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Effect of Green Tea on Periodontal Health: A Short Update on the Recent Evidence

Dental Science

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Dr. Ashit Bharwani	Senior Lecturer, Dept. of Periodontology, K M Shah Dental College & Hospital, Sumandeep Vidyapeeth, Vadodara
Dr. Prasad Nadig	Reader, Dept. of Periodontology, K M Shah Dental College & Hospital, Sumandeep Vidyapeeth, Vadodara.
Dr. Bhavesh Modi	Senior Lecturer, Dept. of Periodontology, K M Shah Dental College & Hospital, Sumandeep Vidyapeeth, Vadodara
Dr. Ekta Shah	Senior Lecturer, Dept. of Periodontology, K M Shah Dental College & Hospital, Sumandeep Vidyapeeth, Vadodara.

ABSTRACT

Green tea has been the topic of discussion in health care fraternity since a long time but recently the interest in this has increased in light of the evidences that have come up. Green tea can be consumed as a drink with many systemic effects or it can also be used as a topical application with localized effects. Because of its active ingredients, green tea has multiple functions which collective prove to be beneficial to the oral and periodontal health. The periodontal effects of green tea include inhibiting the growth of certain known periodontal microbiota, reducing the inflammatory load and preventing bone resorption. The aim of this evidence based literature review is to give a brief introduction of the properties of green tea and to shed light on the recent evidences regarding the role of green tea on periodontal health.

INTRODUCTION:

Herbal products have been in use since historical times and have gained attention recently due to the observations of side effects and resistant strains to the use of pharmaceutical products. Dental medicine has become especially amenable to plant-derived products, driven by evidence that shows populations that regularly incorporate foods or beverages containing certain phytochemicals into their diet have better oral health.[1] As far as oral diseases are concerned, "Miswak" and its various contents are being in use as an effective, cheap, natural and efficient product to maintain oral hygiene.[2] Similarly, tea leaves and its extracts have also been a topic of discussion among general public and health practitioners regarding its beneficial effects on oral tissues.

Ingredients of Tea:

Tea plants are recognized by the name "Camellia Sinensis" by botanists round the world. It can be available as a shrub or evergreen tree. Its leaves may vary from exstipulate, lanceolate to obovate up to 30 cm long, 2–5 cm broad, pubescent, sometimes becoming glabrous, serrate, acute or acuminate.3 There are three main varieties of tea — green, black, and oolong, all derived from the leaves of the Camellia sinensis plant.4 Green tea is prepared from unfermented leaves, the oolong tea leaves are partially fermented, and black tea is fully fermented.5,6 Tea is reported to contain nearly 4000 bioactive compounds of which one third is contributed by polyphenols.7 The polyphenols, that includes the catechins, are thought to be responsible for the health benefits that have traditionally been attributed to tea, especially green tea. Most important kind of catechins present in green tea include epigallocatechin-3-gallate (EGCG), epigallocatechin (EGC), epicatechin-3-gallate (ECG) and epicatechin (EC), all of which exhibit antimicrobial activity.8 Green tea also serves as a great source of anti-oxidants and contributes to improved oral health and decreases the chances of cardiovascular diseases, cancer and acts as an anti-hypertensive, anti-bacterial, anti-viral agent. It also exhibits protection against ultraviolet radiations, helps in weight loss, causes increase in bone mineral density and provides neuro-protective power.8, 9

Recommended dose of green tea to be consumed to have its beneficial effects:

In a study published by Dullo et al, researchers at Yale University after looking at more than 100 studies on the health benefit of green tea, came up with something that they called "Asian paradox". Asian paradox, as pointed by them, refers to lower rate of heart diseases and cancer in Asian populations despite the high incidence of cigarette smoking. They attributed this effect to 1.2 liters of green tea that is consumed by many Asians which provides high levels of anti-oxidants and other polyphenols.10 There have been many other recommendations by various researchers regarding the recommended intake of green tea to have its beneficial effects.

Based on data obtained from Korean National Health & Nutrition Examination Survey, Kyungdo et al put forth their findings that drinking 1 cup of green tea per day decreased the prevalence of periodontitis whereas more than 1 cup per day increased the prevalence of periodontitis.11

Health benefits:

Owing to its high content of anti-oxidants, green tea has a theoretical role in all diseases where anti-oxidants play an active role. However, to what extent green tea helps in controlling or curing general health diseases is still a topic of debate.

