RESEARCH ARTICLE

Effectiveness of Green Tea (*Camellia sinensis*) Mouth Rinse on Wound Healing after Gingivectomy

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Abstract

Background: Green tea or *Camellia sinensis* is regarded as a healthy drink as it contains polyphenols, especially catechins, which possess antioxidative, antimicrobial, anti-inflammatory, and angiogenic effects for healthy periodontium.

Aim and objective: To examine the effectiveness of green tea (*C. sinensis*) mouth rinse on wound healing after gingivectomy.

Materials and methods: Double-blind randomized controlled clinical trial was conducted among 36 participants with non-inflammatory gingival enlargement in the age group of 30–55 years who were randomly allocated with block randomization (18 participants in each group) for the study group (5% green tea mouth rinse) and the control group (0.12% of chlorhexidine mouth rinse). Wound healing was examined by plaque index, gingival index (GI), and bleeding on probing (BOP) before surgery and after the second and the fourth week of gingivectomy.

Results: Significant difference in plaque score ($p > 0.05$) between two groups at the second and the fourth week after gingivectomy was not detected, whereas GI mean score showed a decline in both groups at the fourth week, indicating statistical difference between groups at the fourth week ($p < 0.05$) in which GI score of the control group is more decreased than the study group. Similarly, the mean BOP scores in both groups showed no statistical significance ($p > 0.05$) between the study and the control groups at the second and the fourth week.

Conclusion: This study indicated that green tea mouthwash has comparable efficacy to chlorhexidine mouthwash on wound healing after gingivectomy.

Clinical significance: Green tea mouthwash could be employed as a cost-effective, long-term used herbal mouthwash with antiplaque and anti-inflammatory properties and no obvious side effects as opposed to chlorhexidine mouthwash after surgical procedures.

Keywords: Antibacterial, Gingivectomy, Green tea, Periodontal wound healing.

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Introduction

Green tea has been focused for researches because of the health benefits of its polyphenols contents known as catechins (–)-epigallocatechin gallate (EGCG), (–)-epicatechin gallate (ECG), (–)-epicatechin (EC), and (–)-epigallocatechin (EGC),[1] which inhibited against periodontal pathogens, *Porphyromonas gingivalis*, and *Prevotella* spp., with 1.0 mg/mL of minimum inhibitory concentration (MIC).[2] In addition, green tea also impeded the attachment of *P. gingivalis* to oral epithelial cells below 0.25 mg/mL of concentration.[3] Periodontal breakdown is lessen[4] by collagenase inhibiting property of catechin which also obstruct cysteine proteinase of *P. gingivalis*.[5] Moreover, a 4-week rinsing with dilute catechin solution decreases halitosis due to periodontal disease as EGCG sanitize methyl mercaptan.[6]

Wound healing involves multiple cellular and biochemical processes, such as inflammation, angiogenesis, and collagen deposition. The presence of inflammation and poor vessel formation are the main causes of delayed wound healing.[7]

Periodontal therapy is indicated for the restoration of anatomy and the function of periodontium. Gingival enlargement is frequently seen case and associated with many etiological factors, such as dental plaque, mouth breathing, hormonal imbalance, and medications.[8]

The potency of green tea extract on healing process of surgical wounds in rats has promising results.[9,10] Effectiveness of green tea mouthwash on wound healing after crown lengthening procedure has also proved to be beneficial on dental biofilm and inflammation of gingiva.[11] Green tea catechin mouthwash showed comparable antiplaque efficacy to chlorhexidine gluconate for 7 days of usage.[12]

Green tea mouthwash (5%) is also more beneficial for controlling pain and mouth-opening limitation, in comparison with chlorhexidine.[13] In this research, the effect of green tea mouth rinse on wound healing after gingivectomy will be investigated with clinical parameters.

There are many types of antiseptic mouthwash available in our country, which are imported from foreign countries and rather expensive for most of the people. As green tea is locally available and inexpensive, so its use as mouthwash may be beneficial for our community. Therefore, usage of green tea mouthwash after periodontal surgery may be beneficial for patients in our daily practice.

