

Efficacy of nonsurgical periodontal therapy for treatment of periodontitis: practical application of current knowledge

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This article summarizes the practical application of current knowledge with respect to nonsurgical treatment of periodontitis. The benefits of nonsurgical therapy with or without adjunctive therapies are discussed. The dental literature was searched for articles that addressed outcomes related to mechanical nonsurgical therapy with or without adjunctive aids to treat periodontitis. The classic periodontal literature was assessed for relevant information, and recent systematic reviews and meta-analyses of adjunctive therapies (published within the last 5 years) were evaluated. Mechanical nonsurgical periodontal therapy can provide a predictable result for the treatment of periodontitis in many situations. Unnecessary cementum removal should be avoided because it can cause root sensitivity and loss of clinical attachment in shallow probing depths. Manual and ultrasonic instruments are both effective for treating periodontitis. Depending on the clinician's preference, either manual or ultrasonic instrumentation can be used because both methods achieve equivalent results when treating most cases of periodontitis. Full- and partial-mouth scaling and root planing (SRP) are both effective therapies. At present, clinical trials have failed to show that lasers—whether used as a monotherapy or an adjunct to SRP—provide a significant clinical benefit compared with nonsurgical therapy. To date, studies have shown that the use of systemic and local drug delivery, photodynamic therapy, and probiotics as adjuncts to SRP yields modest improvements compared with SRP alone.

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Periodontal disease is a public health problem in the United States. It is estimated that about 42% of dentate adults older than 30 years develop periodontitis.¹ This chronic inflammatory disease is associated with microbial dysbiosis and is characterized by loss of clinical attachment and bone.² An individual's susceptibility to periodontitis and the disease progression depend on complex interactions among subgingival microbes, the host's genetic factors, and acquired environmental stressors.^{3,4}

The goals of periodontal treatment are to prevent, control, and/or eliminate signs of periodontal disease. Successful periodontal therapy includes the removal of bacterial accretion to attain a clean root surface, elimination of inflammation, reduction in probing depth (PD), gain in clinical attachment level (CAL), arrest of disease progression, and restoration of normal function. These objectives should be achieved in an efficient manner with minimal discomfort for the patient and should produce long-term effects that can be maintained. Periodontal therapy can be separated into 2 categories: nonsurgical and surgical. Nonsurgical therapy includes adequate personal plaque control, mechanical instrumentation (ie, scaling and root planing [SRP]), and possible adjunctive aids such as systemic antibiotics, local delivery of therapeutic agents, photodynamic therapy (PDT), lasers, and probiotics (Table 1).⁵⁻²⁴ The purpose of this review is to discuss what has been learned with respect to the efficacy of nonsurgical mechanical therapy—with or without adjunctive aids—for treating periodontitis.

Methods

Relevant and pertinent information was obtained from early scholarly studies that were published prior to the systematic reviews. In addition, recent systematic reviews and meta-analyses evaluating the outcomes of nonsurgical mechanical therapy with or without adjunctive aids to treat periodontitis (published within the last 5 years) were found by searching the PubMed (MEDLINE), Ovid, Embase, Google Scholar, and Cochrane Reviews databases using the search term “periodontitis and nonsurgical therapy of periodontal diseases.” Systematic reviews were incorporated into this article to succinctly summarize multiple recent articles on diverse subjects. Relevant articles were manually searched to determine whether additional articles could be included in this review.

Interpretation of statistical significance

The term *statistically significant results* means that the differences found between the test and control groups did not occur by chance.²⁵ However, it does not indicate that these differences

Table 1. Adjunctive therapies used with nonsurgical periodontal therapy.

