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Dr. Kanchan K Katore
MDS Student, YCMM & RDF'S Dental College, Maharashtra, India

Dr. Nilima M Landge
MDS, YCMM & RDF'S Dental College, Maharashtra, India

Dr. Nilima S Rajhans
MDS, Ph.D., YCMM & RDF'S Dental College, Maharashtra, India

Dr. Nikesh N Moolya
MDS, YCMM & RDF'S Dental College, Maharashtra, India

Dr. Asawari S Lawande
MDS, YCMM & RDF'S Dental College, Maharashtra, India

Dr. Yogita U Landage
MDS Student, YCMM & RDF'S Dental College, Maharashtra, India

Dr. Minal Pawar
MDS Student, YCMM & RDF'S Dental College, Maharashtra, India

Dr. Vaishnavi Chaudhari
MDS Student, YCMM & RDF'S Dental College, Maharashtra, India

Corresponding Author:
Dr. Kanchan K Katore
MDS Student, YCMM & RDF'S Dental College, Maharashtra, India

The effectiveness of glucosite gel in reducing bleeding on probing and anaerobic bacterial count pre and post intra-periodontal pocket application

Dr. Kanchan K Katore, Dr. Nilima M Landge, Dr. Nilima S Rajhans, Dr. Nikesh N Moolya, Dr. Asawari S Lawande, Dr. Yogita U Landage, Dr. Minal Pawar and Dr. Vaishnavi Chaudhari

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Abstract
Background: A periodontal pocket is a condition characterized by the pathological deepening of the gingival sulcus, accompanied by both hard and soft tissue damage. Complete eradication of subgingival bacteria from infected sites through mechanical means alone is challenging. Microorganisms that persist after scaling and root planing (SRP) can potentially be reduced using microbial agents, enhancing the efficacy of mechanical instrumentation. This approach aims to prevent plaque regeneration, which can otherwise lead to recolonization and the formation of biofilm to assess the impact of using both chlorhexidine and hydrogen peroxide (Glucosite gel) in comparison to chlorhexidine alone on the total viable count within periodontal pockets as a supplementary measure to scaling and root planning.
Methods: This research included 33 periodontal pockets in each set, with depths ranging from 5-6 mm on both sides, employing a split-mouth method. Scaling and root planning were performed solely on the upper side, and the lower right was jaw treated with Glucosite gel, and the left side with chlorhexidine gel. The study evaluated bleeding upon probing and total anaerobic count initially and after 4 weeks. Inter-group comparisons of anaerobic bacterial count between the upper, right, and left sides were documented at baseline and after a month of treatment.
Results: The evidence suggests that the use of a combination CHX-H2O2 gel applied into the periodontal pockets resulted in improved outcomes for both BOP and anaerobic bacterial count compared to SRP alone.
Conclusion: Glucosite can be more effective in reducing bleeding on probing when compared to chlorhexidine gel when used as an adjuvant to scaling and root planning.

Keywords: Bleeding on probing, glucosite gel, local drug delivery, anaerobic count and chlorhexidine gel

Introduction
Employing topical antibacterial agents to reduce bacterial plaque presents a valuable strategy for both preventing and treating gingivitis, particularly in patients prone to periodontal issues. These agents work by targeting and eliminating harmful bacteria in the oral cavity, thereby mitigating the inflammation and tissue damage associated with gingivitis [1].
There has been notable attention focused on assessing the efficacy of diverse topical antibacterial substances, such as chlorhexidine, hydrogen peroxide, and similar agents, within clinical contexts. Clinical trials have been instrumental in assessing the efficacy and safety of these agents when incorporated into oral rinses and toothpaste formulations. These trials typically involve rigorous methodologies, including randomized controlled trials (RCTs), to provide reliable evidence regarding the impact of these agents on gingivitis prevention and treatment [2]. Chlorhexidine (CHX) digluconate stands out as one of the most commonly utilized compounds in dental and medical practices, earning its status as a gold standard over the decades. Since its introduction in 1950, CHX has been recognized for its potent broad-spectrum antiseptic properties. It demonstrates impressive effectiveness against a broad spectrum of microorganisms, encompassing both Gram-negative and Gram-positive bacteria, along with fungi and specific viruses [3].