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Materials and Methods

Patients with non-inflammatory hyperplastic gingival enlargement (n = 36), who had previously given consents, were selected according to the selection criteria. Baseline periodontal parameters were recorded and blood investigations of complete blood count, bleeding time, clotting time, and screening for retroviral test, HBsAg, anti-HCV Ab, and random blood sugar were performed. Before surgery, all participants were treated with non-surgical periodontal therapy as scaling and root planing (SRP). After 1 week of SRP, patients with gingival enlargement were treated with gingivectomy. Antibiotic amoxicillin with the dose of 500 mg Tid for 7 days and an analgesic paracetamol 500 mg were prescribed orally after gingivectomy. The patients were randomly selected with block randomization method to the study and the control groups (18 subjects each). To be double blind, each patient received closed opaque plastic bottle containing mouthwash which was given by supervisor without knowing of both participant and researcher. From 24 hours after surgery, participants of the study group and the control group were instructed to rinse the assigned mouth rinse two times per day. After the second and the fourth week, healing was examined with parameters scores [plaque index (PI), gingival index (GI), bleeding on probing (BOP)] (Flowchart 1, Figs 1 and 2).

Data Analysis

The mean value of PI, GI, and BOP was used to calculate the results. Non-normal distribution was detected and Mann–Whitney test was applied in comparison between the study and the control groups. Confidence interval was set to 95% and power was 80% (Tables 1 to 3).

Flowchart 1: Outline of the procedure

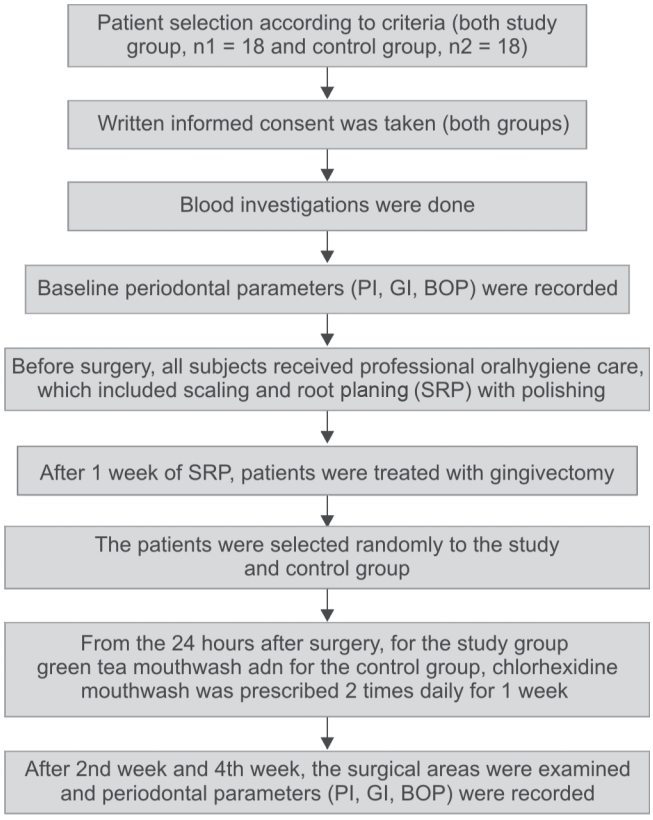

Fig. 1: Green tea leaves

Fig. 2: 500 mL of methanol and 100 g of grinded dried green tea leaves to achieve 5% w/v green tea aqueous extract

Table 1: Comparison of plaque index (PI) between the study and the control groups at the baseline, the second week, and the fourth week following gingivectomy (n = 36)

	Study group (green tea) (n = 18)	*Control group (chlorhexidine) (n = 18)*	
Variable	*Mean ± SD*		*p value**
PI (baseline)	2.11 ± 0.58	2.11 ± 0.58	1.000
PI (2nd week)	2 ± 0.49	2.06 ± 0.24	0.674
PI (4th week)	0.61 ± 0.61	1.28 ± 0.46	0.075

