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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF SUBGINGIVALLY DELIVERED TEA TREE OIL GEL AND 0.2% CHLORHEXIDINE GEL ADJUNCTIVE TO SCALING AND ROOT PLANING IN CHRONIC PERIODONTITIS

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Abstract

Background: Periodontitis is a common inflammatory disease leading to periodontal tissue destruction. Traditional treatments, including mechanical debridement and systemic antibiotics, often face limitations. Recent interest has focused on alternative therapies like chlorhexidine and tea tree oil, both known for their antimicrobial properties. This study explores their efficacy in managing periodontitis, aiming to enhance treatment outcomes and offer viable adjunctive options.

Material and Methods: In this double-blinded, randomized controlled trial, ten patients with periodontitis underwent scaling and root planing (SRP). In a split-mouth design, one side of the mouth received a subgingival application of 0.2% chlorhexidine gel, while the other side was treated with 5% tea tree oil gel. Clinical parameters, including probing depth and clinical attachment level, were assessed before and after treatment to evaluate the efficacy of each gel in managing periodontal disease

Results: The study revealed significant improvements in probing depth (PPD), clinical attachment level (CAL), gingival index (GI), and bleeding on probing (BOP) within each treatment group. However, there were no significant differences between the chlorhexidine and tea tree oil gel treatments.

Conclusion: Both 0.2% chlorhexidine gel and 5% tea tree oil gel significantly improved clinical parameters of periodontitis, including probing depth, clinical attachment level, gingival index, and bleeding on probing. However, no significant differences were observed between the two treatments, suggesting that tea tree oil gel may be a viable alternative to chlorhexidine in periodontal therapy.

Keywords: Tea tree oil gel, Chlorhexidine, Periodontitis, Gingival bleeding

Introduction

Periodontitis, a prevalent and chronic inflammatory disease, poses a significant public health challenge due to its association with tooth loss and systemic health complications. This condition is characterized by the progressive destruction of the periodontal tissues, including the gingiva, periodontal ligament, and alveolar bone, primarily as a result of complex interactions between pathogenic microorganisms and host immune responses. Periodontitis is considered a multifactorial and polymicrobial inflammatory disease initiated by the accumulation of dental plaque at the gingival margin. The imbalance between the microbial load and the host immune response leads to the development of periodontal disease. Based on the understanding of the etiology and the pathogenesis of periodontal disease the treatment modalities rely on the concept of eliminating or suppressing the pathogenic bacteria.[1]

Scaling and root planing considered a gold standard treatment modality had a few limitations such as the difficulty of accessing deep periodontal defects compromising the effectiveness of biofilm removal. The persistence of pathogens such as Aggregatibacter Actinomycetum comitans and Porphyromonas Gingivalis often found following scaling and root planing resulting in microbial recolonization and consequent destruction of periodontal tissue.[2] Traditional management of periodontitis typically involves mechanical debridement, such as scaling and root planing, accompanied by adjunctive antimicrobial therapies. However, the effectiveness of these conventional treatments can be limited by factors such as patient compliance, microbial resistance, and adverse effects associated with systemic antibiotics.

Systemic administration of drugs has been useful in treating periodontal pockets, but it has various disadvantages such as the development of resistant bacteria and drug toxicity, and requires a higher dosage to attain the required gingival crevicular fluid concentration at the target site. Therefore, to override these shortcomings, local delivery of antibacterial agents into periodontal pockets has been introduced.[3]

In recent years, there has been growing interest in alternative or complementary therapeutic approaches that may enhance the management of periodontal disease while minimizing potential drawbacks. Among these alternatives, topical antimicrobial agents like chlorhexidine and tea tree oil have garnered attention due to their broad-spectrum antimicrobial properties and potential benefits in periodontal care. Chlorhexidine, a potent antiseptic, has been extensively studied and widely used in the prevention and management of periodontal infections. It is known for its efficacy in reducing microbial load and controlling plaque formation.[2] On the other hand, tea tree oil, derived from the Melaleuca alternifolia plant, has demonstrated promising antimicrobial and anti-inflammatory effects in various studies, suggesting its potential as a therapeutic adjunct in periodontal therapy.[4]

This study aims to evaluate the efficacy of chlorhexidine and tea tree oil gel in the management of periodontitis. By comparing these two agents, both individually and in combination, we seek to determine their relative effectiveness in reducing clinical parameters of periodontal disease, such as probing depth and clinical attachment level.

Materials and Methods

The present study was a randomized clinical trial with a split-mouth design, conducted under standardized protocol after obtaining ethical clearance from the college ethical clearance committee, Sibar Institute of Dental Sciences.