What distinguishes CHX is its capacity to hinder the development and advancement of bacterial plaque over prolonged durations. This attribute was prominently showcased in research dating as far back as the 1970s. CHX accomplishes this through its strong attraction to oral surfaces, ensuring sustained antimicrobial efficacy beyond its initial application. This feature holds significant value in dentistry, where preventing plaque accumulation is crucial for preserving oral health and averting conditions such as gingivitis and periodontitis.

Moreover, CHX's efficacy has been well-documented in various clinical settings, further solidifying its reputation as a go-to antiseptic agent. Its versatility and proven track record make it a cornerstone in oral care regimens, often incorporated into mouth rinses, gels, and other dental products. The widespread acceptance and continued use of CHX underscore its indispensable role in dental hygiene and underscore the ongoing relevance of this stalwart antiseptic agent in modern dental practice [4].

For over seven decades, hydrogen peroxide (H2O2) has been a cornerstone in dentistry, whether employed alone or in conjunction with salts. Its significance lies in therapeutic interventions aimed at thwarting periodontal diseases, necessitating mechanical access to subgingival pockets. Moreover, its antimicrobial properties play a pivotal role in fostering wound healing following gingival surgeries. Notably, the efficacy of hydrogen peroxide is most pronounced when its concentration surpasses 1% [5].

This versatile compound demonstrates a wide spectrum of effectiveness, addressing diverse pathogens such as bacteria, yeasts, fungi, viruses, and even spores, rendering it a versatile option for oral care purposes. Due to its extensive advantages, hydrogen peroxide has garnered significant attention in the realm of oral health management.

Through these clinical investigations, researchers aim to elucidate the optimal concentrations, formulations, and application protocols of topical antibacterial agents for maximal efficacy against gingivitis while minimizing adverse effects. Additionally, studies may explore the potential synergistic effects of combining different antibacterial agents or incorporating them into comprehensive oral care regimens [6].

Overall, the extensive examination of topical antibacterial agents in clinical trials underscores their importance in oral health management and highlights the ongoing efforts to refine and optimize their use for the benefit of patients with gingivitis and other periodontal conditions.

In this study, our goal is to examine the synergistic effects of chlorhexidine (CHX) and hydrogen peroxide. Recognizing the unique advantages of each agent, we aim to investigate the possibility of synergistic effects when they are used in tandem. By comprehensively analyzing their individual strengths and exploring potential synergies, we seek to enhance our understanding of their combined potency in oral health maintenance.

AIM

The objective of this study is to evaluate and contrast the effects of chlorhexidine and hydrogen peroxide when used alongside scaling and root planing on the total viable count within periodontal pockets.

Objectives

Assessing Anaerobic Viable Count Pre- and Post-Scaling and Root Planing (SRP).

Evaluating Anaerobic Viable Count Pre- and Post-Local Drug Delivery of Glucosite Gel.

Investigating Anaerobic Viable Count Pre- and Post-Local Drug Delivery of Chlorhexidine.

Comparing Anaerobic Bacterial Viable Count between Treatment Groups.

Determining the Efficacy of Glucosite Gel in Reducing Bleeding on Probing in Chronic Periodontitis.

Methods

A clinical investigation was carried out at the Department of Periodontology at Yashwant Rao Chavan Dental College and Hospital in Ahmednagar. The study comprised 33 male and female participants aged between 35 and 50, who voluntarily enrolled and oral informed consent was taken from all the participants.

The study utilized a split-mouth technique, where each participant received different treatments on different sides of their mouth. Specifically, the right side of the lower periodontal pockets was treated with Glucosite Gel, while the left side was treated with 0.2% Chlorhexidine GEL after scaling and root planning. Meanwhile, the upper maxillary periodontal pockets served as a control site, where only scaling and root planning were conducted.

This study design allows for a comparison of the effectiveness of the two gels (Glucosite and 0.2% Chlorhexidine) in treating periodontal pockets, as well as evaluating their efficacy compared to scaling and root planning alone.

Inclusion criteria

Subjects between the age of 35-50.
Subjects with localised or generalised periodontitis.
Periodontal pockets of 5-6mm.
Systemically healthy subjects.

Exclusion criteria

Subjects undertaken periodontal treatment in last 6 months prior to initial examination.
Subjects on antibiotic therapy in last past 3 months.
Subjects smoking tobacco.
Subjects using any medicated toothpaste or antibacterial mouthwash 6 months prior to study.
Subjects with pregnancy / Lactation.

