Periodontal Monitoring & Maintenance in 2019

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Getting Started
A few basics

Periodontitis - is bacterial-triggered, inflammatory-mediated loss of connective tissue attachment to teeth, and loss of tooth-supporting alveolar bone

- Loss of supracrestal connective tissue fibers and periodontal ligament fibers
- Apical migration of junctional epithelium
- Loss of crestal alveolar bone height

Risk Factors for Periodontitis
Older age
Poor oral hygiene
Gender → more in males
Race/ethnic group → more in Blacks & Hispanics
Educational status → more if less than high school
Economic status → more in poor
Smoking → markedly increases risk
Certain systemic diseases (poorly-controlled diabetes)
Psychosocial stress → poor coping increases risk
Genetic predisposition → family history increases risk
Subgingival biofilm dysbiosis → with specific pathogenic bacteria (i.e., red and orange complex species)

Subgingival biofilm dysbiosis (imbalance) → get abundance of periodontal bacterial pathogens
- Host immuno-inflammatory response
- Gingival tissue inflammation
- Deepened periodontal pockets, and progressive loss of periodontal connective tissue
- Progressive loss of crestal alveolar bone
- Tooth loss

Abusleme et al. 2013

454-pyrosequencing of 16S rRNA genes

Abusleme et al. 2013
Most severe periodontitis comes from *hyper-inflammatory host responses* to pathogenic biofilm growth on teeth

Pathogenic Subgingival Microbiome

Traditional Therapy:
- Patient Plaque Control
- Mechanical-Surgical Debridement
- Ongoing Periodontal Maintenance Care

Susceptible Host

Virus

Inflammation

Attachment Loss and Bone Resorption

PERIODONTITIS

Most, but not all, periodontitis patients and sites respond adequately to conventional mechanical/surgical periodontal therapy, oral hygiene, and maintenance care.

Severe periodontitis patients treated with ScRP + MWF surgery better probing depth reductions and CAL gains over 6 years post-treatment with 3-month maintenance care vs. no recall

"only isolated surfaces in the recall group patients lost attachment whereas more than half of the surfaces examined in the non-recall group lost between 2-5 mm of attachment"

Alveolar bone height & CAL remained stable during 14 years of systematic maintenance care for most patients
But, how often is the response to conventional therapy inadequate?

Despite comprehensive periodontal therapy, intensive maintenance care, and excellent oral hygiene, a subset of 25% of patients experienced progressive periodontal breakdown.

**Haffajee AD et al.:**

57 adults with chronic periodontitis
≥ 3 hours of ScRP, OHI & 3 month maintenance care
After 9 months
Ongoing loss of mean periodontal attachment in 18 (32%) patients

**Rams TE, Listgarten MA & Slots J:**

78 adults with severe periodontitis
Comprehensive periodontal therapy: OHI, ScRP, pocket elimination surgery
Maintenance every 3 months
Study Baseline: Clinical evaluations, Microbiological testing
12 months Maintenance every 3 months
53 subjects clinically stable
25 subjects (32%) disease active
2+ mm AL with 2+ mm PD or 3+ mm PD

**Rams et al. 1996**

Findings:
Elevated subgingival proportions of one or more of 5 major putative microbial pathogens (*P. gingivalis, A. actinomycetemcomitans, P. intermedia, P. micra, and/or C. rectus*) still found in 48 (61.5%) of 78 adults with severe periodontitis after comprehensive pocket elimination surgical treatment, good oral hygiene, and regular 3-month maintenance care.

**Lindhe J & Nyman S (1984)**

<table>
<thead>
<tr>
<th>Duration of maintenance</th>
<th>0-5 years</th>
<th>6-10 years</th>
<th>11-14 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with attachment loss &gt; 3 mm</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Sites with attachment loss &gt; 3 mm</td>
<td>12</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>3-4 mm</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5-6 mm</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

43 sites (0.8%) in 15 patients (25%)
Higher disease progression rate in subjects with persisting elevated levels of either *P. gingivalis*, *Aa*, *P. intermedia*, *P. micra* and/or *C. rectus*

**Findings:**
In multivariate analysis, persistence of elevated levels of microbial pathogens was associated with a 2.5 (150%) excess relative risk for periodontitis recurrence within 12 months post-treatment.

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**Colombo APV et al.**
Impact of periodontal therapy on the subgingival microbiota of severe periodontitis: Comparison between good responders and “refractory” subjects by the Human Oral Microbe Identification Microarray (HOMIM).
*Journal of Periodontology* 83: 1279, 2012

Compared 17 refractory subjects (RP) to 30 good responders (GR) at 15 months after ScRP, surgery, and systemic amoxicillin-metronidazole

**Refractory periodontitis (RP)** – defined as presence of mean post-tx AL, and/or > 3 sites with AL ≥ 2.5 mm from baseline.

