

NON SURGICAL THERAPY IN PERIODONTAL DISEASE

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Abstract :Nonsurgical therapy aims to eliminate bacteria within the microbial biofilm and calcified biofilm microorganisms from the tooth surface and adjacent soft tissues. Complete elimination of such pathogenic microorganisms is probably over-ambitious. However, absence of inflammation in the periodontium results in beneficial clinical changes.In addition, nonsurgical therapy aims to form an environment during which the host can more effectively prevent pathogenic microbial recolonization using personal oral hygiene methods..The various methods utilized in nonsurgical therapy, like hand instrumentation, ultrasonic and sonic scalers, and ablative laser therapy.

Keywords : Periodontitis, non-surgical therapy, scaling and root planning, lasers, host modulation therapy, local drug delivery, systemic antibiotics.

1. INTRODUCTION

Periodontitis is a disease which causes inflammation of the periodontal tissues by specific groups of microorganisms leading to progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession, or both.¹ These inflammatory changes can be reversed when proper cleansing methods are resumed, which therefore shows clear proof that bacteria are involved in the initiation of gingivitis.^{2,3} Periodontitis is related to various clinical criteria such as bleeding on probing, periodontal pocket depth, and clinical attachment loss.

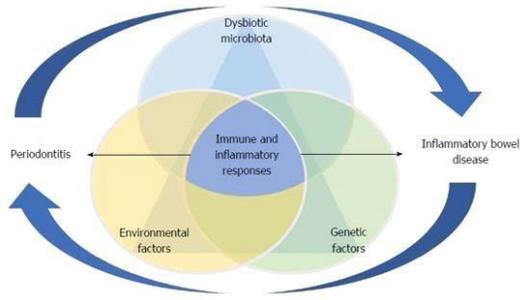


Figure 1

II. PATHOGENESIS OF PERIODONTAL DISEASE

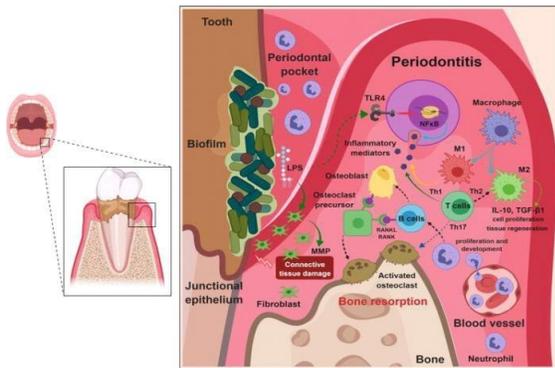


Figure 2: Periodontal Disease

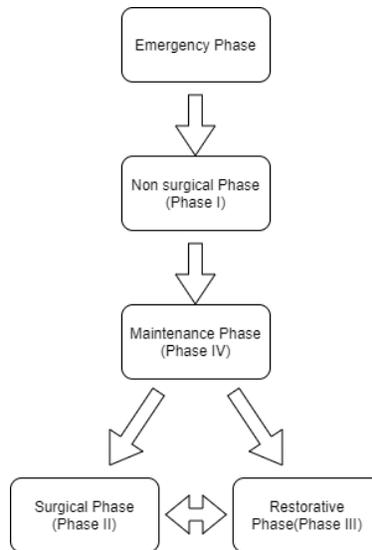


Figure 3: Sequence of periodontal therapy

III. NONSURGICAL PHASE THERAPY (PHASE I THERAPY)

Nonsurgical periodontal therapy (NSPT) is the cornerstone of periodontal therapy and the preliminary approach to the control of periodontal infections. It is also known as “Cause-related therapy,”⁴ “Phase I therapy or Etiotrophic phase,” and “Initial therapy.” It is defined as “plaque removal, plaque control, supragingival and subgingival scaling root planning (SRP), and adjunctive use of chemical agents.” Although NSPT has been in use over years, it is still considered to be the “gold standard” measure.^{5,6}

A. GOAL OF THIS THERAPY

- To alter or eliminate the microbial etiology and factors that contribute to gingival and periodontal diseases.
- To halt the progression of disease and returning the dentition to a state of health.

The goal of non-surgical phase I therapy aims at the removal of pathogenic biofilm, toxins and calculus, and the reestablishment of a biologically acceptable root surface.

B. ELEMENTS OF PHASE I THERAPY

- Elimination of calculus.
- Correction / replacement of poorly fitting restorations and prosthetic devices.
- Restoration or temporization of carious lesions.
- Orthodontic tooth movement.
- Treatment of food impaction areas.
- Treatment of occlusal trauma.
- Extraction of hopeless teeth.
- Possible use of antimicrobial agents.

