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"Non-Surgical Periodontal Therapy: A Comprehensive Review Of Treatment Modalities"

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Abstract-
Non-surgical periodontal therapy (NSPT) serves as the first phase of care in managing periodontal diseases. Its primary goal is to reduce microbial load, resolve inflammation, and prevent further attachment loss through mechanical debridement, complemented by adjunctive measures. Over the decades, numerous clinical trials and longitudinal studies have established the efficacy of NSPT, demonstrating significant improvements in probing depth reduction, clinical attachment gain, and long-term periodontal stability.
This review article summarizes the principles, procedures, and outcomes of NSPT, with emphasis on scaling and root planing, patient education, and supportive periodontal maintenance. Limitations of conventional therapy in eliminating pathogens from anatomically complex sites have led to the development of adjunctive strategies, including local and systemic antimicrobials, host modulation therapy, photodynamic therapy, probiotics, laser applications, and ozone therapy.
Evidence suggests that NSPT achieves results comparable to surgical interventions in shallow and moderate pockets, while advanced defects may require surgical access. Nonetheless, NSPT remains the foundation of comprehensive periodontal management, providing predictable outcomes when combined with tailored maintenance protocols. Continued research into novel adjuncts and minimally invasive technologies promises to further enhance the effectiveness of non-surgical periodontal care.
Keywords- *non-surgical periodontal therapy, scaling and root planning, plaque control, antimicrobial agents, Phase I therapy*

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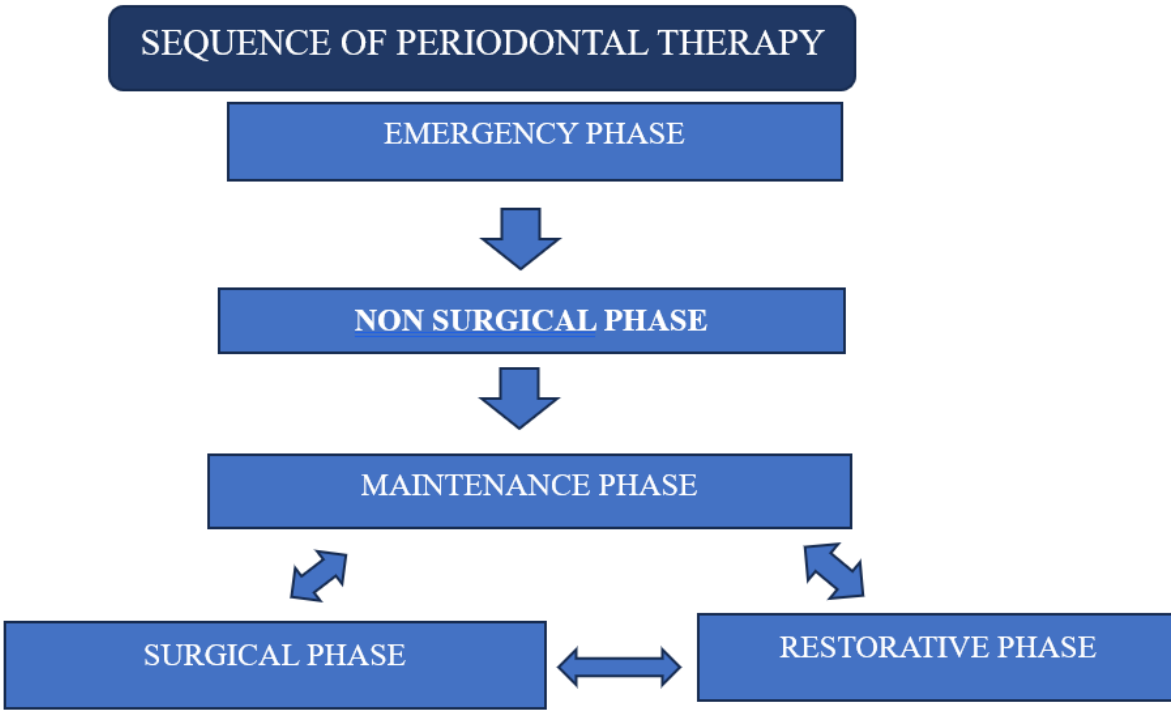
I. Introduction

Nonsurgical periodontal therapy (NSPT) is the crucial step in periodontal therapy and is the first recommended approach to the control of periodontal infections. Phase I therapy/nonsurgical periodontal therapy includes both mechanical and chemotherapeutic approaches to minimize or eliminate microbial biofilm (the primary etiological factors of gingivitis and periodontitis). It also includes measures to relieve the aggravating factors associated with periodontal disease progression.