**Good responders (GR)** – defined as mean post-tx attachment gain, and no sites with AL ≥ 2.5 mm from baseline.

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**Species that increased or persisted in high frequency in Refractory Periodontitis but were significantly reduced in Good Responders** included the following:
- *Porphyromonas gingivalis*
- *Tannerella forsythia*
- *Eubacterium* spp.
- *Prevotella* spp.
- *Parvimonas micra*
- *Fusobacterium* sp. OT203
- *Filifactor alocis*
- *Streptococcus constellatus* and *intermedius*

**Overall findings**
Many classical periodontal pathogens, and some “unusual” bacterial species, were *found more commonly* in “refractory” periodontitis → failure to adequately suppress or eliminate periodontal pathogens an important determinant in “treatment-resistant” periodontitis.

(Not merely an impaired host immune response problem)
How do clinicians identify and better manage the subset of periodontitis patients and sites not responding adequately to conventional mechanical/surgical therapy?

The American Academy of Periodontology recommends an annual comprehensive periodontal evaluation ➔ need to assess 6 checklist areas to determine periodontal status

Stage based on 1.) severity of periodontitis, and 2.) complexity of management

Grade is estimate of patient’s periodontitis progression rate as either slow, moderate or rapid (Grade A, B or C)
Step #1
Determine periodontitis stage

<table>
<thead>
<tr>
<th>Periodontitis stage</th>
<th>Initial periodontitis</th>
<th>Moderate periodontitis</th>
<th>Severe periodontitis with potential for additional tooth loss</th>
<th>Advanced periodontitis with extensive tooth loss and potential for loss of dentition</th>
</tr>
</thead>
</table>

Clinical Periodontal Attachment Level

Clinical periodontal attachment level is equal to the sum of the Probing Depth (in mm) plus the distance (in mm) from the CEJ to the free gingival margin (a positive number if recession is present; a negative number if the CEJ is located subgingivally).

Step #2
Determine complexity of periodontitis management

<table>
<thead>
<tr>
<th>Complexity</th>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodontitis stage</td>
<td>Stage I</td>
</tr>
<tr>
<td>Initial periodontitis</td>
<td>Moderate periodontitis</td>
</tr>
<tr>
<td>Probing depth</td>
<td>Vertical bone loss</td>
</tr>
<tr>
<td>Mobility</td>
<td>Degree of mobility</td>
</tr>
</tbody>
</table>

Complexity may shift stage to a higher level ➔ Class 2 or 3 furcation involvement would shift stage to either stage 3 or 4 irrespective of CAL measurement.

Grade 2 or 3 tooth mobility and/or posterior bite collapse would indicate a stage 4 diagnosis

“in general it only takes one complexity factor to shift the diagnosis to a higher stage”
Step #3
Determine periodontitis grade

Estimate of patient’s periodontitis progression rate as either slow, moderate or rapid (Grade A, B or C)

Multi-dimensional periodontal risk assessment ➔ identifying and modifying risk factors predisposing to progressive periodontal breakdown

Bleeding on Probing

Is scored with periodontal probing

Bleeding on Probing

Usually scored as absent or present within 10-15 seconds of periodontal probing.

No bleeding on probing is a reliable indicator of stable periodontal conditions (no or low risk of progressive periodontal attachment loss occurring in the absence of bleeding on probing).

<table>
<thead>
<tr>
<th>Lang NP et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding on probing. A predictor for the progression of periodontal disease?</td>
</tr>
</tbody>
</table>

Repeated lack of BOP at maintenance appointments every 3-5 months over 2 years associated with almost negligible risk of progressive periodontal attachment loss
39 treated periodontitis patients on recall every 2-8 months for 4.5 years had 4.2% sites with 2+ mm attachment loss. Patients with a mean BOP ≤ 20% had significantly lower risk for progressive periodontitis (only 1/5 of loser sites present).

Matulienė G et al.
Influence of residual pockets on progression of periodontitis and tooth loss: results after 11 years of maintenance.
*Journal of Clinical Periodontology* 35: 685, 2008

