



Does the adjunctive use of green tea improve periodontal indices in patients undergoing non-surgical periodontal treatment?



A summary of the full literature review conducted

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Question

In adult patients with periodontal disease, undergoing non-surgical periodontal treatment, does the adjunctive use of green tea improve periodontal indices?

Introduction

The British Society of Periodontology (BSP) describe periodontal disease (PeD) as a 'chronic inflammatory disease of bacterial aetiology that affects the supporting tissues around the teeth'.¹ It is 'caused by an imbalance between oral biofilms and the host's response, in which there is a possibility of loss of tooth support tissues'.²

Treatment is achieved via removal of biofilm from affected surfaces; absolute eradication is not always accomplished due to several factors. The use of adjunct agents has been utilised in previous years; the Scottish Dental Clinical Effectiveness Programme (SDCEP) reviewed evidence and concluded the use of local microbial adjuncts alongside non-surgical periodontal treatment (NSPT) can lead to reductions in some periodontal indices. The quality of the evidence was low therefore they could not support microbial adjunct use.³ The focus of adjunct therapy by BSP and SDCEP is concentrated around antimicrobials eg antibiotics and chlorhexidine gluconate. Long term use of both can have side effects including bacterial resistance, loss of/alteration to taste, staining and allergic reactions. Increasing concerns surrounding antibiotic resistance and side-effects of long-term chlorhexidine use are resulting in growing interests in herbal alternatives. Green tea (GT) exhibits promising benefits due to polyphenols; these have an antioxidant and antibacterial effect on pathogens such as *Porphyromonas gingivalis*

and *Prevotella intermedia*;⁴ *in vitro* studies have suggested that GT catechins inhibit periodontal pathogens and the destruction of periodontal tissue.⁵

With growing concern over antibiotic resistance and reported increases in chlorhexidine allergies, I want to ascertain if there is a place for herbal antimicrobial adjunctive therapy alongside conventional NSPT.

Methodology

Searches were conducted in Web of Science, Cochrane Library and PubMed, references from papers were also perused. Studies were restricted to English, published between 2011–2021, participants aged 18–80 years old undergoing NSPT were included.

Critical appraisal was implemented using the Critical Appraisal Skills Program.⁶

Results

Seven hundred and seven papers were identified, inclusion criteria assessed and duplicates removed, leaving four systematic reviews (SRs) and ten randomised controlled trials (RCTs); all sit high on the Hierarchy of Evidence.

The SRs examined 64 studies with mixed conclusions, the consensus being that GT may help reduce parameters but due to heterogeneity results should be viewed cautiously.

The RCTs explored different applications of GT. Clinical parameters measured, indices and instruments used varied. GT solutions were produced locally with differing preparations. Results favoured the use of GT in improving clinical parameters associated with PeD.

DISCUSSION

RCTS

Catechin strips

Two trials study the use of Hydroxypropyl Cellulose strips (HPC) containing catechin. Hattarki, Pushpa and Bhat⁷ conducted a five-week split mouth, placebo-controlled RCT with 20 participants aged over 35. Participants had over 20 natural teeth with pocket depths over 5 mm. Forty contralateral sites were studied. Measurements at baseline, one week and five weeks. Statistical significance (SS) was $P < 0.05$.

Kudva, Tabasum and Shekhawat⁸ conducted a 21-day, split mouth RCT with 14 participants aged 30 to 55. Participants had pocket depths between 5–8 mm. Twenty-eight contralateral sites were studied. Measurements at baseline and 21 days. SS P value was not clarified.

Both studies looked at gingival index (GI) and plaque index (PI) using the same indices

but different probes, Kudva, Tabasum and Shekhawat⁸ additionally looked at probing pocket depth (PPD). Reductions in all parameters were SS in both groups.

In both studies HPC strips were manufactured locally, no formulations or strengths were indicated. Randomisation was not described meaning possible allocation bias. Sample sizes were small, and power calculations (PC) were not conducted. Confidence Intervals (CI) were not reported thus reliability of results is uncertain.

The methodology of both studies is vague suggesting unreliable evidence quality.

Gel applications

Three studies examined thermo-reversible gel application. Chava and Vedula⁹ split mouth, placebo controlled RCT ran over four weeks with 30 participants; ages were not indicated. Probing Depths (PD) were between 4–6 mm in over 30% of sites. Sixty contralateral sites were studied. Data collected at baseline and four weeks. SS was $P < 0.05$.

The evaluator was blinded to results which reduced bias; however, allocation bias is possible as randomisation was by coin toss. There was no mention of indices or instruments used, although probing sites and measurements were standardised in all areas by using an acrylic stent. All results were SS favouring use of GT gel improving PD and GI.

