ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 7, Issue – 3, June – 2024, Page No. : 56 - 61

Clinically and Microbiologically Evaluating the of Efficacy of SRP and its combination with Tetracycline fibers and Mouthwash against P. gingivalis in patients with periodontitis

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Citation of this Article: Dr. Arun Garg, Dr. Amit Bhardwaj, Dr. Suresh Kumar, "Clinically and Microbiologically Evaluating the of Efficacy of SRP and its combination with Tetracycline fibers and Mouthwash against P. gingivalis in patients with periodontitis", IJDSIR- June – 2024, Volume –7, Issue - 3, P. No. 56 – 61.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Scaling and root planing (SRP) is widely recognized as the primary non-surgical treatment for periodontal disease. However, relying solely on mechanical debridement may not fully eradicate the suspected pathogens involved. Combining systemic or locally delivered antimicrobial agents and host modulating agents with SRP is often seen as an effective strategy for selectively targeting and controlling pathogenic microbes, particularly P. gingivalis, at specific sites of active disease so, present study was evaluated the efficacy of scaling and root planing (SRP) alone or in combination with LDD or tetracycline mouthwash against P. gingivalis in patient with chronic periodontal disease.

Materials and methods: The present study was conducted in the Department of Periodontology, S.G.T Dental College in collaboration with Department of Biotechnology, Chaudhary Devi Lal University (CDLU), Sirsa. Clinical parameters recorded were Simplified Oral hygiene Index (SOHI), Plaque Index (PI), Gingival Index (GI), Periodontal Pocket Depth (PPD). All clinical parameters were measured at 0 (baseline), 21st and 42nd days and recorded.

Division of groups: The patients were randomly divided into 3 groups as follows: Group I: 50 pts – SRP, Group II: 50 pts - SRP with LDD (Tetracycline fibers - Periodontal plus AB), Group III: 50 pts - SRP with Mouthwash (Tetracycline mouthwash - Formulated). For each assessment point, data were statistically analyzed using one way ANOVA. The level of significance was set at $p < 0.05$.

Results: A statistically significant difference in OHIS, GI and PI at 21 and 42 day but results at baseline was not significant. A statistically significant difference in PPD at 42 day but results at baseline and 21st day were

not significant. A statistically significant difference in CFU of P.gingivalis at 21 and 42 day but results at baseline was not significant. It also depicts that mean value of CFU of P.gingivalis were comparatively lowest in Group II followed by Group III and least reduction from baseline to 42th day was noted in Group I.

Conclusion: The result of study showed that Group II resulted in better optimum clinical results in comparison to the other two treatment groups, i.e. Group III and Group I.

Keywords: P. Gingivalis, Scaling, Root Planning, Tetracycline

Introduction

Periodontitis is a disease of the periodontium, whose treatment aims at the restoration of lost periodontium or supporting tissues and this implies the formation of a new bone in region of the defect.[1,]

Scaling and root planing (SRP) is considered the gold standard for non-surgical treatment, yet relying solely on mechanical debridement may not completely eradicate the suspected pathogens involved.

The selective removal or inhibition of pathogenic microbes specially P.gingivalis with systemic or locally delivered antimicrobial and host modulating agents, in combination with SRP, is often considered as an effective approach at specific disease active sites.[3,4]Tetracycline hydrochloride (TTC-HCl) is recognized as one of the most effective and cost-efficient local antimicrobial agents against P. gingivalis. It can persist in crevicular fluid for at least 7 days. When used in a single irrigation, TTC-HCl functions as an antiseptic. The exposure of dentinal tubules in teeth treated with TTC has been linked to enhanced adhesion between crevicular glycoproteins and dentin. This treatment stimulates fibroblast proliferation and adhesion, enhances anti collagenase activity, and inhibits osteoclast and neutrophil functions.[5]

So, we have conducted this study to evaluate clinical and microbiological efficacy of scaling and root planing (SRP) alone or in combination with LDD or mouthwash against P. gingivalis in patient with chronic periodontal disease.

Materials and methods

The present study was conducted in the Department of Periodontology, S.G.T Dental College in collaboration with Department of Biotechnology, Chaudhary Devi Lal University (CDLU), Sirsa. Written informed consent was obtained from all patients (in the language best understood by the patient). Approval for the study was obtained from the institutional ethics committee. 150 systemically healthy subjects with chronic periodontitis with periodontal pocket depth ≤ 5mm aged between 20 to 50 years of either gender were selected for the study from August 2021 to July 2023.[6,7]

Clinical parameters recorded were Simplified Oral hygiene Index (SOHI), Plaque Index (PI), Gingival Index (GI), Periodontal Pocket Depth (PPD) (University of Michigan "O" probe with William's marking).[8] All clinical parameters were measured at 0 (baseline), 21st and 42nd days and recorded on predesigned proforma. For standardizing the measurement of Periodontal Pocket Depth customized acrylic occlusal stents were prepared.