Adjunctive therapy	Description
Systemic antibiotics ^{5,6}	Amoxicillin, metronidazole, azithromycin, clindamycin, doxycycline, tetracycline, or a combination of drugs
Locally delivered antibiotics ⁷⁻⁹	Tetracycline fibers, chlorhexidine chips, minocycline microspheres, metronidazole gel, or doxycycline hyclate gel
Photodynamic therapy ¹⁰⁻¹⁴	Dynamic interaction of photosensitizer, low-intensity laser, and molecular oxygen
Laser therapy ¹⁵⁻²⁰	Neodymium-doped yttrium-aluminum-garnet (1064 nm), carbon dioxide (10,600 nm), erbium-doped yttrium-aluminum-garnet (2940 nm), or erbium, chromium-doped yttrium-scandium-gallium-garnet (2780 nm)
Probiotics ²¹⁻²⁴	Lozenges or tablets containing <i>Lactobacillus reuteri</i> or <i>Bifidobacterium</i> sp, among others

are actually large or important; therefore, clinicians have to determine whether the results are clinically significant as well. One interpretation of clinical meaningfulness is that the findings may alter the way a patient is treated.²⁵

Outcomes of SRP

Wound healing and expected results

Periodontal outcomes after mechanical nonsurgical therapy depend on several factors, including initial PDs, degree of gingival inflammation, and the patient's hygiene and systemic health. A direct relationship between changes in CAL and initial PD has been observed.^{26,27} Maximum gain in CAL and reduction in PD occur at sites with deep pockets (≥ 7 mm).^{26,27} In contrast, SRP results in CAL loss at shallow probing sites (1 to 4 mm).^{27,28} The latter result is because SRP removes the cementum where the Sharpey fibers are inserted.²⁹

Cobb reported the following expected clinical results after SRP: mean PD reduction values at shallow (1 to 3 mm), moderate (4 to 6 mm), and deep (≥ 7 mm) sites were 0.03, 1.29, and 2.16 mm, respectively.²⁸ The mean changes in CAL values for shallow, moderate, and deep sites were -0.34 mm (indicating a loss in CAL), 0.55 mm, and 1.19 mm, respectively (indicating a gain in CAL in the latter 2 groups).²⁸

With respect to healing time after instrumentation, Proye et al demonstrated that recession may occur as early as 1 week after SRP, and a gain in CAL can be noticed after 3 weeks (Fig 1).³⁰ In some patients, it may take as long as 8 weeks to achieve an excellent result (Fig 2). These data suggest that patients can be reevaluated as early as 3 to 4 weeks after SRP to assess alterations in PD and CAL.

Wærhaug reported that a new junctional epithelium (approximately 1 mm long) forms within 2 weeks after disruption from mechanical therapy.³¹ In this regard, Caton and Zander noted that a long junctional epithelium (average length 2.5 mm) may form at treated sites with advanced bone loss.³² Other researchers reported that sites with a long junctional epithelium are not more susceptible to disease progression than sites with a short junctional epithelium in the presence of good oral hygiene.^{33,34} A long junctional epithelium may form after SRP of deep pockets, and no new connective tissue attachment is achieved.³² These data indicate that clinicians should be cautious when making surgical decisions

immediately after SRP during maintenance visits, because SRP may initially disrupt the long junctional epithelium and the PD may measure deeper than initially recorded.

Loss of tooth structure

The quantity of cementum removed during nonsurgical mechanical therapy depends on several factors: modality of treatment (eg, sonic or ultrasonic scalers, hand instruments, or a diamond bur), softness of diseased roots, pressure application, instrumentation time, and sharpness and number of strokes. The cementum becomes thicker as it approaches the apex of teeth. Maximum cementum thickness ranges from 25 to 1140 μ m in maxillary molars and 20 to 700 μ m in mandibular molars.³⁵

Ritz et al reported the mean loss of cementum after instrumentation with 12 strokes using 4 different treatment modalities.³⁶ The amounts of cementum removal with ultrasonic scalers, sonic scalers, curettes, and a diamond bur were 11.6, 93.5, 108.9, and 118.7 μ m, respectively. Zappa et al found that low instrument pressure (3.0 N) resulted in cementum loss of approximately 30 μ m with 5 strokes; when higher instrument force (8.5 N) was applied, the reduction of cementum increased to 100 μ m with the same number of strokes.³⁷ The data indicate that cementum is lost due to SRP; therefore, if there are no mechanically attached deposits on the roots and a site is healthy, it is recommended that treatment of that site during therapy or maintenance visits be limited to removal of plaque from the sulci. This will avoid unnecessary cementum removal that could cause root sensitivity and loss of CAL in shallow probing depths.^{28,38}

