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GREEN TEA AS A DISINFECTANT FOR DENTAL APPLIANCES- A REVIEW

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ABSTRACT

Green tea polyphenols are derived from the leaves of the *Camellia Sinensis* plant which have been studied for many years. Recently, studies have been done to look at the possibility of green tea in antimicrobial therapy. The particular properties found in the catechins have portrayed a promising antimicrobial effect. The antimicrobial effects shown by green tea have proven that the potential for preventive, therapeutic and disinfecting purposes is present .

In this review the antimicrobial effects of green tea prove to be used as a disinfectant in the field of dentistry will be discussed. Green tea is used in the field of Ayurveda medicine for treatment, they are used in mouthwashes owing to its excellent antimicrobial properties and disinfectant nature. The other benefits of green tea pertaining to health include: anti inflammatory, antioxidant, anticarcinogenic. There is a need for a chemical free disinfectant in the field of dentistry and hence green tea, a natural ingredient can be used as an alternative to disinfect dental appliances.

Keywords: Green tea; disinfection; anti microbial activity; dental appliances

INTRODUCTION

Green tea, a very popular beverage in the world, has received considerable attention because of its immense health benefits to humans **[1]**. It is extracted from the leaves of *Camellia Sinensis* which is a semi tropical plant found in South East Asia **[2]**. The plant is cloned or grown in nurseries. They are grown by obtaining seeds from the mother bush. This process takes about a year or two and is usually done in terraces or grown in rows. Group of polyphenols form catechins and these are the active components of green tea.The components of green tea are: carotenoids, ascorbic acid, tocopherols, minerals like chromium, magnesium, selenium and zinc. Caffeine is also present in green tea. Recently, studies have been done to look at the possibility of green tea in antimicrobial therapy. The particular properties found in the catechins have portrayed a promising antimicrobial effect. Green tea is said to be the most abundant catechin.

The key concept of using green tea as a disinfectant for dental appliances is due to four main mechanisms. These mechanisms are

1) Inhibition of cell wall synthesis of the microorganisms
2) Inhibition of metabolic activity
3) Inhibition of Protein synthesis **[3]**

Apart from antimicrobial properties, green tea also shows anti inflammatory, antioxidant and anti carcinogenic **[4]**.

Use of green tea as a disinfectant in the field of dentistry leads to the use of not only an effective uses but also a chemical free solution **[5]**.

Green tea is used in the field of Ayurveda medicine for treatment, they are used in mouthwashes owing to its excellent antimicrobial properties and disinfectant nature. The other benefits of green tea pertaining to health include: anti inflammatory, antioxidant, anticarcinogenic. Clinical benefits in dentistry for green tea can be immense and a number of studies are being done. Clinical performance of green tea has been assessed and therefore it can even be considered using as an irrigant and studies show that green tea is effective in reducing caries with its effect on bacteria **[6]**.

There is a need for a chemical free disinfectant in the field of dentistry and hence green tea, a natural ingredient can be used as an alternative to disinfect dental appliances. Green tea extracts can be diluted in solutions or manufactured as a paste but this might cause staining. Previously our team had conducted numerous clinical trials

[6–12] and lab animal studies **[13–17]** and in-vitro studies **[18-20]** over the past 5 years.

NEED FOR DISINFECTION

Disinfection of dental appliances is a major protocol for infection control **[21]**. It is said that the disinfection process eliminates all pathogens except the spores of bacteria. It is very important to disinfect any dental appliance used by the patient. The use of a natural product like green tea for disinfection can be included as a recent advancement as dentistry has seen and included many advancements in recent years. The microbial degree present in dental appliances will be immense **[22]**. Accumulation of these microbes within the appliance can cause infection in the oral cavity and even the respiratory system and from there they can enter the blood and saliva **[23]**.

Spread of these microorganisms is also possible by sneezing and coughing **[10]**. Therefore, disinfection of the appliance is necessary not just for the patient using it but also to prevent any sort of cross contamination.

Streptococcus Mutans, the most common bacteria found in the oral cavity, is a determinant of oral health **[24]**. Green tea has a direct antimicrobial effect on this bacteria plus it seems to inhibit the attachment of the bacteria to oral surfaces **[25]**. Dental appliances as we know can be permanent or removable. The removable appliance like prosthesis and retainers can be disinfected by using a solution containing green tea extracts **[26]**. Regular rinsing and maintenance of oral hygiene is very important as it is, but the use of green tea is only going to boost the hygiene process of not only the fixed appliance but also the oral cavity **[27]**. Green tea polyphenol extracts are found in many disinfecting agents owing to its properties **[28]**.