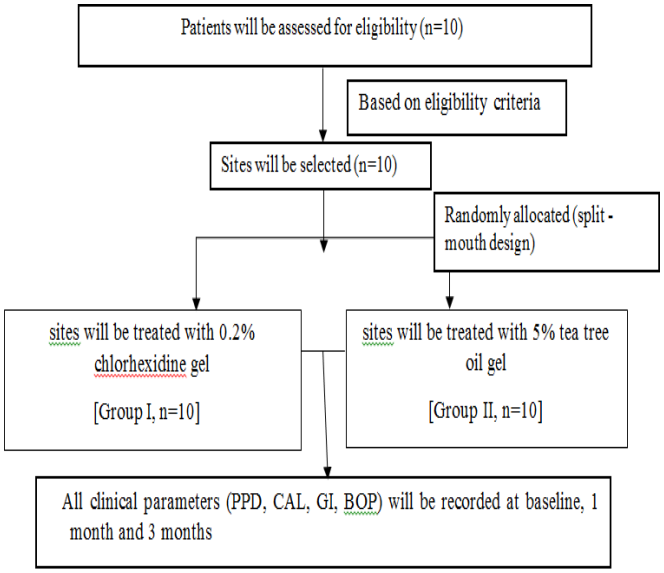
A total of 10 participants from the outpatient Department of Periodontology, who were diagnosed as systemically healthy having chronic periodontitis in at least three different quadrants with 5–6 mm pocket depth were selected for the study.

The sample size was calculated using the formula for comparing mean data between the groups. Sample size estimation was determined by using G power version 3.1.9.2 with Effect size – 0.67, Alpha error – 0.05, and Power (1- β) – 0.80. Simple random sampling was carried out to divide the patients and sites into two groups.

After obtaining approval from the ethical committee of Sibar Institute of Dental Sciences, the study was carried out within a time frame of Jan 2023- June 2023.

A total of 10 patients aged between 20-55 years of either gender, apparently systemically healthy, having periodontitis with moderate pockets ranging from 4-6mm were enrolled in the study.

At the initial visit after obtaining informed consent from patients, clinical parameters such as PPD, CAL, GI, and BOP were recorded. All the patients underwent scaling and root planing followed by the application of 0.2 % chlorhexidine gel for group -I and 5% tea tree oil gel for group II in the deepest pocket site. The gel was applied by using a bent, blunt-ended needle and syringe with careful insertion into the pocket area and filling the selected site till the gingival margin. Any excess gel will be removed. Further clinical parameters were recorded at 1 month and 3 months to assess the difference in the mean scores.



Data analysis

Data were analyzed by using SPSS IBM version 2.0. Friedman test, Wilcoxon signed rank test, Cochrans Q test & Mc nemer test were used to analyze the data. P-values less than 0.05 were considered statistically significant.

Results

Demographic Data

A total of 10 patients participated in this study. Among them, 6 males and 4 females with 4-6mm pockets were subjected to the chlorhexidine gel group and tea tree oil gel group. The average age was reported to be 30.6 ± 2.12 with no significance. (Table -1).

Table 1 Descriptive analysis of demographic details

Variable	Group-I	Group-2	P-Value
Number of patients	10	10	
Age (Mean age)	30.6±2.12	30.6±2.12	0.45 (NS)
Gender	6 males 4 females	6 males 4 females	

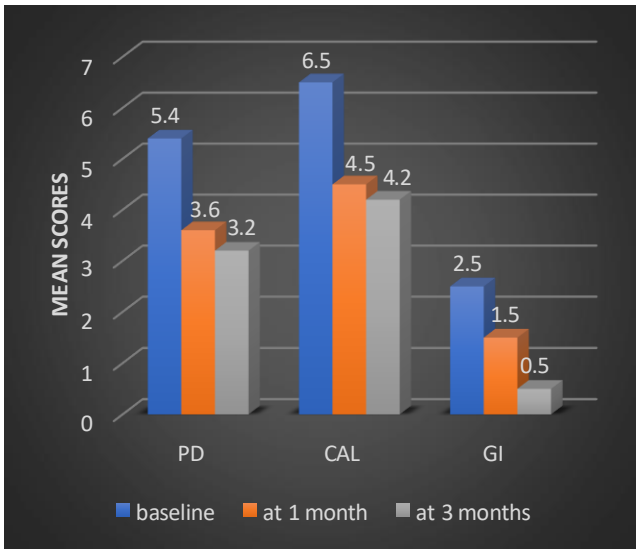
Main Findings

All the clinical parameters were analyzed by intragroup and intergroup comparison. Intra-group comparative analysis of various parameters by Friedman test such as PPD, CAL GI at different time intervals in GROUP 1(0.2 %CHX), shows that there exists a statistically significant decrease in PD, CAL, and GI from baseline to 3 months with p-value 0.000. (Table 2, Graph -1).