Agents Used

Glucosite Gel

A solution containing 0.2% chlorhexidine and 3% hydrogen peroxide was utilized as an antimicrobial agent in conjunction with scaling and root planning to treat the periodontal pockets on the right side.

For the left side of the periodontal pocket, 0.2% Chlorhexidine gel was administered as an antimicrobial adjunct in combination with scaling and root planing.

Procedure

A) Subgingival biofilm sampling

Subgingival biofilm samples were collected from all three sites using sterile curettes, meticulously gathered, and then stored for analysis in three distinct Anaerobic Tissue Transport Mediums (ATTM).

Fig 1: Subgingival plaque sample collection

B) Scaling and root planning

Following subject selection, a thorough full-mouth supragingival scaling and root planning procedure was conducted. Subsequent to this, participants received oral hygiene instructions, which included demonstrations of proper brushing techniques and the correct utilization of interdental aids.

C) Intra-application of GEL

After scaling and root planning, Glucosite Gel (fig. 2) and chlorhexidine gel (Figure 3) were locally applied into the pocket of the right and left sites, respectively, using a syringe. The gel was administered until it overflowed from the gingival margin (Figure 4), repeating this procedure three times within a ten-minute interval. Participants were advised not to gargle for one hour after the application.

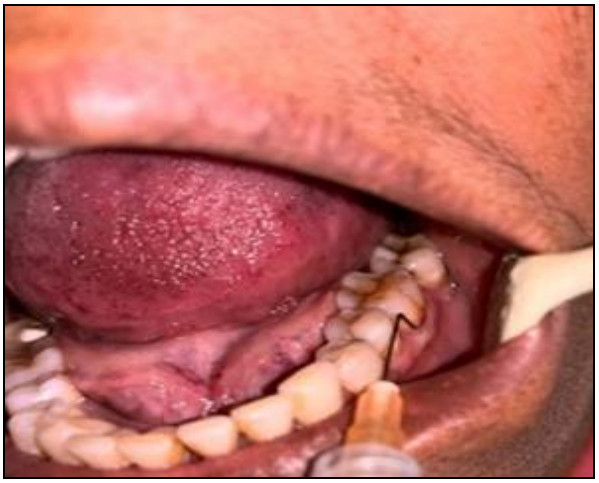

Fig 3: Application of CHX gel

Fig 2: Depicts the application of Glucosite Gel.

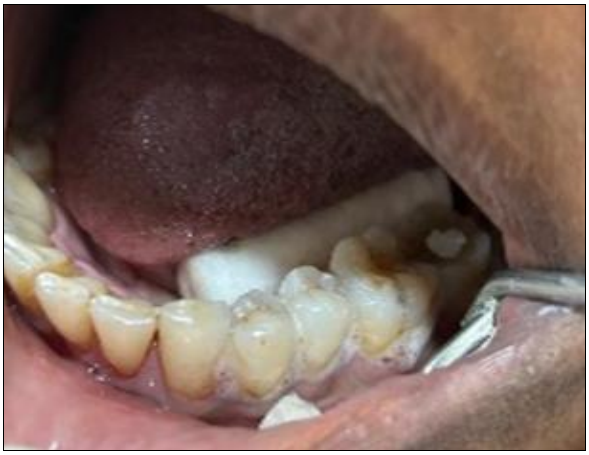

Fig 4: The gel was delivered until flowed out from the gingival margin

D) Microbiological procedure

The procedure begins by placing the sample in glass universal tubes containing 3mm glass beads and 10 ml of phosphate buffer saline. Afterward, it is agitated for 2-3 minutes using a vortex mixer. Subsequently, serial dilutions are prepared, with 0.1 ml extracted from each 10 ml solution and spread onto petri dishes containing brain heart infusion agar using a sterile microbiological spreader. These dishes are then anaerobically incubated in a sealed anaerobic jar with a gas pack for 48 hours at 37 °C.

