



RESEARCH ARTICLE

F.U. Med.J.Health.Sci.
2025; 39 (2): 171 - 178
<http://www.fusabil.org>

Vesile Elif TOY^{1, a}
Ekin Ezgi DOĞAN^{1, b}
Gizem GÜL^{1, c}

¹ İnönü University,
Faculty of Dentistry,
Department of
Periodontology,
Malatya, TÜRKİYE

^a ORCID: 0000-0001-5183-6295

^b ORCID: 0009-0004-6332-7315

^c ORCID: 0009-0008-7176-1524

Efficacy of Oil Pulling Therapy with Coconut Oil in Patients with Periodontitis: A Randomized Clinical Trial

Objective: The aim of this study was to compare the efficacy of oil pulling (OP), chlorhexidine mouthrinse (CHX) and saline rinse (SR) after nonsurgical periodontal treatment (NSPT) in patients with periodontitis.

Materials and Methods: Patients diagnosed with periodontitis were randomly assigned to one of the three intervention groups: OP group (oil pulling with coconut oil), CHX group (0.12% CHX mouthrinse) and SR group (2% saline rinse). All patients underwent NSPT and afterwards they were instructed to use their assigned adjunctive therapy daily for four weeks. Clinical periodontal parameters, including plaque index (PI), gingival index (GI), probing depth (PD), clinical attachment loss (CAL) and bleeding on probing (BOP), were measured at baseline and at 4-weeks. Additionally, patient perceptions and adverse events were evaluated through a questionnaire.

Results: Forty-five individuals (15 patients per group) participated in the study, at baseline no significant differences were found in any of the clinical periodontal parameters between the groups. At 4-weeks' follow-up, all three groups demonstrated a statistically significant reduction in all clinical parameters ($p<0.05$). OP and CHX groups presented similar levels of PI, GI, and BOP ($p>0.05$), while SR group exhibited higher levels ($p<0.05$). Oil pulling was associated with fewer adverse effects and patients in the OP group reported higher overall satisfaction with the product.

Conclusion: Oil pulling with coconut oil may be considered an effective adjunct to NSPT in managing periodontitis, providing clinical benefits similar to CHX mouthwash, but with the advantage of fewer adverse events.

Key Words: Chlorhexidin, non-surgical periodontal therapy, oil pulling, periodontitis

Periodontitisli Hastalarda Hindistan Cevizi Yağı ile Yağ Çekmenin Etkinliği: Randomize Klinik Çalışma

Amaç: Bu çalışmanın amacı periodontitisli hastalarda cerrahi olmayan periodontal tedavi (COPT) sonrasında oil pulling (OP), CHX gargara (CHX) ve tuzlu su gargarasının (SR) etkinliğini karşılaştırmaktır.

Gereç ve Yöntem: Periodontitis tanısı konulan hastalar rastgele üç müdahale grubundan birine atanmıştır: OP grubu (hindistan cevizi yağı ile yağ çekme), CHX grubu (%0.12 CHX gargara) ve SR grubu (%2 tuzlu su gargarası). Tüm hastalara COPT uygulanmış ve ardından dört hafta boyunca kendilerine atanan ek tedaviyi günlük olarak kullanmaları talimatı verilmiştir. Plak indeksi (PI), gingival indeks (GI), sondalama derinliği (SD), klinik ataşman kaybı (KAL) ve sondalamada kanama (SK) gibi klinik periodontal parametreler başlangıçta ve 4. haftada ölçülmüştür. Ayrıca, hasta algıları ve yan etkiler bir anket aracılığıyla değerlendirilmiştir.

Bulgular: Çalışmaya 45 kişi (her grupta 15 hasta) katılmış, başlangıçta gruplar arasında klinik periodontal parametreler açısından anlamlı bir fark bulunmamıştır. Dört haftalık takipte, üç grupta da tüm klinik parametrelerde istatistiksel olarak anlamlı bir azalma gözlenmiştir ($p<0.05$). OP ve CHX grupları benzer PI, GI ve BOP seviyeleri göstermiştir ($p>0.05$), ancak SR grubu daha yüksek seviyeler sergilemiştir ($p<0.05$). Oil pulling daha az yan etkiyle ilişkili bulunmuş olup OP grubundaki hastalar üründen genel olarak daha yüksek memnuniyet bildirmiştir.

Sonuç: Hindistancevizi yağı ile yağ çekme, periodontitis yönetiminde COPT'ye etkili bir destekleyici tedavi olarak düşünülebilir, CHX gargaraya benzer klinik faydalar sağlamakla birlikte, daha az yan etki avantajına sahiptir.

