ORIGINAL RESEARCH

EFFECT OF COCONUT OIL ON PLAQUE –INDUCED GINGIVITIS: A CLINICAL STUDY

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ABSTRACT

Background: Recent studies and literature regarding the use of "oil pulling" therapy especially using virgin coconut oil have resulted in reduction of plaque-induced gingivitis. There are still a few evidences in literature of studies regarding the properties of coconut oil in relation to the oral cavity.Hence, the present study was conducted to assess the effect of coconut oil on plaque formation and plaque-induced gingivitis.

Materials and method:45 Mild to moderate cases of plaque-induced gingivitis aged between 18-35 years were enrolled in the study. Gingival Index and Modified Plaque Index were used for clinical assessment. All the subjects after that were advised to take 10 ml of edible coconut oil and were instructed to follow this procedure of oil pulling for 5 minutes after brushing the teeth, preferably in the morning on empty stomach for 30 consecutive days. The parameters were recorded at baseline, 7th day, 15th day and 30th day, for which the patients were recalled at these days for reevaluation of parameters used for assessment.

Results: The results of this study showed that out of 45 patients, 27(60%) were females and the remaining 18 (40%) were males. On statistical analysis, statistically significant difference was found Gingival Index in the mean values Baseline and 7th day (p=0.000), Baseline and15th day (p=0.000), and Baseline and 30th day (p=0.000).A statistically significant difference was found in the Plaque Index mean values Baseline and 7th day (p=0.000), Baseline and 15th day (p=0.000), and Baseline and 30th day (p=0.000). A statistically significant results in mean Plaque index was also observed between day 7 and 15 (p=0.000), and day 15 and day 30. (p=0.000)

Conclusion: From day 7 and on a continuous decrease in the indexes was reported and they were significantly reduced after 30 days of treatment. The results obtained from our study were significant, relevant, and promising; however, to be more statistically significant outcome, more studies are required to fully understand the mechanism of action of coconut oil.

Key words: Coconut Oil, Oil pulling, Plaque-induced gingivitis.

INTRODUCTION

Gingivitis is defined as reversible inflammatory disease characterized by inflammation, bleeding, gingival hypertrophy, edema, and absence of periodontal pockets.[1] It is multifactorial origin; however, the primary etiological factor is accumulation of plaque on the surfaces of teeth and gums. According to the classification of periodontal diseases, plaque-induced gingivitis is a gum inflammation which is induced by bacteria especially located on the gingival margin.

As plaque is considered the primary cause for periodontal disease, with first clinical appearance in the form of gingivitis, a proper and efficient oral hygiene plays a key role in maintaining the oral health and prevention of future destruction of periodontal structures. The professional mechanical removal of plaque is performed with manual, ultrasonic, and sonic instruments. Moreover, a proper home oral hygiene care is sufficient to reduce the accumulation of plaque on soft and hard surfaces, which further decreases the incidence of several gingival diseases.To achieve this, a correct use of manual or electric toothbrushes, combined to mechanical interdental cleaning, is mandatory. Furthermore, additional chemical plaque

control measures can be added, through the use of toothpaste and mouthwashes. Many substances can be used as an adjuvant in reducing plaque formation, but there are still few scientific evidence validating it.[2,3] Recent studies and literature regarding the use of "oil pulling" therapy especially using virgin coconut oil have resulted in reduction of plaque-induced ginigivitis.[4-8]. Other than coconut oil, sunflower oil, and sesame oil were also studied to reduce plaque induced gingivitis. "Oil pulling" is a term defining a traditional ayurvedic remedy consisting in rinsing the mouth with oil. This practice is mentioned in the text "Charak Samhita and Sushruta Samhita" as "Kavala Graha" or "Kavala Gandoosha.". Dr. F. Karach introduced the concept of oil pulling in 1990s in Russia, but his statements could not be sustained by evidence.[6]