IV. SCALING AND ROOT PLANNING

The primary role of scaling and root planning (SRP) is to regain gingival health by completely removing causative factors for the gingival inflammation (i.e., plaque, calculus, and endotoxins) in the oral environment. The numbers of subgingival microorganisms can be reduced with both hand and ultrasonic instruments. The outcome of any treatment method is determined by complete and adequate access to pocket areas, the time taken by the operator to the procedure, and the thoroughness of the procedure.⁷



Figure 4: Scaling and Root Planing

The primary goals of SRP are to reduce or eliminate subgingival microbial organisms, remove subgingival calculus, remove soft and diseased cementum, and smooth roughened root surfaces.^{8,9} A systematic review by Cobb⁸ reported that average improvement in PD following SRP was 1.29 mm in pockets that had an initial PD of 4 to 6 mm, and 2.16 mm in pockets of ≥ 7 mm. There is an increase in clinical attachment levels (CAL) on an average of 0.55 mm and 1.19 mm for initial PDs of 4 to 6 mm and ≥ 7 mm, respectively. In periodontitis, SRP is highly effective in controlling the signs of periodontal inflammation. However, the bony defects often associated with the moderate and severe stages of periodontitis requires surgical intervention.

V. SYSTEMIC ANTIBIOTICS

The use of systemic antimicrobials as a part of the therapy in the management of periodontal disease has been accepted as an adjunctive therapy for years.¹⁰ The activity of the antimicrobial agent against the infecting organisms predicts the therapeutic success. Periodontitis is a condition caused by number of microbes where making the choice of antibiotic regimen difficult. Certain antibiotics target specific parts of the subgingival biofilm. For example, metronidazole affects mainly the gram-negative anaerobes from the red and orange Socransky complexes such as *Fusobacterium nucleatum*, *Tannerella forsythia*, *Porphyromonas gingivalis* and *Treponema denticola*, while they usually affect the members of the genera *Actinomyces*, *Streptococcus* and *Capnocytophaga* in a less count.

Metronidazole also has a limited effect on the species *Aggregatibacter*.¹¹ Early approaches to systemic antibiotic therapy for periodontal treatment involved monotherapy with metronidazole, tetracyclines, doxycycline, amoxicillin (with or without clavulanic acid), spiramycin, clindamycin, and azithromycin^{12,13}. The use of systemic antimicrobials as a part of the therapy in the management of periodontal diseases has been accepted as an adjunctive therapy for decades

VI. LOCAL DRUG DELIVERY

The use of local drug delivery in periodontal disease is to chemically kill or reduce the plaques within the biofilm in the pocket by placing high concentrations of an antibiotic or antiseptic in direct contact with the root surface without noticeable systemic effect, which may not be always possible with systemic antibiotics.¹⁴

A. CLASSIFICATION

I. On the basis of application [Rams and Slots] 1996

a. Personally applied (in patient home self-care)

- Nonsustained subgingival drug delivery Home oral irrigation Home oral irrigation jet tips Traditional jet tips Oral irrigation (water pick) Soft cone rubber tips (pick pocket)
- Sustained subgingival drug delivery

b. Professionally applied (in dental office)

- Nonsustained subgingival drug delivery Professional pocket irrigation
- Sustained subgingival drug delivery Controlled release devices Hollow fibers Dialysis tubing Strips 8 Films

II. On the basis of duration of medicament release 9 (Greenstein and Tonetti 2000)

- Sustained release devices – Designed to provide drug delivery for a fewer than 24 hours
- Controlled release devices – Designed to supply drug release that a minimum at of exceeds 1 day or for at least 3 days following application (Kornman 1993)

III. On the basis of degradability

- No degradable devices (first generation)
- Degradable devices (second generation) 15

There are various drug delivery systems for treating periodontitis. Some of them are fibers, films, injectable systems, gels, strips, compacts, 3 vesicular system, micro particles and nanoparticles.

Numerous non-resorbable and resorbable intrapocket delivery systems have been developed. The first local antibiotic delivery agent developed for periodontitis was Actisite™, supplied as hollow, non-resorbable fibers filled with tetracycline (12.7 mg/9 inch fiber)¹⁶. Though very effective, the non-absorbable fibers were difficult to insert in the deep pockets and required a second visit for retrieval from pocket. Due to these deficiencies the development of absorbable systems for LAD were initiated.

