Dental professionals are required to update their knowledge about the initiation and progression of periodontal disease. Various risk factors have a tremendous impact on periodontal disease progression and treatment outcome. Risk assessment involves identifying elements that may either predispose a patient to develop periodontal disease or may influence the progression of disease that already exists. This review paper discusses the risk assessment of periodontal disease.

All persons are not equally susceptible to periodontal disease and do not respond equally to periodontal therapy. Loe et al in a classic longitudinal study including a homogenous population observed an enormous variability between individuals in their rates of periodontal disease progression.1 Similarly Hirschfeld and Wasserman found varying response to periodontal treatment amongst individuals undergoing maintenance therapy.2 Comparable results were reported by many other longitudinal studies which suggested that periodontal disease progression and response to treatment depend on various risk factors. Thus it is clear that risk factors have a tremendous impact on periodontal disease progression and treatment outcome. Such information would help the clinician to establish more accurate prognosis. The purpose of this paper is to review the available literature regarding factors that may influence and are associated with overall response of patient to periodontal therapy.

**Key Words:** Periodontal Disease; Risk Factor; Risk Assessment

**Introduction**

Dentistry is the branch of medicine with enormous impact on general population. Over the past few years there has been an increasing awareness and concern about dental health among world population. Periodontal disease i.e., gingivitis and periodontitis are one of the most prevalent dental diseases. Therefore, dental professionals are required to update their knowledge about etiopathogenesis, diagnosis, prognosis and design of treatment plan of periodontal diseases which are most prevalent dental diseases and a major cause of tooth loss. This review paper discusses the risk assessment of periodontal disease.

**Behavioral Risk Factors**

**Tobacco smoking:** Tobacco smoking is a well-established risk factor for periodontitis.3,4 A direct relationship exists between smoking and periodontal disease which is independent of other factors. Studies comparing the response of periodontal therapy in smokers, former smokers and non-smokers have shown that smoking has a negative impact on response to therapy.5 Cigarette smoking is related to periodontal disease in a dose related manner. This deleterious relationship between smoking and periodontal disease is regardless of overall levels of plaque accumulation. However, the specific microbial flora in smokers may shift to a more pathogenic profile.6 Recent reports show that the rate of recovery of harmful pathogens from relatively shallow pockets is greater in smokers.7 These findings corroborate that tobacco smoking itself may promote the development of local environment that favor the growth of pathogenic organisms. Moreover, substances in smoke such as nicotine may also promote the pathogenic activities of periodontal flora. Tobacco products may also exert a deleterious effect on the periodontium by impairing host defenses and by stimulating destructive effect of host response.6 Thus, it can be conciliated that smoking has detrimental effects on periodontium which is observed particularly in regard to periodontal therapy. Therefore, it is recommended that smoking patients should be following a successful smoking cessation program before periodontal therapy, especially surgical procedures.

**Patient Compliance:** The outcome of periodontal therapy enormously depends upon patient compliance. Various longitudinal studies have shown that patients who do not comply with recommended recall protocol are more likely to have less favorable results.7,8 Plaque plays an important role in initiation and progression of periodontal disease. Thus oral hygiene maintenance remains a mainstay for the success of periodontal therapy and patient compliance with maintenance protocol may be even more important at predicting long-term stability and preventing future disease. Several studies in this regard have contemplated that patients who comply with the recommended maintenance protocol experience less attachment loss and loose fewer teeth than patients who fickle in their compliance.7,8

**Age:** It has been advocated by many studies that both prevalence and severity of periodontal disease increases with age.9,10 It is possible that degenerative changes related to aging may increase susceptibility to periodontitis. Perversely, it is also possible that the attachment loss and bone loss seen in older individuals are the result of prolonged exposure to other risk factors over the lifespan, creating a cumulative effect over time. In support of this hypothesis, many studies have shown minimal bone loss in aging subjects enrolled in preventive programs throughout their life.10 Thus, although aging does not appear to affect the outcome of periodontal therapy, age is a very important factor that should always be considered while assessing patients susceptibility. Perhaps, presence of loss of attachment in young individuals is of more concern.
as these individuals would have more time to be exposed to various causative factors. Although prevalence and severity of attachment loss increases with age, persons with more aggressive type of periodontitis are generally young. Therefore, young individuals with periodontal disease may be at greater risk for continued disease as they age.