Anahtar Kelimeler: Cerrahi olmayan periodontal tedavi, klorheksidin, periodontitis, yağ çekme

Introduction

Periodontal disease is a widespread public health concern affecting nearly half of the global population and significantly impairing quality of life by causing tooth loss and edentulism (1). It is also closely associated with various systemic conditions in a bidirectional manner, thus improved periodontal health will contribute to better systemic health and overall well-being. Dysbiotic dental plaque is the primary etiological factor in periodontitis and mechanical debridement of supra- and subgingival dental biofilm by means of nonsurgical periodontal therapy (NSPT) remains the gold-standard for the

Received : 19.03.2025
Accepted : 28.05.2025

Correspondence

Vesile Elif TOY
İnönüUniversity,
Faculty of Dentistry,
Department of
Periodontology,
Malatya - TÜRKİYE

elif.toy@inonu.edu.tr

treatment of periodontitis (2). Furthermore, various adjunctive therapies to mechanical plaque control have also been used to improve treatment outcomes and patient compliance (3).

Patients are frequently recommended to use mouthwashes as adjuncts to NSPT. Chlorhexidine gluconate (CHX) is recognized as the gold-standard chemical plaque-inhibiting agent due to its well-established antimicrobial and antiinflammatory effects (4). When used alongside mechanical debridement, CHX mouthrinse improves supragingival plaque control and prevents subgingival bacterial recolonization by targeting bacterial reservoirs within the oral cavity. However, its use may lead to side effects such as tooth discoloration, increased calculus formation, oral mucositis, loss of taste and gingival hypersensitivity which may reduce patient acceptance (5).

Rinsing with saline solution is a traditional approach widely practiced across various cultures. Studies have demonstrated that salt water promotes wound healing and, similar to CHX, reduces pathogenic bacterial counts and plaque (6, 7). It has also been shown to decrease gingival inflammation and promote the healing of oral ulcerations. In an in-vitro study, rinsing human gingival fibroblasts with sodium chloride was found to facilitate healing by upregulating type-I collagen and fibronectin expression (6). Additionally, the antiinflammatory efficacy of salt water has been reported to be comparable to that of CHX (8).

Oil pulling (OP) is an ancient Ayurvedic practice that involves swishing edible oils in the mouth and has recently gained popularity as a complementary approach for providing local and systemic health benefits (9). Coconut oil, the most commonly used oil for OP, has been recognized for its antiinflammatory, antimicrobial and antioxidant properties (10). Previous studies have evaluated the role of OP as an adjunct to conventional oral hygiene practices and its effect on halitosis (11-13). Oil pulling with sesame oil has been reported to reduce halitosis and target associated microorganisms, demonstrating comparable efficacy to CHX (11, 12). Incorporating OP into participants' oral hygiene practices has been shown to reduce periodontal parameters and decrease the total colony count of aerobic microorganisms (14, 15). These findings suggest that OP may provide additional benefits in controlling oral biofilms and inflammation related to periodontitis.

Despite favorable effects of OP and increasing number of studies on OP in the literature, its efficacy as an adjunct to NSPT remains unexplored. To date, and to the best of our knowledge, no study has evaluated the effectiveness of OP as an adjunct to NSPT in comparison to CHX in patients with periodontitis. This gap in the literature emphasizes the need for well-designed clinical studies to assess both clinical and patient-centered outcomes. Therefore the present study was conducted to compare the efficacy of OP with coconut oil, CHX mouthrinse and saline rinse (SR) following NSPT in terms of clinical outcomes, patient-centered variables, and adverse events in the

management of patients with Stage 2 Grade A periodontitis. It was hypothesized that OP would be as effective as CHX mouthrinse in improving periodontal parameters.

Materials and Methods

Research and Publication Ethics: The study was approved by Malatya Clinical Studies Ethics Committee (2022/55), conducted in accordance with the Declaration of Helsinki (revised in 2013) and followed the CONSORT guidelines. Informed consent was obtained from all participants prior to enrollment.

Study Population: Patients who were referred to the Department of Periodontology at Inonu University, Faculty of Dentistry, for periodontal therapy between June 2022 and February 2023 were included in this randomized controlled clinical trial.

Patients diagnosed with Stage II Grade A periodontitis (interproximal attachment loss of 3-4 mm and radiographic bone loss at the coronal third) (16), over 18 years of age were included in the study. Exclusion criteria were smoking, alcohol use, systemic conditions that might affect the course of periodontitis (e.g., diabetes, cardiovascular, renal, or hepatic diseases), history of periodontal treatment within the past 12 months, use of antiinflammatory, antimicrobial, antioxidant, or immunosuppressive drugs in the past 6 months, known allergies to coconut oil or chlorhexidine, and pregnancy or lactation.

Study Design: After radiographic and clinical examinations, participants who met the above criteria were randomly assigned to one of the three intervention groups (n=15 each) using a computer-generated randomization by the study coordinator (VET). Allocation was concealed using sealed opaque envelopes. Oral rinses were provided by the same investigator. The study groups were as follows; OP Group: oil pulling with 10 ml of coconut oil (Cold Pressed Coconut Oil, Zade Vital, Türkiye) for 15 minutes twice daily; CHX Group: rinsing with 10 ml of 0.12% chlorhexidine gluconate mouthrinse (Kloroben, DROGSAN, Ankara, Türkiye) for 60 seconds twice daily; and SR group: rinsing with 10 ml of 2% saline solution for 60 seconds twice daily.

