Comparison of conventional periodontal therapy versus scaling and root planing with subgingival minocycline gel 2%

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ABSTRACT

Background: Alternative regimens using subgingival minocycline plus scaling and root planing (SRP/M) significantly improved clinical attachment (CAL) and reduced probing depth (PD) compared with SRP alone. The purpose of this study was to evaluate clinical and radiographic outcomes in 2 periodontitis cohorts, one receiving conventional periodontal therapy and the other receiving scaling and root planing with multiple doses of subgingival minocycline.

Materials and Method: Moderate to advanced chronic periodontitis patients were concurrently treated with either (1) scaling and root planing with 4 subgingival doses of minocycline in all ≥5mm pockets over a 6 month period (SRP/M) n = 25 patients or (2) conventional therapy 6 month period (SRP n = 25 patients). Clinical and radiographic measurements including (PD), CAL, BOP and interproximal bone height (BH), were analyzed at baseline and 1 year.

Results: Baseline clinical and radiographic data were similar between SRP/M and SRP patients. PD showed greater mean improvement in SRP/M (1.1 ± 0.1 versus 0.5 ± 0.1 mm P=0.02) with 25% of subject of SRP/M gaining ≥2mm compared to 4.2% in SRP. The mean loss in bone height and percent subjects losing bone height were less in SRP/M (2.9 ± 0.6 mm) than SRP (3.7 ± 0.7mm) while cross sectional SRP/M data between CAL and BH or PD and CAL were highly correlated, changes over 1 year were not correlated among any of these parameters.

Conclusion: Scaling and root planing and subgingival minocycline in experimental sites resulted in more PD reduction and less frequent bone height loss than conventional periodontal treatment alone.

Keywords: Root planing, minocycline.

INTRODUCTION

The management of periodontal disease includes many treatment modalities such as conventional therapies consisting of surgery and/or non surgical methods. In any case, the purpose of periodontal treatment is to arrest progressive tissue destruction and to prevent further attachment loss. Undoubtedly to successfully treat periodontitis we have to find more effective technique surgical as well as non surgical (1-3).

Antimicrobial therapy has become an accepted part in periodontal treatment (4). Use of subgingival antimicrobial medications including tetracycline, has been shown to improve probing depths (PD) and clinical attachments levels (CAL) (5,6). This is presumably due to decreases in gingival inflammation by modulating the inflammatory response and suppressing the pathogenic microbiota. The use of these medications may improve the clinical outcome of therapy (7).

The fact that periodontal tissues can be infected by specific anaerobes and that these bacteria are present in some sites with recurrent or persistent disease even after mechanical treatment methods so that it requires a special treatment concept, a combination of mechanical treatment modalities with antibiotics therapy had been suggested (8,10).

Clinical studies have demonstrated that minocycline has a beneficial effect on various parameters of chronic and acute inflammatory periodontal disease. Due to the antibacterial and anticollagenolytic properties of tetracyclines, use of minocycline in conjunction with scaling and root planing (SRP +M) may further slow the rate of bone loss (10,11).

In a randomized, double blind comparative study subgingival administrated minocycline in patients with adult periodontitis revealed that it was a safe and efficient adjunct to scaling and root planing (13). It also led to significant adjunctive improvement after subgingival instrumentation in both clinical and microbiological variables over a 3 to 15 months period (12,13). In vitro studies have also suggested that minocycline may be more effective than the other tetracyclines on various microbiological components of dental plaque (14,15).

In recent years, numerous studies have demonstrated improvement in clinical periodontal parameters after additional treatment with metronidazole and tetracycline in cases of severe periodontitis (7,16,17). It has become clear that scaling and root planing are essential in initial periodontal therapy to reduce inflammation via the removal of plaque, calculus and endotoxins from the root surfaces of all teeth. Therefore, the purpose of this study was to assess the comparison of conventional periodontal treatment versus scaling and root...
planning (SRP) with subgingival minocycline gel.