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>OR</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMHS &gt;30% versus &lt;30%</td>
<td>0.7</td>
<td>0.3-2.0</td>
<td>0.531</td>
</tr>
<tr>
<td>Smoking 1+ vs. 0+ vs. non-smoking</td>
<td>1.8</td>
<td>0.7-4.7</td>
<td>0.208</td>
</tr>
<tr>
<td>Smoking/30+ vs. 20+ vs. non-smoking</td>
<td>5.9</td>
<td>1.6-21.3</td>
<td>0.007</td>
</tr>
<tr>
<td>Diabetes mellitus versus healthy</td>
<td>0.7</td>
<td>0.1-4.6</td>
<td>0.726</td>
</tr>
<tr>
<td>University versus private practice</td>
<td>0.8</td>
<td>0.4-1.6</td>
<td>0.478</td>
</tr>
<tr>
<td>Gender: male versus female</td>
<td>1.2</td>
<td>0.6-2.6</td>
<td>0.571</td>
</tr>
<tr>
<td>Diagnostic level 2 versus level 1</td>
<td>0.3</td>
<td>0.1-0.9</td>
<td>0.027</td>
</tr>
<tr>
<td>SPT: ≥10-15 years versus &lt;10 years</td>
<td>2.5</td>
<td>1.1-5.6</td>
<td>0.026</td>
</tr>
<tr>
<td>SPT: ≥15 years versus &lt;10 years</td>
<td>1.8</td>
<td>0.7-4.9</td>
<td>0.257</td>
</tr>
<tr>
<td>≥1 site with PPD ≥5mm</td>
<td>2.4</td>
<td>1.1-5.1</td>
<td>0.025</td>
</tr>
</tbody>
</table>

The model controlled for age of the patients.

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**Results**

Angular bony defects (odds ratio = 10.6) and periodontal probing depths ≥5 mm (odds ratio = 4.2) identified as statistically significant independent predictors of progressive periodontitis at posterior interproximal sites.
Angular bony and horizontal lesions with intact radiographic lamina dura revealed an absence of progressive periodontitis through 24 months.

**Results**

Angular bony defects and periodontal probing depths ≥5 mm were significant independent predictors of progressive periodontal breakdown within 30 months at posterior interproximal sites in treated periodontitis patients receiving regular supportive periodontal therapy.

**Conclusions**

Presence of a radiographic crestal lamina dura within intraosseous angular defects or at the crestal interdental septum of sites with horizontal bone topography was associated with clinical periodontal stability through ≥24 months.

**Conclusions**

Maintenance or restoration of a radiographic crestal lamina dura around periodontitis-affected teeth could be considered as a new therapeutic goal in periodontics.

**Conclusions**


Mobile teeth (Grade 2 or 3), and mobile teeth with furcation involvement (Grade 2 or 3), are at greater risk of post-treatment clinical periodontal attachment loss.

Teeth with furcation involvement (Grade 2 or 3) were 2.54 times more likely to be lost during maintenance period.
Essential components of an effective periodontal maintenance care program

- Continued patient education & motivation
- Reinforce patient oral hygiene instructions
- Counsel patient control of systemic risk factors (stress, smoking, medical status)
- Remove supra- and subgingival biofilm & dental calculus
- Possible adjunctive local-systemic chemotherapy
- Possible adjunctive periodontal surgery
- Possible occlusal therapy
- Adequate time


12 dental hygienists attempted to remove all supragingival plaque without any time restriction and without the use of a disclosing agent. None were able to entirely remove dental plaque; positive correlation between time spent and amount of plaque removed (better when > 30 minutes)

Air polishing with sodium bicarbonate-water slurry

EMS Air-Flow S1
Smiley CJ et al.: Evidence-based clinical practice guideline on the nonsurgical treatment of chronic periodontitis by means of scaling and root planing with or without adjuncts. 
*J Am Dent Assoc* 146:525, 2015

This clinical practice guideline is intended to assist general practitioners with decision making about the use of SRP, as well as locally delivered and systemic adjuncts, for patients with periodontitis.

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**Smiley CJ et al., 2015**

Use of antimicrobial agents in periodontal maintenance care

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**PerioChip**

2.5 mg Chlorhexidine
Is made of biodegradable matrix of hydrolyzed gelatin cross-linked with glutaraldehyde, plus glycerin and purified water. Chlorhexidine is a bactericidal antiseptic.

Maintains effective levels of chlorhexidine over a period of 7 days.

$365 for box of 20 chips; cost per site = $18.25


PerioChip data


PerioChip data

Local Chlorhexidine Chip


“data currently available on the chlorhexidine chip are limited and conflicting”

“It is not possible to make any firm clinical recommendations”
Atridox doxycycline polymer

- Biodegradable polymer containing 10% doxycycline - polymer resorbs over 27 days.
- Provides 420 μg/ml of doxycycline in GCF over an extended time period.
- Doxycycline release is passive into pocket and does not penetrate into subepithelial gingival connective tissues.

$469 for one box of six syringes; one syringe treats 8-10 sites; cost per site = $7.15 (for 10 sites)

Smiley CJ et al.: Systematic review and meta-analysis on the nonsurgical treatment of chronic periodontitis by means of scaling and root planing with or without adjuncts.

JADA 146:508, 2015

"the data were compatible with no benefit"

Smiley CJ et al.: Evidence-based clinical practice guideline on the nonsurgical treatment of chronic periodontitis by means of scaling and root planing with or without adjuncts.

JADA 146:525, 2015

Arestin

minocycline microspheres
Advance tip subgingivally, and inject Arestin into periodontal pocket as tip is being withdrawn. Microspheres adhere to pocket surfaces on contact with crevicular fluid.

