

REVIEW ARTICLE



Risk factors associated with periodontal diseases and their clinical considerations

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Abstract

Periodontal diseases are a group of chronic infections caused by pathogenic bacteria colonizing the periodontium. Initiation and progression of periodontal infections are affected by local and systemic conditions. The local factors include dental plaque and plaque retentive areas such as dental calculus and defective restorations. Systemic risk factors include poorly controlled diabetes mellitus and tobacco smoking. Systemic conditions associated with immunodeficiency state such as neutropenia, AIDS/HIV infections are also important risk factors. Recent studies have revealed several potentially important periodontal risk indicators. These include stress and coping behaviors and osteopenia associated with estrogen deficiency. There are also demographic factors associated with periodontal disease including gender, and hereditary factors.

Keywords: Diabetes mellitus, periodontitis, risk factors, smoking, systemic factors

Introduction

A major objective of dental care is extending the life span of the dentition either by prevention or by treatment of dental diseases. It has been well-accepted that the number of teeth decreases with age and that caries and periodontal disease are the main causes of tooth loss.^[1]

From a periodontal point of view, several studies' results showed that the percentage of teeth lost because of periodontitis was higher than the percentage of patients who lost teeth because of periodontitis. In other words, about periodontitis, relatively many teeth were lost in relatively few patients.^[2,3] Although a large proportion of the population is susceptible to periodontitis, it appears that there is a small segment of the population that is susceptible to severe forms of periodontitis. This observation leads to the proposal that there is susceptibility or risk factors that modulate susceptibility to destructive periodontitis.^[4]

Risk factor is defined as an environmental, behavioral, or biologic factor confirmed by temporal sequence, usually in longitudinal studies, which if present, directly increases the probability of a disease occurring, and if absent or removed, reduces the probability. Risk factors are part of the causal chain or expose the host to the causal chain. They can be both modifiable or non-modifiable. Once disease occurs, removal of a risk factor may not result in a cure.^[5,6]

This overview discusses various risk factors associated with periodontal diseases and dental considerations while managing them. Restorative dentistry, which encompasses conservative dentistry, endodontics and prosthodontics also have their own set of factors that play an important role, and that are to be considered before and during treatment of periodontal diseases.

Periodontal Factors

Modifiable risk factors

Smoking

Cross-sectional and longitudinal data provide strong support for the statement that the risk of developing periodontal disease as measured by clinical attachment loss and alveolar bone loss increases with increased smoking.^[6] Studies have shown that smoking does not reduce the amount of plaque present and in fact, smokers may experience less gingival bleeding than non-smokers with lower plaque indexes.^[7] It has been suggested that this reflects an alteration of the caliber of the blood vessels perfusing the gingival tissues. It has also been suggested that reduced bleeding reflects an underlying disruption of the immune response and that this may account for the increased loss of clinical attachment and alveolar bone.^[8]

It has been demonstrated that there are differences in the oxygen saturation of hemoglobin in the gingiva of smokers

and non-smokers, suggesting that smokers have functional impairments in the gingival microcirculation.^[9] Furthermore, it has been shown that smoking has significant adverse effects on the immune system, which include the modification of the humoral and cellular immune systems, and cytokine and adhesion molecule network.^[10]

Diabetes mellitus

It is proven beyond doubt that diabetes (poorly controlled) can lead to aggravation of periodontal infection and exaggerated bone loss and vice versa is also true i.e. poorly controlled diabetes can be due to chronic periodontitis.^[11] The increase in blood glucose level is associated with periodontitis in diabetic patients. Studies have shown there is reduction in glycated hemoglobin after periodontal treatment. All these evidences suggest that control of periodontal infection is not only important for oral health, but also for general health in diabetic patient.

Microorganisms and periodontal disease

Of all of the various microorganisms that colonize the mouth, there are three, *Porphyromonas gingivalis*, *Tannerella forsythia* (formerly *Bacteroides forsythus*), and *Actinobacillus actinomycetemcomitans* which have been implicated as etiologic agents in periodontitis.