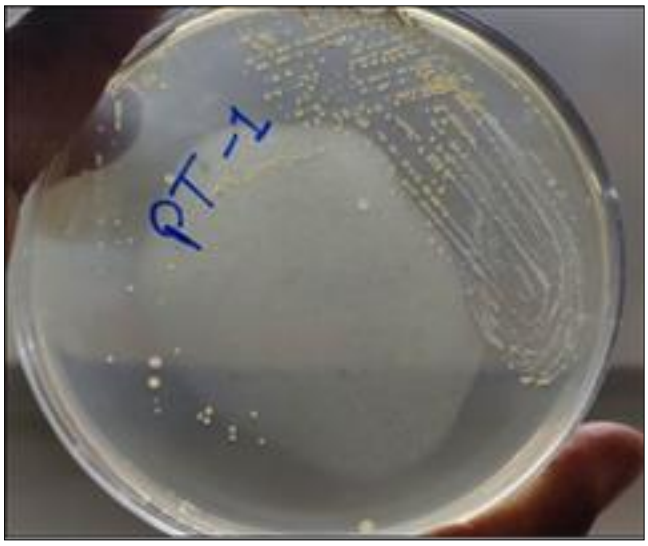

Fig 5: Anaerobic bacterial count after SRP

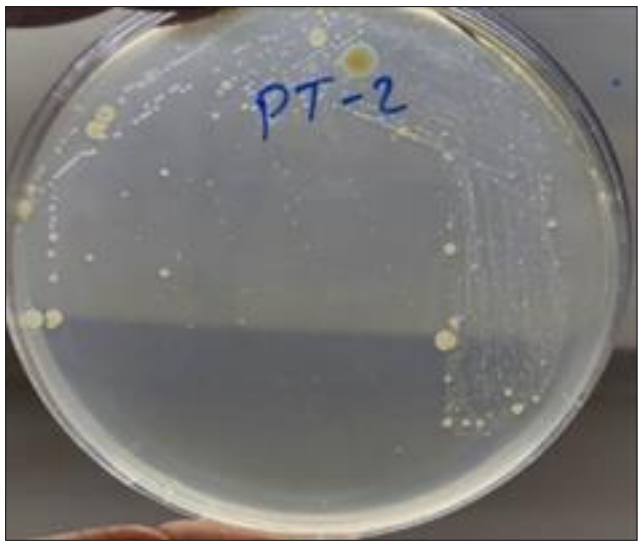

Fig 6: Anaerobic bacterial count after chlorhexidine gel application

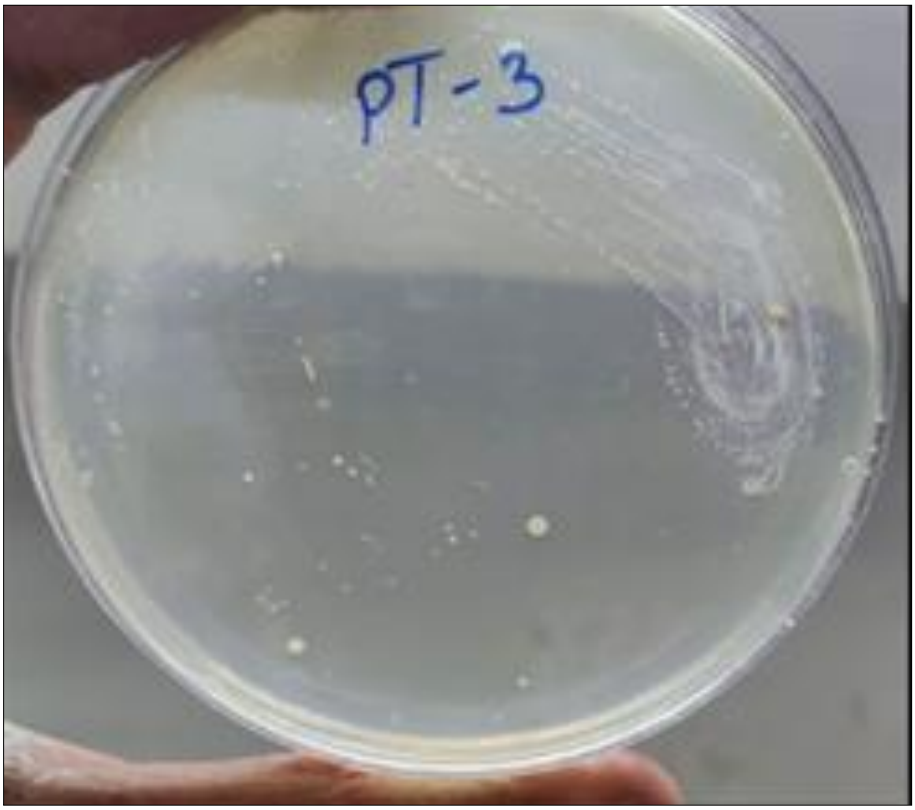

Fig 7: after Glucosite Gel application

Statistical Analysis

Data analysis was performed using SPSS software version 23, which was released in 2019. The normality of the data was evaluated using the Shapiro-Wilk test. Descriptive statistics were utilized, along with inferential statistics, with a significance level set at $p<0.05$ for determining statistical significance.