Atridox™ was the first adsorbable system to be developed, which is a 10% formulation of doxycycline (50 mg in a bioresorbable gel system). The polymer gel fills and conforms to pocket morphology, later solidifies to a wax-like on contact with gingival crevicular fluid. Doxycycline is released at effective concentrations over 7 d, and significant reductions (60%) in anaerobic pathogens are sustained for up to 6 mo post treatment.¹⁷

The success of Atridox™ led to development of other absorbable LAD systems such as minocycline microspheres (Arestin™), chlorhexidine gluconate chips (PerioChip™) and gel (Chlosite™), and metronidazol gel (Elyzol™).



Figure 5: Atridox



Figure 6: Arestin –minocycline HCL 1Mg



Figure 7: ELYZOL



Figure 8: PerioChip

VII.HOST MODULATION THERAPY

Host modulation therapy (HMT) does not change the normal defense mechanism or inflammation, instead, they alleviate excessive or pathologically increased inflammatory processes to amplify the opportunities for wound healing and periodontal stability. Thus it helps in modulating host responses by downregulating the destructive aspects or up regulating the

protective aspects of the host response.¹⁸

HMT includes systemically or locally delivered pharmaceuticals that are used as adjuncts to other forms of periodontal treatment.¹⁹

There are three categories of host-modulating agents in the periodontal therapy:

- Antiproteinases (represented by tetracyclines)
- Anti-inflammatory drugs and
- Bone-sparing drugs (bisphosphonates)

A. HOST MODULATING AGENTS ACTING AGAINST MMPS

MMPs endopeptidases, secreted by a variety of host cells, plays major role in the degradation of the extracellular matrix, basement membrane and modify the action of cytokines as well as activation of osteoclasts.²⁰

B. TETRACYCLINE ANALOGUES AS HOST MODULATING AGENTS

In 1985, Golub et al.²¹ reported that tetracyclines have anti-collagenolytic activity and were proposed as a host-modulating agent for periodontal treatment. According to Burns et al.²² (1989), doxycycline was the most potent tetracycline in the inhibition of collagenolytic activities. Birkedal-Hansen²³ (1989), doxycycline has the ability to downregulate MMPs, a family of the zinc-dependent enzymes that are capable of degrading extracellular matrix molecules, including collagen

C. HOST MODULATING AGENTS ACTING AGAINST ARACHIDONIC ACID METABOLITES

Free arachidonic acid (AA) is produced in the hosts when phospholipase A₂ acts on the phospholipids present in plasma membranes of the cells which is then metabolized to produce prostaglandins via the cyclooxygenase (COX) pathway and leukotrienes via the lipoxygenase (LOX) pathway. In recent time, Dybvig also validated that prostaglandins are an important mediator of bone loss in periodontitis.²⁴

D. LIPID - INFLAMMATORY MEDIATORS AS TARGETS FOR HMT

Among the endogenous chemical mediator's resolvins, protectins, and recently found maresins have the ability to mediate resolution and counter-regulate excessive acute inflammation.²⁵

E. HOST MODULATING AGENTS ACTING AGAINST CYTOKINES

Pro-inflammatory (e.g. IL-1 α , IL-1 β , IL-6, TNF- α , IFN- γ etc) and anti-inflammatory cytokines (IL-4, IL-10 etc) have the ability for controlling the adverse effects of the host immune response, consequently HMT against cytokines (cytokine therapy) may prove to be an effective strategy for treating periodontal diseases.²⁶

F.HOST MODULATING AGENTS ACTING AGAINST BONE RESORPTION

Bone sparing agents Bisphosphonates are used in the treatment of bone-related diseases associated with bone resorption. These compounds represent a class of chemical structures related to pyrophosphate, and its osteoclastic activity is by blocking the acidification by local release.²⁷

G. OTHER HOST MODULATING GENTS: PROBIOTICS

Oral administration of probiotics is useful in treating periodontitis. The periodontal pathogens are targeted by means of antagonistic interactions, with the application of *Lactobacillus reuteri*, which shows the reduction of gingival bleeding and inflammation²⁸Plausible mechanisms of action for probiotics in periodontal diseases are based on modifications of the pathogenic potential of biofilm and include interfering in the growth and development of periodontal pathogens ²⁹, the replacement of pathogenic microorganisms by beneficial bacteria ³⁰, and prevention of colonization by periodontal pathogens ³¹. Teughels et al. (2011) found the use of probiotics in influencing the periodontal microbiota and periodontal health and concluded that probiotics helps to manipulate the oral microbiota, and periodontal health by either direct microbiological interactions or by immunomodulatory interactions.³².

