**Effects of Green Tea in the Treatment of Periodontal Disease**

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**ABSTRACT**

Periodontium comprises of investing and supporting structures of the teeth namely Gingiva, Periodontal ligament, Cementum and Alveolar bone. Periodontal disease is a chronic inflammatory disease affecting the supporting structures of the teeth. Micro organisms present in the dental plaque are considered as the primary etiological agent for periodontal diseases. Dental plaque contains anaerobic organisms such as Porphyromonas gingivalis, Fusobacterium nucleatum. They liberate endotoxins which are harmful to the host tissues. The Lipopolysaccharide layer of these bacteria can trigger hyper inflammatory response. Toxins liberated from the bacteria stimulate inflammatory reaction in hyper responsive manner. During this process, destructive enzymes such as collagenases are liberated from host cells and affected tissues also trigger the release of Prostaglandins. This leads to osteoclast activation and bone loss. To arrest the inflammation, eradicate microbes, and to control the free radicals various treatment strategies have been tried. One of the strategy is use of green tea since it has anti bacterial, antioxidant effect etc. Greeen tea is derived from the dried leaves of the plant Camellia sinensis. Green tea is usually available in the form of beverage, mouth wash containing extract of green tea, and as a chewing gum. Green tea catching can be affected by various factors like type of green tea leaves , type of processing before drying, growing conditions and the geographic conditions. This paper reviews the effect of green tea in the periodontal disease.

**Keywords:** Catechin, green tea, periodontal disease.

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**INTRODUCTION**

Green tea, an aqueous infusion of dried leaves of the plant Camellia sinensis, is the most popular beverage consumed worldwide [1]. It has received considered attention because of its scientifically proved beneficial effects on human health. The effect has been largely attributed to the poly phenol content namely epigallocatechin gallate which is known to induce apoptosis of tumor cells and has little or nil effect in normal cells [2,3]. It is consumed throughout the ages in India, China, Japan and Thailand. Several epidemiological studies have proven that green tea also has some general health beneficial properties like anti-hypertensive, anti-bacterial, anti-viral and anti-fungal activity. Traditional Chinese medicine has recommended this plant for headache, body ache, and as an energy drink. It has cognitive function and positive impact on bone density, dental caries and periodontal health [4]. Green tea is usually available in the form of beverage, mouth wash containing extract of green tea, and as a chewing gum. Green tea catching can be affected by various factors like type of green tea leaves , type of processing before drying, growing conditions and the geographic conditions. This present article reviews the effectiveness of green tea on oral health and periodontium.

**PROCESSING OF GREEN TEA:**

1. **Tea leaves**  
2. **Partial withering**  
3. **Steaming**
Rolling and drying
↓
Final firing
↓
Green tea
↓
Non-oxidized phenol compound/catechin (EGCG, EGC, ECG, EC) [4]

BASIC INFORMATION ABOUT GREEN TEA: Depending upon the manufacturing process green tea can be classified as non-fermented, semi-fermented and fermented black or red tea. Green tea is usually available in the form of beverage, mouth wash containing extract of green tea, and as a chewing gum. Green tea catching can be affected by various factors like type of green tea leaves, type of processing before drying, growing conditions and the geographic conditions [4].

PERIODONTAL DISEASE: Periodontal disease is a chronic inflammatory disease that is more common in India, the incidence and progression of periodontal disease is related to periodontal pathogens and also various host and environmental factors related to it. Green tea catching like eppigallo catechin 3 gallate and epicatechin 3 gallate possess antioxidant, antimicrobial, anticollagenase, anti-mutagenic, and chemo preventive properties [5, -7], which are proved to be helpful in the treatment of chronic diseases like periodontitis. Periodontitis is characterized by exaggerated inflammation, involving the release of excess proteolysis enzymes [8] and reactive oxygen species [9]. A growing body of evidence implicates oxidative stress in the pathology of much human disease and recent in periodontitis several studies demonstrated increased levels of biomarkers for tissue damage induces by reactive oxygen species in periodontitis patient relative to control [10-12].

MECHANISM OF ACTION:
Endoplasmic reticulum + mitochondria = oxygen
↓
Hydrogen peroxide
↓
Reactive oxygen species
↓
DNA, RNA, Oxidative proteins, oxidize lipids
↓
Activate cell suicide

Thus intake of green tea can stop all these degenerative changes by inhibiting the action of the reactive oxygen species molecules.

OXIDATIVE STRESS:
Oral peroxides consist mainly of salivary peroxides and myeloperoxidase and are involved in oral defense mechanism. Salivary peroxides secreted by salivary glands, myeloperoxidase found in polymorph nuclear leukocyte migrates into oral cavity at the gingival crevice [13]. A study conducted by Barach narotzki, aimed to establish the interaction of green tea and oral peroxidase in vitro and in vivo. Addition of green tea, black tea infusions and EGCG to saliva resulted in sharp rise of oral peroxides activity 280%, 54%, and 42% respectively and following green tea infusion mouth rinse.

ANTI-CARIogenic EFFECT:
Catechin is found to have inhibitory action against Streptococcus mutans and Streptococcus sorbins in the minimal inhibitory concentration of 50-1000mg/ml [14]. A study by Araghizadesh A, Kohanteb J, and Fan MM with green tea concluded that the green tea extract exhibited strong anti-bacterial activity on S.mutans, A. actinomycetem comitans, P.gingivalis, P. intermedia and therefore may be used in mouthwash or dentifrice for prevention of dental carious and periodontal diseases [15].
EFFECTS ON BONE HEALTH:
Osteoporosis is the major health problem in ageing population. Tea polyphenols increases osteoblastogenesis and suppress osteoclastogenesis. This osteoprotective effect appears to be mediated through antioxidant or anti inflammatory pathway along with their downstream signaling mechanisms [16].