Microbiological parameters: Plaque samples were collected at zero (baseline), 21st and 42nd day and transported for quantitative analysis of Porphyromonas gingivalis using RT – PCR.

Division of groups: The patients were randomly divided into 3 groups as follows: Group I: 50 pts – SRP, Group II: 50 pts - SRP with LDD (Tetracycline fibers -

Periodontal Plus AB), Group III: 50 pts - SRP with Mouthwash (Tetracycline mouthwash - Formulated).

Periodontal therapy: After recording the clinical parameters, full mouth phase I therapy was performed with the help of ultrasonic scaler and Gracey curettes.

Tetracycline fibers soaked in saline were placed into the pocket with the help of periodontal probe with gentle pressure in Group II subjects. The gingiva was carefully adapted and sealed with Coe-pak to prevent ingress of oral fluids for at least 10 days.

After completing scaling and root planning procedure patients included in Group III were twice given 15 ml of tetracycline mouth wash to rinse. The rinsing was carried out for an approximate period of 1 minute.

Statistical analysis: The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). For each assessment point, data were statistically analyzed using one way ANOVA. The level of significance was set at $p < 0.05$.

Results

Variables			F-Value	P-Value
OHIS	Baseline	SRP	3.59	0.30
		SRP+LDD		
		SRP+ Mouthwash		
	21st	SRP	14.97	.000*
		SRP+LDD		
		SRP+ Mouthwash		
	42nd	SRP	64.51	.000*
		SRP+LDD		
		SRP+ Mouthwash		

Table 1: Comparison of efficacy of treatment of Group I, II and III on OHI-S

Group I, II and III show statistically significant difference in all the indices when compared at baseline, 21st day and 42nd day. A statistically significant difference in OHIS, GI and PI at 21 and 42 day but results at baseline was not significant. As shown in Table 4, a statistically significant difference in PPD at 42 day but results at baseline and 21st day were not significant.

Variables			F-Value	P-Value
GI	Baseline	SRP	7.577	0.01
		SRP+LDD		
		SRP+ Mouthwash		
	21st	SRP	102.28	0.000*
		SRP+LDD		
		SRP+ Mouthwash		
	42nd	SRP	66.79	0.000*
		SRP+LDD		
		SRP+ Mouthwash		

Table 2: Comparison of efficacy of treatment of Group I, II and III on GI

Variables			F-Value	P-Value
PI	Baseline	SRP	0.23	0.79
		SRP+LDD		
		SRP+ Mouthwash		
	21st	SRP	100.79	.000*
		SRP+LDD		
		SRP+ Mouthwash		
	42nd	SRP	103.34	.000*
		SRP+LDD		
		SRP+ Mouthwash		

Table 3: Comparison of efficacy of treatment of Group I, II and III on PI

Variables			F-Value	P-Value
PPD	Baseline	SRP	0.61	0.40
		SRP+LDD		
		SRP+ Mouthwash		
	21st	SRP	0.25	0.97
		SRP+LDD		
		SRP+ Mouthwash		
	42nd	SRP	25.87	.000*
		SRP+LDD		
		SRP+ Mouthwash		

Table 4: Comparison of efficacy of treatment of Group I, II and III on PPD

Group	Baseline		21st Day		42nd Day	
	Mean	SD	Mean	SD	Mean	SD
Group I	241.29	32.44	97.12	10.69	62.48	7.73
Group II	252.74	30.65	51.93	8.23	16.56	4.90
Group III	246.18	35.06	70.88	9.11	39.14	5.81
F-value	1.23		5.62		14.71	
p value	0.56		0.024*		<0.01*	

Table 5: Comparison of efficacy of treatment of Group I, II and III on colony forming units (CFU)

Table 5 shows a statistically significant difference in CFU of P. gingivalis at 21 and 42 day but results at baseline were not significant. It also depicts that mean value of CFU of P. gingivalis were comparatively lowest in Group II followed by Group III and least reduction from baseline to 42th day was noted in Group I.

Discussion

Nonsurgical mechanical periodontal treatment is fundamental in periodontal therapy and is typically the initial recommended approach for managing periodontal infections. Our study found no statistically significant mean differences in plaque and gingival index scores among the three groups at baseline, 21 days, and 42 days. This rule out any bias towards the outcome of the study.

