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IP International Journal of Periodontology and Implantology

Journal homepage: https://www.ijpi.in/

Original Research Article

Evaluation of different local drug delivery systems in the management of chronic periodontitis: A comparative study

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ARTICLE INFO

Article history:
Received 15-05-2023
Accepted 17-06-2023
Available online 29-06-2023

Keywords:
Local drug delivery
SRP
Metronidazole gel
Tetracycline fibres

ABSTRACT

Introduction: Periodontal disease is an immune-inflammatory disease affecting the soft tissues and alveolar bone and surrounding periodontal tissues. The standard treatment involves scaling and root planing (SRP) which removes the sub gingival microbial deposits effectively and the gingival health is maintained. Sometimes the treated areas may show regrowth of the microorganisms and the non-surgical periodontal treatment alone cannot eliminate the micro-organisms in mild periodontitis cases due to the difficulty in reaching the subgingival areas which are deeper and in complex root morphologies. So now a days the non-surgical periodontal treatment combined with the use of systemic antimicrobial agents and host modulating agents has shown to use effectively in the treatment of periodontal diseases.

Materials and Methods: All the patients who were diagnosed with chronic periodontitis underwent initial therapy i.e., full-mouth scaling and root planing. Then the oral hygiene instructions were given to the patients and were recalled after 1 week (baseline visit). A total of 20 patients who met the inclusion criteria and showed satisfactory condition after the initial therapy with persistent periodontal pockets were included in this study. They were randomly assigned into two groups i.e., Group-A: metronidazole gel (metrogyl) and Group B: tetracycline fibre groups with 10 patients in each group. The periodontal clinical parameters like plaque index (PI), gingival index (GI) and periodontal pocket depth (PPD) were evaluated at the baseline visit before the application of local drug delivery and 15 and 30 days after the local drug delivery application.

Results: The mean plaque scores were reduced from 1.41±0.04 at baseline to 1.04±0.14 at 30 days. Likewise in Group-B the mean PI scores reduced from 1.50±0.10 at baseline to 1.25±0.18 at 30 days. The mean gingival index scores reduced from 1.41±0.04 at baseline to 1.01±0.04 at 30 days. Likewise in Group-B mean GI Scores reduced from 1.36±0.03 at baseline to 0.99±0.06 at 30 days. The mean PPD scores were reduced from 5.65±0.12 at baseline to 3.15±0.10 at 30 days in Group-A. Likewise in Group-B mean PPD scores reduced from 5.68±0.06 at baseline to 3.26±0.10 at 30 days.

Conclusion: This study demonstrated that although thorough SRP is an effective treatment method for elimination of chronic periodontal pockets, improved results can be obtained by adjunctive use of locally administered metronidazole gel and tetracycline fibers.

1. Introduction

Gingival and periodontal diseases have affected mankind in their varied forms. Periodontal disease is an immune-inflammatory disease affecting the soft tissues and

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https://doi.org/10.18231/j.ijpi.2023.022

alveolar bone and surrounding periodontal tissues.[1] The inflammation process in the periodontal tissues is started by bacterial infection and microbial plaque. The bacterial organisms form a microbial complex and biofilm in the periodontal pocket. This biofilm extends sub gingivally and affect the periodontal tissues. The periodontal diseases are not just confined to the oral cavity but also affects the systemic diseases through its spread into the systemic circulation.[2]

The periodontal disease starts as gingivitis which is the infection is confined only to the gingival tissues and if left untreated it may progress to periodontitis which is the infection spreads to the periodontal ligament, alveolar bone and causes destruction of the supporting periodontal tissues by pocket formation. This favours the growth of various micro-organisms such as Prevotella intermedia, Aggregatibacter actinomycetem comitans, Porphyromonas gingivalis, Tanerella forsythia etc. Gingivitis is a reversible condition whereas periodontitis is not. The gingival diseases can be treated effectively with non-surgical periodontal treatment i.e., mechanical debridement of the tissues which comprises of scaling and root planing (SRP) whereas periodontitis needs additional treatment besides non-surgical periodontal treatment followed by periodontal surgery if needed.[3]