Minocycline microspheres before bioresorbable degradation in periodontal pocket.

Minocycline sustained released passively into periodontal pocket during 21 day time span.

$599 for 24 cartridges; cost per site = $24.96

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Smiley CJ et al.: Systematic review and meta-analysis on the nonsurgical treatment of chronic periodontitis by means of scaling and root planing with or without adjuncts.
JADA 146:508, 2015

Arestin data

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Mean Difference</th>
<th>Exp/Total Weight</th>
<th>Mean Difference</th>
<th>Exp/Total Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minocycline and Colloidal</td>
<td>0.57 (95% CI)</td>
<td>19/19</td>
<td>19/19</td>
<td>19/19</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>0.57 (95% CI)</td>
<td>19/19</td>
<td>19/19</td>
<td>19/19</td>
</tr>
</tbody>
</table>

Heterogeneity not applicable

Test for overall effect: $\chi^2(1) = 3.03, P = 0.08$

"the data were compatible with no benefit"

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Arestin data

- Better PD reductions with Arestin vs. ScRP alone
- AL changes stated as better but data not presented
- No clinically significant changes in vital signs or oral hard or soft tissues were noted in these studies. All groups experienced a mean gain in clinical attachment at 9 months, but the minocycline microsphere group showed a greater gain.

Data obtained from page 30 of FDA document at:
http://www.accessdata.fda.gov/drugsatfda_docs/nda/2001/50781_Arestin_statr.pdf

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Smiley CJ et al.: Evidence-based clinical practice guideline on the nonsurgical treatment of chronic periodontitis by means of scaling and root planing with or without adjuncts.
JADA 146: 525, 2015

Arestin data

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JADA 146: 525, 2015

Arestin data

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Data obtained from page 30 of FDA document at:
http://www.accessdata.fda.gov/drugsatfda_docs/nda/2001/50781_Arestin_statr.pdf

Table 11A: Comparisons of mean change from baseline in CAL by subgroup at 9 months using ANCOVA (Study 103B)

<table>
<thead>
<tr>
<th>POPULATION</th>
<th>STATISTICS</th>
<th>MINOCYCLINE</th>
<th>VELOCAR</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A31</td>
<td>MEAN</td>
<td>-1.59</td>
<td>-2.92</td>
<td>-9.99</td>
</tr>
</tbody>
</table>

Not statistically significant
Another approach

Povidone-iodine

A water-soluble complex of iodine with polyvinylpyrrolidone

Caufield PW et al.

TABLE 2. MBCs of antimicrobial agents against periodontopathic bacteria after a 5-min exposure

<table>
<thead>
<tr>
<th>Strain</th>
<th>Mode MBC (%)</th>
<th>Chlorhexidine</th>
<th>I₂</th>
<th>SnF₂</th>
<th>NaF</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. actinomycetemcomitans</td>
<td></td>
<td>2.0</td>
<td>0.5</td>
<td>4.0</td>
<td>&gt;4.0</td>
</tr>
<tr>
<td>A. viscosus</td>
<td>0.25</td>
<td>0.5</td>
<td>&gt;8.0</td>
<td>&gt;4.0</td>
<td></td>
</tr>
<tr>
<td>B. gingivalis</td>
<td>0.5</td>
<td>0.25</td>
<td>0.5</td>
<td>&gt;4.0</td>
<td></td>
</tr>
<tr>
<td>B. intermedius</td>
<td>2.0</td>
<td>0.5</td>
<td>8.0</td>
<td>&gt;4.0</td>
<td></td>
</tr>
<tr>
<td>C. ochracea</td>
<td>0.5</td>
<td>0.25</td>
<td>8.0</td>
<td>&gt;4.0</td>
<td></td>
</tr>
<tr>
<td>F. nucleatum</td>
<td>0.5</td>
<td>0.5</td>
<td>4.0</td>
<td>&gt;4.0</td>
<td></td>
</tr>
</tbody>
</table>

Organisms still alive after 5 minute exposure to 0.12% chlorhexidine

Povidone-iodine in oral cavity:

- is “suitable for use on the oral mucosa”,
- for “application to oral lesions when the use of an antiseptic is desirable”, and
- is “useful in dentistry where the antibacterial activity of iodine is indicated.”

Ultrasonic Debridement with Povidone-Iodine
Buy generic povidone-iodine – much less expensive than Betadine – dilute 1 to 3 with water for use in ultrasonic or 1 to 2 with delivery via a hand-held syringe & blunt cannula, must use adequate suction.

Povidone-iodine gel (Aplicare) get more prolonged subgingival contact (2x higher levels after 15 minutes)


2 minute mouthrinsing with ½ diluted Betadine solution 4 x/day for 2 weeks led to significant adverse changes in thyroid function, including above normal serum iodide levels

Do not permit patients to apply povidone-iodine in daily home care - get too much systemic absorption adversely affecting thyroid.