*Mann–Whitney test; $p < 0.05$—significant

Table 2: Comparison of gingival index (GI) between the study and the control groups at the baseline, the second week, and the fourth week following gingivectomy (n = 36)

	Study group (green tea) (n = 18)	*Control group (chlorhexidine) (n = 18)*	
Variable	*Mean ± SD*		*p value**
GI (baseline)	1 ± 0	0.94 ± 0.24	0.317
GI (2nd week)	1.33 ± 0.77	1.28 ± 0.67	0.577
GI (4th week)	0.67 ± 0.59	0.39 ± 0.5	0.038

*Mann–Whitney test; $p < 0.05$—significant

Table 3: Comparison of bleeding on probing (BOP) between the study and the control groups at the baseline, the second week, and the fourth week following gingivectomy ($n = 36$)

	Study group (green tea) (n = 18)	*Control group (chlorhexidine) (n = 18)*	
Variable	*Mean ± SD*		*p value**
BOP (baseline)	0.61 ± 0.61	0.83 ± 0.51	0.210
BOP (2nd week)	0.11 ± 0.32	0.33 ± 0.59	0.198
BOP (4th week)	0	0.06 ± 0.24	0.317

*Mann–Whitney test; $p < 0.05$—significant

Fig. 3: Preoperative condition of the gingival enlargement of the subject

Fig. 4: Gingival condition of the subject at the second week after giving green tea mouthwash following gingivectomy

Fig. 5: Gingival condition of the subject at the fourth week after giving green tea mouthwash following gingivectomy

Results

The PI indicated the decline of mean PI score both in the study and the control groups at the second and the fourth week clinically and statistical difference (*p* value—0.674 and 0.075) between two groups at the second and the fourth week after gingivectomy was not found, whereas there was a slight rise of GI score in both groups. By contrast, GI mean score showed a decline at the fourth week in the study and the control groups, respectively. Statistical difference was significant between the study group and the control group at the fourth week (*p* value—0.038) after gingivectomy in which GI score of the control group is more decreased than the study group. In the parameter of BOP, Table 3 demonstrates a steady decline of BOP mean scores were recorded in both groups at the second and the fourth week clinically, but there was no statistical significance (*p* value—0.317) between the study and the control groups (Figs 3 to 5).

Discussion

In the present study, the mean PI score decreased slightly from the baseline (2.11) to the second week (2) and declined significantly from the second to the fourth week (2 to 1.61), whereas in the control group showed the same manner as in the study group (2.11–2.06 at the second week; 2.06–1.28 at the fourth week). Furthermore, PI score of the study group (green tea) at the fourth week was not markedly different from that of the control group (chlorhexidine). In comparison, there was no significant difference (*p* value—0.674 and 0.075) between two groups at the second and the fourth week after gingivectomy. Therefore, plaque reduction effect of green tea mouthwash is not more than chlorhexidine mouthwash. The possible reason for the reduction of plaque could be explained by the antibacterial activity of catechins that can inhibit the growth of periodontal pathogens, such as *P. gingivalis*, *Prevotella intermedia*, and *Prevotella nigrescens*, and the attachment of *P. gingivalis* onto human buccal epithelial cells.[4] The current PI score results were in accordance with the result of the study conducted by Kaur et al. in which antiplaque action between green tea catechin mouthwash with chlorhexidine gluconate in the 7-day period.[12] In addition, a study by Jenabian et al.[14] on effectiveness of 5% *Camellia sinensis* (green tea) mouthwash in plaque-induced gingivitis showed that significant improvement in PI was observed during the study but not indicated a statistically significant level.