Nagate *et al.*¹⁰ conducted a split mouth RCT over 28 days with 20 participants aged 20–40. Participants had PDs between 4–6 mm, 40 contralateral molars were studied with measurements at baseline and 28 days. Participants were recalled at 14 days for gel re-application. SS was $P < 0.05$. Randomisation was stated but not explained suggesting possible allocation bias. Coe-pak dressings

were placed in both sites to eliminate evaluator bias. Indices and instruments used were omitted from the methodology. Reductions in all parameters were SS, it should be noted that P values in the data tables were reported as 0.000, making me question whether their results have been rounded to the nearest whole number or if there were problems with their data, whilst P 0.000 is possible it is 'generally frowned upon because it suggests there was absolutely zero chance of getting the results if the null hypothesis was true'.¹¹

Rattanasuwan *et al.*¹² conducted a double-blind, placebo controlled RCT over six months with 48 participants, no ages specified. PDs between 5–10 mm without furcation involvement, caries or restorations were required. Data collected at baseline, one week, three weeks and six months. Gel application was carried out at days one, seven and 14. SS was $P < 0.05$. Randomisation was stratified and allocation was via sealed envelope reducing allocation bias and ensuring an even gender split between groups. Although there was no mention of indices used there was a thorough discussion regarding methodology. Results were SS, there was no significant difference between groups for PPD and clinical attachment loss (CAL), the results were more favourable in reducing bleeding on probing (BOP) and GI.

PCs were carried out by Chava and Vedula⁹ and Rattanasuwan *et al.*¹² only. No CIs were reported in any of the studies and Nagate *et al.*¹⁰ and Rattanasuwan *et al.*¹² sample sizes were small therefore result reliability is uncertain. Gels was produced locally resulting in different formulations, strengths, reactive times and temperatures. Gel applications were carried out at varying intervals resulting in interstudy comparisons being problematic.

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GT beverage

Three trials examine the use of GT as a beverage. Chopra *et al.*¹³ performed a three-month double blinded, placebo controlled RCT with 120 participants aged between 20–50, all participants were homogeneous in lifestyles and diets. Participants had mild to moderate periodontitis with CAL under 5 mm. Measurements at baseline, one and three months. SS was $P < 0.001$. Randomisation was by coin toss indicating possible allocation bias. Evaluator calibration omitted so uniformity is questionable. All results were SS in favour of GT use with the greatest results seen in the GT group at the end of three months.

Deshpande, Deshpande and Mafoud¹⁴ conducted a six-month three arm RCT with 42 participants aged between 21–43. Participants had chronic periodontitis (CP) and a minimum of 20 teeth. Measurements at baseline, three and six months. SS was $P < 0.05$. Block randomisation was combined with coin toss method which could cause allocation bias. One original participant was removed prior to the trial commencing with no mention of how it was decided who would be removed leading to potential allocation bias. Sample sizes were small. SS was $P < 0.05$. PI and bleeding index (BI) were SS for all groups with scaling and root planing (SRP) and GT showing the best results. Like Nagate *et al.*¹⁰ there were P values of 0.000 leaving some questionability around results. Overall results favoured the use of GT.

Taleghani *et al.*¹⁵ carried out a six-week RCT of 30 participants with an average age of 45. Participants were required to have PD equal to or over 5 mm in at least two teeth with BOP present and CAL had to be less than 3 mm. Measurements taken at baseline and six weeks. P value not clearly stated casting uncertainty on what figure they based their SS on. There was no information on how randomisation or blinding was carried out suggesting a high risk of bias. The sample size was small. Results show SS reduction in all parameters for both groups with GT shown to have a positive impact on improving effects of SRP.

Chopra *et al.*¹³ is the only study which carried out a PC, none of the studies carried out CIs so the results need to be looked at cautiously. Taleghani *et al.*¹⁵ used commercially available teabags whereas the others manufactured their own. Components, tea strengths, tea bag weights, additives, consumed quantities, brewing instructions and what could/not be added ie milk, sugar etc varied between studies. Like the gel studies, comparisons between results are difficult.

Dentifrice

The double blinded RCT by Hrishu *et al.*¹⁶

investigated GT as a dentifrice, comparing it with commercially available fluoride and triclosan containing dentifrice. This was a four-week study compromising 30 participants aged between 18–60. Participants had PD over 4 mm in at least six sites. Measurements baseline and four weeks. SS was $P < 0.05$. Randomisation was by coin toss which could cause allocation bias. Clinician calibration absent as where PC or CIs, consequently results should be viewed with caution. The sample size was small. The dentifrice was prepared locally and did not include triclosan or fluoride which should be considered when interpreting the data. Results were SS at the end of the trial with no significant intergroup comparisons between PPD and PI. Conclusions favoured the use of GT in controlling GI, BOP and CAL, however, although PI and PPD decreased, results were inconclusive.

Luan has a patent issued for this new scaler tip which leads to a conflict of interest and could bias results in favour of this equipment. This trial was the only one which mentioned the new staging and grading system introduced in 2017. These specific scaler tips and adapted units make it incomparable with other studies, regardless of positive results the additional equipment investment may deter practices.