As the bacterial biofilm extends deep into the subgingival tissues the patients find it difficult to clean in those areas and may lead to microbial deposits sub-gingivally.[2] The standard treatment involves scaling and root planing which removes the sub gingival microbial deposits effectively and the gingival health is maintained. Sometimes the treated areas may show regrowth of the microorganisms and the non-surgical periodontal treatment alone cannot eliminate the micro-organisms in mild periodontitis cases due to the difficulty in reaching the subgingival areas which are deeper and in complex root morphologies.[3] So now a days the non-surgical periodontal treatment combined with the use of systemic antimicrobial agents and host modulating agents has shown to use effectively in the treatment of periodontal diseases.[1] The correct choice of the antimicrobial agent and the route of administration is the key to successful periodontal therapy. The systemic antimicrobials are effective only when given in the correct dosage and form to reach the periodontal pocket area.[3]

Thus, the clinicians choose local drug delivery (LDD) over systemic antimicrobials as they are injected directly into the subgingival and periodontal pocket sites in the oral cavity. The local drug delivery systems also have low side effects, less drug resistance, avoidance of first pass metabolism, reduction in the dosage and patient compliance and are easy to apply and ensures complete penetration into the pocket areas and thus removing the periodontal pathogens responsible for periodontitis.[2,3] The various local drug delivery agents are used individually or in combination with non-surgical periodontal therapy. These include tetracycline, minocycline, doxycycline, metronidazole, chlorhexidine, simvastatin and alendronate gels.[2]

2. Aims and Objectives

AIM: The aim of the present study is to assess the efficacy of different local drug delivery systems in the treatment of chronic periodontitis patients.

3. Objectives

1. To assess the efficiency of SRP+ metronidazole gel (metrogyl) in chronic periodontitis (CP) patients.
2. To evaluate the efficiency of SRP+ tetracycline fibres in chronic periodontitis patients.
3. To compare the efficacy of metronidazole gel and tetracycline fibers as an adjunct to SRP in the management of chronic periodontitis patients.

4. Materials and Methods

This study was conducted in the Department of Periodontics, Mamata Dental College, Khammam, Telangana. The study protocol was approved by the institutional ethical committee, and written informed consent was obtained from all the patients after explaining about the procedure. Patients reporting to the Department of Periodontics were selected in this study.

Inclusion criteria and exclusion criteria: (i) Patients aged between 30-55 years (ii) systemically healthy patients (iii) Two or more teeth that are not adjacent and have a persistent periodontal pocket with bleeding or suppuration on probing (iv) furcation involvement (v) aggressive periodontitis (vi) Use of antimicrobial therapy systemically 2 months before commencement of the study (vii) Known allergy to tetracycline or metronidazole (viii) Patients who underwent periodontal surgeries in the past (ix) Smoking (x) Periodontal treatment done in the past 3 months before the baseline visit.

4.1. Study design

All the patients who were diagnosed with chronic periodontitis underwent initial therapy i.e.,full-mouth scaling and root planing using ultrasonic instruments and Gracey curettes. Then the oral hygiene instructions were given to the patients and were recalled after 1 week (baseline visit). A total of 20 patients who met the inclusion criteria and showed satisfactory condition after the initial therapy with persistent periodontal pockets were included in this study. They were randomly assigned into two groups i.e., metronidazole gel (metrogyl) and tetracycline fibre groups with 10 patients in each group.

The patients in the metronidazole gel group received 1 ml of metrogyl sub gingivally until the base of the pocket and the patients in the tetracycline group were filled with tetracycline fibres in the pocket.

The periodontal clinical parameters like plaque index (PI), gingival index (GI) and periodontal pocket depth (PPD) were evaluated at the baseline visit before the application of local drug delivery and 15 and 30 days after the local drug delivery application.

5. Results

A total of 20 patients with chronic periodontitis after a recall period of 1 week were included, where 10 patients received metrogyl sub gingivally and the other 10 patients received tetracycline fibres. Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) software version 25.0. and independent t test was performed for inter-group comparisons.