On intra group examination there was statistically significant decrease in mean plaque index values and mean gingival index, OHI index value in Group I and Group II and Group III. Our study results were concurrent with the Sharma NK et al,[9]Gurha et al,[10] studies. In all the above studies intra group comparison of the mean plaque index and gingival index values were statistically significant and there was marked reduction in the mean plaque index and mean gingival index values.

On intergroup comparison the OHI-S, plaque index score, gingival score was statistically significant. Our study results are concurrent with the Sharma N K et al.[9] Our study results are in contrast with the study Gurha et al.[10] Various Vitro studies result revealed that tetracycline have capacity to demineralize enamel and dentin surfaces in turn delaying biofilm formation.

Inter group results revealed that in Group I (SRP), Group II (SRP plus tetracycline AB) and Group III (SRP plus Tetracycline Mouthwash) the value of mean pocket depth and colony forming unit (CFU) of P.gingivalis was statistically significant. Our Study results are concurrent with the Sharma NK et al,[9]Gurha S et al.[10]

Inter-group comparisons indicated statistically significant differences in the colony-forming units (CFU) of P. gingivalis among Groups I, II, and III on the 21st and 42nd days. However, no significant differences were observed at baseline showing that at baseline CFU was same in all groups. Out of the all the group the Group II (SRP plus Tetracycline fibers) showed significant results followed by Group III (Tetracycline Mouthwash), Group I (SRP alone), when mean value of

CFU was compared in all study groups. Our results are concurrent with studies of Gurha S et al[10] and Sharma NK et al.[9]

The reduction in pocket depth can be attributed to a decrease in the qualitative and quantitative microbial load of bacteria. Scaling and root planing (SRP) halts disease progression by modifying the subgingival microbiota. In Group II and Group III, tetracycline provides an additional antimicrobial effect and conditions root surfaces, thereby enhancing the migration of periodontal cells.[11]

Terranovaa et al[12] reported that tetracycline treatment even enhanced binding of fibronectin and proliferation and adhesion of fibroblasts. The reason behind the decrease in the count of P. Gingivalis may be supported by antibacterial concept of tetracycline. Chat GPT

Tetracycline, being a broad-spectrum antibiotic, targets periodonto pathogenic bacteria within the subgingival plaque. According to Rams TE et al., local drug delivery (LDD) methods can achieve concentrations of antimicrobial agents up to 100-fold higher in subgingival sites compared to systemic administration. This elevated concentration of tetracycline through LDD not only reduces bacteria but also creates a favorable environment for reattachment and regeneration by enhancing fibroblast activity, inhibiting collagenase activity, and maintaining a basic pH. Additionally, tetracycline has been shown in vitro to enhance soft tissue attachment to treated root surfaces. The demineralization of dentin root surfaces by low-pH tetracycline increases the adsorption of fibronectin, an important extracellular matrix glycoprotein.

The adsorbed or bound fibronectin enhances fibroblast attachment and growth, while suppressing epithelial cell attachment and growth.[14]The differences between Group II and Group III can be attributed to the duration of exposure of antimicrobial agents to the oral microflora. Group II, which experiences prolonged exposure due to slower clearance by gingival crevicular fluid (GCF), demonstrated more substantial improvements in clinical and microbial parameters compared to Group III

Conclusion

The study demonstrated that Group II achieved superior clinical outcomes compared to Group III and Group I.

When selecting a suitable local drug delivery system, clinicians must consider factors such as efficacy, availability, ease of use, and cost. While local drug delivery systems do not replace established periodontal therapies, they represent a valuable interventional strategy in the treatment of periodontal disease. These systems are effective, straightforward nonsurgical methods that provide dentists with an additional tool to help manage periodontal disease effectively.

Summary

Group I, II, and III exhibited statistically significant differences across all indices when compared at baseline, day 21, and day 42. The efficacy of scaling and root planing (SRP) alone and in combination with local drug delivery (LDD) or tetracycline mouthwash on oral hygiene index-simplified (OHI-S), gingival index (GI), and plaque index (PI) indicated significant improvements at day 21 and day 42, although baseline results were not significant. In terms of probing pocket depth (PPD), there was a statistically significant difference among the groups at day 42, but not at baseline or day 21. Inter-group comparisons also revealed statistically significant differences in colony-forming units (CFU) of P. gingivalis among Group I, II, and III at day 21 and day 42, while no significant differences were observed at baseline.

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