Does this work?


13 year clinical trial, 75 chronic periodontitis patients treated with ultrasonics plus povidone-iodine pocket irrigation vs. 148 chronic periodontitis patients treated with ultrasonics alone.

The non-surgical therapy was performed under local anesthesia and by the use of an ultrasonic device (Odonto-son®; Copenhagen, Denmark). The ultrasonic device operates at a frequency of 42,000 Hz and the work piece performs 3-dimensional elliptical movements of <0.02 mm. The treatment was carried out in 4-6, 1-h sessions. The interval between sessions never exceeded 1 week. The supragingival and subgingival instrumentation in the test group was combined with the administration of 0.1% iodoform (water solution of Povidone-Iodine). Thus, in this group of subjects, the traditional cooling liquid for the Odonto-son®, i.e. tap water, was replaced by the iodoform solution. The members of the Control group received an identical treatment but tap water was used as the cooling liquid for the ultrasonic device.


Rosling et al. 2001

Markedly less recurrent disease in povidone-iodine group over 13 years post-treatment ➔ 9 povidone-iodine vs. 31 control “loser subjects” (who experienced annual periodontal attachment loss of 2+ mm at 4+ teeth)

Povidone-Iodine Pocket Irrigation

“Povidone-iodine, topically applied during subgingival instrumentation, may improve the outcome of non-surgical periodontal therapy.”

The addition of an antibacterial agent such as povidone-iodine may be a cost-effective measure to decrease progression of periodontal disease during basic therapy and maintenance.


Better suppression of subgingival periodontal pathogens in deep pockets with povidone-iodine pocket irrigation

Why does it work?

% of 6+ mm sites with >95% total pathogen count reduction

Better suppression of subgingival periodontal pathogens in deep pockets with povidone-iodine pocket irrigation


in meta-analysis:
"adjunctive use of PVP-iodine during scaling and root planing may increase the clinical pocket depth reduction, although the clinical significance is small to moderate"

Evaluation of a unique subgingival irrigation with 10% povidone-iodine after scaling and root planing: A randomized clinical trial

Eve-Maëlle Deney, DDS, MS/Seila Toma, DDS, MS/Andrée F. Lassere, DDS, MS/Michel C. Brecc, DDS, MS, FADP

Quintessence International 47: 549, 2016

Important Findings

Single pocket irrigation with 10 ml of 10% povidone-iodine solution (full-strength) for 60 seconds after ScRP on 2 deep periodontal interproximal posterior pockets (>6 mm) in 20 adults with chronic periodontitis compared over 6 mo. post-tx period to physiologic saline irrigation — significantly greater probing depth reductions (3.9 mm vs. 2.7 mm) and greater gains of CAL (4.0 mm vs. 2.7 mm) found at povidone-iodine treated sites at 6 mo. post-treatment

Anti-Infective Patient Home Care Procedures
**Patient Home Mechanical Plaque Control**

Use powered brush with baking soda toothpaste (Arm & Hammer Dental Care)

**Antimicrobial Effects of Baking Soda**

Rams TE, Keyes PH, Jenson AB. Morphological effects of inorganic salts, chloramine-T, and citric acid on subgingival plaque bacteria. Quintessence International 15:835, 1984

Baking soda immobilized oral spirochetes and motile rods in wet-mound suspensions → inducing abnormal cell morphology and loss of bacterial cell-to-cell coaggregation

At ultrastructural level, baking soda induced loss of bacterial cell wall integrity, leading to extracellular leakage of cytoplasm


Baking soda active against periodontal pathogens → the higher the bicarbonate ion, the faster the bactericidal action

Periodontal pathogens more susceptible to baking soda and chloramine-T than health-associated Streptococcus sanguis

Greater antimicrobial activity with chloramine-T than baking soda

Newbrun et al. 1984

Comparison of Range of Concentration of Antibacterial Agents in Dentifrices and Range Required to Inhibit Growth of Subgingival Bacteria

<table>
<thead>
<tr>
<th>Compound</th>
<th>Dentifrice concentration range</th>
<th>MIC Range mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium fluoride</td>
<td>0.23-0.24</td>
<td>6.6</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>56*</td>
<td>38-300</td>
</tr>
</tbody>
</table>

*Based on a paste formulation. Powdered dentifrice would have a higher sodium bicarbonate content.

Toothpastes with high baking soda concentration highly active against periodontal pathogens - markedly more than sodium fluoride toothpastes


sodium bicarbonate able to disrupt mature dental plaque grown in vitro → get antiplaque effect by plaque biofilm disruption
**Diluted Bleach Rinsing**

A twice-weekly 30 second oral rinse with 0.25% sodium hypochlorite (one teaspoon of household bleach into one-half glass of tap water) produced marked decreases in dental plaque and bleeding on probing in periodontitis patients.