**Gender:** Gender is another factor which plays an important role in periodontal disease. National U.S health surveys conducted since 1960s have demonstrated that men present with more attachment loss than women. This can be attributed to the fact that men tend to be more negligent towards maintenance of their oral hygiene as compared to females. Therefore, gender differences in prevalence and severity of periodontal disease is required to be considered by dental practitioner.

**Risk Predictors**

**Previous history of periodontal disease:** A history of previous periodontal disease is a good clinical predictor or risk for future disease.\(^{11}\) Patients currently free of periodontitis have a decreased risk for developing loss of attachment as compared to patients with most severe existing loss of attachment who are at greater risk for future loss of attachment.

**Bleeding on Probing:** Bleeding on probing is an important and in fact the best clinical predictor of periodontal disease activity. Although this indicator is not the only indicator of periodontal disease, bleeding on probing along with residual pocket depth serve as an excellent predictor of future attachment loss. Absence of bleeding on probing reflects healthy periodontium and may serve as an excellent indicator of periodontal disease activity.

**Systemic Risk Factors**

**Diabetes:** Diabetes is a ubiquitous chronic disease having a clear association with periodontal disease. There is copious evidence of two way relationship between diabetes/poor glycemic control and periodontal diseases. The severity of diabetic condition is particularly related to incidence and severity of periodontal disease.\(^{12}\) Conversely, there is a evidence that the severity of periodontal disease may affect the level of glycemic control in diabetic patients.\(^{12}\) The purported biologically plausible mechanism for this association is the role of chronic bacterial load and chronic inflammation that is characteristic of periodontal diseases. There has been accumulating evidence suggesting a significant reduction in levels glycosylated hemoglobin (test for glycemic control) after receiving periodontal therapy.\(^{13}\) Since poor glycemic control can adversely affect wound healing and can lead to more pathogenic bacterial plaque, the dental practitioner may wish to consult with patient’s physician to optimize the glycemic control prior to periodontal therapy.

**Osteoporosis:** Osteoporosis has been suggested as another risk factor for periodontitis. Although studies in animals indicate that osteoporosis does not initiate periodontitis but rather clearly indicate that reduced bone mass seen in osteoporosis may aggravate periodontal disease progression.\(^{14}\) However, reports in humans are conflicting. In a cross sectional study by Ronderos et al it was found that females with lower bone mineral density showed increased clinical attachment loss as compared to females with normal bone density but similar oral hygiene scores.\(^{15}\) In the light of above mentioned facts and presence of various data supporting the effect of osteoporosis on progression of periodontal disease, dental practitioner should inform and motivate patients having osteoporosis to maintain oral hygiene. Interestingly, medications used for treatment and prevention of osteoporosis in osteoporotic patients especially post menopausal women may also prevent alveolar bone loss and enhance the results of regenerative procedures and periodontal therapy.

**HIV Infection:** In recent years individuals having HIV (human immunodeficiency virus) infection have grabbed attention of many researchers and organization worldwide. With the advent of combined therapeutic regimens consisting of antiretroviral agents and protease inhibitors there has been marked improvement in health status of HIV infected individuals. Thus, there has been substantive increase in lifespan and quality of life of HIV infected patients. Oral lesions are common in HIV infected patients although geographic and environmental variables exist. It has been hypothesized that the immune dysfunction associated with HIV infection and acquired immunodeficiency syndrome (AIDS) increases susceptibility to periodontal disease. Early reports on periodontal health status of patients with AIDS or HIV infection revealed that these patients often had severe periodontal destruction characteristic of necrotizing ulcerative periodontitis. Importantly many longitudinal studies have suggested that HIV positive individuals are more likely to have chronic periodontitis.\(^{16,17}\) However, effects of HIV infection on long term prognosis of dentition in chronic periodontitis remain obscure. Evidence also suggests that AIDS patients who practice good oral hygiene measures and appropriate professional therapy can maintain good periodontal health. Therefore although it seems reasonable to hypothesize that HIV infection and the resulting immune-suppression are risk factors for periodontal disease, the evidence is not conclusive. Thus long term studies are needed to determine how HIV infection affects long term periodontal prognosis.