Descriptive Statistics: SRP + LDD BASELINE						
Group	N	Minimum	Maximum	Mean	Std. Deviation	KRUSKAL WALLIS TEST
1	11	110980	145900	128257.73	9147.565	X^2 = .336, P value = .845
2	11	113400	135890	125371.09	6970.870	
3	11	113240	137606	126066.27	7331.916	
Descriptive Statistics: SRP + LDD 1 MONTH						
Group	N	Minimum	Maximum	Mean	Std. Deviation	KRUSKAL WALLIS TEST
1	11	3245	45376	19240.45	16983.731	X^2 = .5.334, P value =.049
2	11	3678	45890	22932.27	15425.355	
3	11	5679	124465	50412.09	43043.175	

Pairwise comparisons using Post Hoc Bonferroni's correction test	
Comparison between the groups	**P value**
1 – 2	1.000
1 – 3	.043
2 – 3	.088

Descriptive Statistics: BOP BASELINE						
Group	N	Minimum	Maximum	Mean	Std. Deviation	KRUSKAL WALLIS TEST
1	44	62.50	100.00	82.3864	10.72183	X^2 = .362
2	44	18.75	100.00	80.1193	15.32833	P value = .834
3	44	62.50	100.00	81.2602	9.72903	
Descriptive Statistics: BOP 1MONTH						
Group	N	Minimum	Maximum	Mean	Std. Deviation	KRUSKAL WALLIS TEST
1	44	6.25	25.00	21.3068	4.53471	X^2 = 8.319
2	44	12.50	81.25	39.2045	26.46038	P value =.016
3	44	12.50	93.75	44.7500	26.48420	

Pairwise comparisons using Post Hoc Bonferroni's correction test	
Comparison between the groups	**P value**
1 – 2	.001
1 – 3	.000
2 – 3	.703