However, conventional mechanical debridement procedures does not remove all periodontopathic bacteria from the subgingival environment, especially those in inaccessible areas such as furcations, grooves, concavities, and deep pockets. It appears that the effects of mechanical therapy might be augmented using antimicrobial agents which further suppress the remaining pathogens. A recent advance which is receiving much attention is the application of lasers, photodynamic therapy (PDT), and hyperbaric oxygen therapy (HBOT) in NSPT.

The ultimate goal of this mechanical treatment is to allow the diseased periodontal tissues to heal back to an inflammation-free status and restore periodontal health, as demarcated by the improvement of clinical indices.



Synonyms
- Phase I therapy
- Initial therapy
- Hygienic phase
- Preparatory therapy
- Cause-related therapy
- Etiotropic phase of therapy
- Anti-infective therapy

Rationale And Goals Of Non-Surgical Pocket/Root Instrumentation

Rationale
- Correction/replacement of faulty prosthesis
- Orthodontic tooth movement
- Treatment of food impaction areas
- Treatment of occlusal trauma
- To alter or eliminate the microbiological etiology and contributing factors

Goals
- IMMEDIATE GOAL- to prevent, arrest, eliminate periodontal disease
- IDEAL GOAL- To promote healing through regeneration of lost form, function, esthetics and comfort
- PRAGMATIC GOAL- To repair the damage resulting from disease
- ULTIMATE THERAPY- To sustain the masticatory apparatus in state of health.

Landmark Studies

LONGITUDINAL STUDY	RESULTS
MINNESOTA STUDY- Philstrom et al 1981(4 years study)	Compared SRP to modified Widman surgery. The results indicate that both procedures were effective in treating moderate to advanced periodontitis. The additional flap procedure tended to result in greater probing reduction and attachment gain for deeper pockets
Philstrom et al in 1983 (6.5 years study)	This report concludes that SRP alone or in combination with modified Widman flap surgery resulted in sustained decreases in gingivitis, plaque and calculus and neither procedure appears to be superior with respect to the parameters.

Philstrom et al 1984 (6.5 yrs study)	This report examined response of molar and non-molar teeth to SRP alone or along with a flap procedure. There was greater probing dept and more apical attachment level on molar than on non-molar teeth treated by either method for 4 to 6 mm pockets.
MICHIGAN STUDIES- Hill et al 1981 (2 years study)	Each quadrant was treated by one of the 4 treatments- pocket elimination, Modified Widman flap, subgingival curettage, SRP. None of the surgical modalities had any better effect than SRP alone in maintenance of periodontal support which was not directly related to reduction in pocket depth.
Ramfjord et al 1982 (8 years study)	A comparison of 25% of patients having lowest plaque scores with 25% having highest score showed no significant differences in pocket depth responses. This study pointed out the effects of patient performed oral hygiene measures.
Morrison et al 1982 (8 years study)	It analyzed the effect of gingivitis scores on probing depth and attachment levels. For pockets ranging from 1-6 mm there was no differences in pocket reduction maintenance. For 7-12 mm pockets, the lower gingivitis scores seemed to result in better probing levels and attachment gain and was not maintained throughout the experiment.
GOTHENBURG STUDIES- Lindhe et al 1982 (2 years study)	This study reported results of 15 patients comparing SRP to modified Widman surgery. Both treatments resulted in decrease in probing depth. Initial values were 4.2 and 4.1 mm and decreased to 2.4 and 2.5 mm (surgery) and 2.9 and 2.8 mm (no surgery).
Lindhe at al 1982	He determined the critical probing depth for SRP and modified Widman surgery. The results showed that critical probing depth for SRP group was 2.9 mm ± 0.4 and flap group was 4.2 mm ± 0.2 which indicates that in patients with a large number of shallow probing depths, a non-surgical approach is preferable while in patients with large number of pockets > 4.2 mm, surgical treatment may results in more gain of attachment.

CRITICAL PROBING DEPTH- refers to specific probing depth measurement that serves as a threshold for predicting outcome of periodontal treatment.

