

Comparative Evaluation of Local Drug Delivery with Periodontal Plus Ab (Tetracycline Fibers) and 0.2% Hyaluronic Acid Gel as an Adjunct to Scaling and Root Planing in the Treatment of Periodontitis

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ABSTRACT

Introduction: Periodontitis is a chronic inflammatory disease of the periodontium, characterized by the destruction of supporting tissues around the teeth. Local drug delivery (LDD) systems have been proposed as adjuncts to scaling and root planing (SRP) to enhance treatment outcomes. This study aimed to compare the efficacy of tetracycline fibers and 0.2% hyaluronic acid gel as LDD agents in conjunction with SRP for the treatment of periodontitis.

Objective: To clinically compare the efficacy of treatment of periodontitis with Periodontal Plus Ab (Tetracycline Fibers) and 0.2% hyaluronic acid gel.

Methodology: A randomized controlled trial was conducted involving 70 patients diagnosed with moderate to severe periodontitis. The patients were randomly assigned to two treatment groups: Group A received SRP along with Periodontal Plus Ab (Tetracycline Fibers), while Group B received SRP along with 0.2% hyaluronic acid gel. Clinical parameters including probing pocket depth (PPD), clinical attachment level (CAL), plaque index (PI) and gingival index (GI) were recorded at baseline and at 3-month follow-up appointments.

RESULTS: Both treatment groups demonstrated significant improvements in PPD, CAL, and GI scores from baseline to the 3-month follow-up. However, there were no statistically significant differences between the two groups in terms of mean reduction in PPD, gain in CAL, or reduction in GI ($p > 0.05$). Furthermore, both tetracycline fibers and 0.2% hyaluronic acid gel were well-tolerated by the patients with no adverse effects reported.

Conclusion: The findings of this study suggest that both Periodontal Plus Ab (Tetracycline Fibers) and 0.2% hyaluronic acid gel are effective adjuncts to SRP in the treatment of periodontitis. However, no significant differences were observed between the two LDD agents in terms of clinical outcomes. Further research with larger sample sizes and longer follow-up periods may be warranted to confirm these findings and elucidate the long-term efficacy and safety of these LDD modalities in periodontal therapy.

INTRODUCTION

Chronic periodontitis is a common infectious disease marked by the gradual destruction of the tooth-supporting structures due to inflammation. It is primarily associated with the accumulation of dental plaque and calculus and typically progresses at a slow to moderate rate.¹ The standard treatment involves non-surgical mechanical therapy, specifically scaling and root planing (SRP). However, the effectiveness of SRP can be limited in cases with deep periodontal pockets or complex anatomical structures.²

To enhance treatment outcomes, local drug delivery (LDD) systems have gained attention. These systems enable the site-specific administration of antimicrobial agents at higher concentrations directly into the periodontal pocket, while minimizing systemic side effects. Several chemotherapeutic agents have been developed for LDD, including tetracycline fibers, metronidazole gel, minocycline gel, chlorhexidine chips, and doxycycline hyclate.³ Tetracycline, a broad-spectrum antibiotic, is among the most extensively used agents for periodontal therapy. Its effectiveness is partly due to its substantivity—its ability to bind to tooth surfaces and release gradually while maintaining antimicrobial activity. In addition to antibiotics, other biologically active substances like hyaluronic acid (HA) have emerged as potential adjuncts.⁴ HA, a naturally occurring glycosaminoglycan, plays a significant role in wound healing, tissue regeneration, and maintaining gingival health due to its anti-inflammatory and tissue-repairing properties.⁵

This study aims to evaluate and compare the clinical efficacy of tetracycline fibers and 0.2% hyaluronic acid gel as adjunctive treatments to SRP in managing chronic periodontitis, with a focus on improving periodontal outcomes and promoting tissue healing.

MATERIALS AND METHODS

This study was conducted on 70 periodontitis patients visiting the Department of Periodontology at Inderprastha Dental College and Hospital, Sahibabad. Patients were randomly divided into two groups:

Group A (n=35): Treated with Periodontal Plus AB (Tetracycline Fibers)

Group B (n=35): Treated with 0.2% Hyaluronic Acid (HA) gel

Inclusion Criteria:

Participants aged 20–65 years, systemically and mentally healthy, with pocket depth ≥ 4 mm, good oral hygiene (PI < 1), and willing to consent.

Exclusion Criteria:

Systemic/infectious diseases, tobacco use, immunosuppressive therapy, prior periodontal surgeries, material allergies, and pregnancy/lactation.