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**Patient Home Oral Irrigation**

“Sodium hypochlorite seems to constitute an ideal periodontal antiseptic in terms of effectiveness, safety, affordability, accessibility and convenience.”

Galvan et al. 2014

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**Patient Home Irrigation with Diluted Sodium Hypochlorite**


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Subjects: 6 college students with no oral hygiene procedures for 2 days prior to and during 5 days of study.

Teeth: maxillary premolars and canines

Procedure: Oral irrigator (GE Aqua Pulse-2) daily directed 0.5% sodium hypochlorite onto right side, and tap water onto left side, for 5 days.

Gingivitis Score criteria:

0 = clinically normal, no inflammation
1 = slight inflammation - red color, edema and/or altered contour
2 = moderate inflammation - deep red color, edema + altered contour
3 = severe inflammation - dark red-blue color, edema + altered contour (gingival margins and papillae of teeth visually scored)
Mix 0.5 to 1 teaspoon of bleach into full tank of water (1000 ml)

Irrigate at high pressure with blunt tip aimed interproximally (for 2-3 seconds) and along tooth-gingival margin interface.
Not necessary to aim directly at gingival tissues.

In-vitro activity of sodium-hypochlorite gel on bacteria associated with periodontitis

Karolina Jurczyk, Sandra Nietzsche, Claudia Endler, Anton Seelau, Sigrun Eick


Important Findings

Evaluated antimicrobial effects of sodium hypochlorite-based gel (free bleach + amino acids forming chloramine) ≥ bleach more active against gram-negative periodontal pathogens than gram-positive species (including beneficial streptococci and Actinomyces) (selective inhibition - may favor more health-associated microbiota) 0.1% chlorhexidine equally active against both
**Important Findings**

Bleach killed pre-existing (4-day old) 6-species biofilms better than 0.1% chlorhexidine.

No cultivable bacteria when diluted bleach alone applied to plaque biofilms (also degraded biofilm matrix).

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**Chlorhexidine Mouthrinse**

Contains chlorhexidine digluconate – 0.12% in USA.

Has broad antimicrobial spectrum – reduces pellicle formation, alters bacterial attachment to teeth, & ruptures bacterial cell walls.

Has high substantivity to oral soft tissues – gives prolonged antiplaque effects for hours after rinsing.

Use 2x/day - rinse for 30 seconds.

Not absorbed in GI tract if accidentally swallowed.

Need prescription in USA to obtain rinse (not OTC).

Approved by both FDA and ADA for control of supragingival plaque and gingivitis.

Provides average reductions of ~55% in plaque growth, and ~45% in gingivitis.

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Significantly better clinical outcomes with chlorhexine rinse use

Also better reduction in BANA test scores with CHX rinsing – may help in limiting post-tx subgingival microbial recolonization.
Chlorhexidine mouthrinse

Side effects - brown-black tooth staining, increased supragingival calculus formation, altered taste perception


Warming of chlorhexidine solution to 47°C reduced plaque vitality significantly more (25% better kill rate) than a cold (18°C) solution - likely due to the increased rate at which chemical reactions take place with increased temperatures.


Less stain, but similar reduction in dental plaque growth, with 1.5% hydrogen peroxide rinse for 60 seconds after rinsing with 0.2% chlorhexidine.

**Systemic Application of Antimicrobial Agents in Periodontal Therapy**

Pathogenic Subgingival Microbiota

Virus

Susceptible Host

Traditional Therapy: Patient Plaque Control Mechanical-Surgical Debridement

Anti-Infective Therapy: Local Antimicrobials (antiseptic irrigants, antibiotic-eluting products) Systemic Antibiotics Dental Lasers

Inflammation

Attachment Loss and Bone Resorption

PERIODONTITIS


“A conservative and selective approach is recommended for periodontal antibiotic therapy.”

“Indiscriminate antibiotic therapy may ... cause overgrowth of intrinsically resistant pathogens or may unnecessarily increase in vivo resistance to antibiotics that are valuable in potentially fatal medical infections.”
Conclusions

Systemic antibiotics are not indicated for all periodontitis patients → most periodontitis patients can be successfully treated without systemic antibiotics.

Best patients for systemic periodontal antibiotic therapy → patients with acute periodontal infections associated with systemic manifestations, aggressive periodontitis patients, and periodontitis patients not adequately responding to conventional mechanical-surgical treatment.

Warning!!!

Increasing antibiotic resistance in subgingival microbiota is potentially reducing effectiveness of systemic periodontal antibiotic therapy - increasing risk of clinical treatment failure.

Systemic periodontal antibiotic therapy best selected on basis of microbiological testing of patient's cultivable subgingival pathogens.