**Genetic factors:** Traditionally periodontitis was thought to be strictly environmental in origin. Despite this belief, it was recognized that only a portion of the variability of periodontal disease in population could be explained by environmental factors. In recent years there has been a paradigm shift of host susceptibility having a contribution to variations in periodontal disease. These differences in host susceptibility are ultimately determined by genetic variations. Evidence indicates that genetic differences between individuals may explain the development of periodontal disease in particular individuals.

Various studies conducted in this regard in twins showed that genetic factors influence clinical measures of gingivitis, pocket depth, attachment loss and interproximal bone height.\(^{18,19}\)
Research indicates that genetic variations influence the risk for aggressive and chronic periodontitis. Kornman et al demonstrated that alterations in specific genes encoding the inflammatory cytokines interleukin-1α and interleukin-1β (IL-1 α, IL-1 β) were associated with severe chronic periodontitis in non-smoking subjects. Immuneologic alterations such as neutrophil abnormalities, monocytic hyperresponsiveness in patients with localized aggressive periodontitis and alterations in monococyte/macrophage receptors for the Fc portion of antibody have been stated by various studies to function under genetic control. Studies of this region have led to the development of the Periodontal Susceptibility Test (PST), the only genetic susceptibility test for severe chronic periodontitis that is commercially available. It has been suggested that genotype positive patients may need more aggressive therapy and more frequent maintenance visits than genotype negative patients. Today dentistry has just embarked on their understanding of role of specific genes in pathogenesis of periodontal diseases. In the future, genetic testing may testify individuals to be at increased risk for periodontitis.

Psychological factors: Since last many years psychological factors in general and stress in particular have been postulated as risk factors for incidence and progression of periodontal disease. The incidence of necrotizing ulcerative gingivitis increases during periods of emotional and physiologic stress which suggests a link between the two. The biologically plausible explanation for this is that emotional stress may interfere with normal immune function and may result in increased levels of circulating hormones particularly cortisol which may ultimately affect the periodontium. Green W et al in a longitudinal study suggested that stressful life events such as bereavement and divorce appear to lead a greater prevalence of periodontal disease. Furthermore, adult patients with periodontitis who are resistant to therapy are more stressed than those who respond to therapy. Thus, considering the data available in this regard stress may be a putative risk factor for periodontitis.

Microbiologic factors: It has been well documented that accumulation of bacterial plaque at the gingival margin results in the development of gingivitis and then subsequently lead to periodontitis in some of the cases. However, a causal relationship between plaque accumulation and periodontitis was more difficult to establish. Thereafter, researchers’ understanding of the role of bacteria has evolved from a "non specific plaque hypothesis" where plaque quantity was the major etiologic factor of periodontal diseases, to a "specific plaque hypothesis", where the presence of certain species of microorganisms or quality of plaque gained importance. These species include Actinobacillus actinomycetem comitans, porphyromonas gingivalis, Treponema denticola. Several studies have shown that elevated numbers of one or more of these bacterial species either within the patient or within the individual sites correlate with future increase in pocket depth and clinical attachment loss. Moreover, poorer clinical responses to periodontal therapy have been reported in patients who initially harbor elevated numbers of putative pathogenic organisms. Thus, it can be speculated from the available data from various studies that presence of these putative periodontal pathogens is a risk factor for eventual development of periodontal disease. Therefore, several investigators have proposed a treatment protocol which is based upon not only reducing or eliminating these particular organisms from periodontally involved sites but also from other potential niches in oral cavity that may harbor these bacteria. This treatment approach has been termed as "total disinfection". In the future, such specialized therapeutic approaches coupled with specific microbial diagnosis may play a larger role in enhancing treatment outcomes and improving prognosis of periodontal diseases.

Conclusion
Risk assessment involves identifying elements that may either predispose a patient to develop periodontal disease or may influence the progression of disease that already exists. In such case, these patients may require modification of their prognosis and treatment plan. The present review discusses potential adverse influences of variety of factors on periodontal prognosis and treatment plan. These factors include poor compliance, age, genetics, microbiology, smoking, diabetes, stress, HIV infection and other factors. The dental practitioner is required to consider these factors and employ possible risk factor reduction strategies to subjugate the potential adverse effects of these risk factors on periodontal health.

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