Elimination of endotoxins

Endotoxin is a lipopolysaccharide deposited on the roots of teeth and is derived from the cell walls of gram-negative bacteria.³⁹ Studies have quantified the amount of endotoxin found on roots affected by periodontitis (20 to 394 ng) and healthy roots (0.05 to 0.45 ng).^{40,41} Contrary to historical thinking, which held that cementum must be removed to eliminate endotoxins, it is currently understood that endotoxins are lightly bound to the root surface and can be removed easily with gentle washing, brushing, or ultrasonic instrumentation.⁴²⁻⁴⁶ Therefore, aggressive removal of cementum to provide a root surface free of endotoxins is unnecessary.



Fig 1. A. Pretreatment view showing plaque, calculus deposits, and gingival inflammation. B. View 4 weeks after completion of scaling and root planing, showing resolution of gingival inflammation, no bleeding on probing, and shrinkage of inflamed tissues.



Fig 2. A. Pretreatment view showing plaque, calculus deposits, gingival inflammation, and signs of erythematous, edematous gingiva. B. Successful removal of plaque and calculus after initial therapy, which consisted of 1 session of scaling and root planing. C. View 8 weeks after scaling and root planing, showing resolution of gingival inflammation, no bleeding on probing, and gingival shrinkage. Probing depths are also reduced.

Hand vs power-driven instrumentation

Mechanical therapy with hand or power-driven instrumentation (eg, ultrasonic debridement) is used to perform

nonsurgical periodontal therapy.⁴⁷⁻⁵¹ Power-driven devices can be divided into sonic and ultrasonic scalers.⁴⁷ Advantages provided by power-driven instruments include less fatigue, reduced working time, and the ability to access the root furcations (approximately 1 mm wide) due to the thinness of the ultrasonic tips.^{48,49} However, the use of these devices reduces tactile sensation.^{50,51}

Several recent systematic reviews reported no statistically significant differences concerning PD reduction, CAL gain, or the decrease in microbial deposits when hand and power-driven instrumentation were compared for treatment of chronic periodontitis.⁵¹⁻⁵⁴ These data support the concept that hand and ultrasonic instruments are both effective for removing supragingival and subgingival plaque and calculus, decreasing gingival inflammation, and achieving PD reduction and CAL gain. Therefore, depending on the clinician's preference, either mode of root instrumentation is satisfactory.⁵⁵

Full-mouth vs quadrant approach

Historically, SRP has been performed 1 quadrant at a time.⁵⁶ To increase efficiency, Quirynen et al introduced the concept of 1-stage full-mouth disinfection using full-mouth SRP.⁵⁷ This protocol was performed within 24 hours with or without the use of antiseptics (eg, chlorhexidine rinse).^{57,58}

Conceptually, the advantages of the full-mouth approach include the prevention of cross-contamination from untreated pockets and a reduction in the number of treatment visits.⁵⁹ A critical commentary about this procedure concluded that conflicting data from different treatment centers precluded a definitive conclusion as to whether full-mouth therapy provides a clinically relevant improvement beyond that attained with partial-mouth therapy.⁶⁰ Subsequently, others observed no significant differences when full- and partial-mouth disinfection were compared.⁶¹ In contrast, a recent systematic review reported that, in teeth with moderate PD (5 to 6 mm), full-mouth disinfection provided small benefits beyond SRP performed a single quadrant at a time; the mean increase in PD reduction was 0.25 mm, and the improvement in CAL was 0.33 mm.⁶²

In summary, full-mouth disinfection and partial disinfection therapy are both effective modalities for the treatment of periodontitis. The determination as to whether to use full- or partial-mouth disinfection therapy depends on the clinician's and/or patient's preference.