The three main commonalities of *A. actinomycetemcomitans*, *P. gingivalis*, and *B. forsythus* include:^[12]

- i. All are Gram-negative, and therefore produce lipopolysaccharide, which can modulate the local inflammatory response in host cells that express pattern recognition receptors
- ii. All appear capable of invasion of the mucosal barrier to infection and possibly of being sequestered inside epithelial cells. Thus, they can “wait out the bad times” and re-emerge when conditions are permissive for their growth
- iii. All produce factors that enable them to evade the antibacterial functions of the innate immune response either passively (anti-phagocytic capsule) or actively (leukotoxin, gingipains, other proteases, induction of apoptosis).

Other than the above mentioned important three microorganisms, it has also been shown that *Prevotella intermedia*, *P. gingivalis*, and *Fusobacterium nucleatum* may be risk indicators for periodontal disease in a diverse population, though they are not risk factors.^[13]

Socio-economic status

Results from the National Health and Nutrition Examination Survey III in US population suggest that socioeconomic disparities are contributing to the oral health inequities. It was found that the prevalence of gingival bleeding and loss of attachment of = 4 mm increased with the decrease in the socioeconomic level. Low income and a rural residence were significant risk indicators for attachment loss. This and other studies suggest that measures of socioeconomic status, including income, education levels, and urban status are fairly good risk indicators for periodontal diseases. Groups with low

socioeconomic status (low income and/or education) are at a higher risk of having periodontal diseases than groups with high socio-economic status, and the increased risk level in this group seems to be attributed to behavioral and environmental factors.^[14,15]

Psychological factors

A hypothesis of an increased risk for destructive periodontal diseases due to psychological disorders has long been promoted. There is an increased focus on study of the cellular and molecular basis for an increased risk for periodontal tissue loss due to stress and other psychosocial factors, and the interaction between the immune system and the central nervous system, which mediates the effects of these factors in maintaining the host response to infection. It is well established that psychological stress can down-regulate the cellular immune response, and disrupt the homeostasis of the network of signals linking the nervous, endocrine, and immune systems thereby interfering with the communication between the central nervous system and the host immune system.^[14]

Stress

The term stress serves as a convenient description for complex and incompletely understood psychological and physiological phenomena. Anxiety, as well as other emotional or psychosocial stresses, produces well-characterized neuroendocrine and biochemical changes in experimental animals. The physiological consequences of these stress-mediated changes have been shown to have significant adverse effects on the proper functioning of the immune system. It has been reported that periodontal disease is more widespread and severe in those with higher levels of stress. It has been shown that occupational stress may have a relationship to the progression of periodontitis.^[16]

Nutrition

Nutrition can influence the growth, development and metabolic activities of the periodontium; the high rate of cell turnover in the periodontal tissues requires that essential nutrients are readily available. Iron deficiency has a deleterious effect on macrophages, cells that are intimately involved in the immune and inflammatory systems. Cells of the immune system have a high turnover rate, a high demand for the building blocks of DNA, and are vulnerable to folic acid deficiency. Zinc plays a significant role in the regulation of the inflammatory process and a deficiency could negatively influence host resistance to gingivitis.^[17]

Non-modifiable risk factors

Genetic factors

Although bacterial infection is the etiologic agent in periodontal disease, studies of identical twins suggest 50% of the susceptibility to periodontal disease is due to host factors. Interleukin-1 (IL-1) gene polymorphisms have been linked to periodontal disease. Thus, specific IL-1 genotypes have been linked to the presence of pathogenic microorganisms, and to an increased risk of

periodontal diseases in non-smokers and smokers. Furthermore, the evidence suggesting possible interactions between IL-1 and smoking and diabetes suggest that there is interplay between genetic and environmental factors that results in periodontal disease. Evidence also suggests possible relationships between periodontal disease and formyl-methionyl-leucyl-phenylalanine and Fc receptor polymorphisms.^[6]

Osteoporosis

Osteoporosis is a systemic skeletal disease characterized by low bone mass and micro-architectural deterioration with a consequent increase in bone fragility and susceptibility to fracture.^[18] Several cross-sectional studies have shown that alveolar bone density is altered in osteoporotic individuals. In longitudinal studies, a relationship has been shown between osteoporosis and alveolar bone loss, but not between osteoporosis and clinical attachment levels.^[6]