LONGITUDINAL STUDY	RESULTS
AARHUS STUDIES- Isidor et al 1984 (6 months study)	SRP vs modified Widman surgery vs reverse bevel flap. At 6 months SRP resulted in considerable reduction in pocket depth, but more shallow pockets were obtained following surgical treatment.
Isidor at al 1985 (1 year study)	Each patient was then treated with reverse bevel flap surgery in 1 quadrant, modified Widman flap surgery in 2 quadrants with the 4th quadrant treated with SRP. The results indicate that when comparing modified Widman flap surgery, reverse bevel flap and SRP for regeneration of alveolar bone, only the modified Widman flap surgery resulted in significant coronal regrowth of bone in angular bony defects
Isidor and Karring 1986 (5 years study)	Patients with advanced periodontitis were subjected to supra and sub-gingival scaling and oral hygiene instructions. This was followed by modified flap, reverse bevel flap, or SRP. All the methods were effective in halting the progression of periodontitis. No correlation was found between oral hygiene and recurrence of periodontitis, suggesting subgingival scaling at frequent recalls is an important factor in halting the progression of disease.

LONGITUDINAL STUDY	RESULT
TUCSON MICHIGAN HOUSTON STUDIES Becker et al 1988 (1 year study)	A study comparing SRP, modified Widman surgery and osseous surgery utilizing a split mouth design. The results indicate that at 1 year, SRP, osseous surgery and modified Widman procedure were equally effective in treating moderate to advanced periodontitis.
Kerry et al 1990 (5 years study)	All 3 procedures reduced pocket depth significantly with no differences between procedures at 5 yrs.

Becker et al 1990 (5 yrs study)	All procedures produced significant recession post-surgery. It was concluded that all techniques behave similarly regarding clinical attachment levels and recession

NEBRASKA STUDIES-

Kaldahl et al 1988 compared supragingival to subgingival scaling to modified Widman flap to osseous surgery. The osseous resection group showed greatest reduction in probing depth followed by modified Widman flap, root plus and coronal scaling.

Kalkwarf et al 1992 reported 2 years results of 2 previous studies that analyzed patient preference of treatment method. The results indicated that the ability of the patient to cope with post-therapy sequalae following either scaling, root planning, modified Widman surgery or osseous resection is not significantly different.

LOMA LINDA STUDIES-

Cerec et al 1983 reported results of a 2 yrs study that compared supragingival plaque control to subgingival plaque control to scaling and root planning. Minimal effect was derived from patient-performed plaque control, whether supra or subgingival.

Badersten et al in a 13 months study compared the effect of hand vs ultrasonic instrumentation on attachment levels. Improvements in plaque scores, BOP, decreased probing and attachment levels were similar for both treatment methods.

Sequence Of Events

1. Patient education and motivation regarding proper mechanical plaque control
2. Modification of diet and counseling for dietary deficiencies such as iron, zinc, folate, or vitamins (B12, C, or D) are addressed from the start of periodontal treatment.
Referral to a specialist or dietician is done if required
3. Supragingival scaling to remove supragingival plaque and calculus
4. Removal of high points and overhangs from faulty restorations and crowns
5. Treatment of carious teeth and food impaction areas
6. Subgingival scaling and root planing for smoothening of root surface and removal of subgingival plaque and calculus
7. Chemical plaque control and systemic therapy, if required
8. Patient put on maintenance phase. Tissue re-evaluation is done at 4 weeks after scaling and root planing. This allows for healing of both epithelial and connective tissues. This is also sufficient time for the assessment of patient oral hygiene practices.

INDICATIONS	LIMITATIONS
• Patients with low knowledge regarding oral health, awareness of oral hygiene, motivation, and compliance	• Deep pockets
• Patients with poor self-performed plaque control	• Furcation involvement
• Smokers and patients with psychosocial problems	• Areas with complex root anatomy

Patient Education And Motivation

To be successful, the patient is required to make the following efforts-

1) Receptiveness- required to understand the concepts of the pathogenesis, treatment and prevention of periodontal disease.
2) Change the habits of a lifetime- required to adopt a successful, self-administered daily plaque control regimen.

3) Behavioral changes- required to adjust the hierarchy of one's beliefs, practices and values to accommodate the required new oral hygiene habits and return for regular periodontal maintenance visits.