Clinical Parameters Recorded:

Plaque Index (PI)⁶

Gingival Index (GI)⁷

Pocket Probing Depth (PPD)⁸

Clinical Attachment Level (CAL)⁹

(Measurements were taken at baseline, 4 weeks, and 12 weeks using a UNC-15 probe).

Procedure:

All patients received Phase I therapy (scaling, root planing), oral hygiene instruction, and consented participation.

Group A: After 1 week, tetracycline fibers were inserted subgingivally under local anesthesia during curettage, followed by Coe-pak placement.

Group B: After 1 week, 0.2% HA gel was applied subgingivally using a syringe at baseline, 4 weeks, and 8 weeks, followed by Coe-pak.

Postoperative Care:

Patients avoided brushing/flossing treated areas and used 0.2% chlorhexidine mouth rinse twice daily.

STATISTICAL ANALYSIS

Table 1: Intragroup comparison of Plaque index

Group	Interval	Mean	SD	p-value	Pairwise comparisons
Group A	Baseline	0.47	0.22	<0.001*	Baseline vs 4 weeks: 0.031*
	4 weeks	0.38	0.17		Baseline vs 12 weeks: 0.001* 4 weeks vs 12 weeks: 0.192
	12 weeks	0.32	0.18		
Group B	Baseline	0.47	0.22	<0.001*	Baseline vs 4 weeks: <0.001*
	4 weeks	0.33	0.19		Baseline vs 12 weeks: <0.001* 4 weeks vs 12 weeks: 0.249
	12 weeks	0.26	0.19		

Friedman test; Post hoc Bonferroni test; * indicates a significant difference at $p \leq 0.05$

Table 2: Intergroup comparison of plaque index

Interval	Group A		Group B		Difference	p-value
	Mean	SD	Mean	SD		
Baseline	0.47	0.22	0.47	0.22	0.00	1.000
4 weeks	0.38	0.17	0.33	0.19	0.05	0.222
12 weeks	0.32	0.18	0.26	0.19	0.06	0.123

Mann Whitney test

Table 3: Intragroup comparison of gingival index

Group	Interval	Mean	SD	p-value	Pairwise comparisons
Group A	Baseline	0.27	0.10	<0.001*	Baseline vs 4 weeks: 0.167 Baseline vs 12 weeks: <0.001*
	4 weeks	0.23	0.07		4 weeks vs 12 weeks: 0.001*
	12 weeks	0.09	0.11		
Group B	Baseline	0.21	0.13	<0.001*	Baseline vs 4 weeks: 0.002* Baseline vs 12 weeks: <0.001*
	4 weeks	0.13	0.11		4 weeks vs 12 weeks: 0.696
	12 weeks	0.09	0.10		

Friedman test; Post hoc Bonferroni test; * indicates a significant difference at $p \leq 0.05$

Table 4: Intergroup comparison of gingival index

Interval	Group A		Group B		Difference	p-value
	Mean	SD	Mean	SD		
Baseline	0.27	0.10	0.21	0.13	0.06	0.089
4 weeks	0.23	0.07	0.13	0.11	0.10	<0.001*
12 weeks	0.09	0.11	0.09	0.10	0.00	0.797

Mann Whitney test; * indicates a significant difference at $p \leq 0.05$

Table 5: Intragroup comparison of PPD

Group	Interval	Mean	SD	p-value	Pairwise comparisons
Group A	Baseline	4.54	0.51	<0.001*	Baseline vs 4 weeks: <0.001*
	4 weeks	3.51	0.51		Baseline vs 12 weeks: <0.001* 4 weeks vs 12 weeks: 0.283
	12 weeks	3.14	0.36		
Group B	Baseline	4.54	0.51	<0.001*	Baseline vs 4 weeks: <0.001*
	4 weeks	3.49	0.51		Baseline vs 12 weeks: <0.001*
	12 weeks	3.20	0.41		4 weeks vs 12 weeks: 0.566

Friedman test; Post hoc Bonferroni test; * indicates a significant difference at $p \leq 0.05$

Table 6: Intergroup comparison of PPD

Interval	Group A		Group B		Difference	p-value
	Mean	SD	Mean	SD		
Baseline	4.54	0.51	4.54	0.51	0.00	1.000
4 weeks	3.51	0.51	3.49	0.51	0.02	0.812
12 weeks	3.14	0.36	3.20	0.41	0.06	0.529