Many issues remain unresolved about systemic periodontal antibiotic therapy (which patients, which drug, best dose, timing).

Antibiotics of potential systemic use in periodontal therapy

- Anaerobic bacteria associated with progression of periodontitis
  - Treponema denticola & other oral spirochetes
  - Tannerella forsythia
  - Porphyromonas gingivalis
  - Prevotella intermedia/nigrescens
  - Selenomonas noxia
  - Dialister pneumosintes
  - Fusobacterium nucleatum
  - Campylobacter rectus
  - Parvimonas micra
  - Eubacterium nodatum
  - Filifactor alocis

Metronidazole

- Specifically active against anaerobic bacteria.
- Ineffective against A. actinomycetemcomitans, enteric rods/pseudomonads, and Streptococcus constellatus.
- Usual dose → 250-500 mg TID for 10-14 days

"most forms of periodontal disease are chronic anaerobic infections"

"Maximal benefits are obtained when the metronidazole is given after the tooth surfaces are debrided of plaque and calculus"

"The best response is often noted in the more advanced cases, in which an anaerobic flora . . . usually predominates in the subgingival plaque"
Clinical changes following four different periodontal therapies for the treatment of chronic periodontitis: 1-year results.

Haffajee AD et al.  

- 12 month clinical trial, 92 chronic periodontitis patients treated with ScRP alone, or ScRP + azithromycin (500 mg for 3 days), or ScRP + metronidazole (250 mg TID for 14 days), or ScRP + Periostat (20 mg BID for 3 months)

- Best average clinical attachment gains at 12 months in initially deep sites treated with adjunctive metronidazole

Feres M, Soares GM, Mendes JA, Silva MP, Faveri M, Teles R, Socransky SS & Figueiredo LC.  
Metronidazole alone or with amoxicillin as adjuncts to nonsurgical treatment of chronic periodontitis: a 1-year double-blind, placebo-controlled, randomized clinical trial.  
*Journal of Clinical Periodontology* 39:1149, 2012

- 118 chronic periodontitis subjects treated by ScRP alone, or with systemic metronidazole (400 mg TID for 14 days), or with systemic metronidazole + amoxicillin (500 mg TID for 14 days)  
  ➔ better clinical outcomes with systemic antibiotic regimens, with metronidazole + amoxicillin combination only slightly better than metronidazole alone

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<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>SRP</th>
<th>SRP + MTZ</th>
<th>SRP + MTZ + AMX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk for disease</td>
<td>Low risk 09 (22.5%) 24 (61.6%) 26 (66.7%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate risk 06 (15.0%) 4 (10.2%) 4 (10.2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High risk 25 (62.5%) 11 (28.2%) 9 (23.1%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of PD ≥ 7 mm</td>
<td>0 17 (42.5%) 29 (74.4%) 31 (79.5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-2 06 (22.5%) 07 (17.9%) 06 (15.4%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 3 14 (35.0%) 3 (7.7%) 2 (5.1%)</td>
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</tr>
</tbody>
</table>

Low risk = ≤ 4 residual periodontal sites with PD ≥ 5 mm (according to Lang & Tonetti 2003)

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**Drug Interaction Considerations**

- if on anticoagulants: effects increased by metronidazole
- if alcohol intake cannot be stopped: cannot use metronidazole

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**Antibiotic Side Effects: Metronidazole**

- gastrointestinal discomfort, nausea, vomiting, diarrhea
- dizziness, vertigo, irritability, insomomia
- unpleasant metallic taste and dry mouth
- peripheral neuropathy and convulsive seizures (long-term doses only)
- avoid during pregnancy and in patients with central nervous system disorders

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**Amoxacillin + Metronidazole**

- Synergistic against *A. actinomycetemcomitans*
- Usual dose ➔ 250-500 mg of each TID for 10-14 days
Control of periodontal infections: a randomized controlled trial I. The primary outcome attachment gain and pocket depth reduction at treated sites. 

187 chronic periodontitis subjects treated by ScRP alone, and with either systemic amoxicillin + metronidazole, local Actisite placement, or modified Widman flap surgery (or together), with 24 month re-evaluations

Better CAL gains and probing depth reductions found with adjunctive systemic amoxicillin + metronidazole therapy

SMA = systemic metronidazole + amoxicillin drug therapy

Azithromycin

- second generation macrolide
- well absorbed
- long half-life
- concentrates in inflamed tissues
- possible anti-inflammatory properties
- minimal drug interactions
- active against wide range of bacteria

Azithromycin

- Active against a wide range of plaque bacteria, including A. actinomycetemcomitans.
- Ineffective against enteric rods/pseudomonads.
- Usual dose: 500 mg once/day for 7-10 days

Important Findings

Additional benefit of systemic azithromycin occurred at initially deep, but not shallow or moderate, probing depth sites.
Why not use azithromycin on everyone?