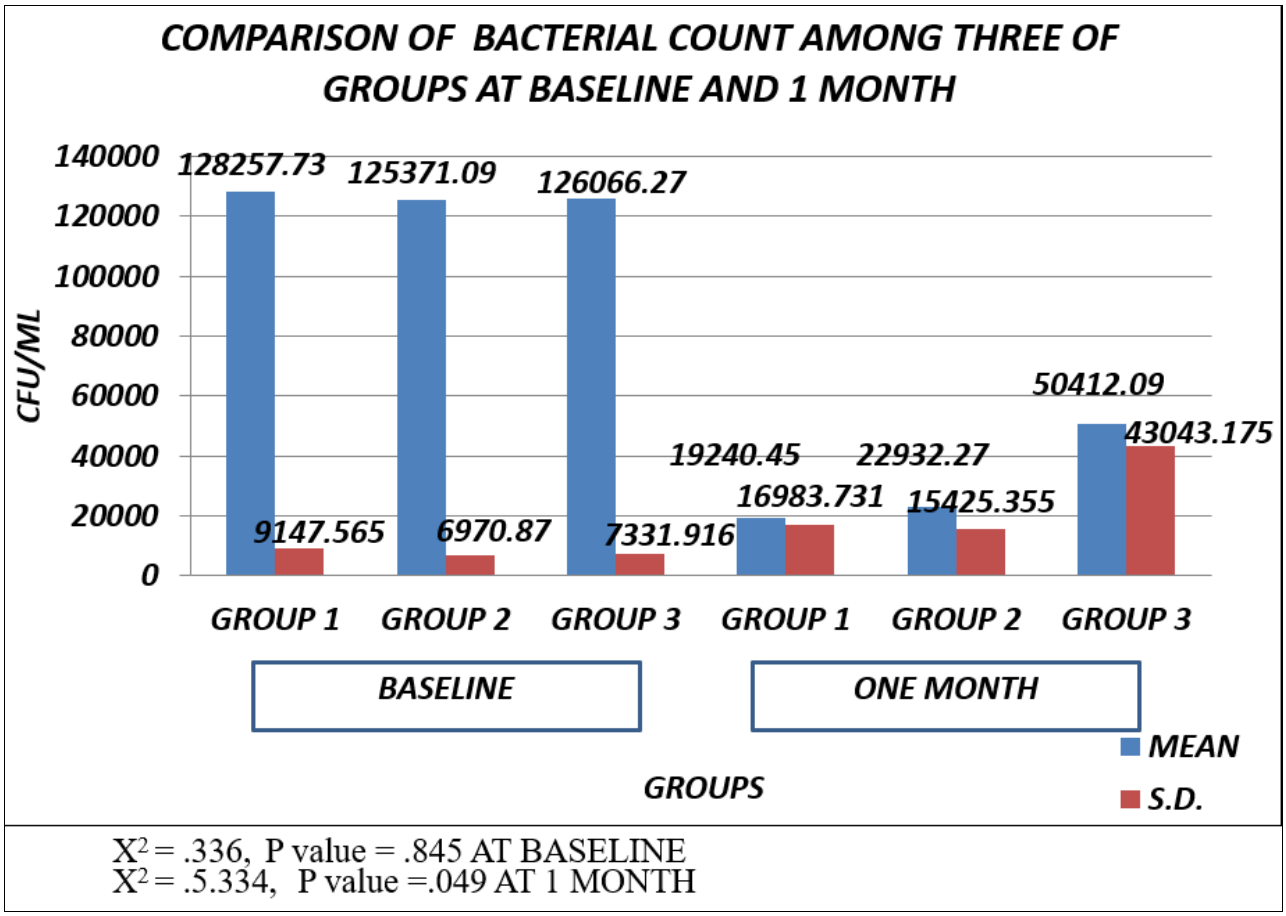

Fig 8: Comparison of bacterial count among three of groups at baseline and 1 month