In context to the benefits of green tea on oral health, green tea has been studied for its possible effects on oral malignancy, caries, halitosis and periodontal disease. However, in this review, we will be focusing only on periodontal implications.

Halitosis:

Halitosis (oral malodor) is a condition mainly caused by volatile sulfur compounds (VSC) generated through bacterial metabolism. As tongue coating is considered as one of the main reasons behind halitosis, in addition to mechanical removal of tongue coating, chemicals have also been used to control halitosis which prevent bacterial growth

(chlorhexidine, cetylpyridinium chloride, triclosan, essential oils) or neutralize VSCs (chlorine dioxide, zinc salts).[12] Few studies have also brought evidence that green tea polyphenols may be effective in reducing halitosis. [13, 14, 15] Due to its increasing popularity, it is also available commercially as Listerine green tea mouthwash.

Periodontal implications:

Animal studies:

Yoshinaga Y et al conducted an experimental study to study the effect of green tea extracts on the onset of periodontitis in a rat model. Rats were infused intraperitoneally with lipopolysaccharides (LPS) of E.Coli. Out of the three groups, one group received topical application of LPS, another group received topical application of green tea extract plus LPS and the third group received topical application of saline. The results showed that the loss of attachment, level of alveolar bone, inflammatory cell infiltration and RANKL expression in green tea extract group were significantly decreased as compared to the other two groups, from which the authors concluded that green tea extracts suppresses the onset of loss of attachment and alveolar bone resorption in a rat model of experimental periodontitis.[16]

In an animal study by *Cai Y et al,* mice were fed with normal food and infected by P.gingivalis every 2 days and that resulted in significant alveolar bone resorption and increase in titer of various inflammatory cytokines like internleukin-1β, interleukin-6, interleukin-17 and TNF-◎. However, the administration of EGCG (green tea extract), resulted in a significant decrease in alveolar bone loss and reduction in the above mentioned inflammatory cytokines.[17]

In another study by *Tsukasa Tominari et al*, primary osteoblastic cells were isolated form newborn mouse calvariae and cultured after which they were exposed to LPS with and without EGCG, and were further cultured for 24h to measure the levels of PGE_2. The bone-resorbing activity was expressed as increase in medium calcium concentrations. The results showed that LPS markedly induced bone-resorbing activity, and EGCG recovered the bone resorption in a concentration-dependent manner. EGCG suppressed the LPS-induced expression of RANKL mRNA in osteoblasts at 12–24 h.[18]

More recently *Gennaro et al* conducted a study to investigate the inhibitory effects of green tea on diabetes induced periodontitis. Diabetes was induced in rats and the rats were divided into water-treated and green tea-treated subgroups and were analyzed at 15, 30, 60 and 90 days. TNF-α, RANKL, OPG, interleukin-10 and RUNX-2 levels were checked and alveolar bone loss was also assessed by morphometric measurements. In the diabetic rats treated with green tea, the authors observed a decreased number of cells expressing RANKL and TNF-α compared to the other group. Additionally, green tea increased the numbers of cells that stained positive for OPG, RUNX-2 and IL-10 in the diabetic rats. The authors concluded that intake of green tea reduced the expression of pro-inflammatory cytokines and increased the levels of anti-inflammatory cytokines.[19]

In-vivo Clinical Studies:

Green tea has been used in various forms like- as a beverage, local drug delivery, as mouthwashes and as dentifrices also.

Green tea intake as beverage:

Use of green tea as a beverage has been studied the most in periodontal research. An epidemiologic study showed that there is an inverse association between the daily intake of green tea and periodontal disease and the authors recommended that drinking green tea is a good and healthy habit to maintain a healthy periodontium.[20] A number of other studies have proved the beneficial role of green tea intake on various periodontal parameters both clinically and biochemically. [21,24]

As local-drug delivery:

