ORIGINAL ARTICLE

Non-Surgical Periodontal Therapy Improves Clinical Outcomes in Patients with Chronic Periodontitis Independent of the Use of Nigella Sativa Oil or Normal Saline Mouthwash; Randomized Controlled Trial

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OBJECTIVES: Chronic periodontitis (CP) is an inflammatory disease of microbial origin that harms the health of the oral tissues. The objective of this study was to analyz the effects of *Nigella sativa* oil mouthwash given for two weeks after non-surgical therapy in patients with CP.

METHODOLOGY: This study was a parallel-arm randomized controlled trial that was conducted after ethical approval and registered with clinicaltrials.gov. The trial followed the guidelines of CONSORT and triple blinding was ensured. A total of fifty voluntary participants, after giving consent and being evaluated for clinical parameters of CP that included Periodontal Pocket Depth (PPD), CAL (Clinical Attachment Loss), PI (Plaque Index) and BoP (Bleeding on Probing) were divided into a control group and a treatment group. Both groups underwent scaling and root planning and were given normal saline solution or *Nigella sativa* oil respectively to be used as mouthwash daily for two weeks. The clinical parameters were recorded after two weeks and data was analyzed using SPSS (version 25.0).

RESULTS: It was noted that a statistically significant change was found in the pre-treatment and post-treatment values of all CP parameters in both the groups after the use of normal saline and *Nigella sativa* oil mouthwash. No statistically significant results were obtained when clinical parameters were evaluated between the two groups.

CONCLUSION: The clinical periodontal parameters of PI, CAL, PPD and BoP improved in both study groups two weeks following non-surgical periodontal therapy irrespective of the *Nigella Sativa* oil-based mouthwash or normal saline-based mouthwash used. It is suggested that either both types of mouthwashes had a beneficial effect or sub-gingival ultrasonic instrumentation itself was enough for improvement of periodontal health irrespective of the mouthwash used.

KEYWORDS: *Nigella sativa*, Chronic periodontitis, Normal Saline, Oral Health, Dental, Non-surgical Periodontal Therapy

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INTRODUCTION

Chronic periodontitis (CP), an inflammatory condition of supporting structures of teeth, that affects more than 75% of the adult population of Pakistan .[1-3] CP presents with clinical attachment loss (CAL) leading to periodontal pockets and bleeding on probing (BoP). In general, an individual can have periodontitis when one or more sites around the tooth have CAL ≥1 mm, periodontal pocket depth (PPD) of >3 mm and inflammation leading to BoP.[4] CP is initiated and mediated through the commensal oral micro-biota that forms the dental plaque. This micro-biota interacts with the immune defense mechanisms of the individual and propagates disease which if untreated leads to tooth loss and systemic inflammation.[5] Individuals with CP are at a higher risk of many other disease conditions including cardiovascular disease, diabetes mellitus, preterm birth, Alzheimer's disease chronic

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obstructive pulmonary disease and kidney disease.[6] The goal of the periodontal treatment is to limit microbial invasion into periodontal tissues by controlling plaque and calculus deposits at early stages through scaling and/or root planning, followed by at home use of teeth-cleaning aids such as dentifrices and mouthwashes.[7]

Medicinal plants have been used for over hundreds of years as a holistic approach for cure of oral and dental diseases. Among the various medicinal herbs that are being widely used in maintaining oral health such as gum arabic, aloe vera, miswak, clove, neem etc, *Nigella sativa* (NS) also known as *"kalongi"* in Urdu language is an herbal plant that is often used as a home remedy for dental problems. Its active ingredient known as thymoquinone (TQ) gives it anti-viral, anti-inflammatory, anti-microbial and anti-parasitic properties.[8] Previously, the role of TQ in rat models of CP has been explored where its administration reduced the severity of gingivitis and decreased alveolar bone resorption.[9] Rats treated with TQ in drinking water or an oral gel were shown to have significantly lower periodontal indices as compared to control groups with no sign of inflammation on mandibular histology in the treatment group.[10] The anti-microbial effects of NS against periodontal pathogens are also documented in literature indicating its possible role in the healing of CP.[11,12] Therefore, it was hypothesized that there will be a difference between the use of NS oil-based and normal saline-based mouthwashes in terms of improvement in periodontal parameters two weeks after non-surgical periodontal therapy in patients suffering from CP.