Other systemic diseases

Several deficiencies of neutrophil function have been related to periodontal disease. These include Chediak-Higashi syndrome, cyclic neutropenias, lazy leukocyte syndrome, agranulocytosis and leukocyte adhesion deficiency and Down syndrome and Papillon-Lefevre syndrome. Except for Downs's syndrome, these diseases are exceedingly rare, so probable though not definitive relationships to periodontal disease have not been established.^[6]

Ageing

Aging is associated with an increased incidence of periodontal disease. Periodontal disease is a chronic infection therefore symptoms of periodontitis such as attachment loss, bone loss, gingival recession can be the result of the cumulative effect rather than older age of a person.^[6]

Clinical Considerations

Certain conditions must be taken into account before starting periodontal therapy for the patient. They can be broadly divided into prosthodontic and endodontic considerations.

Prosthodontic considerations

Placing a patient's prosthodontic needs in the broader contexts of general health, socioeconomic status, lifestyle and dental expectations will allow the dentist to deliver treatment specifically appropriate for that patient.

Factors here can be broadly classified into local and general/systemic factors:

Local factors for edentulous patients

Examination of a patient for any facial asymmetries, disparities in jaw size and concentricity, inter arch space, ridge shape, sulcus depth, muscle attachments, etc. which are all anatomic variations that require correction. Normal physiological factors

like adequate neuromuscular control, quality, and quantity of saliva should be evaluated. Commonly affecting neoplasms and other active problems like retained roots have to be addressed. Psychological makeup of a patient dictates the patient's drive towards having and maintaining healthy and good dentures. The patients are existing dentures if present must be examined. The objective is to determine exactly their quality and how that relates to the experiences stated by the patient earlier and to determine the potential for improvement. Complete dentures are entirely dependent for support on the soft tissue and underlying bone. Their health and quality have to be checked. Surrounding lining mucosa of lips, cheeks have to be examined as they are common sites for pathoses like residual ridge resorption, flabby ridges, bulbous tuberosities and Kelly's combination syndrome, etc. The tongue is an important factor in denture success or failure. Its size and activity are main concerns, which have to be checked.^[19]

Local factors for dentulous patients

In addition to evaluating the soft tissues as listed above in edentulous patients, the dentate patients' teeth must also be examined.

Before any restorative treatment, the pulpal health must be assessed using suitable tests on teeth. They are evaluated for alignment, malocclusion, vertical and horizontal overlap, drift, tipping forces. The relationship of teeth in both centric occlusion and the intercuspal position should be assessed.^[20]

General/systemic factors for prosthodontic patients^[19,21]

- Diabetes: Uncontrolled diabetes is frequently accompanied by multiple small oral abscesses, poor tissue tone, reduced salivary output and lessened resistance to infection
- Arthritis: Arthritic changes in the temporomandibular joint (TMJ) make recording jaw relation difficult and may even cause changes in occlusion
- Paget's disease and acromegaly: These patients may have enlarged maxillary tuberosities and enlarged the mandible respectively, which may cause changes in fit and occlusion of a prosthesis
- Parkinson's disease: Characterized by rhythmic contractions of the musculature which might be affecting the masticatory muscles in this case, it might be so severe that it is impossible for patients to insert even or remove a denture
- Pemphigus vulgaris: This disease presents as formation of bullae in the mouth. Can be very painful and cause dryness of the mouth. Must be controlled for success of the prosthesis
- Epilepsy: A seizure might result in fracture and aspiration of prosthesis and possibly loss of additional teeth. Construction of prostheses in patients with severe frequent seizures with little or no warning are contraindicated. If constructed, all components of the prosthesis must be radio opaque to aid in easy locating in case of aspiration
- Cardiovascular disease: Patient's physician's written approval is a must. Prophylactic antibiotics are recommended if surgical procedures are to be accomplished
- Cancer: Oral complications such as mucositis, xerostomia,

bacterial and fungal infections are most common side-effects of radiation and chemotherapy for malignancies in the oral cavity which will complicate fabrication and wear of prostheses