The patients must understand what periodontal disease is, what its effects are, that he or she is susceptible to it, and what his or her responsibility is in achieving and maintaining oral health. Manual skills must be developed and used to establish a plaque control regimen. Many patients believe that visits to the dental office for periodontal care will eliminate the disease process. Patient- administered plaque control currently is the most important preventive and therapeutic procedure in periodontal therapy.

Patient's involvement in dental care

Active patient involvement is fundamental to successful periodontal care. This means that the patient must have an understanding of the nature of their disease, the treatment and their role in its outcome.

Verbal advice can be supported by providing more general resources such as leaflets or details of appropriate web resources on periodontal disease or oral hygiene methods. The dentist should try not to overload the patient with information on any one visit and should follow up advice at subsequent appointments.

TEACHING PLAQUE CONTROL- No single technique has been devised that will satisfy the needs of every patient or that can be taught by every clinician.

- KEEP INSTRUCTIONS SIMPLE- remember, practicing plaque control is really an exercise in manual dexterity. The more complex the technique, the more the skill the patient needs to learn it.
- DO NOT TEACH TOO MUCH AT ONE TIME- it is far better to introduce the new techniques a few at a time over a longer period, than to expect the patient to remember and practice a long list of procedures that, after a single episode to them appear very complicated.
- ENCOURAGE THE PATIENT- because of varied abilities of patients, not everyone will perform adequate plaque control at first. With further assistance and continued encouragement, all patients can be motivated to practice better oral hygiene.
- CONTINUE OBSERVATION AND SUPERVISION- no matter how well the patient practices plaque control after the initial instructional program, the repeated professional evaluation is required to help maintain a high level of performance.
- BE FLEXIBLE-although you may teach a specific technique to all patients, remember that not all patients have the same problems. Crowded or widely spaced teeth, lengths of crown, presence of fixed prosthetic appliances and physical disabilities are some of the variables encountered.

Diet Control

Dietary supplement use may modify the risk for the development and progression of periodontal disease. The antioxidant activity of nutrients such as vitamin C, tocopherol and the anti-inflammatory activity of PUFA may attenuate the development of periodontal disease.

Studies using NHANES III have demonstrated that lower vitamin C intake is associated with higher risk of having periodontal disease and that higher vitamin C intake is associated with a reduced risk of severe periodontitis.

Few studies have shown that diet may assist with prompt healing from periodontal procedures.

Debridement, Scaling And Root Planing

Kieser (1994) proposed that, in preference to the traditionally practiced combination of scaling and root planing (SRP), pocket/root instrumentation should be performed as three separate stages of treatment – debridement, scaling, and root planing – with objectives pursued in an orderly sequence.

Debridement is defined as instrumentation for disruption and removal of microbial biofilms, scaling - instrumentation for removal of mineralized deposits (calculus), and root planing -instrumentation to remove "contaminated" cementum and dentin in order to restore the biologic compatibility of periodontally diseased root surfaces. Furthermore, it was advocated that the healing obtained following pocket/root debridement should be clinically assessed before any repeated instrumentation efforts, or proceeding to the next stage of instrumentation. The primary objective of (SRP) is to regain gingival health by completely removing elements that are responsible for the gingival inflammation.

According to Horning et al., during SRP the amount of cementum removal with manual scalers with 40 strokes was 57.8 μm. Ultrasonic scaling became an accepted procedure, and it was stated in 1960 that the instruments were an acceptable alternative to hand scalers by Coldiron NB, 1967.

Rosenberg and Ash Van Volkinburg et al. reported that more amount of root surface was removed with manual scalers, whereas Pameijer et al. reported that ultrasonic scalers do so. It was concluded that the root substance removal with one stroke was 1–20 μm and it varied depending on the site of the tooth, the power of the power-driven scaler, the shape of the tip, and whether the root surface was exposed or not.

Effect of supragingival plaque control on subgingival plaque bacteria

Kho et al. reported that with supragingival scaling showed no significant changes in the subgingival bacterial composition of pockets with 7 mm or deeper. In contrast, McNabb et al. reported that supragingival plaque control by professional tooth cleaning induced significant changes in the composition of subgingival microflora, including a decrease of Porphyromonas gingivalis and spirochetes.