All participants underwent full-mouth NSPT, which involved scaling and root planing carried out by a single periodontist (EED) using ultrasonic scalers (Electro Medical Systems SA, Nyon, Switzerland) and hand instruments (Hu-Friedy, Chicago, IL, USA). Before NSPT, all patients were instructed for oral hygiene (the modified-Bass technique and interdental cleaning) and clinical periodontal measurements (plaque index [PI], gingival index [GI], probing depth [PD], clinical attachment level [CAL] and bleeding on probing [BOP]) were performed by one trained, calibrated examiner who was blinded to the intervention groups (GG). PD and CAL were measured at six sites (mesio/disto-buccal, mid-buccal, mesio/disto-lingual, and mid-lingual) for each tooth using Williams periodontal probe (Hu-Friedy, Chicago, IL, USA). All these parameters were

reassessed at the 4-week follow-up. The study was designed for 12-week follow-up, however, due to the earthquake, the follow-up at 12 weeks could not be conducted. Periodontal treatment was completed in two consecutive visits within 24 hours, without any supplementary therapies, including local or systemic antimicrobials. Following NSPT, participants were instructed to use their assigned adjunctive therapy daily for four weeks. In the OP Group, the subjects were asked to perform oil pulling in the morning right after waking up and before breakfast or oral hygiene and in the evening after oral hygiene. They were informed to pull the oil between their teeth, swish it throughout the mouth until the oil turned thin and milky white, spit it out on a paper towel without swallowing and throw it in the trash. All participants maintained regular oral hygiene practices, including brushing with a fluoridated toothpaste and interdental cleaning twice daily. They were also advised to use a timer to ensure proper rinse duration.

At the 4-week follow-up: (i) clinical periodontal parameters were measured, (ii) standardized intraoral photographs of the anterior teeth were captured for the evaluation of staining, (iii) a questionnaire was administered to assess patients' perceptions about the product and side effects, (iv) clinical adverse effects were evaluated by clinical examination, (v) patient compliance was determined by checking the remaining amount of the product.

Tooth staining was determined using standardized photographs of the anterior teeth and stain intensity was scored according to the modified Lobene index (17). Taste alterations and mucosal irritations were evaluated by the questionnaire and patient interviews during the 4-week follow-up. The presence of mucosal irritation was confirmed by intraoral examination. The taste of the mouthwash, the change in the flavor of food and beverages, staining, mucosal sensitivity, dryness, numbness, and burning sensation in the mouth caused by the mouthwash were assessed. A 10-point Visual Analog Scale was used for most questionnaire items, where 1 indicated a very negative and 10 a very positive experience, except for mucosal sensitivity, which was recorded categorically. In order to monitor the participants' compliance, they were instructed to return the product bottles at the follow-up visit.

Sample Size Estimation: The required sample size was calculated utilizing the G*Power 3.1.9.4 (Franz Faul, Universität Kiel, Kiel, Germany) software program. Given an effect size (d) of 0.821 and a standard deviation of 0.17 for the difference in probing pocket depth, it was calculated that a minimum of six participants per group would be required to achieve a study power of 80% with an alpha of 5% (18). However, considering possible dropouts and to enhance the power of the study, 15 patients per group (a total of 45 patients) were included.

Statistical Analysis: The data of the study was analyzed by using a software program (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). The normality of data distribution was assessed using the Kolmogorov–Smirnov test. In addition to descriptive statistical methods (minimum, maximum, mean, standard deviation, median, frequency), Oneway Anova was employed to compare normally distributed quantitative variables among groups. For parameters without normal distribution, Kruskal–Wallis test was used, followed by Dunn's post hoc test to identify intergroup differences. Intragroup comparisons of parameters with and without normal distribution were performed using the Paired samples t-test and Wilcoxon sign test, respectively. Qualitative variables were compared by Chi-square test and Fisher Freeman Halton Exact Chi-square test. A p value < 0.05 was considered statistically significant.

Results

A total of 45 patients, aged between 35 and 52 years (mean age 44.40 ± 4.50 years), of whom 18 (40%) were male and 27 (60%) were female, diagnosed with Stage II Grade A periodontitis were included in the study. They were randomly allocated into three groups; OP Group, CHX Group and SR Group, with 15 participants in each. There were no significant differences between the groups in terms of age, gender and medical history ($p > 0.05$). Only one patient in the OP group was allergic to penicillin, while another had hyperthyroidism. Table 1 shows the demographic data, with no statistically significant differences among the groups.