Taking 5 days of azithromycin, as compared to no antibiotics, had an *increased risk of cardiovascular death* (hazard ratio = 2.88). Amoxicillin had no increase in risk of death. Relative to amoxicillin, azithromycin had increased cardiovascular death risk (hazard ratio = 2.49).

Azithromycin use associated with estimated 47 additional cardiovascular deaths per 1 million courses; patients in the highest risk decile for cardiovascular disease had estimated 245 additional cardiovascular deaths per 1 million courses.

FDA also updated in March, 2012 the label of azithromycin and other macrolide class drugs to indicate potential for drugs to prolong heart QT intervals ➔ increase risk of heart arrhythmia.

“For patients with elevated cardiovascular risk and infections for which there are alternative antibiotics, the cardiovascular effects of azithromycin may be an important clinical consideration.”

Wayne A. Ray
Professor of Preventive Medicine
Vanderbilt University

American Academy of Periodontology Position Paper (primary author: Jorgen Slots)
Systemic antibiotics in periodontics.
*Journal of Periodontology* 75:1560, 2004

“...the dentist is encouraged to know the pathogenic microbial content of the subgingival microbiota and the specific antimicrobial susceptibility pattern of suspected pathogens in order to avoid prescribing antibiotics against pathogens that are resistant to treatment.”

Subject occurrence of antibiotic-resistant subgingival bacterial pathogens in 400 chronic periodontitis patients

<table>
<thead>
<tr>
<th>Antibiotic (breakpoint concentration)</th>
<th>No. (%) of subjects with ≥ 1 bacterial pathogens resistant in vitro to antibiotic breakpoint concentrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>doxycycline (4 µg/ml)</td>
<td>220 (55.0)</td>
</tr>
<tr>
<td>amoxicillin (8 µg/ml)</td>
<td>173 (43.3)</td>
</tr>
<tr>
<td>metronidazole (16 µg/ml)</td>
<td>121 (30.3)</td>
</tr>
<tr>
<td>clindamycin (4 µg/ml)</td>
<td>106 (26.5)</td>
</tr>
<tr>
<td>amoxicillin (8 µg/ml) plus metronidazole (16 µg/ml)</td>
<td>60 (15.0)</td>
</tr>
</tbody>
</table>

Rams TE, Degener JE & van Winkelhoff AJ.
Antibiotic resistance changes in periodontal *Parvimonas micra* over 10 years.
*J Dent Res* 96 (Special Issue A): abstract 780, 2018

Subgingival biofilms positive for *P. micra* from 300 consecutive adults with severe chronic periodontitis in the USA in 2006 and 2016 plated onto enriched Brucella blood agar supplemented with either 4 mg/L of doxycycline or clindamycin, 8 mg/L of amoxicillin, or 16 mg/L of metronidazole (representing non-susceptible/resistant antibiotic breakpoint concentrations), followed by anaerobic incubation. *P. micra* isolates growing on antibiotic-supplemented media considered drug-resistant.

Rams TE, Sautter JD & van Winkelhoff AJ.
Antibiotic resistance in human chronic periodontitis microbiota.
**Occurrence of *P. micra* antibiotic resistance**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>2006</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doxycycline</td>
<td>11.3%</td>
<td>47.3%</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>2.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>0.3%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

% of 300 subjects with *P. micra* clinical isolates non-susceptible to tested antibiotic concentration

**Conclusions**

“Marked and alarming increases were found over a 10 year period in the in vitro resistance of periodontal *P. micra* to doxycycline and clindamycin, but not to amoxicillin or metronidazole.”

“These findings raise serious questions about empiric use of doxycycline or clindamycin, either locally or systemically, in periodontal treatment of patients harboring subgingival *P. micra*.”

Rams et al. 2018

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**Educating and motivating periodontal patients with phase-contrast microscopy**

“*You are waging a war (with your home care) against pathogenic bacteria in your periodontal pockets - the microscope tells us who is winning*”

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**Phase-contrast microscopy in patient education and motivation**
Keyes PH & Rams TE.
Subgingival microbial and inflammatory cell morphotypes associated with chronic periodontitis progression in treated adults.
J Int Acad Periodontol 17:49, 2015

Findings:
High concurrent counts of subgingival spirochetes and crevicular leukocytes post-treatment exhibited strongest association with chronic periodontitis progression (odds ratio = 10.1; 95% CI = 2.2, 45.4) (greater than with either morphotype alone)

Keyes & Rams, 2015

“If no or only low spirochete and crevicular leukocyte counts are attained and maintained by periodontal treatment procedures, then the risk of chronic periodontitis disease progression appears to be minimal.”

Post-treatment spirochete and crevicular leukocyte levels may be diagnostically useful as simplified biomarkers of pathogenic biofilm infection and host inflammatory responses in periodontal pockets.

Thank you!