Mann Whitney test; * indicates a significant difference at $p \leq 0.05$

Table 7: Intragroup comparison of CAL

Group	Interval	Mean	SD	p-value	Pairwise comparisons
Group A	Baseline	4.23	0.48	<0.001*	Baseline vs 4 weeks: <0.001*
	4 weeks	3.51	0.51		Baseline vs 12 weeks: <0.001* 4 weeks vs 12 weeks: 0.192
	12 weeks	3.14	0.36		
Group B	Baseline	4.09	0.37	<0.001*	Baseline vs 4 weeks: 0.002*
	4 weeks	3.49	0.51		Baseline vs 12 weeks: <0.001* 4 weeks vs 12 weeks: 0.249
	12 weeks	3.20	0.41		

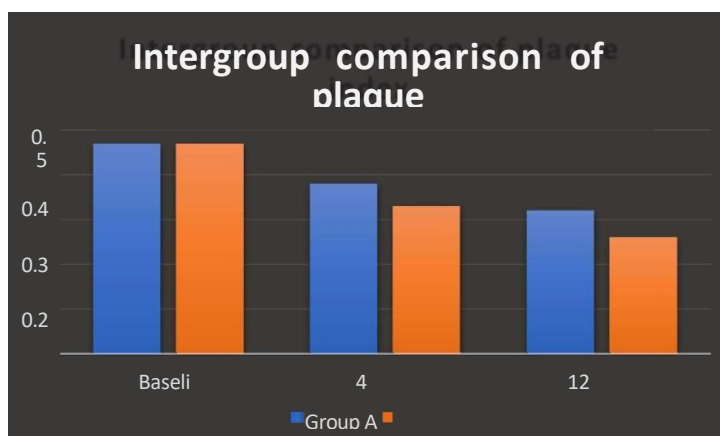
Friedman test; Post hoc Bonferroni test; * indicates a significant difference at $p \leq 0.05$

Table 8: Intergroup comparison of CAL

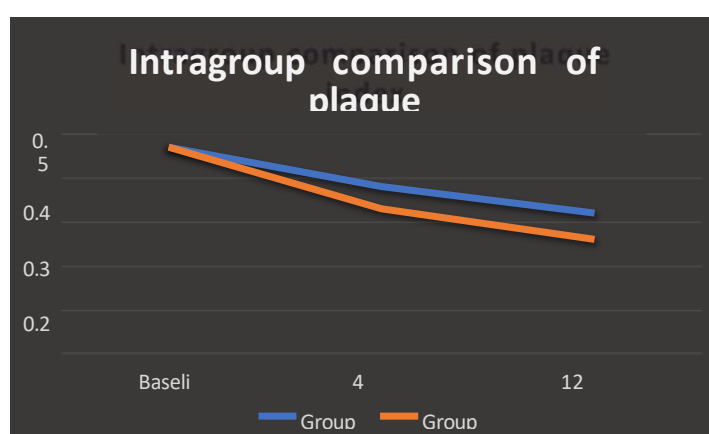
Interval	Group A		Group B		Difference	p-value
	Mean	SD	Mean	SD		
Baseline	4.23	0.48	4.09	0.37	0.14	0.030*
4 weeks	3.51	0.51	3.49	0.51	0.02	0.812
12 weeks	3.14	0.36	3.20	0.41	-0.06	0.529