Coconut oil (*Cocos nucifera*) is still a little-known product, obtained through the cold squeezing of the dried coconut copra. It has antibacterial, antiviral, antimycotic properties together with many others. It contains 92% of saturated acids, 49% of which is lauric acid, a medium chain saturated fat acid. Medium chain saturates and their derived products (e.g., monoglycerides) are effective in destroying a wide range of bacteria (lipid coated bacteria) demolishing their lipidic membrane. They can be effective, for instance, against the bacteria causing gastric ulcer, sinusitis, food poisoning, urinary tract infections, and caries.[9]

There are still a few evidence in literature of studies regarding the properties of coconut oil in relation to the oral cavity.Hence, the present study was conducted to assess the effect of coconut oil on plaque formation and plaque-induced gingivitis.

MATERIALS AND METHOD

It's a prospective interventional study. 50 Mild to moderate cases of plaque-induced gingivitis were enrolled in the study. Inclusion criteria included study population aged between 18-35 years with at least 20 teeth permanent teeth present in the oral cavity. Patients with history of pervious periodontal treatment, patients using anti-inflammatory drugs, topical antibiotics from past one month, and patients allergic to coconut oil were excluded from the study.

After verbal information to the patients about the nature and objectives of this study, informed consent was obtained from the subjects willing to participate in the study. All the patients after a thorough medical and medication history, and history regarding the current oral hygiene habits were subjected to clinical examination. To avoid the discrepancy in results, all the subjects were instructed correct brushing technique for maintenance of proper oral hygiene.

Clinical Parameters for examination
- Gingival Index (GI) by Loe and Silness (1963)
- Modified plaque Index (PI) by Silness and Loe (1967)

These parameters were used for clinical assessment in the present study. The clinical examination was performed by only one examiner. All the subjects after that were advised to take 10 ml of edible coconut oil for whichthe patients were given 30 pre-dosed bottles containing 10 ml of Coconut oil. (Patanjali's Virgin coconut oil),

Oil Pulling Procedure.

The patients were asked to sip 10 ml of edible coconut oil, through the teeth and then forcefully swish it from right side to left side, front to back, and vice versa for 5 minutes. Patients were asked to spit the liquid after 5 minutes of swishing, when the oil the turned into a frothy milky white color and become thin in consistency. All the patents were instructed to follow this procedure of oil pulling after brushing the teeth, preferably in the morning on empty stomach for 30 consecutive days.

Method

The parameters were recorded at baseline,7th day, 15th day and 30th day, for which the patients were recalled at these days for reevaluation of parameters used for assessment. Out of all 50 patients, 2 patients dropped out the study because they did not liked the taste of coconut oil and 3 patients did not completed the study, as they did not returned after first recall visit. None of the participant reported any adverse

effect with coconut oil pulling. So out of 50, complete data was collected 45 subjects, who completed the study. The data thus collected was put to statistical analysis.

STATISTICAL ANALYSIS

The data was grouped into a Microsoft excel sheet and statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. Results on categorical variables was presented as Number and Percentage and continuous as Mean and Standard deviation. The values of the gingival and plaque index at different recall visits were compared using student paired t-test. In our study, a two tailed Probability value (p-value) < 0.05 was considered as statistically significant and p-value ≤ 0.01 considered as highly significant. P-value > 0.05 was considered as non-significant.

RESULTS

The results of this study showed that out of 45 patients, 27(60%) were females and the remaining 18 (40%) were males. The ratio of females to males in this study was 1.4: 1. The mean age of the patients in the study population was found out to be 24.08 ± 4.18 years, with a range of 18-35 years. The results of clinical parameters are listed below.