HALITOSIS:
Halitosis or bad breath is caused due to volatile sulphur compound (VSCs) such as H (2) s and CH (3) SH produced in oral cavity, oral micro organism degrade proteinaceous substrate to cysteine and methionine, which is then converted by volatile sulfur compounds. A study conducted by Lodhia P,Yaegaki K, on effects on green tea on volatile sulfur compounds with other foods which claims to control halitosis, green tea is very effective in reducing oral malodor temporarily because of its disinfectant and deodorant activity[17].

GREEN TEA AND ITS ASSOCIATION WITH PERIODONTIUM:
EGCG, a major polyphenol of green tea, reportedly exerts various biological effect including cryostatic property for preserving cells, anti-bacterial, anti-inflammatory reactions and anti-oxidant and anti-carcinogenic effect [18], due to its effect against periodontal pathogen and to inhibit the production of related cytokines and their inflammatory pathway, such as carbon tetra chloride, tumor necrosis factor a, nuclear factor KB, cyclooxygenase 2 and inducible nitro oxygenase synthase [19-22].
The preservative potential of EGCG has been attributed to its intrinsic property and in particular ,its molecular structure and amphipathic property [23,24].It neutralizes the free radical and reactive oxygen species by chelating with free radical ,which cause hazard alteration of cell component and protect cells and tissue from oxidative - stress induced damage [24,25].
A recent study evaluated the relationship between the intake of green tea and periodontal disease and found that there is modest inverse association between intake of green tea and periodontal disease. The intake of green tea was inversely proportional to pocket depth, mean clinical attachment level, and bleeding on probing [26] so continuous application of greet tea catechin has been shown to have effect on treating bleeding gums and periodontitis. Alveolar bone resobtion is a characteristic feature of periodontal disease and involves removal of both the minerals and organic constituent of bone matrix, a process mainly carried out by multinucleated osteoclast cells or matrixmetalloproteinases(MMPs) [26].EGCG inhibited osteoclast formation in a culture of primary osteoclastic cells and bone marrow cells, and it induced apoptotic cell death of osteoclast-like multinucleated cells in a dose-dependent manner thus suggesting the role of green tea in the prevention of bone resorbtion [27].

EFFECTS ON HOST DEFENCE, HUMAN GINGIVAL CELLS AND INFLAMMATORY RESPONSE:
Green tea catechin is reported to be effective in preventing gingival and periodontal inflammation.EGCG inhibits the m-RNA expression of cox-2, MMPS-1, IL-1, 6 and 8 by cultured cells. Effective concentration to achieve these was greater than equal to 1 microgram per mille liter.EGCG inhibits the activation of NF-kappa (nuclear factor-kappa B), which one of the key positive regulator COX -2 expression [28].

RECOMMENDED DOSAGE:
Depending upon the brand 2-3 cups of green tea /day (for total of 240-320mg polyphenol) or 100-750mg/day of standardized green tea extract is recommended [29].
In one study the author recorded the daily intake of green tea as number of cups, and found that every one cup/day increment in green tea intake was associated with a 0.023-mm decrease in the mean probing depth (p<0.05), a 0.028-mm decrease in the mean CAL (p<0.05) a nd a 0.63% decrease in the BOP (p<0.05) [30].

RISK ASSOCIATION: [31]
1) Excess consumption of green tea increases bleeding time.
2) Caffein, catechin and tannic acids constituents of green tea can cause neural tube defect in babies due to folic acid antagonism and therefore, pregnant women should not take green tea.
3) Increase risk of bladder cancer.
4) Restlessness, irritability, sleeping problem, tremor, heart palpitations in people with caffeine sensitivity.
5) Green tea is a potent gastric acid stimulant and causes stomach upset.
CONTRAINDICATING CONDITION: [31]
- Patients under warfarin
- Patients under chemotherapy
- Antibiotic therapy
- Oral contraceptives

CONCLUSION
It has been reported that there are numerous health benefits related to consumption of green tea. Various studies have reported that the daily use of green tea may be beneficial to cure or prevent inflammatory disease. It can also be beneficial for certain age group people such as adolescents, who are more affected by periodontal inflammation. EGCG a major constituent of green tea represents a natural and alternative anticariogenic agent because it inhibits both S.mutans planktonic and biofilm cultures and also inhibits various cariogenic virulence factors of S.mutans at the transcriptional and enzymatic levels, leading to reduce acidogenicity [32].

Green tea catechin (EGCG) significantly reduced the expression of matrix metalloproteinase-9 in osteoblast, thus, EGCG may prevent alveolar bone resorption that occurs in periodontal disease [33]. Another inhibitory effect of green tea catechin on the adherence of porphyromonas gingivalis is onto the buccal epithelial cells [33]. Numerous studies conducted on animals model with green tea catechin demonstrated antioxidant, antimutagenic, anti-inflammatory, antidiabetic, antibacterial, and above all, cancer-preventive properties [18]. Thus the evidence is strong that daily intake of green tea has a beneficial effect in prevention and treatment of chronic inflammatory diseases like periodontitis.

REFERENCES