Single vs multiple sessions

Conflicting results have been reported with respect to the effectiveness of single vs repeated mechanical sessions of non-surgical therapy.⁶³⁻⁶⁵ Magnusson et al demonstrated a reduction in mean PD from 7 to 6 mm after a single scaling session, and a second session decreased PD to 4.9 mm.⁶⁶ Similarly, Listgarten et al reported a reduced PD from 7 to 5.3 mm after 2 to 4 SRP visits; a few months later, additional SRP decreased the mean PD to 4.8 mm.⁶⁴ In contrast, when Badersten et al compared the outcomes of single vs repeated sessions of SRP, they noted no additional improvement in mean PD reduction, and Caton et al also observed similar outcomes after single and multiple episodes of SRP.^{63,65} The discrepancy in results may be due to

Table 2. Recent meta-analyses (within the last 5 years) assessing the clinical efficacy of SRP plus different adjunctive agents (intervention).

Study	RCTs, n ^a	Intervention	Follow-up, mo	Outcomes compared with SRP alone
Khattari et al (2020) ⁶	45	SRP + systemic antibiotics	12	SRP + systemic antibiotics achieved minimally greater PD reduction and CAL gain (MD = 0.3-0.4 mm), but the differences were clinically insignificant.
Herrera et al (2020) ⁸	50	SRP + locally delivered antibiotics	6-9; 12-60	Short-term (6-9 mo): SRP + locally delivered antibiotics achieved significantly greater PD reduction (MD = 0.36 mm) and CAL gain (MD = 0.26 mm). Long-term (12-60 mo): SRP + antibiotics achieved significantly greater PD reduction (MD = 0.19 mm); there was no difference between groups in CAL.
Zhao et al (2020) ⁹	7	SRP + CHX gel	6	Application of SRP + CHX gel at selected sites achieved minimal improvement in PD reduction (MD = 0.15 mm) and no difference in CAL gain at 3 months. Full-mouth application of SRP + CHX resulted in no significant difference in PD or CAL changes at 3 or 6 mo of follow-up.
Salvi et al (2020) ¹³	8	SRP + PDT	6	There was no statistically significant difference in PD or CAL.
Xue et al (2017) ¹⁴	11	SRP + PDT	3-6	Short-term (3 mo): SRP + PDT achieved significantly greater PD reduction (MD = 0.13 mm) and CAL gain (MD = 0.18 mm). Long-term (6 mo): SRP + PDT achieved significantly greater PD reduction (MD = 0.4 mm) but no difference in CAL gain.
Lin et al (2021) ¹⁹	8	Laser (mostly Er:YAG)	6	There was no statistically significant difference in PD reduction (MD = 0.14 mm) or CAL gain (MD = 0.04 mm).
Li et al (2021) ²⁰	16	Er,Cr:YSGG laser	3-6	Short-term (3 mo): Laser achieved statistically significant improvement in PD (MD = 0.34 mm) and CAL (MD = 0.71 mm). Long-term (6 mo): There was no statistically significant difference in PD or CAL.
Ho et al (2020) ²⁴	10	SRP + probiotics	3-12	SRP + probiotics achieved significantly greater PD reduction (MD = 0.18 mm) and CAL gain (MD = 0.21 mm) at 3 and 12 mo. ^b There was no statistically significant difference at 6 or 9 mo. There was no statistically significant difference in periodontal pathogen levels at 3 mo.

Abbreviations: CAL, clinical attachment level; CHX, chlorhexidine; Er,Cr:YSGG, erbium, chromium-doped yttrium-scandium-gallium-garnet; MD, mean difference; PD, probing depth; PDT, photodynamic therapy; RCT, randomized controlled trial; SRP, scaling and root planing.

^aInclusion was limited to RCTs in all meta-analyses.

^bCompared with SRP + placebo.

the efficiency of the mechanical procedures, differing severity of the treated probing depths, the time allotted for procedures, and the personal hygiene performed by the patients.

