

Risk factors for periodontitis & peri-implantitis

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1 | INTRODUCTION

What is risk? Risk has a number of definitions depending on the point of view or profession from exposure to danger, interaction with uncertainty to the potential for loss in insurance or finance terms. However, in the medical and dental fields it generally means the chances of getting some form of illness.

The management of noncommunicable disease is fundamentally about managing risk and risk factors, both modifiable and non-modifiable, to prevent either initiation or progression of the disease. A risk factor is a known variable that has a direct detrimental effect by enhancing the disease process or increasing the likelihood of a disease developing.¹ Risk indicators, on the other hand, may be risk factors, but the data are weaker and associated with cross-sectional studies. Risk factors/indicators will be different for every patient, and it is likely that the progression is a result of the interaction of many risk factors, some of which we know about and some of which are still to be discovered. An example of this over the last 20 years is the emerging evidence of the effect of inflammation in mental health disorders and the development of neuro-immunology.²

In the same time frame, the understanding of periodontal diseases has improved with identification of more risk factors, such as lifestyle, the interaction with systemic diseases, and the role of the inflammatory burden. The new classification of periodontal disease directly assesses risk and has been left open for the addition of further factors over and above smoking and diabetes.³ This volume looks at a number of risk factors, known and emerging.

The development of dental implants has revolutionized dentistry. Millions of dental implants are placed each year, and a great number will develop biological complications, including inflammation and bone loss. When we plan for implant outcomes, we are really planning for many years ahead. Getting it "right" at the start is vital to optimal outcomes. It is clear that there are risk factors for peri-implant diseases, but these are less well understood compared

with periodontal risk factors. This volume also looks at the known and emerging risk factors for dental implant disease. In addition, the operator placing the implant may also be a risk, which is known, but perhaps under-reported or poorly understood. The clinician also needs to be aware of the materials used and their possible host interactions.

Socioeconomic status has been implicated as a risk indicator for several chronic diseases including periodontitis.⁴ Multivariate analysis of data from large databases and cohort studies have demonstrated that socioeconomic status indicators such as income and education have an independent association with periodontitis. Since behavioral factors, such as smoking, only partially explain the association between socioeconomic status adversity and periodontitis, socioeconomic status may be proposed as a true risk factor for periodontitis. Cumulative biologic effects of psychosocial and physical stress during an individual's lifetime, known as allostatic load, have been suggested as an underlying plausible mechanism for the inter-relationship between low socioeconomic status and periodontitis. The results of studies on socioeconomic status mobility showed that the childhood socioeconomic status could have important and possibly irreversible impacts on adulthood oral health. In addition, the effect of socioeconomic status on periodontal health might be further complicated by interactions with factors such as sex, race/ethnicity, culture, and occupation. Future investigation of association between socioeconomic status and periodontal health seems warranted to identify high-risk groups and to design public health policies.

Tobacco smoking has been implicated in periodontal pathology through various mechanisms, including perturbations of the inflammatory and host responses to putative periodontal pathogens, alterations in the subgingival microbial communities, and a compromised healing potential of the tissues leading to an imbalance of tissue homeostasis.⁵ Critical appraisal of study limitations is required, especially the differences in study protocol designs of (a) early and more recent studies exploring cigarette smoking-induced changes

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in periodontal clinical indices, (b) subgingival microbial flora analysis employing traditional detection methods for selected microorganisms in addition to modern techniques such as deep sequencing and bioinformatic analyses that are able to fully characterize the microbial communities, and (c) inflammatory and immune responses.⁵ Periodontal treatment outcomes in addition to implant therapy outcomes are reviewed with an attempt to shed light on possible mechanisms for the inferior treatment outcome noted in smokers. The potential harmful effects of passive smoking are also reviewed, providing evidence for the advantages of smoking cessation. Quitting cigarette smoking should be recommended by the dentist, and effort should be made to inform smokers about the negative effects of smoking on the periodontal status and implant therapy outcomes.