Table 1 - Mean value for Gingival Index at different intervals of observations in the study population

Observation Interval	N	Mean	Std. Deviation
Baseline	45	1.06	0.06
Day 7	45	0.96	0.05
Day 15	45	0.83	0.06
Day 30	45	0.69	0.06
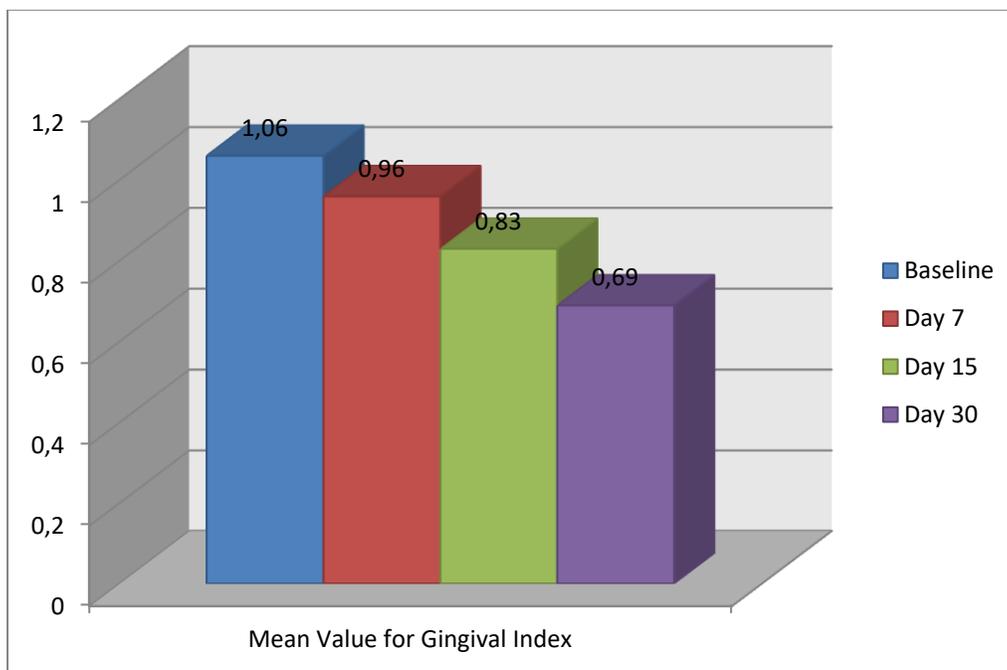
Figure 1 - Bar diagram showing the mean value for Gingival Index at different intervals of observations in the study population.

Table 2 – Correlation of Baseline Gingival Index with Mean Gingival Index at 7th, 15th and 30th day.