Table 1. Demographics of the study groups

		OP Group (n=15)	CHX Group (n=15)	SR Group (n=15)	p
Age, Mean $\pm$ SD		44.53 $\pm$ 4.34	44.93 $\pm$ 4.67	43.73 $\pm$ 4.71	¹ 0.767
Gender, n (%)	Female	9 (%60)	9 (%60)	9 (%60)	² 1.000
	Male	6 (%40)	6 (%40)	6 (%40)	
Systemic disease, n (%)	Yes	1 (%6.7)	0 (%0)	0 (%0)	³ 1.000
	No	14 (%93.3)	15 (%100)	15 (%100)	
Allergy, n (%)	Yes	1 (%6.7)	0 (%0)	0 (%0)	³ 1.000
	No	14 (%93.3)	15 (%100)	15 (%100)	

¹ Oneway ANOVA test

² Chi-square test

³ Fisher Freeman Halton Exact test

Table 2. Intragroup and intergroup comparison of changes in clinical variables

		OP	CHX	SR	<i>p</i>
		Mean±SD (median)	Mean±SD (median)	Mean±SD (median)	
PI	Baseline	1.52±0.5 (1.5) ^{Aa}	1.5±0.82 (1.2) ^{Aa}	1.51±0.44 (1.6) ^{Aa}	¹ 0.973
	4 weeks	0.16±0.15 (0.1) ^{Ab}	0.24±0.28 (0.1) ^{Ab}	0.64±0.34 (0.8) ^{Bb}	¹ 0.001*
	Change	-1.36±0.53 (-1.4) ^A	-1.26±0.91 (-1) ^A	-0.87±0.37 (-0.8) ^A	¹ 0.095
	² p	0.001*	0.001*	0.001*	
GI	Baseline	1.52±0.59 (1.8) ^{Aa}	1.47±0.57 (1.7) ^{Aa}	1.5±0.47 (1.6) ^{Aa}	¹ 0.814
	4 weeks	0.32±0.47 (0.2) ^{Ab}	0.35±0.39 (0.2) ^{Ab}	0.63±0.27 (0.6) ^{Bb}	¹ 0.006*
	Change	-1.2±0.64 (-1.2) ^A	-1.12±0.49 (-1) ^A	-0.87±0.26 (-0.9) ^A	¹ 0.203
	² p	0.001*	0.001*	0.001*	
PD	Baseline	2.48±0.49 (2.6) ^{Aa}	2.37±0.56 (2.3) ^{Aa}	2.35±0.46 (2.4) ^{Aa}	³ 0.770
	4 weeks	2.08±0.53 (2.2) ^{Ab}	2.09±0.50 (2.1) ^{Ab}	2.01±0.42 (2.2) ^{Ab}	³ 0.894
	Change	-0.4±0.29 (-0.3) ^A	-0.28±0.2 (-0.2) ^A	-0.34±0.19 (-0.3) ^A	¹ 0.426
	⁴ p	0.001*	0.001*	0.001*	
CAL	Baseline	3.08±0.7 (3.2) ^{Aa}	3.15±0.92 (2.9) ^{Aa}	3.01±0.44 (3.1) ^{Aa}	³ 0.867
	4 weeks	2.43±0.81 (2.3) ^{Ab}	2.6±0.86 (2.5) ^{Ab}	2.57±0.42 (2.7) ^{Ab}	³ 0.795
	Change	-0.66±0.45 (-0.5) ^A	-0.55±0.35 (-0.4) ^A	-0.44±0.21 (-0.4) ^A	¹ 0.445
	⁴ p	0.001*	0.001*	0.001*	
BOP (%)	Baseline	67.73±29.82 (80) ^{Aa}	67.53±30.02 (76) ^{Aa}	67.2±14.49 (66) ^{Aa}	¹ 0.947
	4 weeks	10.40±15.41 (4) ^{Ab}	10.87±7.07 (10) ^{Ab}	31.0±8.14 (28) ^{Bb}	¹ 0.001*
	Change	-57.33±28.22 (-60) ^A	-56.67±25.51 (-61) ^A	-36.2±12.91 (-34) ^A	¹ 0.053
	² p	0.001*	0.001*	0.001*	
PD (4-5)	Baseline	4.42±0.17 (4.4) ^{Aa}	4.51±0.29 (4.4) ^{Aa}	4.4±0.22 (4.4) ^{Aa}	¹ 0.575
	4 weeks	3.78±1.12 (4.1) ^{Ab}	3.92±0.21 (4) ^{Ab}	3.9±1.1 (4.1) ^{Ab}	¹ 0.056
	Change	-0.64±1.01 (-0.4) ^{AB}	-0.59±0.24 (-0.6) ^A	-0.5±1.11 (-0.2) ^B	¹ 0.012*
	² p	0.001*	0.001*	0.005*	
PD % (4-5)	Baseline	15.6±9.33 (14.4) ^{Aa}	15.81±9.33 (14.8) ^{Aa}	15.0±6.85 (14.4) ^{Aa}	¹ 0.970
	4 weeks	10.39±9.27 (8.3) ^{Ab}	10.49±7.84 (7.4) ^{Ab}	10.58±5.65 (8.7) ^{Ab}	¹ 0.828
	Change	-5.22±3.54 (-4) ^A	-5.32±3.56 (-4.8) ^A	-4.42±2.21 (-3.9) ^A	¹ 0.882
	² p	0.001*	0.001*	0.001*	
CAL (4-5)	Baseline	4.51±0.30 (4.6) ^{Aa}	4.62±0.51 (4.6) ^{Aa}	4.42±0.23 (4.5) ^{Aa}	¹ 0.384
	4 weeks	3.83±1.03 (4.2) ^{Ab}	4±0.35 (4) ^{Ab}	4.02±0.35 (4) ^{Ab}	¹ 0.251
	Change	-0.68±0.92 (-0.4) ^{AB}	-0.62±0.24 (-0.5) ^A	-0.4±0.42 (-0.3) ^B	¹ 0.010*
	² p	0.023*	0.001*	0.001*	
CAL % (4-5)	Baseline	16.41±9.46 (15.2) ^{Aa}	16.77±9.06 (14.8) ^{Aa}	15.5±9.33 (13.8) ^{Aa}	¹ 0.880
	4 weeks	11.32±8.4 (11.8) ^{Ab}	10.98±9.28 (8.3) ^{Ab}	10.61±7.53 (10) ^{Ab}	¹ 0.884
	Change	-5.09±2.85 (-5.6) ^A	-5.79±6.55 (-4.8) ^A	-4.89±2.79 (-4.8) ^A	¹ 0.960
	² p	0.001*	0.005*	0.001*	