Mann Whitney test; * indicates a significant difference at $p \leq 0.05$

GRAPH 1: INTERGROUP COMPARISON OF PLAQUE INDEX IN BOTH THE GROUPS

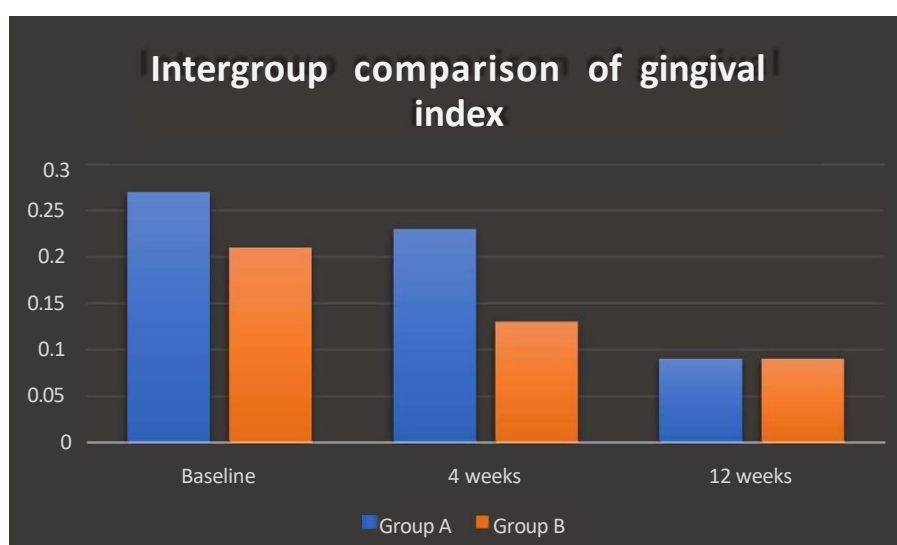


GRAPH 2: INTRAGROUP COMPARISON OF PLAQUE INDEX IN BOTH THE GROUPS

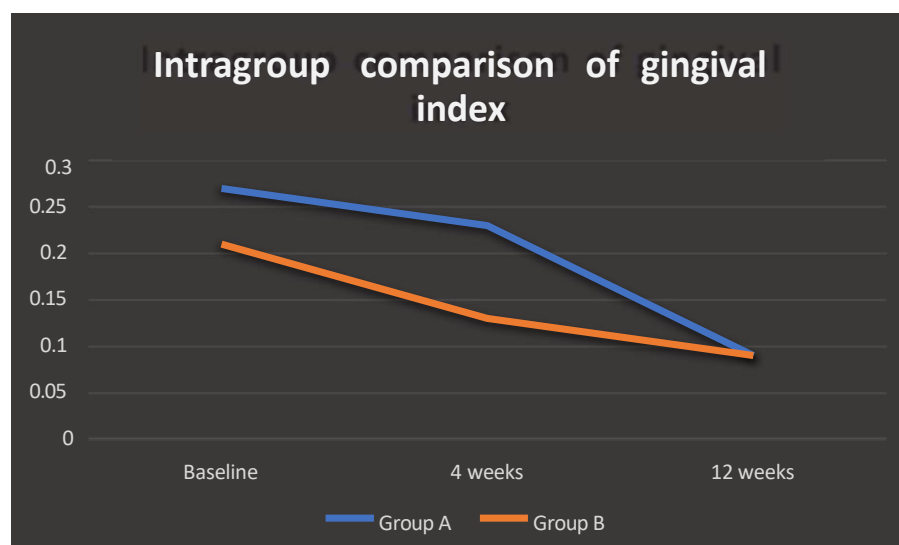


INTERVAL	GROUP A	GROUP B
BASELINE	0.47	0.47
4 WEEKS	0.38	0.33
12 WEEKS	0.32	0.26

GRAPH 3: INTERGROUP COMPARISON OF GINGIVAL INDEX IN BOTH THE GROUPS

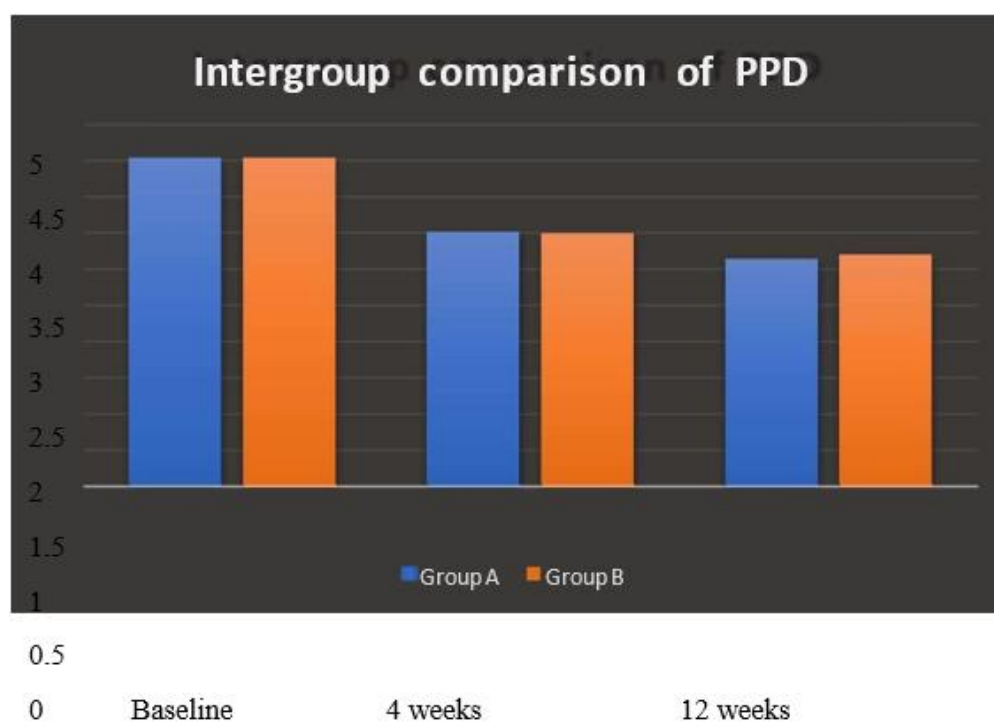


GRAPH 4: INTRAGROUP COMPARISON OF GINGIVAL INDEX IN BOTH THE GROUPS

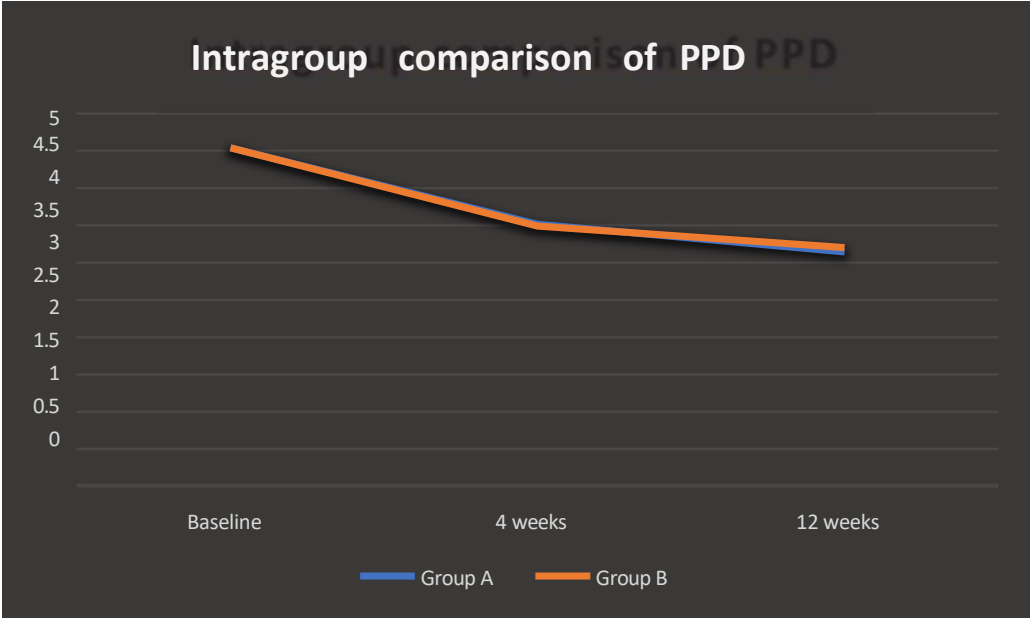


INTERVAL	GROUP A	GROUP B
BASELINE	0.27	0.21
4 WEEKS	0.23	0.13
12 WEEKS	0.09	0.09

GRAPH 5: INTERGROUP COMPARISON OF POCKET PROBING DEPTH IN BOTH THE GROUPS

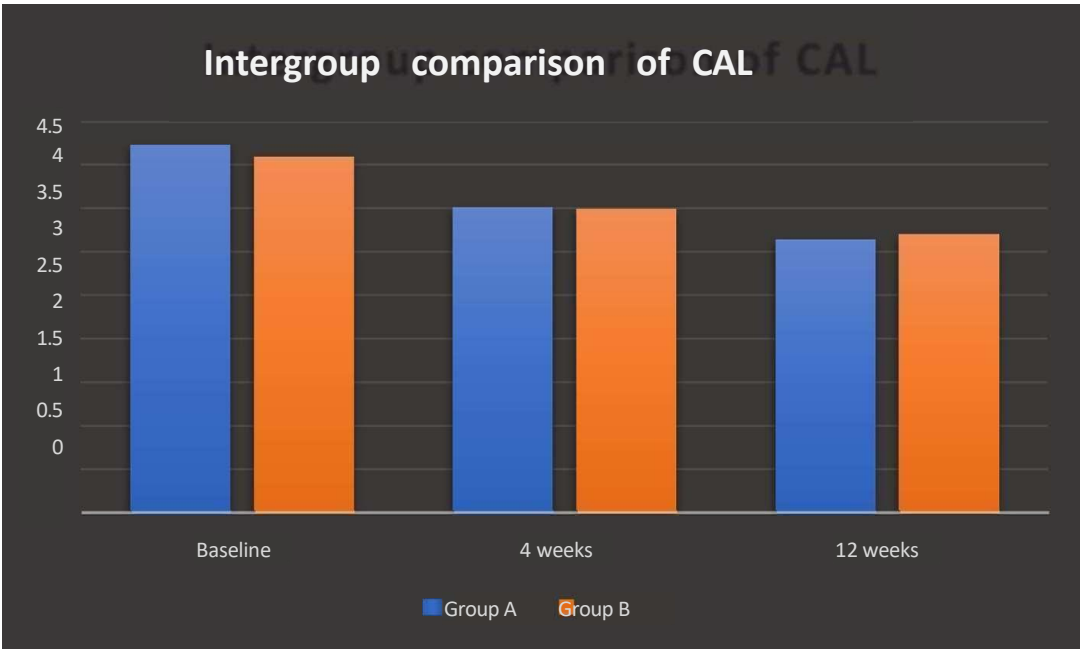


GRAPH 6: INTRAGROUP COMPARISON OF POCKET PROBING DEPTH IN BOTH THE GROUPS