In recent years, the practice of dentistry and periodontology has become complicated by the treatment of an increasing number of patients with substance use disorder.⁶ There are many illegal drugs that may have an impact on periodontal health and conditions, including their effect, medical manifestations, risks, and overall impact on oral health and the periodontium. The clinical management of periodontal patients abusing illegal drugs has been reported in a comprehensive approach inclusive of the detection of illicit drug abusers, screening, interviewing and counseling, the referral to treatment, and the dental and periodontal management. With regard to the impact of illegal substances abuse, there is moderate evidence that regular long-term use of cannabis is a risk factor for periodontal disease, manifested as loss of periodontal attachment, deep pockets, recessions, and gingival enlargements. Limited evidence also shows that the abuse of cocaine can cause a series of gingival conditions that mostly presents as chemical-induced traumatic lesions (application of cocaine on the gingiva) or necrotizing ulcerative lesions. There is a scarcity of data regarding the impact of other drug abuse on periodontal health. The dental treatment of subjects that abuse illegal substances is becoming more common in the daily clinical practice of periodontists and other dental clinicians. When the clinicians encounter such patients, it is essential to manage their addiction properly, taking into consideration the impact of it on the comprehensive dental treatment. Further studies and clinical observations are required to obtain sound and definitive information.

Epidemiologic evidence indicates that periodontitis is more frequent in patients with uncontrolled diabetes mellitus than in healthy controls, suggesting that it could be considered the "sixth complication" of diabetes.⁷ Diabetes mellitus and periodontitis are two extraordinarily prevalent chronic diseases that share a number of comorbidities, all converging towards an increased risk of cardiovascular disease. Periodontal treatment has recently been shown to have the potential to improve the metabolic control of diabetes, although long-term studies are lacking. Uncontrolled diabetes also seems to affect response to periodontal treatment, as well as risk to develop peri-implant diseases. Mechanisms of associations between diabetes mellitus and periodontal disease include release of advanced glycation end products as a result of hyperglycemia and a range of shared predisposing factors of genetic, microbial, and lifestyle nature. There is evidence for the risk of periodontal and peri-implant

disease in diabetic patients and a role for the dental professional in the diabetes-periodontal interface.

Nutrition plays a critical role in the homeostatic balance, maintenance of health, and longevity.⁸ There is a close link between inflammatory diseases and nutritional health. Obesity is a severe pathological process with grave implications on several organ systems and disease processes, including type 2 diabetes, cardiovascular disease, osteoarthritis, and rheumatoid arthritis. The impact of obesity on periodontal inflammation has not been fully understood; the association between nutritional balance and periodontal inflammation is much less explored. There are potential mechanistic links between periodontal diseases and obesity and common inflammatory activity pathways that could be pharmacologically targeted.

Current scientific evidence clearly indicates the importance of the inflammatory reaction in the progressive destruction of periodontal tissues.⁹ The idea to modulate this inflammatory reaction in order to decrease or even cease the progressive destruction was, therefore, a logical consequence. Attempts to achieve this goal involve various kinds of anti-inflammatory drugs or medications. However, there is also an increasing effort in using food supplements or so-called natural food ingredients to modulate patients' immune responses and maybe even improve the healing of periodontal tissues. The evidence of various food supplements and ingredients regarding their possible effects on periodontal inflammation and wound healing is largely underresearched.

The immune response to bacterial challenges is not only influenced by genetic factors but also by environmental factors.¹⁰ Epigenetics involves the study of gene function independent of changes to the DNA sequence and its associated proteins, and represents a critical link between genetic and environmental factors. Epigenetic modifications have been shown to contribute to the progression of several diseases, including chronic inflammatory diseases like periodontitis and peri-implantitis. It is timely to present the latest findings on epigenetic influences on periodontitis and to discuss potential mechanisms that may influence peri-implantitis, given the paucity of information currently available.

Mental health disorders, particularly depression and anxiety, affect a significant number of the global population.¹¹ Several pathophysiological pathways for these disorders have been identified. In addition, life events, environmental factors, and lifestyle affect the onset, progression, and recurrence of mental health disorders. These may all overlap with periodontal and/or peri-implant disease. Mental health disorders are associated with more severe periodontal disease and, in some cases, poorer healing outcomes to nonsurgical periodontal therapy. They can result in behavior modification, such as poor oral hygiene practices, tobacco smoking, and alcohol abuse, which are also risk factors for periodontal disease and, therefore, may have a contributory effect. Stress and some mental health disorders are accompanied by a low-grade chronic inflammation that may be involved in their relationship with periodontal disease, and vice versa. Although the gut microbiome interacting with the central nervous system (gut-brain axis) is thought to play a significant role in mental illness, less is understood about role of the oral microbiome.