¹ Kruskal Wallis test² Wilcoxon sign test³ Oneway ANOVA test⁴ Paired samples t test**p*<0.05 Different uppercase indicate differences between groups, while lowercase indicate intragroup

Table 3. Stain intensity and evaluation of questionnaire responses

	OP	CHX	SR	
	Mean±SD (median) (Min-max)	Mean±SD (median) (Min-max)	Mean±SD (median) (Min-max)	p
Lobene Index	0.27±0.46 (0) (0-1) ^A	1.67±2.66 (1) (0-8) ^B	0.27±1.03 (0) (0-4) ^A	0.007*
Taste of the mouthwash	9.33±0.9 (10) (7-10) ^A	5.87±2.53 (5) (2-10) ^B	4.2±2.08 (3) (2-8) ^B	0.001*
Duration of the mouthwash flavor after use	5.87±2.42 (7) (1-9) ^A	3.8±1.7 (3) (2-8) ^A	1.4±0.63 (1) (1-3) ^B	0.001*
Taste of food and drinks after use	7.67±2.58 (10) (5-10) ^A	3.67±1.95 (5) (1-5) ^B	4.27±2.4 (5) (1-10) ^B	0.001*
Dry mouth	1±0 (1) (1-1) ^A	2.13±1.85 (1) (1-8) ^B	1.47±0.52 (1) (1-2) ^B	0.007*
Oral numbness, and burning sensation	1±0 (1) (1-1) ^A	1.2±0.41 (1) (1-2) ^{AB}	1.73±1.22 (1) (1-5) ^B	0.047*
Discoloration of teeth and tongue	1±0 (1) (1-1) ^A	4.4±2.44 (5) (1-8) ^B	1.27±0.8 (1) (1-4) ^A	0.001*
Overall opinion about mouthwash	9.53±0.74 (10) (8-10) ^A	4.67±1.95 (5) (1-7) ^B	6.2±2.21 (6) (3-10) ^B	0.001*
Oral health improvement	9.27±1.58 (10) (5-10) ^A	4.53±2.07 (4) (1-7) ^B	6.2±2.21 (6) (3-10) ^B	0.001*
Mucosa Sensitivity _{n (%)}	0 (%0) ^A	0 (%0) ^A	5 (%33.3) ^B	¹ 0.004*

Kruskal Wallis test

*Fisher Freeman Halton Exact test

**p*<0.05

Different letters in the columns indicate differences between the groups

Clinical Periodontal Parameters: Full-mouth clinical periodontal parameter scores are presented in Table 2. There were no significant differences among the groups in terms of all clinical periodontal parameters (PI, GI, PD, CAL and BOP) at baseline (*p*>0.05), whereas all of them improved significantly at 4 weeks after NSPT (*p*<0.05). At the 4-week follow-up, PI, GI and BOP scores of the SR Group were significantly higher than those of the OP and CHX groups (*p*<0.05), indicating that both OP and CHX provided superior plaque control and gingival health compared to SR. While reductions in mean PD and CAL were observed across all groups, the CHX group showed significantly greater improvement in scores of sites with 4–5 mm PD and CAL compared to the SR group (*p*<0.05).

Patients' Perceptions and Side Effects: Stain index and the responses to the questionnaire are shown in Table 3. Assessment of tooth staining using the modified Lobene Index demonstrated that the CHX group had significantly higher staining scores compared to both the OP and SR groups (*p*=0.007), while no significant difference was observed between the OP and SR groups. In line with this, participants in the CHX group reported more frequent discoloration of the teeth and tongue.

Taste acceptance, regarding the taste of the mouthwash and taste of food/drinks after mouthwash use, was significantly higher in the OP group compared to CHX and SR groups (*p*=0.001). The retention time of the mouthwash flavor after use was significantly longer in the OP and CHX groups than in the SR group (*p*=0.001). In the OP group, the mouthwash-induced dry mouth score was significantly lower compared to the other two groups (*p*=0.007). Complaints of oral numbness and burning sensation were significantly lower in the OP group than in the SR group (*p*<0.05), while no significant differences were observed between the OP and CHX groups or between the CHX and SR groups (*p*>0.05). With regard to mucosal sensitivity caused by the mouthwash use, no complaints were

reported in the OP and CHX Groups, whereas 33.3 % of the participants in the SR Group complained (*p*=0.004). Scores for the patients' overall opinion about the mouthwash and its perceived impact on oral health improvement were significantly higher in the OP group than in both CHX and SR groups (*p*=0.001). Participants in the OP group also expressed a greater willingness to continue using the product long term, indicating better compliance potential.