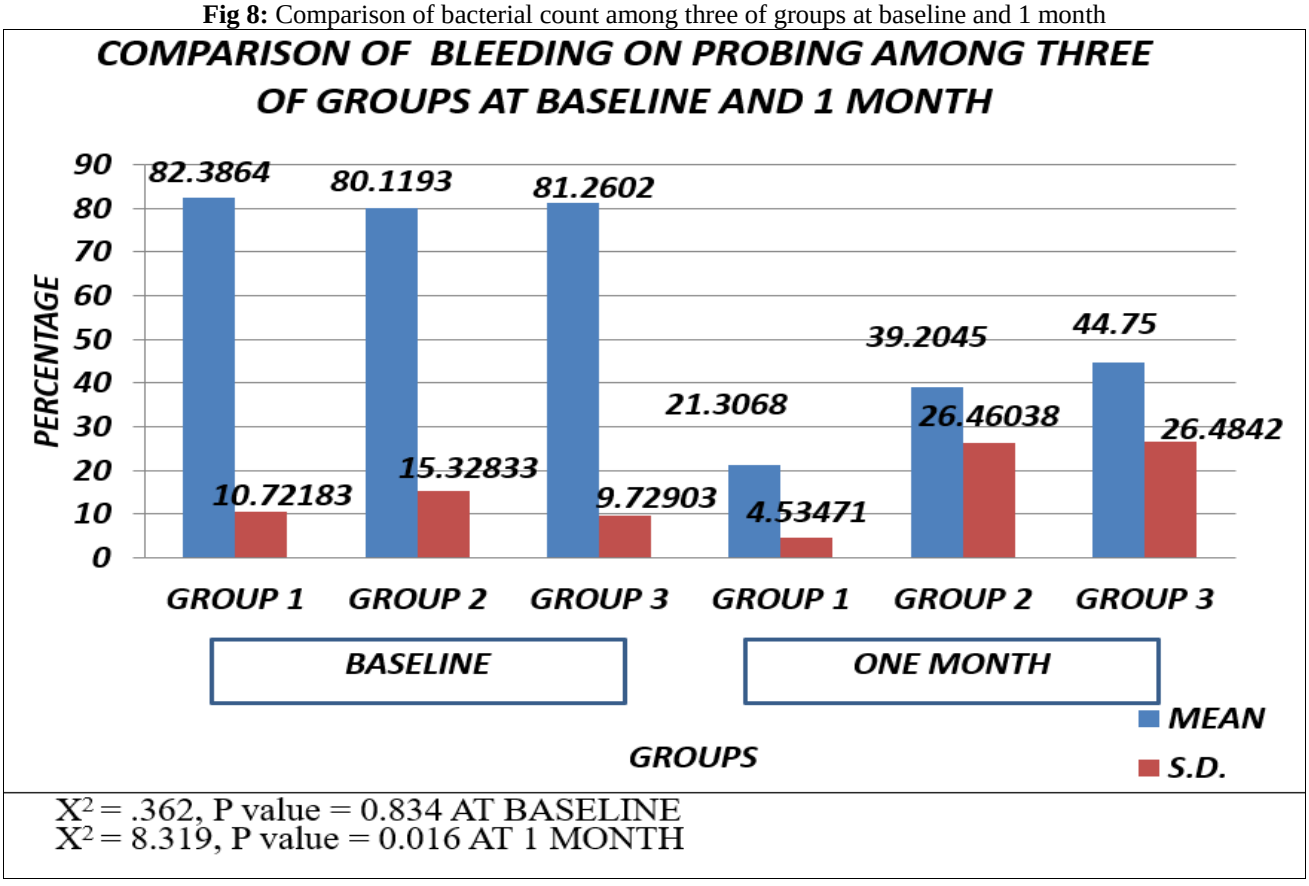

Fig 9: Comparison of bleeding Om probing among three of groups at baseline and 1 month

Discussion

Traditional mechanical therapy alone often proves insufficient in effectively managing moderate to severe periodontitis due to challenges posed by deep periodontal pockets and the infiltration of microorganisms into periodontal connective tissues. To address these challenges, local drug delivery directly into the periodontal pocket is recommended. This method allows for the targeted administration of therapeutic

agents, minimizing systemic side effects. The controlled-release nature of these systems enhances their efficacy, making them valuable adjuncts to mechanical debridement in periodontal disease treatment [7].

Local drug delivery systems offer additional benefits such as reduced drug resistance and fewer overall side effects. They also facilitate higher dispersion of the drug at the affected site, aiding in the comprehensive removal of periodontal pathogens.

In a study by Wolff *et al*. in 1982 [8], the effectiveness of 3% hydrogen peroxide (H2O2) in reducing pocket depth of more than 4 mm was demonstrated, although it did not significantly impact bleeding and other gingival indices [9]. Hydrogen peroxide exhibits broad antimicrobial activity against various microorganisms, making it useful for supragingival plaque control and treating acute ulcerative gingivitis without adverse tissue effects [10]. Moreover, it has effective stain removal capabilities both *in vitro* and *in vivo*, acting through oxygen-releasing mechanical cleansing actions and oxidation or reduction reactions [11].

The delivery of hydrogen peroxide into the periodontal pocket increases oxygen saturation, inhibiting most obligate anaerobes predominant in deeper periodontal pockets. Studies show that hydrogen peroxide and oxygen can modify biofilm from a more virulent to a less virulent entity, resulting in reduced bacteria [12],

Chlorhexidine (CHX) is another crucial agent with broad-spectrum bactericidal properties. Its ability to bind to tissue surfaces provides long-lasting antimicrobial effects by reducing pellicle formation and altering bacterial adherence to teeth. Additionally, there's evidence of a synergistic effect between chlorhexidine and hydrogen peroxide [13-14].

CHX acts by absorption on the cell wall of microorganisms, causing leakage of intracellular components. It exhibits both bacteriostatic and bactericidal effects, depending on concentration. The positively charged ions released by CHX can prevent microbial colonization on the dentine surface [15].

Hydrogen peroxide (H2O2) demonstrates broad antimicrobial activity against various microorganisms, primarily through hydroxyl radicals reacting with macromolecules such as membrane lipids and DNA, leading to bacterial death [16].

In vitro studies indicate synergistic effects of CHX and H2O2 in inhibiting biofilm formation, with significant improvements observed in plaque scores compared to CHX alone. This suggests that CHX may enhance H2O2 penetration and reaction with biofilm bacteria intracellularly [17]. Authors declare no conflict of interest in this study.

Conclusion

The results of this study demonstrated a significant enhancement in clinical parameters, particularly bleeding on probing (BOP), one month post-treatment compared to baseline measurements. When comparing the two treatment groups, a remarkable reduction in BOP was observed in the Glucosite gel adjunctive to SRP group in contrast to the group treated with 0.2% chlorhexidine gel. Additionally, the microbiological analysis revealed a superior outcome in the Glucosite gel group compared to the chlorhexidine gel group.

Conflict of Interest

Not available

Financial Support

Not available

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