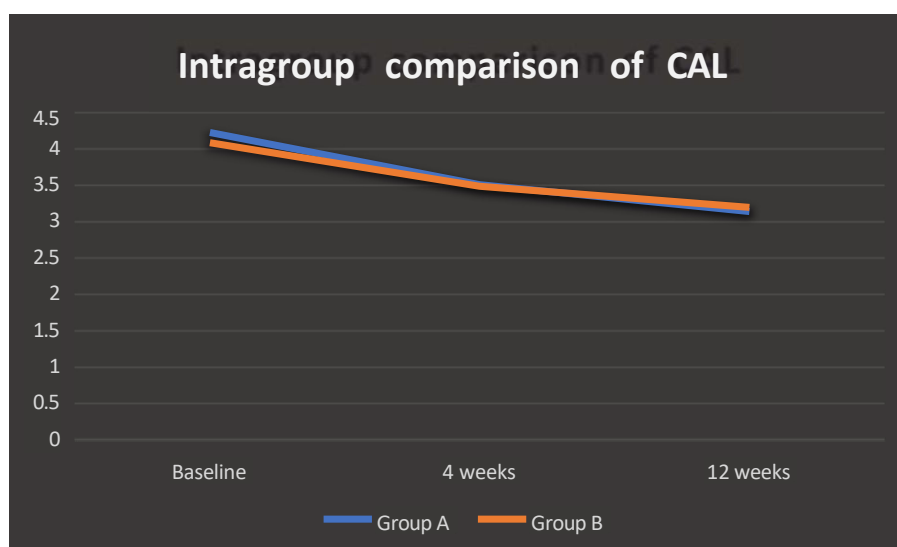


INTERVAL	GROUP A	GROUP B
BASELINE	4.54	4.54
4 WEEKS	3.51	3.49
12 WEEKS	3.14	3.2

GRAPH 7: INTERGROUP COMPARISON OF CLINICAL ATTACHMENT LEVEL IN BOTH THE GROUPS



GRAPH 8: INTRAGROUP COMPARISON OF CLINICAL ATTACHMENT LEVEL IN BOTH THE GROUPS



INTERVAL	GROUP A	GROUP B
BASELINE	4.23	4.09
4 WEEKS	3.51	3.49
12 WEEKS	3.14	3.2

RESULTS AND OBSERVATIONS

The present study aimed to assess and compare the clinical efficacy of tetracycline fibers and 0.2% hyaluronic acid gel in the treatment of periodontitis. Clinical parameters were evaluated at baseline, 4 weeks, and 12 weeks following local drug delivery therapy.

A total of 70 patients aged between 20 and 65 years were enrolled after screening. All patients underwent Phase I therapy involving full-mouth scaling and root planing using hand and ultrasonic instruments. Post-operative evaluations were conducted at 4 and 12 weeks.

The collected data were analyzed using SPSS version 27.0. Mean values were expressed as mean $\pm$ standard deviation. Tests applied included the Friedman test, Post hoc Bonferroni, Student's t-test, One-Way ANOVA, and Mann-Whitney U test. A 95% confidence interval and significance level of $p < 0.05$ were considered for analysis. The clinical parameters analyzed were Plaque Index (PI), Gingival Index (GI), Pocket Probing Depth (PPD), and Clinical Attachment Level (CAL).

Plaque Index (PI)

In Group A, the PI decreased from 0.47 mm at baseline to 0.32 mm at 12 weeks. Group B showed a similar trend, with PI reducing from 0.47 mm to 0.26 mm. Both groups exhibited significant reductions over time, but the intergroup differences at all intervals were statistically non-significant.