Discussion

The current study evaluated the efficacy of OP with coconut oil in comparison to 0.12% CHX mouthrinse and 2% saline rinse. The findings verified the hypothesis that OP could improve clinical periodontal parameters similarly to CHX mouthrinse four weeks after NSPT, while the SR group demonstrated less improvement. Furthermore, the OP group experienced fewer side effects and reported higher satisfaction.

Periodontitis is a chronic inflammatory disease that impacts the supporting structures of the teeth, resulting in tissue destruction and potential tooth loss. NSPT is the standard treatment approach for managing periodontitis and additional use of antimicrobial mouthwashes is often suggested to ensure plaque control especially when proper oral hygiene can not be maintained. Since CHX is recognized as the "gold standard" antiplaque agent, it is often compared to other potential plaque-inhibitory agents or formulations. Similar to various studies in the literature evaluating the antiplaque efficacy of different agents, OP and SR were compared with CHX in this study (8, 11, 12).

The present results demonstrated that OP was similarly effective as CHX in improving clinical parameters while causing less tooth staining. One of the major deficits of CHX is tooth discoloration which limits its long-term use. This disadvantage along with others such as unpleasant taste and gingival hypersensitivity have prompted the search for alternative products that

may offer similar effectiveness with minimum side effects (5). Recently, Ayurvedic therapies have been progressively displacing standard treatment modalities due to their comparable efficacy (19). Therefore, OP could serve as a potential option when chemical antiplaque agents are recommended.

Oil pulling is a traditional Ayurvedic practice that originated in India and has now gained worldwide recognition. Though the definite mechanism of action is still not fully understood, it is proposed that the viscous nature of the oil inhibits plaque formation and prevents bacterial adhesion (14). The saponification process, which results from the alkali hydrolysis of fat, along with the antioxidant content of the oil, may also contribute to its antimicrobial and antiinflammatory effects (10, 20). It has been suggested that the antioxidants in the oil help eliminate microorganisms by preventing lipid peroxidation and enhance the effects of vitamin E. The primary goal of OP is to aid in the removal of heavy metals, toxins and bacteria that accumulate on the tongue and within the oral cavity overnight, thereby supporting the body's natural detoxification mechanisms. In addition, the lower incidence of side effects associated with OP may render it a preferable alternative to other chemical formulations.

Different oils such as sesame oil, sunflower oil and coconut oil can be used for OP (10). Coconut oil differs from the others due to its high content of medium-chain fatty acids, consisting of 92% saturated fats, approximately 50% of which is lauric acid (21). In addition to the antimicrobial and antiinflammatory properties attributed to lauric acid, coconut oil has been reported to exhibit antioxidant, immunomodulatory, anticarcinogenic, antidiabetic, antihyperlipidemic, oral protective, and neuroprotective effects (21). Owing to these characteristics, coconut oil was selected for use in the present study.

Despite its proposed benefits, studies on OP and dental health remain limited. Sood et al. (11) compared OP using sesame oil with a CHX-containing mouthrinse in patients with oral malodor and found both to be equally effective. The effects of OP using various oils on plaque accumulation and plaque-induced gingivitis have been assessed in several studies (14, 22, 23), all of which concluded that OP therapy effectively reduced PI, GI scores and plaque formation. Sezgin et al. (24) examined the antiplaque effects of OP with coconut oil and demonstrated that its plaque-inhibiting efficacy was comparable to that of CHX. However, a recent systematic review and meta-analysis evaluated the efficacy of OP in managing plaque, improving gingival health and reducing bacterial counts in comparison with CHX, various mouthwashes and other oral hygiene methods (25). It was indicated that while OP contributed to improved gingival health, CHX was more effective in reducing plaque accumulation. They concluded that, despite the potential clinical benefits of OP, the overall evidence remained inconclusive.

This study is the first to evaluate the efficacy of OP therapy using coconut oil in patients with periodontitis.

The clinical improvements observed in all groups reinforce the effectiveness of NSPT in managing periodontitis. However, the OP and CHX groups exhibited greater reductions in PI, GI, and BOP compared to the SR group, indicating superior efficacy in plaque control and reduction of gingival inflammation. The significantly greater improvements in scores of sites with 4–5 mm PD and CAL in the CHX group compared to the SR group further emphasize the well-established antimicrobial properties of CHX.