METHODOLOGY

We have recently published the detailed methodology of this parallel-arm randomized controlled trial that was conducted at Department of Periodontology, FMH College of Medicine & Dentistry, Lahore Pakistan from January 2018 to June 2019, after ethical approval from the institutional ethical committee vide letter number FMH-07-2017-IRB-268-F.[13,14] The trial was registered with clinicaltrials.gov (NCT03270280) and followed the CONSORT guidelines.[13,14] The duration of clinical use of mouthwash in this trial was two weeks and details regarding inclusion and exclusion criteria, consent approval, blinding procedure, flow charts etc have been described in our recent publications.[13,14] The sample size was calculated by using the following comparison of mean formula keeping the power of study at 90% and and 5% margin of error based on published values of one of the variables (MMP-8) of the study.[13,15]

$$n = \frac{(Z_{1-\beta} + Z_{1-\frac{\alpha}{2}})^2(\sigma_1^2+\sigma_2^2)}{(\mu_1-\mu_2)^2}$$

Where, n= number of samples in each groups, $Z_{1-\beta}$= Z score for power of study at 90%= 1.28, $Z_{1-\alpha/2}$= Z score for level of significance at 5%= 1.96. The calculated sample size in each group came out to be eighteen; however, sample size was increased to twenty-five participants in each group in order to compensate for the potential drop-outs.[13] A total ninety-three participants were initially screened for CP using the clinical periodontal parameters of plaque index (PI), CAL, PPD and BoP. Among these, fifty individuals having CP were selected as per the inclusion criteria[13,14] and were randomized into two groups of twenty-five participants each, as per the sample size, in which treatment group received NS oil-based mouthwash and the control group received normal saline solution as mouthwash.[13,14]

The recommended dose of NS oil-based mouthwash for this study was calculated as 500 mg (five ml or fifty-five drops) of NS oil, as per previously published.[13,14,16] Same amount was recommended for normal saline solution that was designated as a placebo in this study. A total of eighty ml of NS oil and the normal saline mouthwashes were dispensed in amber bottles which were sequentially numbered and triple blinding was ensured to avoid any bias in the study.[13,14]

All CP patients underwent scaling and root planning therapy and were instructed to apply five ml of the mouthwash on the gingivae with the help of a clean and dry finger, twice daily for two weeks.[13,14] All participants were instructed not to eat or drink for approximately thirty minutes after the use of the mouthwash. No other commercially available mouthwash or any other adjunct therapy was advocated to any of the participant. After using mouthwash for two weeks, all study participants were asked to report for re-assessment of clinical periodontal parameters.[13,14]

STATISTICAL ANALYSIS

All the collected data was coded and analyzed using IBM Statistical Package for the Social Sciences (SPSS, Version 25.0). The variables of age, CAL, PPD, PI, and BoP were presented as means and standard deviations (SDs). Wilcoxon signed-rank test was used to compare the pre-treatment and post-treatment changes in mean values of these clinical periodontal parameters within both the groups while Mann Whitney-U test was computed to observe the differences in periodontal parameters between the two study groups. For all analysis, p value of < 0.05 was considered statistically significant.

RESULTS

As reported previously, a total of forty participants (twenty in each group) completed the study till the end hence a loss to follow-up of twenty percent was observed. The mean of age of the study participants in treatment group and control group was 36.39±8.14 years and 38.27±7.44 years respectively.[13,14]

The pre-treatment and post-treatment changes in the mean values of clinical CP parameters within both the groups were analyzed. It was noted that a statistically significant difference was found in the pre-treatment and post-treatment values of all CP parameters in both the groups (Table 1). This indicated that the clinical CP parameters improved in both the treatment and the control groups irrespective of the mouthwash used.