Gingival Index (GI)

Group A showed a reduction in GI from 0.27 mm at baseline to 0.09 mm at 12 weeks. In Group B, the GI dropped from 0.21 mm to 0.09 mm. Within both groups, the reduction was statistically significant. Intergroup comparison showed a significant difference only at 4 weeks, with Group B performing better.

Pocket Probing Depth (PPD)

PPD in Group A reduced from 4.54 mm at baseline to 3.14 mm at 12 weeks. Similarly, in Group B, it decreased from 4.54 mm to 3.20 mm. Both groups showed statistically significant improvements over time. However, there was no significant difference between the two groups at any time point.

Clinical Attachment Level (CAL)

In Group A, CAL improved from 4.54 mm at baseline to 3.14 mm at 12 weeks. Group B showed a similar trend

with values improving from 4.54 mm to 3.20 mm. Both groups exhibited significant intra-group improvements, while intergroup differences were not significant at 4 and 12 weeks.

DISCUSSION

Periodontitis is a chronic inflammatory disease requiring effective treatment to control infection, reduce inflammation, and support tissue healing.¹⁰ While scaling and root planing (SRP) is the standard non-surgical therapy, adjunctive treatments like tetracycline fibers and hyaluronic acid (HA) gel enhance outcomes.

Tetracycline fibers, known for their sustained local drug release, inhibit bacterial protein synthesis and reduce microbial load, improving clinical parameters such as probing depth (PD), clinical attachment level (CAL), and bleeding on probing (BOP).¹¹ However, they may cause irritation or allergic reactions and have limitations in antibiotic-resistant cases.

HA gel, a naturally occurring substance with anti-inflammatory and tissue-regenerative properties, aids in healing by promoting fibroblast activity and collagen synthesis. It offers a non-antibiotic alternative with minimal side effects and good biocompatibility, though its effectiveness may vary based on concentration and application technique.¹²

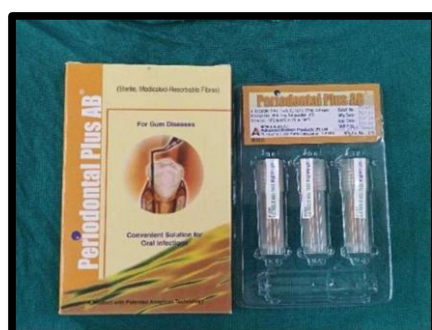
Comparative studies suggest tetracycline fibers are more effective in reducing bacterial load, while HA gel excels in promoting tissue healing and reducing inflammation. The choice of adjunct depends on individual clinical needs, including infection severity and healing potential. Clinical studies support the efficacy of both agents.¹³ Tetracycline fibers showed better BOP reduction (Mandeep Kaur, 2020), while HA gel demonstrated improvements in gingival health (Gontiya & Galgali, 2018). Both showed benefits over SRP alone.¹⁴

This study confirms the value of both local therapies in enhancing periodontal treatment, suggesting individualized use based on patient condition. Further long-term studies are needed to evaluate their sustained effectiveness in periodontal stability and regeneration.

Group- A Treated with Periodontal Plus Ab (Tetracycline Fibers)



PHOTOGRAPH NO. 1
Preoperative Patient Preparation



PHOTOGRAPH NO. 2
Periodontal Plus AB
(Tetracycline Fibers)



PHOTOGRAPH NO. 3
Periodontal dressing (Coe-Pak)



PHOTOGRAPH NO. 4
Surgical Armamentarium



PHOTOGRAPH NO. 5
Baseline Measurement of Pocket
Probing Depth (5mm) by using UNC-
15 (Hu-Friedy)



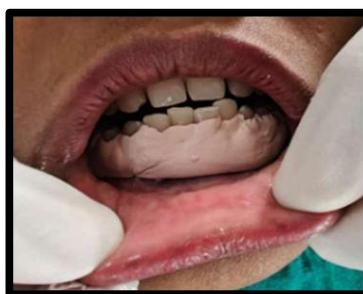
PHOTOGRAPH NO. 6
Tetracycline Fibers soaked in
saline



PHOTOGRAPH NO. 7
Periodontal Plus
AB (Tetracycline
Fibers) placed



PHOTOGRAPH NO. 8
Curettage done by using
Hu- Friedy 1/2 Gracey
Curette



PHOTOGRAPH NO. 9
Periodontal dressing (Coe-Pak)



PHOTOGRAPH NO. 10
Measurement of Pocket Probing
Depth (4mm) at 4th week by using
UNC- 15 (Hu-Friedy)