Efficacy of SRP plus adjunctive therapies

A number of systematic reviews published within the last 5 years have examined the outcomes of adjunctive therapies to treat periodontitis. Table 2 presents the results of recent systematic reviews that included meta-analyses of outcomes.^{5,6}

Systemic antibiotics

Antibiotics are prescribed to reinforce mechanical periodontal treatment and support host defense in select groups of patients with periodontitis, such as patients who do not respond to

conventional mechanical therapy, patients with active infections, or medically compromised patients.⁶⁷⁻⁶⁹ Systemic antibiotics have several advantages, including low cost, convenience for the patient, and the ability to cause a reduction in intraoral microbes.⁷⁰ Disadvantages include difficulty achieving a high drug concentration in the gingival crevicular fluid, the risk of drug interactions, the possibility of developing antibiotic-resistant bacterial strains, and the dependence on patient compliance.⁷¹⁻⁷³

In a systematic review, Haffajee et al reported that the mean benefit of using SRP plus adjunctive antibiotics compared with SRP alone was about a 0.3- to 0.4-mm gain in CAL.⁵ It is possible that subjects with aggressive or severe periodontitis may attain a greater benefit from systemic antibiotics. Another recent systematic review by Khattari et al compared the benefits

of adjunctive systemic antibiotics (amoxicillin, metronidazole, Augmentin, tetracycline, doxycycline, azithromycin, or clindamycin) with SRP alone.⁶ They found that SRP plus an antibiotic provided a modest beneficial effect with respect to PD reduction and CAL gain, both ranging from 0.3 to 0.5 mm. However, there was insufficient evidence to determine whether some antibiotics are better than others when used with SRP.⁶

Adjunctive systemic antibiotics should be sensibly administered and restrictively used. They should be reserved for patients who do not respond to conventional therapy or who have an active infection.⁶⁷ However, there may be situations where the gingival tissues are extremely edematous, hemorrhagic, and sensitive, and it may be beneficial to prescribe an antibiotic such as metronidazole for 1 week (500 mg, 3 times a day for 7 days) prior to any root instrumentation or probing so that the patient can be assessed and treated more comfortably (eg, for necrotizing periodontal diseases) at the next visit.⁷⁴

Locally delivered antibiotics and antiseptics

Local delivery of antibiotics provides certain advantages, including minimally invasive targeted therapy, a high concentration of drugs in the gingival crevicular fluid, reduced antibiotic adverse effects, and decreased development of bacterial resistance strains.⁷⁵ The success of local drug delivery depends on several factors: the ability to deliver the medication to the base of the pocket, the medication's prolonged retention to attain an effective outcome, and increased drug dosage.⁷⁶ Several delivery systems have been investigated, including tetracycline fibers, metronidazole gel, chlorhexidine chips, minocycline microspheres, and doxycycline hyclate gel.⁷⁷

A recent systematic review reported that statistically significant differences in PD reduction (0.36 mm) and CAL gain (0.26 mm) were noted 6 to 9 months after therapy with SRP plus local drug delivery (tetracycline fiber, chlorhexidine chips, minocycline microspheres, or doxycycline hyclate gel) compared with SRP alone.⁸ However, long-term data (12 to 60 months) revealed minimal benefits with respect to PD reduction (0.19 mm) and CAL gain (0.09 mm).⁸ Specifically, a phase III trial of minocycline hydrochloride microspheres suggested that the drug therapy plus SRP provided a small but statistically significant benefit, measured in tenths of millimeters, compared with SRP alone.⁷⁸ At probing depths ≥ 5 mm, the decreases in PD were 1.32 mm after combined therapy and 1.08 mm after SRP alone, and at sites ≥ 6 mm, the decreases were 1.46 and 1.05 mm in the combined therapy and SRP-alone groups, respectively.⁷⁸ The percentages of sites with a 2-mm decrease in PD were 41% after combined therapy and 33% after SRP alone.^{78,79}