An increasing number of people retain their natural teeth into old age; and further, the prevalence of endosseous implants for supporting oral prostheses is ever increasing.¹² These teeth and implants now present a considerable challenge in terms of maintenance, especially when patients become dependent on care. Periodontal and peri-implant diseases are more prevalent in elders than in younger age cohorts. There are distinct differences related to the inflammatory response between periodontal and peri-implant tissues, both in young and old age. The age-related reasons for the increase of periodontal infections may be related to poor oral hygiene due to a loss of dexterity or vision, but also to immunosenescence. Low-grade infections, like chronic periodontitis, may cause low-grade inflammation and subsequently increase the likelihood to develop chronic diseases. A second mechanism by which poor oral health translates into systemic disease is the risk of developing aspiration pneumonia. The treatment options in old age should be evaluated in view of general health and maintenance issues. Systematic periodontal maintenance therapy as in younger age cohorts may be difficult to implement in elders with institutional and hospital confinement due to logistics, barriers related to patients, caregivers, or cost.

The impact of lifestyle factors has been increasingly studied and discussed in oral health care.¹³ Positive lifestyle factors are important in maintaining oral health or controlling disease, but they are not easy to adopt long-term. Along with public health initiatives within communities and groups, there is a role for behavior change interventions delivered in dental practice settings to improve the periodontal health of individuals. Behavior management is now seen as a part of both prevention and therapy of periodontal diseases. There are behavioral strategies for periodontal health to inform and assist oral health-care professionals in implementing behavior change in their practice. Training in education and communication as well behavior change techniques a part of managing risk factors.

Every year innovative pharmacological agents are introduced medicine to better treat systemic diseases.¹⁴ These include selective serotonin reuptake inhibitors, bisphosphonates, tumor necrosis factor alpha inhibitors, cyclosporine, and steroids. Since implant, periodontal, and osseous surgery are common treatment modalities used, it is of critical importance to understand the effect of the new medications and the risks that they present. Many of these have possible detrimental ramifications on bone healing and may change our approach to treatment.

Placing a dental implant in the correct three-dimensional position is a paradigm for long-term survival and success. Computer-assisted implant surgery, either as static or dynamic, is well documented to significantly improve the accuracy of implant placement.¹⁵ Fully guided implant placement is becoming more common and promoted as an “easier” and/or “less risky” approach with fewer postoperative complications. Whether the increased accuracy leads to corresponding improvement of clinical outcomes and reduces risk has not yet been systematically investigated. One would expect that it would improve outcomes, but the clinical evidence needs thorough assessment before introduction into practice. A discussion of

the strengths and limitations is timely. There may also be occasions where computer-assisted implant surgery is not appropriate.

However, a number of other factors related to implant placement and restoration may affect long term outcomes.¹⁶ Although the prevalence of peri-implantitis has been evaluated by several clinical studies with different follow-ups, there are currently little data on the impact of implant location and the prevalence of peri-implantitis. As already mentioned, an understanding of the factors that can affect the risk of long-term adverse outcomes is important, one of which may be where the implant is placed.

Historically, there has been broad consensus that osseointegration represents a homeostasis between a titanium dental implant and the surrounding bone, and that the crestal bone loss characteristic of peri-implantitis is a plaque-induced inflammatory process.¹⁷ However, this notion has been challenged over the past decade by proponents of a theory that considers osseointegration an inflammatory process characterized by a foreign body reaction and peri-implant bone loss as an exacerbation of this inflammatory response. A key difference in these two schools of thought is the perception of the relative importance of dental plaque, with obvious implications for treatment. A persistent foreign body reaction at osseointegrated dental implants has been suggested to have a possible role in crestal bone loss characteristic of peri-implantitis. Further, the role of implant-related material release within the surrounding tissue (particularly titanium particles and corrosion by-products) in the establishment and progression in peri-implantitis is poorly understood. Further, there is a lack of evidence for a unidirectional causative role of corrosion by-products and titanium particles as possible non-plaque-related factors in the etiology of peri-implantitis.

2 | CONCLUSION

Risk and risk factors are an evolving area that will continue to change as the understanding of periodontitis and peri-implant diseases improves. Reducing risk is paramount during treatment, but also successful management of risk is necessary for good and prolonged treatment outcomes. We can change modifiable risk factors, but non-modifiable present a challenge. Risk is not necessarily just related to patient factors.

ACKNOWLEDGMENTS

Open access publishing facilitated by The University of Melbourne, as part of the Wiley - The University of Melbourne agreement via the Council of Australian University Librarians.

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How to cite this article: Darby I. Risk factors for periodontitis & peri-implantitis. *Periodontol 2000*. 2022;90:9-12. doi: [10.1111/prd.12447](https://doi.org/10.1111/prd.12447)