Table 1: Comparison of Clinical Parameters of Chronic Periodontitis before and After Treatment within Each Study Group

Clinical Parameters	Assessment measure	*Nigella Sativa* Group	*P* value*	Normal Saline Group	*P* value*
PPD (mm)	Pre-treatment	3.21±0.627	0.001	3.08±0.71	0.003
	Post-treatment	2.99±0.57		2.93±0.69	
CAL (mm)	Pre-treatment	1.31±0.735	0.002	1.32±0.67	0.003
	Post-treatment	1.18±0.68		1.23±0.64	
PI (%)	Pre-treatment	69.15±11.56	0.000	68.85±10.66	0.000
	Post-treatment	61.95±12.20		65.35±10.71	
BoP (%)	Pre-treatment	43.15±18.16	0.000	35.20±15.61	0.000
	Post-treatment	28.70±15.84		29.85±15.35	

Upon comparison of clinical parameters within the group, a statistically significant value is observed for all clinical parameters in both the groups. PPD: Periodontal Pocket Depth, CAL: Clinical Attachment Loss, PI: Plaque Index, BoP: Bleeding on Probing. * Level of Significance.

Table 2: Comparison of Pre-treatment and Post-treatment Values of Clinical Parameters of Chronic Periodontitis between Treatment and Control groups

Clinical Parameter	Assessment measure	Treatment Group	Control Group	*P* value
PPD (mm)	Pre-treatment	3.21±0.627	3.08±0.71	0.665
	Post-treatment	2.99±0.57	2.93±0.69	0.903
CAL (mm)	Pre-treatment	1.31±0.735	1.32±0.67	0.946
	Post-treatment	1.18±0.68	1.23±0.64	0.776
PI (%)	Pre-treatment	69.15±11.56	68.85±10.66	0.946
	Post-treatment	61.95±12.20	65.35±10.71	0.303
BoP (%)	Pre-treatment	43.15±18.16	35.20±15.61	0.151
	Post-treatment	28.70±15.84	29.85±15.35	0.871

PPD: Periodontal Pocket Depth, CAL: Clinical Attachment Loss, PI: Plaque Index, BoP: Bleeding on Probing. All the clinical parameters of pre-treatment groups except BoP are almost similar in both the study groups. *Level of significance

Using Mann Whitney-U test (Table 2) the mean values of clinical parameters of CP before treatment were similar so the two groups had the same severity of CP at the baseline. The post-treatment PPD, CAL, PI and BoP values of control & treatment groups have been shown in table 2 and the findings highlighted that the difference in improvement of periodontal health between the treatment and control group was not statistically significant, indicating that periodontal health improved in both trial arms with no difference between groups after two weeks of use of NS oil-based or normal saline-based mouthwashes.

DISCUSSION

The World Health Organization (WHO) has advocated the use of medicinal plants in treatment of any disease condition owing to their promising results and fewer side effects. The organization also encourages developing countries to use medicinal plants as a resource in their health care systems.[8] Keeping in view the anti-inflammatory and anti-microbial potential of NS in mind, we investigated the efficacy of NS oil-based mouthwash as an adjunct therapy measure for unhealthy periodontium for two weeks after initial scaling and root planning. We used normal saline as placebo adjuvant solution in our control group. Interestingly, following scaling and root planning, we found that use of both normal saline mouthwash and NS oil-based mouthwash had statistically significant results regarding improvement in the clinical parameters of CP after two weeks of usage. These results can have two potential implications, one that that both NS oil and normal saline solution have a beneficial effect on improvement of clinical periodontal parameters and two that clinical periodontal parameters improve due to the non-surgical periodontal therapy and any mouthwash used would have a limited effect.