- Transmissible diseases: Hepatitis, tuberculosis, etc. pose a particular hazard for dentists, patients and dental auxiliaries. It is imperative that the dentist knows of any infectious disease the patient has and takes precautions to prevent contamination and transmission of the disease
- Temporomandibular disorders: They can cause disturbances in occlusion, myofascial pain, displacement disorders and arthritic diseases. These have to be controlled for success of the prostheses
- Nutrition: Prostheses wearers are particularly vulnerable to compromised nutritional health. Nutritional deficiencies can result in protein and vitamin deficiencies causing a range of unpleasant symptoms. The dentist must be aware of it if present and is expected to guide the patient toward a healthier diet.

Endodontic consideration

Proper selection of cases avoids pitfalls during endodontic treatment and ensures the success.

Local factors

- Pulp exposure, fractured or mobile teeth, bleeding gingival, acute abscess, TMJ pain, broken prosthesis, dislodged restoration, etc.
- Masticatory inefficiency due to multiple missing teeth, malocclusion, prematurities, etc.
- Cosmetics considerations – missing teeth, edematous gingival, poorly matching or shaped jackets, diastemas, etc.^[22]

Systemic factors

The dentist must consider not only the actions of treatment modalities on the patient's existing conditions, but also the potential impact of the patient's medical profile on the health of the entire dental operating team. Some of such conditions are:^[23]

1. Rheumatic fever: Any patient with a history of rheumatic fever has the potential of suffering an attack of subacute bacterial endocarditis (SBE). Since every dental procedure causes some degree of bacteremia, definite measures must be taken to avoid the possibility of SBE
2. Artificial heart valves: This carries the danger of clumping of bacterial colonies on them. Therefore, all patients with artificial heart valves should receive the same prophylaxis as patients with rheumatic fever do
3. Coronary heart disease: Coronary occlusion and other cardiovascular diseases are most common after middle age. Associated factors may include hypertension, angina pectoris, arteriosclerosis, stressful occupations and smoking. Patients exhibiting these conditions may be suspected of tendency toward cardiovascular disease and should be treated accordingly

4. Diabetes: Healing is retarded, radiolocencies take longer to fill, susceptibility to infection is high due to which use of antibiotics is common, alteration in blood glucose level in acute infection or during and after a surgical procedure is common, so patient's physician's advice must be consulted. Use of epinephrines is not indicated in anesthetics as it increases blood sugar levels, scheduling of appointments has to be made judiciously
5. Hepatitis: Microorganisms responsible for hepatitis are highly resistant to sterilization, so all intra canal instruments used in such patients have to be discarded after use. Drugs detoxified by liver are to be avoided
6. Blood diseases: This group includes hemophilia, aplastic anemia, cyclic neutropenia, thrombocytopenia, leukemia, purpura, and macroglobulinemia. All possible care to avoid bleeding in such patients is mandatory
7. Other serious diseases: Some infrequently present but often debilitating diseases (like malignancy, nephritis, pemphigus, etc.) will indicate that treatment may take longer than usual to gain a desirable result, with the delay being due to alteration of local responses by the systemic condition. Asthma, hay fever, hives or skin rashes indicate hypersensitivity states. Only when necessary should drugs and medication be used for patients with this type of problems
8. Psychologic problems: In general, two types of patients with emotional conditions must be considered in relation to endodontic therapy. One type is the patient who has converted a psychologic condition into a physical problem in or around the oral cavity. The other is the patient with such severe fears and anxieties that treatment becomes extremely difficult. In treating patients of this type, the practitioner must maintain a friendly but firm manner. Case presentation must be brief, but confident. Instruments should be kept out of sight of the patient during explanatory period.

To conclude, it is imperative that the clinician looks beyond the oral cavity for factors of which to potentially recommend modification in order to help their patients reach their common goal of prevention or management of periodontal disease – and thereby possibly improve general health as well.^[24]

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