MATERIALS AND METHODS

Patients’ selection and assignment to treatment groups

Subjects presenting to the department of Periodontology College of Dentistry, University of Baghdad were selected after a periodontal screening examination by a periodontist. The selected patients were given an oral explanation of the clinical trial. A total of 50 patients with moderate to advanced chronic periodontitis were selected for these studies (28 females and 22 males, 35-65 years of age) met the following criteria:

1. At least 2 molar or premolar teeth with ≥ 5mm interproximal pockets,
2. Did not have specific systemic diseases.
3. Had not recently taken medication.
4. No scaling and root planing within the past 6 months.
5. Not pregnant or lactating. Once subjects were selected for participation, they were assigned to their respective treatment groups.

The subjects were randomly divided into 2 groups. The test group, n=25; in those patients, all ≥ 5 pockets were scaled and root planed (SRP) using ultrasonic and hand curettes, then a dose of minocycline gel 2% is injected subgingivally. After baseline, no additional instrumentation was performed for 1 year.

Control group, n=25, those patients received concurrent conventional therapy consisting of scaling, plaque debridement and root planing without minocycline application. Both groups received oral hygiene instructions as necessary.

Delivery of minocycline

After baseline clinical measurements, scaling and root planing, the minocycline gel 2% was delivered into each ≥ 5 pockets in every study subjected. Prior to delivering the minocycline gel into pocket, the site was dried and cleansed of blood, debris and saliva then application of a subgingivally-administrated gel formulation containing 2% minocycline hydrochloride delivered with a specially designed disposable applicator versus a vehicle control immediately after root planing, and after 1 month, 3 months and 6 months according to study protocol. After baseline appointment and over the course of 1 years investigation, study subject included in the data analysis did not receive any prophylaxis, root planing or drug therapy which could affect the plaque microorganisms.

Clinical and radiographic measurements

The clinical parameters that were recorded at baseline and 1 year including probing pocket depth (PPD), bleeding on probing (BOP) and clinical attachment level, (CAL). In addition four posterior vertical bitewing radiographs were taken at baseline and 1- year following up measurement were made by a masked evaluator from CEJ to alveolar bone height (BH).

Statistical Analysis

Data obtained in the present study were presented as a mean value and standard error. The comparison of clinical outcomes between control group and test group was done by the Mann–Whitney U–test, changes in PPD and BH within groups were evaluated using paired t-test and between groups changes were tested using analysis of variance and chi-square analysis. Correlation coefficients were calculated among clinical and radiographic changes. The statistical computation was performed using a statistical soft ware program.

RESULTS

The baseline clinical data indicated that test group SRP/M and control group SRP were similar according to interproximal probing depths of experimental sites (Table 1), as expected with the matching strategy in the study design. SRP/M had 12 premolar/38 molar sites and SRP had 10 premolars/40 molars.

Bleeding upon probing was reduced over the period of investigation, both protocols reduced percent of patients bleeding on probing, but no statistical differences were found after 1 year (SRP/M =81%; SRP=72%). Changes in PD and BH over 1 year are summarized in Table 2. During one year, an improved PD and CAL were noticeable. The mean PD was reduced from 5.0 ±0.5 mm to 4.5 ± 0.4mm in control group, and from 5.0 ±0.5 mm to 3.9 ±0.4mm in the test group. Probing depths were improved more than 1 mm on average for SRP/M which was significantly different than the SRP group. Both groups showed a significant reduction in PD between baseline and one year visits (P<0.0001 for both groups). Twenty five percent (25%) of SRP/M patients had an experimental site which was improved by ≥ 2.0mm compared to only 4.2% for SRP. In fact 8.3% of SRP patients had a site
which lost ≥ 2.0mm probing depths, while SRP/M patients had no such sites.

During the period of study, the mean CAL was reduced from 7.7 ± 0.6mm to 5.7 ± 0.2 mm in the control group, and from 7.7±0.6mm to 4.7±0.2mm in the test group. Both groups showed a significant CAL gain between the baseline and one year visits (P=0.01 for the control group and p = 0.001 for the test group). The mean gain of CAL was 2.0± 0.3mm in control group and 3.0 ± 0.3mm in the test one, and this difference was statistically significant (P=0.03 and P<0.05) according to the Mann–Whitney U–test.

Average bone height losses appeared to parallel probing gain in that SRP/M had about twice the PD gain and almost about one of the BH losses of the SRP group over the 1 year period (Table 2). There was a statistical significant difference between groups for BH.