It is commonly believed that rinsing with salt water may help reduce gingival inflammation and promote the healing of oral ulcers. Studies have suggested that salt water may facilitate healing by inducing vasodilatation and enhancing the accumulation of phagocytes at the wound site (26, 27). Additionally, salt water alkalizes saliva, imparting bacteriostatic characteristics. Contrary to our findings, Osunde et al. (26) suggested that rinsing with saline was as effective as CHX in minimizing inflammation following surgical procedures. A recent randomized controlled trial, performed by Collins et al. (8), evaluated the antiinflammatory effects of 0.12% CHX compared to saline rinse after periodontal surgery. A significant reduction in GI was observed in both groups with respect to baseline values, with no notable difference between the groups at the 12-week follow-up. It was concluded that salt water and 0.12% CHX exhibited similar antiinflammatory efficacy. In another study, 2% NaCl rinse combined with peri-implant mechanical debridement was found to significantly reduce soft tissue inflammation, however its antiinflammatory effectiveness compared to 0.12% CHX remains uncertain (28).

Patient perception and satisfaction play a crucial role in determining long-term adherence to oral hygiene practices. In our study, OP was associated with fewer side effects compared to CHX and SR. The CHX group exhibited significantly higher stain index scores, which was consistent with patient-reported concerns about tooth and tongue discoloration. Additionally, participants in the CHX and SR groups reported higher dissatisfaction due to the flavor of the mouthwash and its negative impact on the taste of food and beverages, compared to those in the OP group. However, the retention of mouthwash flavor after use was significantly shorter in the SR group. In contrast, the OP group reported significantly lower scores for dry mouth compared to both the CHX and SR groups, indicating greater tolerability. With regard to oral numbness and burning sensation, participants in the OP and CHX groups reported similar responses. Patients in the OP group also exhibited higher overall satisfaction with the product as they perceived it to improve their oral health, which may contribute to better compliance over time. A major drawback of CHX is its well-documented adverse effects, including staining, altered taste perception and mucosal irritation. Our findings support these concerns, as CHX users reported significantly higher levels of taste alteration, dry mouth and staining compared to those in the OP group. Conversely, OP was well tolerated, with no complaints of mucosal sensitivity or discomfort.

The findings of this study suggest that OP with coconut oil may serve as an effective adjunct to NSPT, comparable to CHX in improving plaque and gingival indices while exhibiting fewer side effects. Given the growing interest in natural and holistic approaches to oral care, OP may represent a viable alternative for patients seeking to avoid the side effects commonly associated with CHX. However, the extended duration required for OP may negatively affect patient adherence. On the other hand, CHX remains superior to SR in reducing PD and CAL, reinforcing its position as the gold standard in adjunctive periodontal therapy. The limitations of SR, both in terms of clinical outcomes and patient comfort, suggest that it may not be the most suitable long-term adjunct for the management of periodontitis.

Despite promising findings, this study is limited by a small sample size and short follow-up period. Longer-

term studies are needed to evaluate the sustained benefits of OP and to compare its effectiveness with that of CHX beyond the four-week period. Furthermore, microbiological and inflammatory biomarker analyses may offer deeper insights into the mechanisms underlying the effects of OP. Future research should also explore the use of different oil types and determine the optimal duration of OP for achieving periodontal health benefits.

In conclusion, coconut oil pulling was found to be as effective as CHX in improving clinical periodontal parameters while demonstrating better patient tolerance and fewer side effects. Given its natural composition, OP may serve as a promising adjunct being an alternative to CHX, especially in patients with CHX allergy. However, further research involving larger sample sizes and longer follow-up periods is needed to confirm its long-term efficacy in periodontal therapy.