There was a slight rise of GI score in both groups at the second week comprising 1.33 ± 0.77 in the study group and 11.28 ± 0.67 in the control group. By contrast, mean GI scores were declined in both groups at the fourth week, showing 0.67 ± 0.59 in the study group and 0.39 ± 0.5 in the control group. The significant difference is found between the study and the control groups at the fourth week (*p* value—0.038) after gingivectomy in which GI score of the control group was more decreased than the study group. In this study, there was a temporary rise in the GI score at the second week in both groups after gingivectomy. It may be due to an increase of inflammatory cells in the connective tissue adjacent to the gingival sulcus though inflammatory cells are decreasing elsewhere on the wound. This may be attributable to the slower healing rate seen in the area of the future epithelial attachment, despite the epithelium has already covered the wound. This possible explanation has a greater clinical significance, because the gingiva will appear normal at this stage, while the epithelial attachment has several weeks to go before healing is completed.[15] The decline in the mean GI score at the fourth week in the study group could be explained by catechins properties in decreasing the production of IL-1 and TNF-α mediators and enhancing the production of the anti-inflammatory cytokine, IL-10.[16,17] Furthermore, green tea inhibits the production of nitric oxide (NO) synthase by downregulation in the transcription of nuclear factor-kB (NF-kB) as it acts as a control for the expression of a large amount of proinflammatory genes, EGCG may act a modulating inflammatory process.[18] Moreover, Awadalla et al.[19] examined the effect of a 2% green tea mouth rinse for 5 minutes in 25 patients, showing a statistically significant reduction in inflammation. In addition, the present data of GI score reduction are in line with the data of the study on green tea extract-based mouth rinse by Forouzanfar et al.[11]

In the study, GI score in the control group is more decreased than the study group at the fourth week after surgery and it seems that chlorhexidine is more effective in the reduction of gingival inflammation. However, mean BOP score of the study group was 0, whereas 0.06 ± 0.24 in the control group which indicated that there was scanty amount of inflammation in the study group. The data in comparison of the clinical parameters showed that there was no statistical significance between the study and the control groups but there was obvious reduction in parameters clinically in the study group. This means that green tea mouthwash has similar reduction in inflammation as chlorhexidine. In addition to comparable efficacy to chlorhexidine, green tea mouthwash has no obvious adverse effects, such as taste changes, allergic processes, and staining.

There was a steady decline of BOP score in the study group from the baseline (0.61 ± 0.61) to the second week (0.11 ± 0.32) and the fourth week (0). Interestingly, there was no inflammation at the surgical site clinically at the fourth week. This may be due to the fact that when granulation tissue is transformed into the new lamina propria, there is decrease in vascularity and further organization of tissue elements. On the other hand, there was a steady fall of BOP scores (0.83 ± 0.51 to 0.33 ± 0.59 at the second week and 0.33 ± 0.59 to 0.06 ± 0.24 at the fourth week) in chlorhexidine group which indicated that there was a scanty amount of inflammation in contrast to BOP score in the green tea group. This means that green tea mouthwash seems to be better in the reduction of bleeding than chlorhexidine. However, mean GI scores of the both groups were not exceeded than mean score 1, which indicated that there was mild inflammation but no BOP was detected in clinical recording. This clinical result was in accordance with statistical data and it may be due to a small amount of tannin and vitamin K within green tea that might improve bleeding score.[20] Moreover, a study conducted by Forouzanfar et al.[11] in which the effectiveness of green tea mouthwash on wound healing after crown lengthening showed that the differences in BOP ($p < 0.0001$).

In summary, the green tea mouthwash has antiplaque properties which decreased gingival inflammation that showed the decline of the clinical parameters of PI, GI, and BOP scores. Overall, the effect of 5% green tea mouth rinse can be compared with 0.12% chlorhexidine gluconate mouth rinse on wound healing after gingivectomy.

Conclusion

The study indicated that green tea mouth rinse possesses antibacterial, anti-inflammatory properties which has decreased the clinical parameters of PI, GI, and BOP scores and has a similar efficacy and effectiveness to chlorhexidine on periodontal wound healing following gingivectomy. Since green tea is locally available and cost-effective, green tea herbal extract mouthwash can be used alternatively to chlorhexidine mouthwash after periodontal surgery to promote periodontal wound healing without obvious side effects.

Clinical Significance

This study suggested that 5% green tea mouth rinse can be used as an alternative herbal mouth rinse with no significant side effects, such as taste changes, allergic processes, and staining, compared to 0.12% chlorhexidine gluconate after gingivectomy.

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