Locally applied antimicrobial agents have been used for many years as an effective means to control plaque in periodontal therapy. Local delivery has advantage over systemic antibiotics in providing highly concentrated drug delivery, improved compliance and fewer propensities for development of bacterial resistance. Green tea extract has been used as a local drug delivery in a number of studies.[22,23,25] *Gadagi et al* studied the effect of locally delivered green tea extract in patients with periodontitis and diabetic patients with periodontitis. The authors concluded that green tea extract showed promising results when used as a locally delivered agent as evident from the improvements in clinical parameters (probing pocket depth, clinical attachment levels, gingival index) and microbiological parameters. (Porphyromonas gingivalis concentrations).[25] The results of other similar studies showed that green tea can be safely administered as a locally delivered agent to improve the clinical and microbiological parameters in patients with periodontitis.[22,23]

In form of oral rinses:

The chemical plaque control agents can be delivered in a variety of ways, out of which oral rinses have proved their role as a safe and effective delivery system for antimicrobials. Green tea extract mouthwash was compared to the gold standard chlorhexidine in a study by *Kaur H et al*. In this cross-over type study, subjects were divided into two groups. After phase-1, the mouthwash samples were exchanged between the groups and at the end of the study period the results showed that green tea mouthwash was equally effective in controlling plaque.[26] Other researches also showed similar beneficial effect with green tea usage. [27,28]

In dentifrices:

A number of medicinal agents have been added to the dentifrices to supplement its anti-plaque activity. Green tea extract dentifrice was compared to a triclosan-fluoride-containing dentifrice in a RCT by *Hrishi TS et al* to compare its effect on clinical and biochemical parameters related to periodontitis. The authors concluded that a significant improvement was noticed in all clinical parameters (gingival index, plaque index, percentage of BOP sites, clinical attachment levels) and biochemical parameters. (total antioxidant capacity levels)[29]

CONCLUSION:

Numerous studies support the fact that green tea has a proved role in prevention and controlling gingivitis and periodontitis. However, a watch has to be kept on the acceptable dose of green tea and its side effects like worsening of anemia, increased bleeding time, irregular heartbeats, risk of glaucoma, increased risk of bladder cancer, stomach upset and negative pregnancy outcomes.[30]

REFERENCES:

1. Groppo FC, Bergamaschi CC, Cogo K, Franz- Montan M, Motta RH, Andrade ED. Use of phytotherapy in dentistry. Phytother Res. 2008;22:993-8.
2. Almas K. Miswak (chewing stick) and its role in oral health. Postgrad Dent 1993;3:214-8.