Sr.no	Observation period	GI values		Correlation of GI values between	P value	Sig
		Mean	Mean difference			
1	Baseline	1.06± 0.06	0.10	Baseline and Day 7	0.002	HS
2	Day 7	0.96±0.05				
3	Baseline	1.06±0.06	0.23	Baseline and Day 15	0.000	HS
4	Day 15	0.83±0.06				
5	Baseline	1.06±0.06	0.37	Baseline and Day 30	0.000	HS
6	Day 30	0.69±0.06				
7				Day7 and Day 15	0.000	HS
8				Day 15 and Day 30	0.000	HS
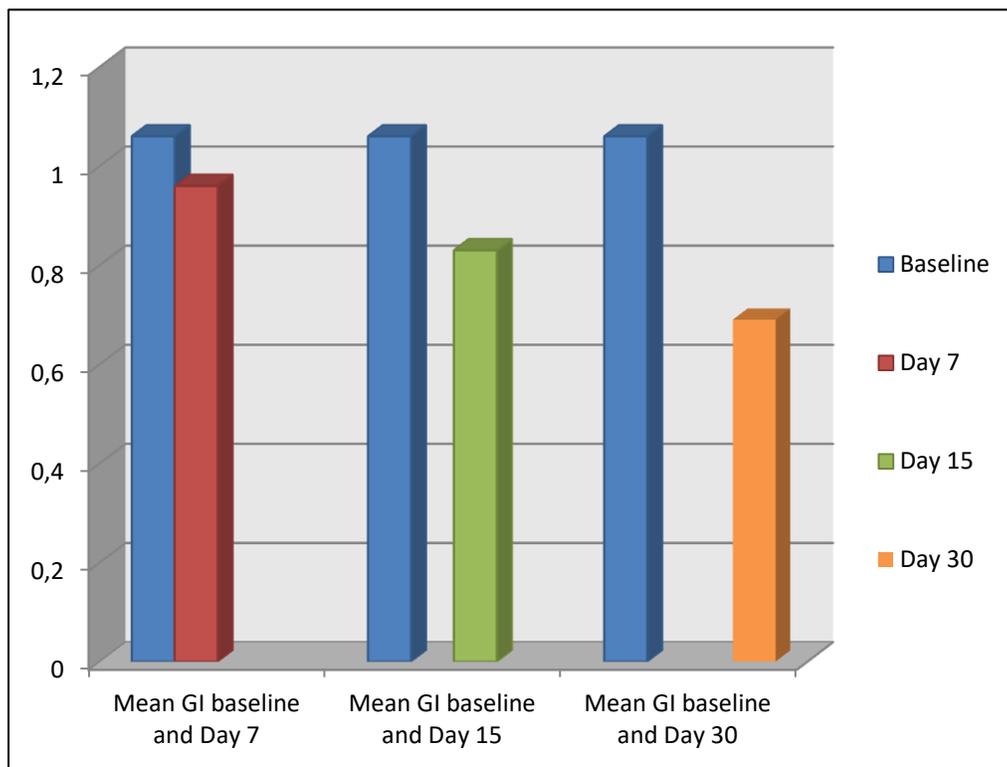
Figure 2 – Bar diagram showing Correlation of Baseline Gingival Index with Mean Gingival Index at 7th, 15th and 30th day.

The results showed that the mean values of Gingival Index at Baseline, 7th day, 15th day and 30th day was 1.06 ± 0.06, 0.96± 0.05, 0.83 ± 0.06, and 0.69 ± 0.06 respectively. **(Table 1, Figure 1).** On statistical analysis, statistically significant difference was found Gingival Index in the mean values Baseline and 7th day (p=0.000), Baseline and15th day (p=0.000), and Baseline and 30th day (p=0.000). Even the difference in mean gingival Index at day 7 and day 15 (p=0.000) and day 15 to day 30. (p=0.000) were highly significant. (**Table 2, Figure 2)**

Table 3 - Mean value for Plaque Index at different intervals of observations in the study population