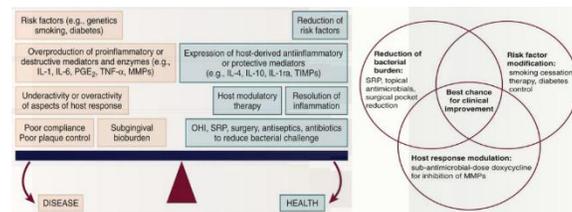


Figure 9

VIII.HYPERBARIC OXYGEN THERAPY

The method of administering pure oxygen at greater than atmospheric pressure to a patient is known as hyperbaric oxygen therapy.

Guo and Zhu ³³ proved that HBOT combined with supragingival and subgingival scaling therapy had synergistic action on periodontitis.

Chen et al.³⁴ proved that HBO had good therapeutic effects on human severe periodontitis, the effects can keep more than 1 year.

IX. PHOTODYNAMIC THERAPY

An oxygen-dependent photochemical reaction which acts with light – mediated activation of a photosensitizing compound leading to the generation of cytotoxic reactive oxygen species is known as photodynamic therapy.³⁵ PDT can be used topically into a periodontal pocket avoiding overdoses and side effects often seen with the systemic antimicrobial agent administration. It also minimizes the occurrence of bacterial resistance.^{36,37}

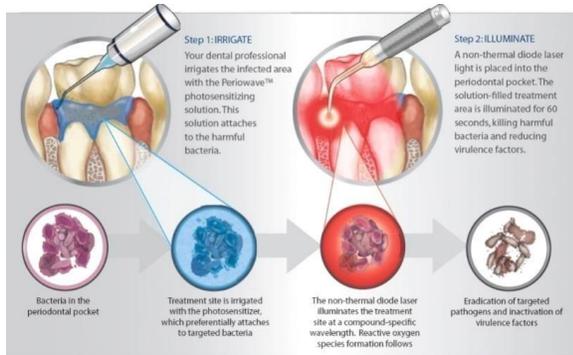


Figure 10: Photodynamic Therapy

The advantage of PDT is that it has dual selectivity, which limits the damage to the normal tissues. It acts by control of light delivery and selective accumulation of photosensitizers in the diseased tissues. Moreover, PDT used low-level lasers, which helps to reduce pain, promote faster healing, and aid in hemostasis.^{38,39}

X. LASERS IN PERIODONTAL THERAPY

LASER, light amplification by stimulated emission of radiation, was first established by Maiman in 1960⁴⁰

A. CLASSIFICATION OF LASERS

Lasers can be classified according to⁴¹

I. On the basis of spectrum of light

- UV light
- Visible light
- Infrared light

II. On the basis of material used

- Gas
- Liquid
- Solid

III. On the basis of hardness

- Soft lasers
- Hard lasers

IV. On the basis of output energy⁴²

- Low output
- High output

V. On the basis of state of gain medium

- Solid state
- Gas state
- Excimer state
- Diode state

VI. On the basis of oscillation mode

- Continuous wave
- Pulsed wave

Lasers can be used in two ways (ie) in a focused beam for excision and incisions and in unfocused beam for ablation and coagulation. Certain evidence suggests that lasers used as an adjunct to scaling and root planning (SRP) provides more benefits. 43

Lasers help to control bacteremia, bacterial reduction, elimination of subgingival calculus (using Er:YAG lasers), improved eradication of the pocket epithelium in pockets involving teeth, and promotes periodontal regeneration without destructing the pulpal tissues and bone.44,45,46,47,48,49,50,51.



Figure 11

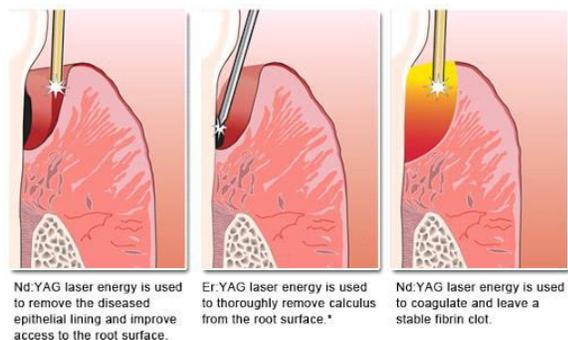


Figure 12

2. CONCLUSION

Nonsurgical periodontal therapy acts as the primary therapeutic measure in treating periodontal disease and also acts as the maintenance measure after surgical therapy. Thus nonsurgical periodontal therapy plays a major role in periodontitis.

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