodontal development, while the remaining 80% are generated from the direct and indirect risk of the modifying factors [9]. While oral hygiene remains the most important factor in obtaining and maintaining periodontal health, it does not have to be the only focus. Additional factors need to be addressed in seeking to achieve or maintain periodontal health.

Clinical periodontal health indicators

In its ideal form, periodontal health would be defined as the absence of histological evidence of periodontal inflammation and no evidence of periodontal anatomical changes. However, we must admit that, for most adults (if not all), this is unlikely. Therefore, the healthy clinical term should be adopted to cover the absence (or a very significant reduction) of clinical periodontal inflammation either on an anatomically intact periodontium or on a reduced periodontium. In addition, a compromised definition or paradigm for periodontal clinical health should be developed for people who have had periodontal disease (gingivitis or periodontitis), have undergone treatment, then returned to a clinical state of health either on an intact periodontium (in the case of gingivitis) or a reduced periodontium (in the case of periodontitis).

Health monitoring or inflammation of the gingival tissues is best documented by bleeding on probing index (BoP) [9]. Gingival bleeding, in the absence of periodontal pockets, should be understood as bleeding caused in the coronary marginal gingiva after applying pressure on the lateral wall of the sulcus or the periodontal pocket, which reflects the microvascularization of the sulcular epithelium. However, BoP is usually measured by applying a sulcus / pocket probe. In most studies on BoP as a clinical parameter, the following definition applies. The histological characteristics of the gingival tissues associated with BoP were evaluated [10]. The sites that bleed after light pressure testing applied to the tissues (0.25 N) are associated with a significantly increased percentage of connective tissue rich in cells and collagen, but not by increasing the vascularization or size of the lumen of the vessel that would justify the bleeding tendency. Furthermore, clinical and histological data suggest that bleeding is an earlier sign of gingivitis compared to
visual signs of inflammation (redness and swelling).

Obviously, BoP can be caused by tissue trauma using a periodontal probe. Therefore, the sampling pressure to be applied to the tissue (sulcus / pouch base) when evaluating BoP should not cause trauma; rather, it should be sufficient only to cause bleeding if there is an increased fragility of the blood vessels resulting from inflammation. It has been shown that BoP caused by pressures greater than 0.25 N results in false positive readings. By gradually increasing the pressure by 0.25 N, an increase of about 13% was observed in the BoP points [11].

A retrospective study evaluated the prognostic value of BoP compared to repeated visits to identify sites at risk of losing periodontal attachment during supportive treatment after periodontal therapy [12]. The results showed that sites with probing depth ≥5 mm had a significantly higher incidence of BoP. BoP sites with 4 out of 4 visits had a 30% risk of losing the attachment.

This decreased to 14%, with a BoP incidence at 3 of 4 visits, at 6%, with a BoP incidence at 2 of 4 visits, at 3%, with a BoP incidence at 1 of 4 visits, and in finally, at 1.5% without BoP on any of the 4 visits. Sensitivity and predictability calculations have shown that BoP is a limited but useful prognostic indicator in periodontal tissue monitoring after active therapy.

Subsequent studies investigated the predictive value of BoP absence as an indicator of periodontal stability [13, 14]. While the positive predictive value remained relatively low for repeated BoP prevalence (≤30%), the negative predictive value in the same studies was almost 100%. This showed that the absence of BoP on repeated examinations represents periodontal health and was a very safe indicator for periodontal stability.

Therefore, from the clinical point of view, the absence of BoP would indicate clinically healthy periodontal tissue. These findings were subsequently validated in a prospective study aiming at applying BoP as a clinical indicator for disease progression or periodontal stability.

Because the absence of BoP at 0.25 N indicates periodontal health, with a negative predictive value of 98% to 99%, this clinical parameter seems to be the most reliable for monitoring patients in daily practice over time. Non-bleeding sites may be considered clinically stable periodically. It would be logical to assume that the positive results of the periodontal treatment, in the receptive patients, would reach a stage characterized by the lack of bleeding at the soft probe.

Because different factors, such as probe size, probe angulation and applied pressure, can affect the evaluation of gingival inflammation, it is imperative to standardize BoP as a result of a defined level of force (tissue pressure), preferably not exceeding 0.25 N [15].

A multilevel analysis of different site-specific factors and patients who influence BoP in 601 adult patients showed that BoP can be associated with site-specific factors (probing depth, tooth type) but also patient (e.g., sex and smoker status) [16]. Although the severity and extent of gingival bleeding are often associated with the degree of bacterial plaque accumulation, it is observed that other factors may lead to increased gingival bleeding.

For example, vitamin C deficiency or aspirin ingestion can cause significant gingival bleeding through mechanisms that cannot be primarily linked to bacterial plaque accumulation [17]. In a retrospective study of 445 patients on periodontal maintenance therapy for at least 5 years, the average BoP increase in patients with periodontal therapy was related to the severity of the disease and periodontal instability regardless of smoking status; smokers demonstrated a
low average BoP value, concomitant with an increased prevalence of depth at residual wells [18].

The characteristics of an ideal periodontal probe are essential for a periodontal health determination. It is necessary to develop an international organization of experimentation of periodontics to ensure not only that the probe size is consistent, but that the checking force is standardized to 0.25 N, thus eliminating the problem of BoP induced by too much pressure, as well as useless bleeding from trauma.

Although it would seem intuitive that superficial pockets are consistent with health and deep pockets consistent with disease, there is ample evidence that this is not necessarily true [19]. For example, deep pockets can remain stable and non-inflamed, especially if careful periodontal care is provided for very long periods of time.