Observation Interval	N	Mean	Std. Deviation
Baseline	45	1.68	0.27
Day 7	45	1.56	0.26
Day 15	45	1.36	0.23
Day 30	45	1.11	0.19
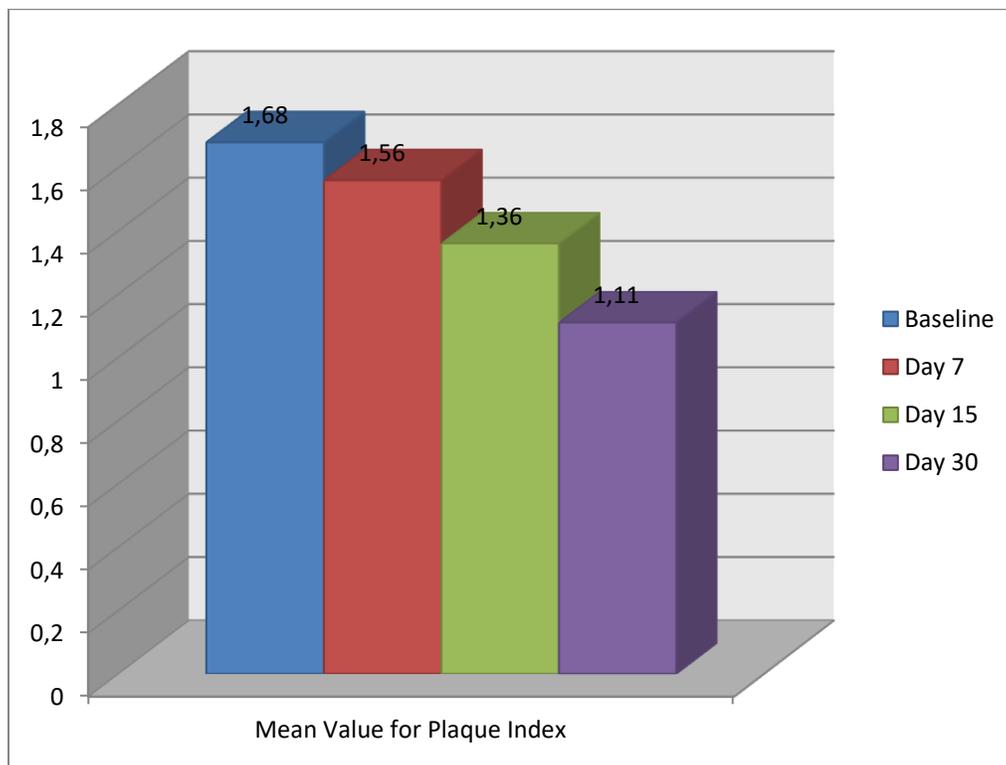
Figure 3 - Bar diagram showing the mean value for Plaque Index at different intervals of observations in the study population.

Table 4 – Correlation of Baseline Plaque Index with Mean Plaque Index at 7th, 15th and 30th day.

Sr.no	Observation period	PI values		Correlation of PI values between	P value	Sig
		Mean	Mean difference			
1	Baseline	1.68± 0.27	0.12	Baseline and Day 7	0.000	HS
2	Day 7	1.56±0.26				
3	Baseline	1.68± 0.27	0.32	Baseline and Day 15	0.000	HS
4	Day 15	1.36±0.23				
5	Baseline	1.68± 0.27	0.57	Baseline and Day 30	0.000	HS
6	Day 30	1.11±0.19				
7				Day 7 and Day 15	0.000	HS
8				Day 15 and day 30	0.000	HS
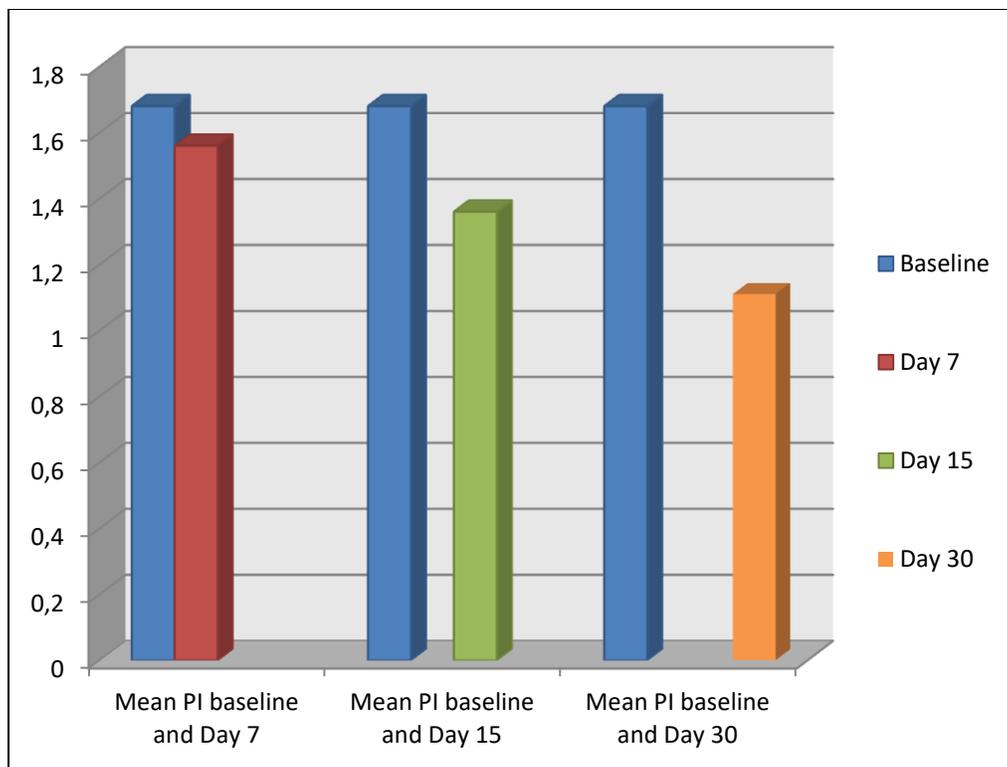
Figure 4 – Bar diagram showing Correlation of Baseline Plaque Index with Mean Plaque Index at 7th, 15th and 30th day.