Table2.Intragroup comparative analysis of parameters in Group 1- 0.2%CHX gel (Friedman test)

Group 1	Parameters	Intervals	Mean rank	p-value
Group 1 (0.2% CHX)	PD	Baseline	3.00	0.000*
		At 1 month	1.70	
		At 3 months	1.30	
	CAL	Baseline	3.00	0.000*
		At 1 month	1.65	
		At 3 months	1.35	
	GI	Baseline	3.00	0.000*
		At 1 month	2.00	
		At 3 months	1.00	

Graph 1 Intragroup comparison of mean values of parameters in Group 1- 0.2%CHX

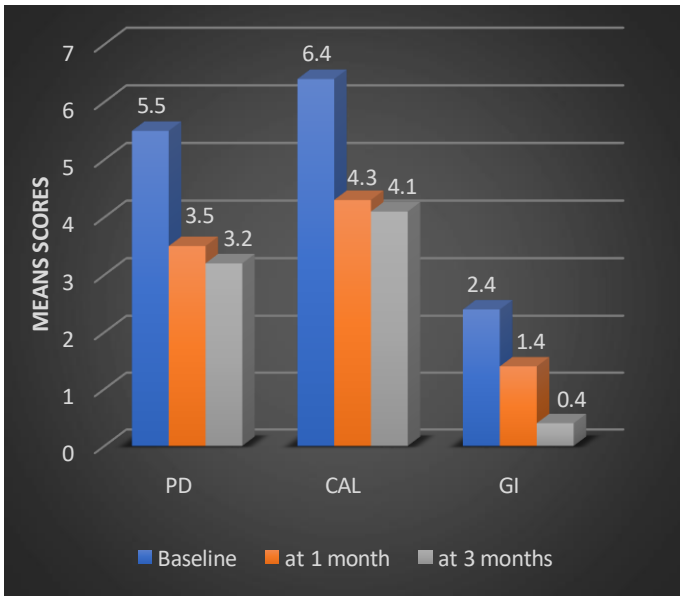


Intragroup analysis of various parameters by Friedman test such as PPD, CAL, and GI at different time intervals in Group II (5% Tea Tree oil gel) shows that there exists a statistically significant decrease in PD, CAL, and GI from baseline to 3 months with p-value 0.000 (Table-3, Graph -2).

Table 3. Intragroup comparative analysis of parameters in Group 2- Tea tree oil gel (Friedman test)

Groups	Parameters	Intervals	Mean rank	P value
Group 2 (tea tree)	PD	Baseline	3.00	0.000*
		At 1 month	1.65	
		At 3 months	1.35	
	CAL	Baseline	3.00	0.000*
		At 1 month	1.60	
		At 3 months	1.40	
	GI	Baseline	3.00	0.000*
		At 1 month	2.00	
		At 3 months	1.00	

Graph 2 Intragroup comparison of mean values of parameters in group 2- tea tree oil gel



Intra-group comparative analysis of Bleeding on probing scores by Cochrans Q test in both groups infers that bleeding on probing from baseline to 3 months decreased significantly ($p<0.05$) in both control and test groups (Table -4)

Table 4. Descriptive and intragroup comparative analysis of Bleeding on probing in group 1 (chlorhexidine gel) group and group 2 (tea tree oil gel) (Cochran Test)

Parameter	Groups	Intrvals	Value		Cohrans Q	p-value
			0	1		
BOP	GroupI (0,2% CHX)	Baseline	2	8		
		At 1 monts	6			
		At 3monts	8			
	GroupII (Tea tree)	Baseline				
		At 1 monts				
		At 3monts				

Intergroup comparative analysis of various parameters such as PPD, CAL, and GI by Wilcoxon Signed rank test between two groups at different time intervals depicts that no significant difference ($p>0.05$) was found between both the study groups in terms of PD, CAL, and GI at all the time intervals i.e baseline 1 month and 3 months (Table -5).