As for the effectiveness of NS oil-based mouthwash in the present study, other studies support the claim. A study compared the efficacy of mucoadhesive TQ gel mucoadhesive NS extract after scaling and root planning in chronic periodontitis patients. It was found that the use of adjunct treatment to mechanical debridement was more effective in treatment of chronic periodontitis as compared to mechanical treatment by scaling and root planning alone.[17] It has also been shown that application of a biodegradable periodontal chip containing TQ for sixty days following conventional scaling and root planning significantly reduced clinical periodontal parameters of CP in patients as compared to the chlorhexidine group. This study advocated the use of TQ-based chips in chronic periodontitis patients as an adjunctive therapy during the scaling and root planning, or

for follow-up visits.[18] Another study also reported an improvement in clinical parameters of CP after scaling and root planning followed by use of TQ gel in patients with CP as compared to patients undergoing scaling and root planning alone. The results of this study indicated the importance of NS in periodontal treatment even after scaling and root planing.[19] Similarly, another study found the use of TQ gel in chronic periodontitis patients significantly led to improvement of parameters of CP as compared to those patients that had only scaling and root planning done. This indicated that use of NS oil also leads to improvement in clinical parameters of CP.[20]

As regards to normal saline-based mouthwashes, there is mixed data available. Normal saline solution is commonly used as a gargle-based home remedy for conditions such as cough, sore throat and as a mouthwash for oral ulcers.[21] An in vitro study advocated the use of short-term rinsing with saline mouthwash solution for improvement of oral health. This study showed the saline solution promoted human gingival fibroblasts migration and increased the expression of extracellular matrix including collagen-I and cytoskeletal proteins such as F-actin.[22] Another study compared the effectiveness of use of normal saline and chlorhexidine for five days in reducing dental plaque in patients with chronic periodontitis. The use of normal saline solution proved to be as effective as chlorhexidine and thus the authors suggested that saline mouthwash rinse can be utilized as an adjunct measure for plaque control and promotion of oral health.[21] Our study has also suggested the normal saline solution can be an effective measure for improvement in all clinical parameters of CP after initial scaling and root planning has been performed.

The second implication is that both the mouthwashes had a negligible effect on the improvement of clinical periodontal parameters which would have been improved even after simple use of sub-gingival ultrasonic instrumentation (SUI) for scaling and root planning as SUI is in itself reported as an effective measure in removing the periodontal bacteria thus improving healing in the deeper periodontal tissues.[23,24] Following SUI, different studies have employed the use of mouthwashes including normal saline, povidone-iodine, chlorhexidine and some essential oils ranging in follow-up from two weeks to six months but all the studies did not find any difference in the type of mouthwash used for healing and concluded that the use of SUI through sub-gingival plaque removal and bacterial cell disruption achieved by the vibrating chipping action of the scaler tip, cavitational activity, and acoustic micro-streaming alone is effective for controlling and treating periodontal disease.[23-25] In our study, we also performed scaling and root planning and then patients were advised to apply a minimal amount of NS oil or normal saline solution to their gingiva for two weeks. It is possible that we found an improvement in clinical parameters just due to performing of SUI. This also suggested the possibility that the improvement of clinical parameters of CP in our study could be due to the role of scaling and root planning alone without any adjunct therapy mouthwashes, however, the limitations of the current findings was the use of NS oil mouthwash for only two weeks duration and therefore results cannot be generalized for longer duration studies. Future studies on NS oil may focus on increased sample sizes and longer duration use with follow-up at different time points.

CONCLUSION

It is concluded that the clinical periodontal parameters of PI, CAL, PPD and BoP in the present study improved after two weeks following non-surgical periodontal therapy in both CP groups using NS oil-based mouthwash and normal saline-based mouthwashes. Thus either both mouthwashes had a beneficial effect on clinical parameters or non-surgical periodontal therapy itself was enough for improvement of periodontal health irrespective of the mouthwash used.

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AUTHORS' CONTRIBUTION

GH did experiments and manuscript writing.
SG conceived, designed, did manuscript writing, provided critical revisions through intellectual output and did final approval of the manuscript.
SA provided critical revisions through intellectual output and did manuscript writing
SC provided critical revisions through intellectual output and did manuscript writing.
ZAK provided clinical assistance and gave intellectual output during the sampling procedure

CONFLICT OF INTEREST

The authors have no conflict of interest

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