Thus, deep pockets can exist in the form of so-called healthy pockets. It is important to recognize that, after successful treatment, recurrent inflammatory periodontitis may occur in individual sites, despite the fact that most of the dentition remains well maintained and in a relative state of health. This was interpreted to indicate that mean values of clinical parameters, probing depth, attachment levels, and bone height are not adequate predictors for re-infected sites and suffer from recurrent disease.

Thus, probing or attachment levels should not be used as evidence of gingival health or disease. These should be considered together with other important clinical parameters, such as BoP, as well as modification and predisposition factors. This highlights, as shown above, that the most useful indicator of the disease is given by the clinical evidence of inflammation and that the historical evidence of the disease (increased probing depth, recession and attachment loss, bone loss) may be less relevant in the context of periodontal health on a reduced periodontium [20].

Radiographic evaluation is a critical component of the periodontal clinical evaluation. The radiographic features of a normal, anatomically intact periodontium would include an intact hard lamina (both lateral and alveolar ridge), absence of bone loss in the furcation areas, and a distance of 2 mm, on average, from the most coronary portion of the alveolar ridge (AR) at the cement-enamel junction (CEJ).

The distance between the CEJ and AR in healthy persons can vary between 1.0 and 3.0 mm. It is important to note that factors such as patient age, tooth type, tooth angulation and severe wear can, however, influence CEJ-AC height, so caution should be taken when evaluating this parameter as a measure of periodontal health. While the periodontal ligament space is also evaluated radiographically, it may vary and is not considered a useful indicator of health [21].

Once the periodontitis developed, by definition there was alveolar bone loss due to the inflammatory process. Thus, the clinical periodontal health on a reduced periodontium cannot be determined only by radiographs; they provide information on historical destruction and are valuable for longitudinal determination of progressive bone loss.

Clinicians often evaluate the status of a tooth by estimating its mobility. Because the teeth are not ankylosed, as are the implants, but are suspended in the alveolar bone through a network of collagen fibres, they exhibit a degree of physiological mobility. This is usually evaluated as the amplitude of the crown displacement resulting from the application of a defined force [21].

The size of this movement was used to distinguish between physiological and pathological mobility of the teeth, up to 0.2 mm considered physiological. In teeth with non-inflamed periodontal tissue,
two fundamental histological factors determine the mobility of the teeth: 1) the height of the periodontal tissue support and 2) the width of the periodontal ligament.

In a clinically healthy situation, increased dental mobility associated with enlargement of the periodontal space most likely indicates a tooth in occlusal trauma. Moreover, increased dental mobility cannot be used as a sign of disease for a low but healthy periodontal tooth. Such increased mobility can be permanently increased due to the reduced periodontal support, but the periodontium can be completely healthy.

If the height of the periodontal support is reduced, but the width of the ligament is unchanged (approximately 250 μm), it should be appreciated that the amplitude of the root mobility in the remaining periodontium is the same as for a tooth with the normal height of the periodontal support. Therefore, the so-called hypermobility of a healthy periodontal tooth with reduced support, but with a normal width of the periodontal space must be considered physiological mobility of the teeth.

Increased tooth mobility due to the extension of the periodontal ligament is the result of the joint or multidirectional forces of the crown, which are large and frequent enough to induce resorption of the alveolar bone walls in the pressure zones. In a series of controlled experimental studies on animals with healthy periodontal tissues, alveolar bone resorption resulted in increased tooth mobility, but not a loss of attachment of connective tissue, regardless of the height of the supporting bone.

Because alveolar bone loss has been shown to be reversible upon cessation of applied forces, it was concluded that increased dental mobility as a result of the enlarged periodontal ligament represents a physiological adaptation to the altered function, rather than a sign of pathology [21]. Therefore, dental mobility is not recommended to be used as a sign of health or disease.

It is proposed to have 4 levels of periodontal health, depending on whether the periodontal has normal attachment and the bone level or low support, as well as the ability to control the modifying factors and the relative results of the treatment. These four categories include: 1) periodontal health, defined as a complete absence of clinical inflammation and immune physiological surveillance on a periodontal with normal support (without attachment or bone loss); 2) clinical periodontal health, characterized by the absence or minimal levels of clinical inflammation in a periodontal with normal support; 3) the stability of the periodontal disease in a reduced periodontium; 4) remission / control of periodontal disease in a reduced periodontium.

The stability of the periodontal disease and the remission / control of the periodontal disease are differentiated based on the ability to control the modification factors and the therapeutic response. Stability is characterized by minimal inflammation and optimal therapeutic response, with the control of modifiable risk factors; it is a major treatment goal for periodontitis [21].

For patients in whom it is not possible to completely control the factors of modification and predisposition, remission / control may be the more realistic therapeutic objective. Remission / control is characterized by a significant decrease in inflammation, a certain improvement in other clinical parameters and a stabilization of disease progression. Ideally, restoration to periodontal stability should be a major treatment goal and can be achieved by controlling inflammation and infection, reducing predisposing factors and controlling any modifying factor.

While remission / control should be a clear target, based on available
evidence, low disease activity may be an acceptable alternative therapeutic goal, particularly in long-term disease.

Conclusions

The term impeccable clinical health is a rare but realistic entity, resulting in no loss of attachment, no bleeding at probing (BoP), no probing depth> 3 mm, and no redness, clinical oedema or purulent discharge. We must recognize that this condition is associated with immune physiological surveillance, rather than with pathological inflammation. The term "clinically healthy" should refer to tissue that demonstrates the absence or very low level of clinical indicators of inflammation, such as BoP and inflammatory markers in the gingival crevicular fluid.

References