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3. Ferrara L, Montesano D, Senatore A. The distribution of minerals and flavonoids in the tea plant. Farmaco 2001;56:397-401.
4. Banerjee S, Chatterjee J. Efficient extraction strategies of tea (Camellia sinensis) biomolecules. J Food Sci Technol 2015;52:3158-68.
5. Araghizadeh A, Kohanteb J, Fani MM. Inhibitory activity of green tea (Camellia sinensis) extract on some clinically isolated cariogenic and periodontopathic bacteria. Med Princ Pract. 2013;22:368-72.
6. Narotzki B, Reznick AZ, Aizenbud D, Levy Y. Green tea: A promising natural product in oral health. Arch.Oral Biol. 2012;57:429-35.
7. Tariq M, Naveed A, Barkat Ali K. The morphology, characteristics, and medicinal properties of *Camellia sinensis* tea. J.Med. Plants Res. 2010;4:2028-33.
8. McKay DL, Blumberg JB. The role of tea in human health: an update. J Am Coll Nutr 2002;21:1-13.
9. Namita P, Mukesh R, Vijay KJ. *Camellia Sinensis* (green tea): a review. Global J Pharmacol 2012;6:52-9.
10. Dulloo AG, Duret C, Rohrer D, Girardier L, Mensi N, Fathi M et al. Efficacy of green tea extracts rich in catechin polyphenols and caffeine in increasing 24-h energy expenditure and fat oxidation in humans. Am.J.Clin.Nutr. 1999;70:1040-5.
11. Han K, Hwang E and Park JB. Excessive consumption of green tea as a risk factor for periodontal disease among Korean adults. Nutrients 2016;8:E408.
12. Armstrong BL, Sensat ML, Stoltenberg J. Halitosis: a review of current literature. J Dent Hyg. 2010;84:65-74.
13. Lodhia P, Yaegaki K, Khakbaznejad A, Imai T, Sato T, Tanaka T et al. Effect of green tea on volatile sulfur compounds in mouth air. J Nutr Sci Vitaminol 2008;54:89-94.
14. Morin MP, Bedran TB, Fournier-Larente J, Haas B, Azelmat J and Grenier D. Green tea extract and its major constituent epigallocatechin-3-gallate inhibit growth and halitosis-related properties of Solobacterium moorie. BMC Complement Altern Med 2015;15:48.
15. Farina VH, Lima AP, Balducci I, Brandao AA. Effects of the medicinal plants Curcuma zedoria and Camellia sinensis on halitosis control. Braz Oral Res. 2012;26:523-9.
16. Yoshinaga Y, Ukai T, Nakatsu S, Kuramoto A, Nagano F, Yoshinaga M et al. Green tea inhibits the onset of periodontal destruction in rat experimental periodontitis. J Periodontal Res. 2014;49:652-9.
17. Cai Y, Chen Z, Liu H, Xuan Y, Wang X, Luan Q. Green tea epigallocatechin-3-gallate alleviates P. gingivalis-induced periodontitis in mice. Int Immunopharmacol 2015;29:839-45.
18. Tominari T, Matsumoto C, Watanabe K, Hirata M, Grundler FM, Miyaura C et al. Epigallocatechin gallate (EGCG) suppresses lipopolysaccharide-induced inflammatory bone resorption, and protects against alveolar bone loss in mice. FEBS Open Bio 2015;5: 522-7.
19. Gennaro G, Claudino M, Cestari TM, Ceolin D, Germino P, Garlet GP et al. Green Tea modulates cytokine expression in the periodontium and attenuates alveolar bone resorption in Type 1 Diabetic rats. PLoS One 2015;10:e0134784.
20. Kushiyama M, Shimazaki Y, Murakami M, Yamashita Y. Relationship between intake of green tea and periodontal disease. J. Periodontol. 2009;80:372-7.
21. Deshpande N, Deshpande A, Mafoud S. Evaluation of intake of green tea on gingival and periodontal status: An experimental study. J Interdiscip Dentistry 2012;2:108-12.
22. Hattarki SA, Pushpa SP, Bhat K. Evaluation of the efficacy of green tea catechins as an adjunct to scaling and root planing in the management of chronic periodontitis using PCR analysis. J Indian Soc Periodontol 2013;17:204-9.
23. Kudva P, Tabasum ST, Shekhawat NK. Effect of green tea catechin, a local drug delivery system as an adjunct to scaling and root planing in chronic periodontitis patients. J Indian Soc Periodontol 2011;15:39-45.
24. Chopra A, Thomas BS, Sivaraman K, Prasad HK, Kamath SU. Green Tea intake as an adjunct to mechanical periodontal therapy for the management of mild to moderate chronic periodontitis: A Randomized controlled clinical trial. Oral Health Prev Dent 2016. May 12 (Epub ahead of print)
25. Gadagi JS, Chava VK, Reddy VR. Green tea extract as a local drug therapy on periodontitis patients with diabetes mellitus: A randomized case-control study. J Indian Soc Periodontol 2013;17:198-203.
26. Kaur H, Jain S, Kaur A. Comparative evaluation of the antiplaque effectiveness of green tea catechin mouthwash with chlorhexidine gluconate. J Indian Soc Periodontol 2014;18:178-82.
27. Jenabian N, Moghadamnia AA, Karami E, Mir A PB. The effect of Camellia Sinensis mouthwash on plaque-induced gingivitis: a single-blinded randomized controlled clinical trial. Daru. 2012;20:39.
28. Sarin N, Marya C, Nagpal R, Oberoi SS, Rekhi A. Preliminary clinical evidence of the antiplaque, antigingivitis efficacy of a mouthwash containing 2% green tea-a randomized clinical trial. Oral Health Prev Dent 2015;13:197-203.
29. Hrishi TS, Kundapur PP, Naha A, Thomas BS, Kamath S, Bhat GS. Effect of adjunctive use of green tea dentifrice in periodontitis patients. Int J Dent Hyg. 2016;14:178-83.
30. Available from http://www.webmd.com/vitamins-supplements/ingredientmono-960-green%20tea.aspx?activeingredientid=960, accessed on 23 July 2016.