The results showed that the mean values of Plaque Index at Baseline, 7th day, 15th day and 30th day was 1.68 $\pm$ 0.27, 1.56 $\pm$ 0.26, 1.36 $\pm$ 0.23, and 1.11 $\pm$ 0.19 respectively. **(Table 3, Figure 3).** On statistical analysis, a statistically highly significant difference was found in the Plaque Index mean values Baseline and 7th day (p=0.000), Baseline and 15th day (p=0.000), and Baseline and 30th day (p=0.000). A statistically significant results in mean Plaque index was also observed between day 7 and 15 (p=0.000), and day 15 and day 30. (p=0.000) **(Table 4, Figure 4)**

DISCUSSION

The primary cause of gingival inflammation is plaque. Dental plaque is defined clinically as a structured, resilient substance that adheres to intraoral hard surfaces and is composed of bacteria in a matrix of salivary glycoprotein and extracellular polysaccharides. Plaque induced gingivitis is the result of an interaction between plaque and the tissues and the inflammatory response of the host. It is associated with the subtle microbial alterations as the plaque matures.[9] It is believed that adjuncts are strongly recommended in treating the patients of gingivitis along with tooth brushing and other interdental aids. Recently in several studies, the use of coconut oil pulling has demonstrated to be very effective in reduction of plaque formation and therefore, reduce plaque-related gingivitis.

There are many theories regarding the mechanism of action of virgin coconut oil (VCO) during the present study, such as the antioxidants generated damaging the cell wall of microorganisms that are then killed; but also, the oily film generated by its emulsification, covers teeth and gums, reducing plaque and bacterial cohesion. Coconut oil also contains lauric acid that together with sodium hydroxide and bicarbonates creates a substance that reduces adhesion and plaque accumulation, having a cleaning action. Despite its ambiguous mechanism of action, some studies have clearly demonstrated an anti-inflammatory effect, together with the one against adhesion/ aggregation of plaque.[6]

The results of our study was in accordance with the study done by Peedikayil et al[8] (2015) on 60 adolescents aged between 16 and 18 affected by plaque-induced gingivitis. Our study included individuals

with age between 18-35 years. Similar to the present study, study by Peedikayil et al[8] (2015) observed a statistically significant decrease in plaque and gingivitis indexes after coconut oil pulling therapy. The subjects performed the mouth rinses in the early morning before eating, together with their daily oral hygiene routine (toothbrush and floss). They have been evaluated after 4 hours and PI and modified gingival index have been measured on day 1, 7, 15, and 30. From day 7 and on a continuous decrease in the indexes was reported and they were significantly reduced after 30 days of treatment. Their study observed a 50% drop in the indexes after 4 weeks compared with the ones obtained with chlorhexidine, concluding that coconut oil pulling is effective in reducing formation of plaque and gingivitis.