Fig. 1: Tetracycline fibres (Periodontal plus AB)

Fig. 2: Metronidazole gel

Fig. 3: Measuring probing pocket depth

Fig. 4: Placement of Metrogyl gel

Fig. 5: Measuring probing pocket depth

Fig. 6: Placement of tetracycline fibres

5.1. Plaque index (PI)[4]

The mean PI scores were 1.41±0.04, 1.27±0.08 and 1.04±0.14 at baseline, 15 days and 30 days in Group-A. The mean plaque scores were reduced from 1.41±0.04 at baseline to 1.04±0.14 at 30 days. Likewise in Group-B the mean PI scores reduced from 1.50±0.10 at baseline to 1.25±0.18 at 30 days. (Tables 1, 2 and 3)

The two groups demonstrate statistically significant difference at various intervals.

5.2. Gingival index (GI)[4]

The mean GI scores were 1.41±0.04, 1.16±0.06 and 1.01±0.04 at baseline, 15 days and 30 days respectively in Group-A. The mean gingival index scores reduced from 1.41±0.04 at baseline to 1.01±0.04 at 30 days. Likewise in Group-B mean GI Scores reduced from 1.36±0.03 at baseline to 0.99±0.06 at 30 days.

The two groups demonstrate statistically significant difference at various intervals. (Tables 4, 5 and 6)

5.3. Probing pocket depth (PPD)

The mean PPD scores were 5.65±0.12, 4.42±0.21 and 3.15±0.10 at baseline, 15 days and 30 days respectively. The mean PPD scores were reduced from 5.65±0.12 at baseline to 3.15±0.10 at 30 days in Group-A. Likewise in Group-B mean PPD scores reduced from 5.68±0.06 at baseline to 3.26±0.10 at 30 days. (Tables 7, 8 and 9). The two groups demonstrate statistically significant difference at various intervals.

Table 1: Mean comparison of Plaque index scores - inter group comparisons

Intergroup Comparison		Mean	SD	P Value
Baseline	Group A	1.4130	0.04423	1.000
	Group B	1.4130	0.04165	
15 days	Group A	1.2600	0.06549	0.058
	Group B	1.1490	0.16024	
30 days	Group A	1.0440	0.14524	0.846
	Group B	1.0340	0.06947	

6. Discussion

Scaling and root planing in combination with proper plaque control by a patient can stop periodontitis. However, there might be regrowth of the microorganisms in some instances leading to failure to stop periodontitis in such patients. In such cases use of adjunctive treatments becomes necessary.[2] It has been shown that systemic antibiotics delivered to the periodontitis patients showed a decrease in the probing pocket depth and improvement in plaque scores and gingival health. High concentrations of the drug are necessary for their effective action in the gingival

Table 2: Mean comparison of plaque index scores - intra group comparisons in Group A

Intergroup Comparison		Mean	SD	P Value
Group A	Baseline	1.4130	0.04423	**0.000***
	15 days	1.2600	0.06549	
	30 days	1.0440	0.14524	
Pair wise comparisons –Tukeys test				
Comparison between		Mean Difference		p value
Baseline	15 days	0.153		**0.000***
	30 days	0.369		**0.000***
15 days	30 days	0.216		**0.000***

Table 3: Mean comparison of plaque index scores - intra group comparisons in Group B

Intergroup Comparison		Mean	SD	P Value
Group B	Baseline	1.4130	0.04165	**0.000***
	15 days	1.1490	0.16024	
	30 days	1.0340	0.06947	
Pair wise comparisons –Tukeys test				
Comparison between		Mean Difference		p value
Baseline	15 days	0.264		**0.001***
	30 days	0.379		**0.000***
15 days	30 days	0.115		**0.000***

Table 4: Mean comparison of gingival scores - inter group comparisons

Intergroup Comparison		Mean	SD	P Value
Baseline	Group A	1.4110	0.04433	0.021*
	Group B	1.3670	0.03268	
15 days	Group A	1.1620	0.06713	0.169
	Group B	1.1230	0.05376	
30 days	Group A	1.0130	0.04523	0.408
	Group B	0.9910	0.06855	

Table 5: Mean comparison of gingival scores - intra group comparisons in Group A

Intergroup Comparison		Mean	SD	P Value
Group A	Baseline	1.4110	0.04433	0.000*
	15 days	1.1620	0.06713	
	30 days	1.0130	0.04523	
Pair wise comparisons –Tukeys test				
Comparison between		Mean Difference		p value
Baseline	15 days	0.249		0.000*
	30 days	0.398		0.000*
15 days	30 days	0.149		0.000*

