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Does cigarette smoking really have an impact on periodontal disease - A Review

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Abstract

Smoking is a well confirmed risk factor for many systemic diseases like Hypertension, Cardio vascular events, lung cancer, COPD and many other diseases. Currently there is strong evidence linking smoking with etiology and pathogenesis of Periodontal disease. The aim of this Review is to throw light on the possible mechanisms of smoking contributing to periodontal disease and the evidence for the association between cigarette smoking and periodontal disease.

Keyword: Periodontal, Disease, Periodontal

Introduction

Periodontal disease is one of the widespread dental diseases worldwide and has multifactorial etiology. Periodontitis that affects the supporting tissues of the teeth is an inflammatory condition that results from the Immuno-inflammatory reaction of the Host-bacterial interactions. Though Periodontitis has a multifactorial etiology, cigarette smoking is considered as a major environmental risk factor for Periodontitis.

Tobacco smoke contains over 3800 chemicals, including carbon monoxide, hydrogen cyanide, and reactive oxidizing radicals, and sixty of these chemicals are known or suspected to be carcinogens.[1] A direct causal relationship between smoking exposure and the prevalence and the severity of periodontal disease has been firmly established (American Academy of Periodontology 1996, Grossi et al. 1994).[2,3]

The use of tobacco products, in general, and smoking products, in particular, is the major preventable risk factor for the initiation and progression of periodontal diseases.[4]

Tobacco smoke contains more than 3800 chemicals including carbon monoxide and hydrogen cyanide. At least 60 of these chemicals are suspected carcinogens.[5]

Smoking produces harmful effects on many body organs and cause systemic diseases like Coronary artery disease COPD, lung cancer, Oesophageal, Oral and throat cancer, and adverse effects on Reproductive system. Periodontitis is mainly caused by Dental plaque Bio film

bacteria and tissue destruction is caused by the host interaction with these bacteria. However, the progression of Periodontal disease and its severity depends on the influence of genetic and various environmental factors.[6] Cigarette smoking is one of the environmental and behavioural risk factors for Periodontal disease. The relationship between smoking and Periodontal disease has been well established by epidemiological studies in various populations.[7]

The relationship between smoking and Periodontal disease was reported in a study by Pindborg (1947) who in his study reported that Tar and nicotine in tobacco smoke could cause irritation to gingiva and contraction of capillaries and eventually leading to infection.[8]

The aim of this Review paper is to throw light on various mechanisms by which cigarette smoking contribute to the initiation and progression of Periodontal disease.

Mechanisms of Smoking contributing to Periodontal disease.

Smoking and Gingivitis

Heavy smokers are likely to have greyish discolouration and hyperkeratosis of gingiva. The gingival epithelium is hyperkeratotic and hyperplastic.

Smokers when compared to non-smokers exhibit less clinical signs of Gingival inflammation in response to Plaque biofilm. A number of cross-sectional studies have demonstrated that smokers exhibit less gingival inflammation than non-smokers.[9] This could be due to peripheral constriction of gingival vasculature caused by nicotine that could mask the clinical signs of gingival inflammation like gingival bleeding, redness and oedema. Nicotine has stimulatory effect on the sympathetic ganglia to produce neurotransmitters like catecholamines and this in turn affects the alpha receptors on blood vessels causing vasoconstriction.[10] However, the inflammatory cytokines in GCF have been found to be elevated in various invitro studies.[11]

Smoking and Acute necrotizing ulcerative gingivitis

The relationship between smoking and necrotizing ulcerative gingivitis has been well established and Pindborg in his studies reported that 98% of his NUG patients were smokers.[12] Rowland (1999) reported from his series of studies that smoking is a potential risk factor for NUG and also the frequency of NUG increases with increased use of tobacco smoke.[13]

Smoking may alter the host immune response to the pathogens and predispose to NUG or may be due to the direct irritation caused by the tar product in tobacco or may be due to the nicotine causing vascular contraction.[14]

Smoking and Oral hygiene status

The oral hygiene status is found to be poor in smokers than in non-smokers. Studies done by Macgregor (1984) found significantly more plaque accumulation in smokers than non-smokers and also the plaque accumulation increased with increasing tobacco smoke concentration.[15] However, there were other studies with contrasting reports. Berg storm et al 1987 found no quantitative difference in plaque scores between smokers and non-smokers.[16]

The smokers exhibited poor tooth brushing efficiency when compared with non-smokers.[17]

Smokers were found to have more calculus than non-smokers which may be attributed to increased salivary flow rate and increased calcium concentration in saliva of smokers.[18]

Smoking and Periodontal microflora Smoking plays an important role in altering the oral microflora. It has been found that smoking lowers the oxidation-reduction potential (Eh) thereby cause an increase in anaerobic plaque bacteria.[19] Studies demonstrated significant

increase in the proportion of certain Periodontal pathogens like T forsythia and P gingival is in smokers.[20] These periodontal pathogens were recovered from shallower pockets without much periodontal breakdown in the smokers.