Overall, the data suggest that locally delivered antibiotics and antiseptics provide a minor improvement as an adjunct to conventional nonsurgical treatments; therefore, it is unnecessary to routinely use combined therapy. However, local drug delivery may be indicated for nonresponding sites or for patients with recurrent disease who need an alternative treatment approach.⁷⁹

Photodynamic therapy

Photodynamic therapy is a localized minimally invasive therapeutic modality. The mechanism of action of PDT includes 3 main agents: a photosensitizer (eg, methylene blue), a

low-intensity laser (usually a diode laser), and molecular oxygen.¹⁰ The laser is used to activate the photosensitizer, which is bound to a target cell. The activated photosensitizer reacts with molecular oxygen to produce highly reactive, oxygen-free radicals, which are cytotoxic to a variety of microorganisms.¹¹ In animal studies, it was noted that PDT provided a beneficial effect against putative periodontal pathogens such as *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis*.¹² However, human studies have shown inconsistent outcomes in the treatment of periodontitis with PDT.^{80,81} A recent systematic review indicated that PDT plus nonsurgical therapy provided a small benefit compared with SRP alone (approximately 0.5-mm additional CAL gain).⁸² In contrast, another systematic review that compared PDT plus SRP with SRP alone demonstrated no significant difference with respect to CAL gain.^{13,14}

In summary, some short-term data show a minimal improvement in PD reduction and CAL gain when PDT is used in conjunction with SRP. At present, there is limited evidence pertaining to the long-term efficacy of PDT as an adjunctive therapy.

Laser therapy

A number of different laser types have been used as an alternative therapy or as an adjunct to conventional nonsurgical mechanical therapy. Examples of commercially available lasers and their wavelengths include Nd:YAG (1064 nm), carbon dioxide (10,600 nm), Er:YAG (2940 nm), and erbium, chromium–doped yttrium-scandium-gallium garnet (Er,Cr:YSGG; 2780 nm). Animal and human studies have demonstrated that lasers have the ability to remove plaque, diseased cementum, and granulomatous tissues as well as to decrease the amount of putative periodontal bacteria without significantly altering root morphology.^{15,83–85} Lasers have several beneficial functions, such as tissue ablation, hemostasis, and disinfection, and they have a bactericidal effect.¹⁶ Histologically, a few case series have demonstrated some degree of periodontal regeneration with new cementum, periodontal ligament, and alveolar bone after the use of Er:YAG (2940 nm) or Nd:YAG (1064 nm) lasers.^{17,18}

A recent systematic review compared the efficacy of Er,Cr:YSGG lasers with that of SRP among patients with chronic periodontitis.²⁰ The researchers concluded that, in the short term, lasers provided a statistically significant improvement with respect to PD reduction (0.34 mm) and CAL gain (0.71 mm) when compared with SRP alone. However, after 6 months, there were no significant differences in clinical parameters. A systematic review by Lin et al compared the treatment effects of lasers as a monotherapy with SRP alone in periodontitis patients.¹⁹ They reported similar outcomes in PD reduction and CAL gain for both techniques.¹⁹

To clarify the status of laser therapy, the American Academy of Periodontology provided a best evidence consensus report addressing the use of lasers alone and as adjuncts to mechanical therapy.⁸⁶ The report concluded that the current data are insufficient to determine whether laser therapy alone is better than or equal to conventional periodontal therapy with respect to PD reduction or CAL gain for treating moderate to severe chronic periodontitis. With regard to using a laser as an adjunct to

mechanical treatment, it was determined that current data suggest comparable or marginally better clinical results compared with laser therapy alone in the treatment of periodontitis.⁸⁶ This subject remains controversial; for example, Clem et al recently reported that laser therapy utilizing Er,Cr:YSGG showed results similar to those of the minimally invasive surgical technique in intrabony defects.⁸⁷

Laser therapy may be a promising adjunct or alternative therapy; however, at present, clinical trials have failed to demonstrate that lasers provide a significant clinical benefit compared with nonsurgical mechanical therapy alone.