Table 6: Mean comparison of gingival scores - intra group comparisons in Group B

Intergroup Comparison		Mean	SD	P Value
Group B	Baseline	1.3670	0.03268	0.000*
	15 days	1.1230	0.05376	
	30 days	0.9910	0.06855	
Pair wise comparisons –Tukeys test				
Comparison between		Mean Difference		p value
Baseline	15 days	0.244		0.000*
	30 days	0.376		0.000*
15 days	30 days	0.132		0.000*

Table 7: Mean comparison of periodontal pocket depth - inter group comparisons

Intergroup Comparison		Mean	SD	P Value
Baseline	Group A	5.6570	0.12711	0.539
	Group B	5.6850	0.06169	
15 days	Group A	4.4260	0.21009	0.784
	Group B	4.4480	0.13596	
30 days	Group A	3.1550	0.10522	**0.029***
	Group B	3.2690	0.10888	

Table 8: Mean comparison of periodontal pocket depth - intra group comparisons in Group A

Intergroup Comparison		Mean	SD	P Value
Group A	Baseline	5.6570	0.12711	**0.000***
	15 days	4.4260	0.21009	
	30 days	3.1550	0.10522	
Pair wise comparisons –Tukeys test				
Comparison between		Mean Difference		p value
Baseline	15 days	1.231		**0.000***
	30 days	2.502		**0.000***
15 days	30 days	1.271		**0.000***

Table 9: Mean comparison of periodontal pocket depth - intra group comparisons in Group B

Intergroup Comparison		Mean	SD	P Value
Group B	Baseline	5.6850	0.06169	**0.000***
	15 days	4.4480	0.13596	
	30 days	3.2690	0.10888	
Pair wise comparisons –Tukeys test				
Comparison between		Mean Difference		p value
Baseline	15 days	1.237		**0.000***
	30 days	2.416		**0.000***
15 days	30 days	1.179		**0.000***

crevicular fluid and in the periodontal pocket areas. The use of antibiotics over prolonged period may lead to antibiotic resistance. Thus the sustained and controlled release delivery systems of the drugs locally have been employed and are shown to be effective as they are site specific and have more penetration into the gingival tissues than systemic antimicrobials.[1]

The present study showed a significant decrease in the mean probing depth in the tetracycline group. Awartani FA conducted a study using metronidazole gel in combination with SRP and showed a significant reduction in probing pocket depth from baseline to 14 weeks after therapy.Panwar M also conducted a study using tetracycline fibres and showed reduction in probing depth.[5] which is in accordance with the present study.[6]

The present study showed a decrease in the plaque scores. Soares PB et al conducted a study where tetracycline fibres were used with SRP and showed a decrease in the plaque index scores after 28 days.[7]

The present study showed a decrease in the gingival scores significantly in the metrogyl group. Pandit N conducted a study using metronidazole and showed a decrease in the gingival scores from baseline to 3 months which is in accordance with the present study.[8] Jeong SN et al conducted a study using mixture of tetracycline fibres and citric acid containing gel and observed a decrease in the probing pocket depth from the baseline to 12 weeks.[9]

The improvement in gingival and plaque indices and PPD was nearly same in the two groups. The gingival and plaque indices improved in all patients post treatment and the results were sustained during the study.

The limitations of the present study are small sample size, the short evaluation period, the locally delivered antimicrobial agents were assessed for short-term benefit in periodontal management.

7. Conclusion

This study demonstrated that although thorough SRP is an effective treatment method for elimination of chronic periodontal pockets, improved results can be obtained by adjunctive use of locally administered metronidazole gel and tetracycline fibers. Studies with a bigger sample size are needed in the future to assess the clinical effectiveness of these drugs as a local drug delivery system in patients with chronic periodontitis.

8. Source of Funding

None.

9. Conflict of Interest

None.

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Cite this article: Himaja G, Paul RA, Mutthineni RB, Muralidharan G, Burli VVA, Duddukuri H. Evaluation of different local drug delivery systems in the management of chronic periodontitis: A comparative study. *IP Int J Periodontol Implantol* 2023;8(2):109-114.