Table 5. Descriptive and intergroup comparative analysis (Wilcoxon signed rank test)

Parameters	Intervals	Groups	Mean std	T value	p-value
PD	Baseline	Tea tree	5.50± 0.707	-.351	0.725
		0.2% CHX	5.40± 0.843		
	At 1 month	Tea tree	3.50± 0.707	-.378	0.705
		0.2% CHX	3.60±0.516		
	At 3 months	Tea tree	3.20±0.632	.000	1.000
		0.2% CHX	3.20±0.422		
CAL	Baseline	Tea tree	6.40±0.516	-.447	0.655
		0.2% CHX	6.50±0.527		
	At 1 month	Tea tree	4.30±0.483	-.816	0.414
		0.2% CHX	4.50±0.527		
	At 3 months	Tea tree	4.10±0.568	.723	00.213
		0.2% CHX	4.20±0.789		
GI	Baseline	Tea tree	2.40±0.516	-.642	0.107
		0.2% CHX	2.50±0.527		
	At 1 month	Tea tree	1.40±0.616	-.325	0.201
		0.2% CHX	1.50±0.527		
	At 3 months	Tea tree	0.40±0.516	-.956	0.101
		0.2% CHX	0.50±0.527		

Intergroup Comparative analysis of BOP by Cochrans Q test between two groups at different time intervals demonstrated no significant difference between group 1 and group 2 at all the time intervals (Table 6).

Table6.Descriptive and intergroup comparative analysis of Bleeding on probing (Mc nemer test)

Parameter	Intervals	Groups	Mean std	P value
BOP	Baseline	0.2% CHX	0.80±0.422	1.000
		Tea tree	0.80±0.422	
	At 1 month	0.2% CHX	0.40±0.516	1.000
		Tea tree	0.30±0.483	
	At 3 months	0.2% CHX	0.20±0.422	1.000
		Tea tree	0.10±0.316	

Discussion

In the present study, the local application of chlorhexidine gel and Tea tree oil gel was investigated as a delivery system for an active agent to treat cases of chronic periodontitis. The studied groups consisted of untreated moderate chronic periodontitis patients; therefore, all of them received the standard Phase I periodontal therapy.

In the present study, the Intragroup analysis of all variables demonstrated significant differences among the chlorhexidine group which is collinear with the studies done by Siddarth,[3] Basavaraj[4], Vadiati[5], kumar[6], Ahmad[2], Ripari,[11] Manikandan[12], and Chitsazi[13]. The observed results showed similar findings with other studies mainly attributed to the fact that the local delivery of CHX gel in periodontal pockets enhances the effect of scaling and root planning, thus CHX gel application shows long-lasting (up to 90 days) favorable effects. In the present study, the intragroup analysis of all variables demonstrated significant differences among the Tea tree oil gel group which is collinear with studies done by Elgendy,[7] Awleir[8], Abdel Aziz[9], Raut[10], Ripari1[11], Manikandan1[2], Chitsazi[13], Taalab[14] and Soukuolis[15].

The observed results were attributed to the inherent properties of tea tree oil such as anti-microbial, anti-inflammatory, and antioxidant effects. The presence of tea tree oil being a herbal formulation is found to be of better use in patients allergic to chlorhexidine and also in patients with the problem of staining with long-term use of chlorhexidine.

TTO (Melaleuca alternifolia) results in a reduction of inflammation due to the presence of 1,8cineole and terpinen4ol. These properties of TTO could account for the antiplaque and antigingivitis activities of the formulated gel. TTO is efficacious against oral bacteria, with antiseptic, fungicidal, and bactericidal effects due to its active ingredients.[2]

The present Intergroup analysis of variables at different times was inferior to the studies done by Siddarth,[3] Basavaraj[4], Vadiati[5], Kumar[6], Ahmad[2], Ripari,[11] Manikandan[12], and Chitsazi[13], Abdel Aziz[9], Raut[10], Taalab[14] and Soukuolis[15]. The observed results were attributed to the fewer limitations in the present study such as shorter follow-up, and split-mouth design.

Considering the limitations of the present study future investigations should be directed toward the evaluation of microbiological analysis and the antioxidant effects with longer follow-up studies and the presence of control groups.

Conclusion

The study findings demonstrated significant clinical improvements within the 0.2% chlorhexidine and 5% tea tree oil gel treatment groups for moderate periodontitis. However, no significant difference was found between the two treatment modalities. This indicates that both treatments are effective in managing moderate periodontitis, but neither shows superior efficacy over the other. This suggests that both options are equally viable, and treatment selection should consider individual patient needs and preferences. Future studies could further investigate additional variables or alternative approaches to optimize treatment efficacy.

Ethical committee approval

The study was approved by the institutional Ethical Committee of the Sibar Institute of Dental Sciences with protocol number: 181/IEC/SIBAR/2022.

Funding sources: Self-funded

Informed consent

Written informed consent was obtained from patients who agreed to participate in the study.

Declaration of Interests: The authors have no conflict of interest to declare.

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