No untoward effects were reported during any of the trials.

SRs

Castro *et al.*² reviewed 21 papers discussing the use of antioxidants as adjuvants to periodontal treatment and highlighted the strong relationship between oxidative stress and periodontal disease and how it can be a two-way path. Seven databases were searched to answer a clearly focused question. Dates up

‘Components, tea strengths, tea bag weights, additives, consumed quantities, brewing instructions and what could/not be added ie milk, sugar etc varied between studies.’

Scaler solution

Wang *et al.*¹⁷ carried out a split mouth, double blinded, placebo controlled RCT over six months compromising 20 participants; age was not specified. Inclusion requirements were PDs ≥ 4 mm and BOP in maxillary dentition, except wisdom teeth, hopeless or to be extracted teeth with CAL in over 30% of sites. Measurements at baseline, three and six months. SS was $P < 0.05$. Randomisation was by coin toss potentiating allocation bias. Sample sizes were small. PC was conducted but no CIs mentioned. Inter-examiner calibration was conducted. Results at three months indicated both test and control sites showed SS PD and CAL gain with no difference between groups. PD and CAL for the test group were SS at six months compared to control group showing that the results favour the use of GT in improving PD and CAL. This trial required specific scalers and tips manufactured by Guangdong SKL Medical Instrument Co. Ltd. The scaling solution was locally manufactured, implying ingredients, strengths and stability are not comparable. It should be noted that Dr

to February 2019 were included. Papers were split into three subgroups: GT, lycopene and other antioxidants; high risk of bias studies were excluded from calculations, Standardised Mean Differences (SMD) and 95% CIs used. Heterogeneity and random effects models were used to generalise results from the meta-analysis due to the studies not being equal. Risk of bias was assessed using Cochrane Collaborations and ROBINS tools and quality of evidence was assessed using the GRADE tool. Reviewer calibration omitted leading to uncertainty over their similarity. SR was part government funded so could lead to bias.

Results found GT was a good adjunct to periodontal therapy with positive effects on PI, GI, BOP and CAL. Further longitudinal studies were recommended.

Gartenmann *et al.*⁴ reviewed eight studies investigating topical applications of GT substances. Five databases were utilised. Studies in English, German and Spanish up to 2017 were included. Bias was assessed using Cochrane Collaborations tool. SMD and 95% CIs used. Heterogeneity measured using

I²-test finding a high heterogeneity of studies. Clinical parameters evaluated were PPD, PI and GI. Results found adjunctive application of GT catechins resulted in beneficial reduction of PD compared to SRP without placebo. The results are subject to high risks of bias and heterogeneity, so caution is advised when interpreting them. Certainty of evidence was not assessed and inclusion criteria limiting the use of GT as a topical application limited the number of included studies.

Mazur *et al.*¹⁸ searched three databases, dates ranged from 1950 to 2019, 26 papers assessed GT for managing periodontitis and caries, specific languages were considered which could lead to bias. SMD and 95% CIs used. Heterogeneity measured using I²-test and high heterogeneity of studies found. Clinical parameters considered were GI, PI, BOP, GBI, PPD and CAL. Results found positive effects of GT on periodontitis however more homogeneous studies required. This review contains very open search terms and a very broad scope resulting in this SR feeling, in my novice opinion, incomplete.

Melo *et al.*¹⁹ reviewed seven databases and grey literature investigating the different forms and applications of GT for periodontal treatment. No language restrictions were imposed, dates searched up to July 2020 with nine studies found. SMD and 95% CIs used, and heterogeneity measured using I²-test. Risk of bias assessed through Cochrane Risk of Bias tool and certainty of evidence assessed through the GRADE approach. Reviewer calibration using Cohen's Kappa coefficient, scoring 0.862, showed almost perfect equality. Clinical parameters considered were PPD, CAL, BOP, PI and GI. Results found GT as an adjunct has minimal effect on periodontal parameters. This conclusion was reached due to heterogeneity, risk of bias, inconsistency and confounding.

Conclusion

Having reviewed all evidence there are still unanswered questions. Many studies failed to state participant oral hygiene routines prior/during trials. Several of the RCTs were in Asia with no mention of participant nationality so results may not consider, or be applicable to all ethnicities, which can prejudice results.

Recommendations

The studies suggest that GT as an adjunct to NSPT can result in improved clinical parameters. The use of locally formulated adjuncts combined with the different indices and instruments used, the varying durations of studies and the differences in participant inclusion/exclusion criteria are confounding. Further studies over longer timespans with

larger sample sizes, greater ethnic diversity and homogeneity in indices, instruments and composition of medicaments are required to strengthen the evidence base.

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Since this article was written Jeniffer has passed her exams and is now a fully qualified dental therapist.