References

- Chen MX, Zhong YJ, Dong QQ, Wong HM, Wen YF. Global, regional, and national burden of severe periodontitis, 1990-2019: An analysis of the Global Burden of Disease Study 2019. *J Clin Periodontol* 2021; 48(9): 1165-1188.
- Sanz M, Herrera D, Kebschull M, et al. Treatment of stage I-III periodontitis-The EFP S3 level clinical practice guideline. *J Clin Periodontol* 2020; 47(S22 Suppl 22): 4-60.
- Kwon T, Lamster IB, Levin L. Current concepts in the management of periodontitis. *Int Dent J* 2021; 71(6): 462-476.
- Figueró E, Herrera D, Tobías A, et al. Efficacy of adjunctive anti-plaque chemical agents in managing gingivitis: A systematic review and network meta-analyses. *J Clin Periodontol* 2019; 46(7): 723-739.
- Kotsailidi EA, Kalogirou EM, Michelogiannakis D, Vlachodimitropoulos D, Tosios KI. Hypersensitivity reaction of the gingiva to chlorhexidine: Case report and literature review. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2020; 130(2): 156-160.e1.
- Huynh NC, Everts V, Leethanakul C, Pavasant P, Ampornaramveth RS. Rinsing with saline promotes human gingival fibroblast wound healing in vitro. *PLoS One* 2016; 11(7): e0159843.
- Aravinth V, Aswath Narayanan MB, Ramesh Kumar SG, Selvamary AL, Sujatha A. Comparative evaluation of salt water rinse with chlorhexidine against oral microbes: A school-based randomized controlled trial. *J Indian Soc Pedod Prev Dent* 2017; 35(4):319-326.
- Collins JR, Veras K, Hernández M, et al. Anti-inflammatory effect of salt water and chlorhexidine 0.12% mouthrinse after periodontal surgery: A randomized prospective clinical study. *Clin Oral Invest* 2021; 25(7):4349-4357.
- Gbinigie O, Onakpoya I, Spencer E, et al. Effect of oil pulling in promoting oral dental hygiene: A systematic review of randomized clinical trials. *Complement Ther Med* 2016; 26: 47-54.
- Naseem M, Khiyani MF, Nauman H, et al. Oil pulling and importance of traditional medicine in oral health maintenance. *Int J Health Sci (Qassim)* 2017; 11(4): 65-70.
- Sood P, Devi MA, Narang R, Swathi V, Makkar DK. Comparative efficacy of oil pulling and chlorhexidine on oral malodor: A randomized controlled trial. *J Clin Diagn Res* 2014; 8(11): ZC18-21.
- Asokan S, Kumar RS, Emmadi P, Raghuraman R, Sivakumar N. Effect of oil pulling on halitosis and microorganisms causing halitosis: A randomized controlled pilot trial. *J Indian Soc Pedod Prev Dent* 2011; 29(2): 90-4.
- Shanbhag VK. Oil pulling for maintaining oral hygiene - A review. *J Tradit Complement Med* 2016; 7(1): 106-109.
- Asokan S, Emmadi P, Chamundeswari R. Effect of oil pulling on plaque induced gingivitis: A randomized, controlled, triple-blind study. *Indian J Dent Res* 2009; 20(1): 47-51.
- Peedikayil F, Sreenivasan P, Narayanan A. Effect of coconut oil in plaque related gingivitis-A preliminary report. *Niger Med J* 2015; 56(2): 143-7.
- Caton JG, Armitage G, Berglundh T, et al. A new classification scheme for periodontal and peri-implant diseases and conditions - Introduction and key changes from the 1999 classification. *J Clin Periodontol* 2018; 45(Suppl 20): S1-S8.
- Grundemann LJ, Timmerman MF, Ijzerman Y, van der Weijden GA. Stain, plaque and gingivitis reduction by combining chlorhexidine and peroxyborate. *J Clin Periodontol* 2000; 27(1): 9-15.
- García-Gargallo M, Zurlohe M, Montero E, et al. Evaluation of new chlorhexidine- and cetylpyridinium chloride-based mouthrinse formulations adjunctive to scaling and root planing: pilot study. *Int J Dent Hyg* 2017; 15(4): 269-279.
- Pradeep AR, Suke DK, Martande SS, et al. Triphala, a new herbal mouthwash for the treatment of gingivitis: A randomized controlled clinical trial. *J Periodontol* 2016; 87(11): 1352-1359.
- Asokan S, Rathinasamy TK, Inbamani N, et al. Mechanism of oil-pulling therapy – in vitro study. *Indian J Dent Res* 2011; 22(1): 34-7.

21. Beegum PPS, Pandiselvam R, Ramesh SV, et al. A critical appraisal on the antimicrobial, oral protective, and anti-diabetic functions of coconut and its derivatives. *Quality Assurance and Safety of Crops & Foods*. 2022; 14(2): 86–100.
22. Kandaswamy SK, Sharath A, Priya PG. Comparison of the effectiveness of probiotic, chlorhexidine-based mouthwashes, and oil pulling therapy on plaque accumulation and gingival inflammation in 10-to 12-year-old schoolchildren: A randomized controlled trial. *Int J Clin Pediatr Dent* 2018; 11(2): 66-70.
23. Nagilla J, Kulkarni S, Madupu PR, et al. Comparative evaluation of antiplaque efficacy of coconut oil pulling and a placebo, among dental college students: a randomized controlled trial. *J Clin Diagn Res* 2017; 11(9): ZC08-ZC11.
24. Sezgin Y, Memis Ozgul B, Alptekin NO. Efficacy of oil pulling therapy with coconut oil on four-day supragingival plaque growth: A randomized crossover clinical trial. *Complement Ther Med* 2019; 47: 102193.
25. Jong FJX, Ooi J, Teoh SL. The effect of oil pulling in comparison with chlorhexidine and other mouthwash interventions in promoting oral health: A systematic review and meta-analysis. *Int J Dent Hyg* 2024; 22(1): 78-94.
26. Osunde OD, Adebola RA, Adeoye JB, Bassey GO. Comparative study of the effect of warm saline mouth rinse on complications after dental extractions. *Int J Oral Maxillofac Surg* 2014; 43(5): 649-653.
27. Ballini A, Cantore S, Signorini L, et al. Efficacy of sea salt-based mouthwash and xylitol in improving oral hygiene among adolescent population: A pilot study. *Int J Environ Res Public Health* 2020; 18(1): 44.
28. Alqutub MN, Alhumaidan AA, Alali Y, et al. Comparison of the postoperative anti-inflammatory efficacy of chlorhexidine, saline rinses and herbal mouthwashes after mechanical debridement in patients with peri-implant mucositis: A randomized controlled trial. *Int J Dent Hyg* 2023; 21(1): 203-210.