Baseline PD versus CAL and BH versus CAL, as well as 1 year PD versus CAL and BH versus CAL, were significantly correlated in the SRP/M, with r values >0.61. Baseline BH also was correlated with 1 year CAL (r=0.72, P=0.001), and baseline CAL was correlated with 1 year BH (r=0.81, P=0.0001) in the SRP/M. PD was not significantly correlated to BH at any time in either group. Although there is cross sectional connections, no significant correlations could be found in either group when changes across the 1 year period were compared (Table 3). The highest correlation coefficient occurred between clinical attachment level and bone height changes measured in SRP/M group (r=0.45; P=0.09).

DISCUSSION

It is widely recognized that scaling /root planing constitutes the basis of periodontal therapy. Clinical research has documented however, that conventional mechanical therapy often leaves behind significant numbers of pathogenic periodontal bacteria. Scaling and root planing may fail to eliminate these bacteria because of their location within the gingival tissue or because their location in tooth structures makes them inaccessible to periodontal instruments.

This investigation demonstrated that local delivery of a minocycline periodontal formulation directly into the gingival crevice following root planing results in a greater reduction of periodontal pocket depth than root planing alone. Other investigators have also examined the effect of the antibiotics delivered into the gingival crevice on the subgingival plaque microbial flora. Our results are consistent with the findings of Goodson et al in 1985, Addy et al in 1988, Deasy et al in 1989, and Minabe et al in 1989 (18-21), in that all of these investigators demonstrated the antibacterial effectiveness of local delivery antimicrobial agents including tetracycline and metronidazole as well as minocycline.

All clinical and radiographic outcomes were numerically better in test group if compared with control group (Table 2). The SRP/M group in our study had a mean decrease in PD of 1.1mm while the SRP was 0.5mm for ≤ 5mm pockets (Tables 1 and 2).Other studies have shown PD reduction with SRP and subgingival chemotherapeutics but most of these studies were less 12 months in length

The SRP/M data was comparable to the study of Garrett et al in 2000 (15) who did scaling and root planing combined with subgingival medication in which SRP/M participated showed a mean 1.31mm reduction in PD for all pockets (5 to 9 mm) while our results demonstrated an overall 1.10mm PD reduction. The SRP group outcome was comparable to the study of Drisko et al in 1995 (26), who reported a 0.36 mm PD decrease with prophylaxis alone while in our study PD reduction in this group was 0.50 Other studies of SRP alone during initial therapy of moderate pockets have shown PD reduction around 1mm after 1 year (26-30).

The mean difference in PD changed between the 2 groups in this study was statistically significant (Table 2). The amount may appear to be less than clinically significant. However, no further instrumentation after baseline was performed in the SRP/M group and no chemotherapeutic treatment was given after the 6 months appointment. In addition, none of the patients had sites which increased in PD in the SRP/M group over 1 year study, (8.3% of SRP subjects had sites which increased, while 25% of subjects had at least one site which improved in PD ≥2mm (P=0.02). In the present investigation the local subgingival delivery of minocycline antimicrobial agent aids in the reduction of periodontal pocket depth and therefore, can help the clinician to achieve a more favorable therapeutic result when used as an adjunct to a
root planing when compared to that observed with root planing alone, this is agreed with many studies. (4,5,16,31).

Little information is available radiographically comparing changes in bone height for various local chemotherapeutics. Jeffcoat et al. showed no bone loss with the chlorhexidine chip in combination with SRP, while 25% of the sites showed some gain in the 9 months study (24). No thresholds to determine real change were described, but mean changes in bone height were within ±0.1mm. Our study had a predetermined threshold of ±0.5mm based on three standard deviations of replicate measurements to provide 99% confidence of real change. The test group (SRP/M) and control group (SRP) in this study showed a minimal incidence of subjects with bone gain ≥0.5mm (4%) and no statistically significant difference between groups. Bone loss of ≥0.5mm occurred in more of the SRP subjects (17.0% SRP, 11.9% SRP/M) but differences were not significant. A comparable 15% of participants receiving SRP alone lost bone in the Jeffcoat study (24).

It is thought that chemotherapeutics work by modulating the inflammatory response and/or by suppressing or eradicating the pathogenic microbiota which should result in maintenance of bone height (32). Even if additional bone height was not gained, a treatment which reduces the progression of bone loss is a step toward effective periodontal maintenance (33).