Probiotics

According to the Food and Agriculture Organization/World Health Organization, probiotics are defined as “Live microorganisms which when administered in adequate amounts confer a health benefit on the host.”²¹ Possible mechanisms of action have been proposed, including host modulation, restoration of the oral microbial ecologic balance, and an antibacterial effect.^{22,23}

A systematic review reported a statistically significant short-term clinical benefit with respect to CAL gain (0.42 mm) and PD reduction (0.67 mm) at deep sites when probiotics were used in conjunction with SRP.⁸⁸ Similarly, Ho et al conducted a meta-analysis to assess the clinical, microbiologic, and immunologic outcomes of probiotics as an adjunct to nonsurgical mechanical therapy.²⁴ The study found that the probiotic group with SRP showed a small benefit, compared with SRP alone, of decreased PD (0.18 mm) and gain in CAL (0.21 mm) at 3 months, but this benefit was not noted after 6 months. In addition, there was no statistically significant difference between the groups in periodontal pathogen levels at 3 months.²⁴

There is a major heterogeneity issue among studies with regard to probiotic dosage, duration, assessed bacterial strains, and patient characteristics, which makes it difficult to reach a conclusion about the ability of probiotics to enhance nonsurgical therapy.⁸⁹ At present, the data suggest that the use of probiotics as an adjunct to nonsurgical therapy may provide a very small, short-term effect, but this benefit does not appear to last 6 months.

Effectiveness of SRP vs surgical debridement

Several longitudinal multicenter clinical trials in the 1970s compared the effects of nonsurgical and surgical treatment with respect to PD reduction, CAL gain, and resolving gingival inflammation.⁹⁰⁻⁹⁵ They revealed that SRP and flap surgery for access were both effective treatment modalities for management of various stages of chronic periodontitis. However, in these clinical trials, root instrumentation was frequently done to the bone, and patients required sutures at the end of the procedures.⁹⁶ In addition, definitive SRP (sole and final therapy, about 1 hour per quadrant) is one of the most demanding technical procedures in periodontics, and the efficacy of root surface debridement decreases when probing depths are 5 mm or greater.^{31,95,97}

Therefore, based on the complexity of the situation and the skill of the clinician, either nonsurgical or surgical therapy can be used to manage periodontitis.⁹⁰⁻⁹⁵ However, in the presence of deep PDs and osseous defects where guided bone regeneration

is desired, surgery is usually advantageous to gain access for debridement of roots and osseous defects. Thus, depending on the response to nonsurgical therapy and the objectives of therapy, it is up to the clinician's best judgment as to whether surgical therapy is needed.⁹⁸

Frequency of maintenance visits

Periodontal maintenance is a critical determinant for long-term success of periodontitis treatment. Patients with a history of periodontitis may need to be seen every 3 months to reduce the bacterial challenge so that the immune system can maintain homeostasis.⁶⁶ The frequency of maintenance visits also must be tailored to the patient's level of personal hygiene, history of periodontal conditions, and number of residual deep PDs.⁹⁹

Conclusion

Nonsurgical periodontal therapy is an effective therapeutic modality for reducing signs of inflammation and improving clinical and microbiologic parameters. A prodigious amount of information is available, and a review of the literature identified several trends with respect to mechanical instrumentation of roots with and without adjunctive procedures:

- Mechanical nonsurgical periodontal therapy can provide a predictable outcome for the treatment of periodontitis in many situations. Patients need continuous maintenance and must be monitored postoperatively to ensure that disease activity does not return.
- Adjunctive therapy with systemic antibiotics should be sensibly administered and restrictively used. In general, this therapy should be reserved for patients who do not respond to conventional therapy.
- Laser therapy may be a promising adjunct to SRP and/or an alternative therapy. However, at present, clinical trials have failed to show that lasers provide a significant clinical benefit compared with nonsurgical therapy.
- To date, studies suggest that the use of local antibiotic or antiseptic delivery, PDT, or probiotics as an adjunct to SRP yields modest improvements.

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