Impact of smoking on immunology and host defence

Alterations in host-microbial balance due to changes in subgingival flora or decreased immune response or a combination of both. Various studies have shown the adverse effect of smoking on host immunity by alteration of immune response in the local tissue.[21]

Neutrophils, the important cells in host immunity are affected both quantitatively and qualitatively by the nicotine in smokers. Though the neutrophils are increased systemically in smokers their number that breaches the gingival sulcus are decreased. Also, their function gets altered by the nicotine where both chemotaxis and phagocytosis are affected. Intercellular adhesion molecule-1 (ICAM-1) are very much increased in smokers that could interfere with the receptor ligand binding function of leucocytes and alter the defence mechanism.[22,23]

The neutrophils exposed to tobacco smoke causes increased oxidative burst producing direct toxic effect on tissues.

Nicotine in tobacco smoke also increase proteolytic enzymes like MMP s and Neutrophil elastase that could contribute for increased tissue destruction in smokers.[24]

Smoking affects both humoral and cellular immunity. The immunoglobulin IgG2 levels that are crucial in defence against gram negative periodontal pathogens are found to be significantly reduced in smokers when compared to non-smokers and this compromises the phagocytosis of the Periodontal pathogens.[25]

In addition, various inflammatory mediators like IL-1, TNF-α and MMP-8 are all elevated in the tissues and GCF of smokers.

Impact of smoking on Response to Periodontal therapy

Tobacco smoke alters the tissue response and have an adverse impact on response to various non-surgical and surgical periodontal treatment. The smokers do not have favourable healing response to regenerative and periodontal plastic surgical procedures and the success rate of such treatment modalities are greatly reduced in smokers.[26] Those individuals who smoke more than 10 cigarettes a day are considered heavy smokers and they respond very poorly to any periodontal treatment than the light and moderate smokers. Tobacco smoke also affects the fibroblasts connective tissue matrix and bone. The invitro studies have shown proliferation, migration, matrix production and root surface attachment of fibroblasts to be affected and reduced in smokers.[27]

Smoking and Implant failures

Cigarette smoking has a dramatic effect on the success and failure of dental Implants. The Dental Implant Clinic Research group (DICRG) has in fact the largest data on influence of smoking on success rate of Implants. Their data of three years on a randomized, prospective clinical study that included >2900 Implants showed that 8.9% of Implants placed in smokers failed as compared to 6% in non-smokers or former smokers.[28]

Various mechanisms have been hypothesized for compromised wound healing in smokers. This includes cytotoxicity of nicotine carbon monoxide and hydrogen cyanide to the cells involved in wound healing. Also there is marked vasoconstriction and reduced tissue perfusion due to release of catecholamines.[29] The influence of smoking on failure of Implants are more frequent in areas of poor quality trabecular bone and

failure rates are more in maxilla than in mandible probably due to lower bone quality.[30]

To increase implant survival in smokers, various protocols have been recommended. Bain and Moy suggested that the patient should cease smoking at least 1 week prior to surgery to allow reversal of the increased levels of platelet adhesion and blood viscosity, as well as the short-term effects associated with nicotine. The patient should continue to avoid tobacco for at least 2 months after implant placement, by which time bone healing would have progressed to the osteoblastic phase and early osseointegration would have been established. Lambert et al suggested that detrimental effects may be reduced by cessation of smoking, using pre-operative antibiotics and hydroxyapatite-coated implants.[31]

Conclusion

The higher prevalence of smoking worldwide increases the global burden of smoking related diseases and Periodontal disease is definitely one among them. There is increased risk of early tooth loss in smokers with poor oral hygiene than non-smokers.

Evidence clearly suggest that smoking has detrimental effects on the outcomes of various Periodontal treatment procedures and hence the patient should be strictly advised to quit smoking before any extensive Periodontal or Implant treatment. The American academy of Periodontology recommends tobacco cessation as a part of Periodontal therapy. The Dental council of India encourages the dental professionals to be more active in tobacco cessation counselling at various levels.

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