The mean clinical attachment gain of the test group receiving the non-surgical SRP and local minocycline therapy improved significantly over that of the control group receiving only conventional therapy SRP (Table 2). On the other hand Zucchelli (34), administrated a slow releasing dental gel containing metronidazole benzoate (25%) and they found no statistically significant difference between test group receiving the local antimicrobial therapy and control group given systemic antibiotics. Although some studies concerning the local delivery of antimicrobial therapy, they had no effect of clinical significance on bone regeneration or on soft tissue attachment (3,35,36).

Cross-sectional correlations were found between PD versus CAL and BH versus CAL in the SRP.M group but not between PD versus BH in either group. In additions, BH at baseline was correlated with CAL at 1 year and vice versa. These findings suggest that CAL and BH may parallel each other, but especially BH is not related to the common clinical measurement of PD.

Changes in PD and CAL are subject to changes of inflammation where an increase in soft tissue integrity due to decreased inflammation may decrease probe penetration (37,38).

Bone height measurements would not be expected to be affected by such inflammatory changes and appear to be an efficient measure to compliment PD and CAL in long-term analysis of subgingival antimicrobials (10).

In general, it seems reasonable to conclude that minocycline delivered subgingival as an adjunct to scaling and root planing resulted in more PD reduction and slower BH loss than conventional therapy alone. The data from local-delivery controlled release antimicrobial studies in general, and this study in particular, suggest that further understanding is needed relative to the effects observed in no treatment groups and the impact of supragingival plaque control on the long term outcomes of this type of therapy.

Table 1: Base line clinical and radiographic data

<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
<th>Gender</th>
<th>PD</th>
<th>CAL</th>
<th>Interproximal bone height</th>
<th>BOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test (SRP/M)</td>
<td>53.5±0.5</td>
<td>M=11 F=14</td>
<td>5.0 ±0.5</td>
<td>7.7±0.6</td>
<td>4.5± 0.4</td>
<td>56.2±0.5</td>
</tr>
<tr>
<td>Control (SRP)</td>
<td>55.1±2.5</td>
<td>M=12 F=13</td>
<td>5.0 ± 0.5</td>
<td>7.7±0.6</td>
<td>4.0 ±0.4</td>
<td>57.5±0.5</td>
</tr>
<tr>
<td>P value</td>
<td>0.23</td>
<td></td>
<td>0.72</td>
<td>0.50</td>
<td>0.11</td>
<td>NS</td>
</tr>
</tbody>
</table>

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Table 2: Change in clinical and radiographic data over 1 year

<table>
<thead>
<tr>
<th>Groups</th>
<th>PD reduction</th>
<th>% subjects with sites changing ≥ 2.0mm PD</th>
<th>CAL gain</th>
<th>Interproximal bone height</th>
<th>% subject with sites changing ≥ 0.5mm BH</th>
<th>BOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test (SRP/M)</td>
<td>1.1 ±0.1</td>
<td>+ 25.0</td>
<td>3.0 ±0.3</td>
<td>2.9 ±0.6</td>
<td>+4.5</td>
<td>32.4±0.5</td>
</tr>
<tr>
<td>Control (SRP)</td>
<td>0.5 ±0.1</td>
<td>+4.2</td>
<td>2.0 ±0.3</td>
<td>3.7±0.7</td>
<td>+4.1</td>
<td>33.0±0.5</td>
</tr>
<tr>
<td>P value</td>
<td>0.07</td>
<td>S</td>
<td>0.08</td>
<td>S</td>
<td>0.13</td>
<td>NS</td>
</tr>
</tbody>
</table>

Higher incidence of subject with PD improvement in SRP/M (P=0.020)

Table 3: Correlations among clinical and radiographic changes

<table>
<thead>
<tr>
<th>Comparison</th>
<th>SRP/M</th>
<th>SPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD vs CAL</td>
<td>-0.18</td>
<td>0.61</td>
</tr>
<tr>
<td>PD vs BH</td>
<td>-0.12</td>
<td>0.72</td>
</tr>
<tr>
<td>CAL vs BH</td>
<td>0.40</td>
<td>0.11</td>
</tr>
</tbody>
</table>

PD= interproximal probing depth; CAL= interproximal clinical attachment level; BH= interproximal bone height.

REFERENCES
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