PHOTOGRAPH NO. 11
Measurement of Pocket Probing
Depth (3mm) at 8th week by using
UNC- 15 (Hu-Friedy)

Group- B Treated with 0.2% Hyaluronic Acid Gel (Gengigel)



PHOTOGRAPH NO. 12
Preoperative Patient Preparation



PHOTOGRAPH NO. 13
0.2% Hyaluronic Acid Gel
(Gengigel)



PHOTOGRAPH NO. 14
Surgical Armamentarium



PHOTOGRAPH NO. 15
Baseline Measurement of Pocket
Probing Depth (5mm) by using UNC-
15 (Hu-Friedy)



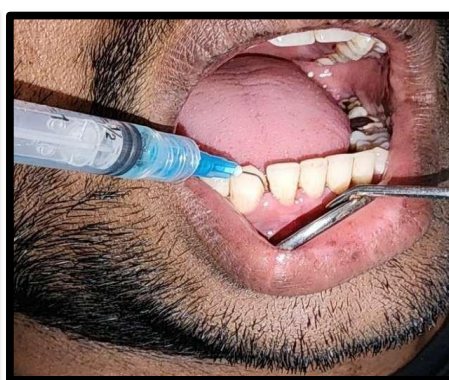
PHOTOGRAPH NO. 16
Crettage done by using Hu- Friedy
1/2Gracey Curette



PHOTOGRAPH NO. 17
0.2% Hyaluronic Acid Gel
(Gengigel)
Placed at baseline



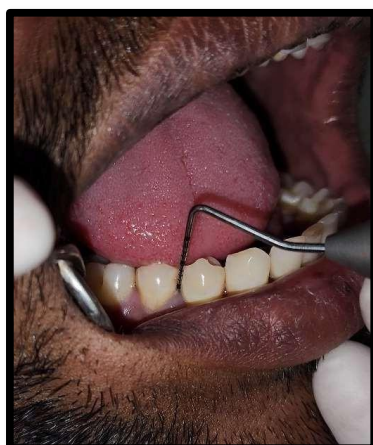
PHOTOGRAPH NO. 18
0.2% Hyaluronic Acid Gel (Gengigel)
Placed at 4th week



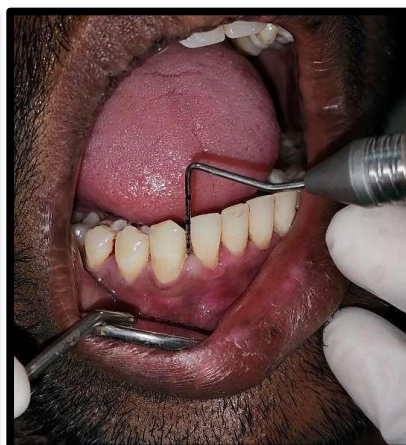
PHOTOGRAPH NO. 19
0.2% Hyaluronic Acid Gel (Gengigel)
Placed at 8th week



PHOTOGRAPH NO. 20
Periodontal dressing (Coe-Pak)



PHOTOGRAPH NO. 21
Measurement of
Pocket Probing
Depth (4mm) at 4th
week by using UNC-
15 (Hu-Friedy)



PHOTOGRAPH NO. 22
Measurement of Pocket
Probing Depth (3mm)
at 8th week by using
UNC- 15 (Hu-Friedy)

CONCLUSION

This study evaluated and compared the efficacy of local drug delivery systems using tetracycline fibers and 0.2% hyaluronic acid gel as adjuncts to scaling and root planing (SRP) in the treatment of periodontitis. Both agents demonstrated positive effects on clinical parameters such as pocket depth reduction, clinical attachment level improvement, and enhanced periodontal healing when used alongside SRP.

Tetracycline fibers, known for their strong antimicrobial properties, helped reduce microbial load in periodontal pockets and provided sustained drug release, which contributed to better control of bacterial infection and improved tissue healing. This resulted in greater clinical gains, particularly in pocket depth reduction and attachment level improvement.

Hyaluronic acid gel, a naturally occurring substance with anti-inflammatory and tissue- regenerative properties, also showed beneficial effects. It supported wound healing, reduced inflammation, and aided in tissue regeneration. Although clinical improvements were noted in both groups, the outcomes were slightly more pronounced in the tetracycline group, possibly due to its direct antibacterial action.

In conclusion, both adjunctive therapies are effective, but their use should be tailored based on individual patient needs and treatment goals. Further long-term studies with larger samples are needed to validate these findings and provide more definitive clinical guidelines for periodontitis management.

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