ADVANTAGES OF GREEN TEA AS A DISINFECTANT

The catechins inhibit the growth of both gram positive and gram negative bacteria, but they also increase the number of beneficial bacteria such as lactobacilli. The growth of *P.gingivalis, Prevotella intermedia and Prevotella nigrescens* is inhibited by the catechins in green tea **[29]**.

Plus it's a natural ingredient which is readily available. The potential shown by it is immense not just for disinfection purposes but also for its other health benefits **[30]**. It can be placed in the category of an all-in-all therapeutic naturally available ingredient **[31]**.

In addition to green tea, black and oolong tea are also common beverages derived from *Camellia Sinensis* that contain polyphenols.

But these are fermented unlike green tea. Since green tea is unfermented it contains the highest concentration of polyphenols and most likely possesses the greatest antibacterial effect **[32]**. Green tea is also effective in reducing caries and enamel erosion according to certain studies. Other natural ingredients used for the prevention of enamel erosion include grape seed, cranberry etc.

Extracts of green tea polyphenols are found in mouthwashes, handwashes, sanitizers, toothpaste etc owing to its excellent properties and its potentials **[33]**. The particular properties found in the catechins have portrayed a promising antimicrobial effect. The antimicrobial effects shown by green tea have proven that the potential for preventive, therapeutic and disinfecting purposes is present. The disinfecting property of green tea can also make it useful as an irrigant and in future it may replace commonly used irrigants like NaOCl, CHX etc. The below mentioned **Table 1** compares the use of green tea as an irrigant with the commonly used irrigants.

Apart from acting as a disinfectant in the field of dentistry, green tea is said to promote periodontal health by reducing inflammation, preventing bone resorption, and as discussed earlier, preventing the growth of microbes that are responsible for periodontal disease **[36, 37]**.

Green tea is a boon in the field of dentistry and if the use is implemented well enough.

MAJOR ANTIMICROBIAL PROPERTIES OF GREEN TEA

The major antimicrobial properties of green tea are listed below in **Table 2**.

Table1: Comparative effects of green tea as an irrigant with commonly used irrigants

AUTHOR	Green tea	OTHER IRRIGANTS	PROPERTIES	RESULTS
[34]	Green tea polyphenols	Sodium Hypochlorite	Antimicrobial Effect against Enterococcus Faecalis.	Both green tea and commonly used irrigants show antimicrobial effect. In the study, highest inhibitory zone against E. Faecalis was shown by NaOCl but considerable effect was also shown by green tea polyphenols.
[35]	Green tea polyphenols	Sodium Hypochlorite	Disintegration of biofilm.	NaOCl showed maximum efficacy against biofilm formed while significant but slower disintegration was shown by green tea.

Table 2: Antimicrobial properties of green tea

ANTIMICROBIAL PROPERTIES OF GREEN TEA
1) Damage to bacterial cell membrane
2) Inhibition of fatty acid synthesis
3) Inhibition of other enzyme activity
4) Inhibition of protein synthesis
5) Synergy of green tea with antimicrobials

Green tea, as discussed earlier, inactivates bacteria and other microorganisms by damaging the cell membrane, inhibiting the important synthesis and activities of enzymes.

Green tea can also be used as a herbal root canal irrigant because of its excellent properties of disinfection and cleansing. The main irrigants used like CHX can thus be replaced by this herbal wonder. An irrigant is necessary after and during the cleaning and shaping of a root canal and hence studies are being done to test if green tea can be a substitute.

DISADVANTAGES OF GREEN TEA AS A DISINFECTANT

Even though green tea has proven to be a very promising disinfectant, a set of disadvantages come with it **[38]**.

The most common disadvantage of green tea is its staining property. This staining potential of green tea is due to the presence of tannins.

There is every possibility for green tea to stain the appliances and hence extracting a variable amount of it for disinfection is a solution to prevent excessive staining **[39]**.

Green tea as a medicinal product can also not be so cost-effective and hence they have to be bought in bulk. Moreover, organisms like Streptococcus mutans may be responsible for deteriorating oral health but direct or complete elimination of these microbes can also prove to be fatal to the oral health.

CONCLUSION

Green tea, a very popular drink which is used worldwide, is indeed a boon for maintaining health and prevention of infection. The idea for this review stemmed from the current interest in the field of dentistry. In this review, the possibility of green tea as a disinfectant for dental appliances was discussed.The knowledge and awareness regarding the use of natural products like green tea for treatment among the general dental practitioners should be studied . It can be concluded that green tea is an excellent disinfectant for dental appliances but in order to prevent staining, the extract used must be minimal but enough.

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