The results of our study are in line with Chalke et al[11] (2018)that showed a significant decrease in pre- and post-treatment scores of plaque index and gingival index by oil pulling method using coconut oil from baseline to 15th and 30[th]days ($P < 0.0001$). They included 75 age-matched (19–21 years) subjects with plaque-induced gingivitis. In their study subjects were advised to perform oil pulling with 5 ml of edible coconut oil every morning for 5 min on empty stomach and before tooth brushing. The clinical parameters such as plaque and gingival index scores were assessed periodically at baseline, 15th day, and 30th day. This study was similar to our study and results were in accordance to our study.

In a similar study done by Menaka V et al[12] (2019) to evaluate the benefit of oil pulling along with normal brushing techniques in adults under the age group of 35–44 years. In this study the authors included 40 healthy subjects belonging to both the sexes who presented with plaque-induced gingivitis and divided them into control and study groups. There was no significant difference between the scores at baseline indicating that the baseline mean values of both the groups were the same. The comparison was again done after 6 weeks of study between the mean gingival index and plaque index in Groups A and B, where the graphs show a significant difference between the two groups. There was a significant reduction in both mean gingival index and plaque index of Group A with mean ranging from 1.496 to 0.68 (mean gingival index) and 1.885 to 1.102 (mean plaque index) whereas in Group B, the mean value showed no statically significant reduction. The results were similar to our study, however we had only one group and the duration of evaluation in our study was 30 days (4 weeks) and in the study done by MenakaV et al was 6 weeks.

In a recent pilot study conducted by Ripari F et al[13] (2020) to evaluate the Role of Coconut Oil in Treating Patients Affected by Plaque-Induced Gingivitis had similar results to our study. In this study of 20 patients aged between 18-35 years clinical parameters for plaque formation and gingivitis—plaque index (PI), bleeding index (BI)—were evaluated during the recalls. (Baseline, 7th day, 15thday and 30 day) after coconut oil pulling. They divided the subjects in study and control group. The results of this study showed that the comparison of the pre- and post-treatment values of the single study group and the single control group showed a statistically significant result for $p < 0.01$, similar to the results of our study.

In all the studies mentioned, as well as in our study, natural co-adjuvants with specific properties, especially coconut oil used with oil pulling procedure, proved to be efficient in reducing the accumulation and aggregation of plaque and therefore PI and the further risk of plaque-induced gingivitis. There are numerous theories regarding the mechanism of action of coconut oil during this practice, such as the antioxidants generated damaging the cell wall of microorganisms that are then killed; but also, the oily film generated by its emulsification, covers teeth and gums, reducing plaque and bacterial cohesion. Coconut oil also contains lauric acid that together with sodium hydroxide and bicarbonates creates a substance that reduces adhesion and plaque accumulation, having a cleaning action. Despite its ambiguous mechanism of action, some studies have clearly demonstrated an anti-inflammatory effect, together with the one against adhesion/ aggregation of plaque.[14,15]

CONCLUSION

The main purpose to conduct this study was to consider this as a preliminary study for future research purposes. Limitations included limited literature on the topic of the study and small sample size. The results obtained from our study were significant, relevant and promising; however, to be more statistically significant outcome, more studies are required to fully understand the mechanism of action of coconut oil and to bring coconut oil pulling more into practice.

Despite having shown significant improvements in this study, the exact mechanism of this treatment is still unclear. It is therefore mandatory to open gateways for oral research in this product with larger sample sizes and more comparative studies are required with other adjuncts/products to demonstrate the anti-inflammatory as well as antibacterial effect of the coconut oil, so that the quality of evidence can be implemented.

Conflict of interest: The authors declared no conflict of interest.
Availability of data: The information regarding any resources and data availability that support the findings of this study should be directed to the corresponding author and will be considered upon reasonable request.
Consent for Participation: A written informed consent was taken from the patient after explaining them the purpose of study.

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