Haffajee et al. reported reduction in gingival redness, bleeding, reduction of 40 bacterial species including Aggregatibacter actinomycetemcomitans, P. gingivalis, Prevotella intermedia, and Treponema denticola and mean gain in attachment level.

Gingival Curettage

Curettage or not to curettage- is the question – Echeverria JJ et al 1983

In 2 groups of patients- one group in which only SRP was performed and the other group in which SRP along with curettage was performed, and after 5 weeks, it was noted that similar improvements in periodontal tissues were observed, regardless of treatment, with reduction in pocket depth and gingival inflammation and an increase in CAL.

Instruments Used For Non-Surgical Pocket/Root Debridement

Both hand and machine-driven instruments (Ultrasonics and sonics) are used to remove plaque and biofilm.

Wear of the ultrasonic tip will affect the working performance of the ultrasonic instrument and therefore the degree of loss of tip dimension should be checked regularly. A 1mm wear of the tip will reduce the amplitude of the tip movement by more than half (Lea et al. 2006).

The same effect is obtained if too much pressure (50g) is applied to the instrument. Water is typically used as coolant during instrumentation, but the use of antiseptic solutions such as CHX or povidone-iodine have also been proposed. A potential hazard for the operator with the use of these devices is the production of contaminated aerosol due to the high vibration frequency (Timmerman et al. 2004).

Bacterial biofilms on root surfaces are effectively removed by glycine powder/air polishing without causing damage to the root surface (Petersilka 2011; Bozbay et al. 2018). However, due the inability of glycine powder/air polishing to remove calculus, air-polishing should only be considered as a potentially adjunctive measure to hand or machine-driven instrumentation in the initial phase of periodontal therapy.

Ablative Laser Devices

Ablative laser therapy has bactericidal and detoxification effects, is capable of removing bacterial biofilm and calculus with extremely low mechanical stress and no formation of a smear layer on root surfaces, and can remove the epithelium lining and inflamed tissue within the periodontal pocket (Ishikawa et al. 2009).

Erbium YAG (Er:YAG) lasers are capable of effectively removing calculus from the root surface. To reduce potential damage to the root surface, some Er: YAG laser devices are equipped with a feedback system based on a diode laser that activates the main laser irradiation only if calculus is detected. Er: YAG laser irradiation energy is absorbed by water and organic components of the biologic tissues, which raises the temperature and causes water vapor production, and thus an increase in internal pressure within the calculus deposits.

Other types of lasers such as carbon dioxide lasers, diode lasers, and Nd: YAG lasers are not effective in removing calculus and hence, their use in periodontal therapy has been primarily as an adjunct therapy to SRP. Carbon dioxide lasers, when used with relatively low energy output in a pulsed and/or defocused mode, have root conditioning, detoxification, and bactericidal effects on contaminated root surfaces.

Miyazaki et al. reported decreased inflammation and PD after treatment with CO2 laser and improvements regarding clinical parameters and subgingival microflora after Nd:YAG, CO2 and ultrasonic treatments. Schwarz et al. reported ineffectiveness of laser for calculus removal, and causes alteration of root surfaces such as grooves and crater-like defects in vivo.

Henry et al.reported effectiveness of low dose argon laser in the treatment of clinical infections caused by biofilm-associated species of Prevotella and Porphyromonas.

Correction Of Restorative And Prosthetic Irritational Factors

Over-contoured restoration makes the professional and individual cleaning difficult. Subgingival microbiological samples from the overhanging margins are composed of a micro-flora resembling that of chronic periodontitis. Increased proportions of gram-negative anaerobic bacteria- Porphyromonas and prevotella and an increased anaerobe – facultative ratio were noted. The overhanging restorations disturb the ecological balance in the periodontal pocket and allow a group of disease associated organisms.

Chemotherapeutic Agents

The effects of mechanical therapy might be augmented using antimicrobial agents which further suppress the remaining pathogens. Many chemotherapeutic agents are now available treating periodontal diseases.

Systemic anti-infective therapy (oral antibiotics) and local anti-infective therapy (placing anti-infective agents directly into the periodontal pocket) can reduce the bacterial challenge to the periodontium.

Four generations of antiseptics that includes:
• I generation: Antibiotics, phenols, quaternary ammonium compounds, and sanguinarine
• II generation: Bisbiguanides, bipyridines, quaternary ammonium compounds, phenolic compounds, metal ions, halogens, enzymes, surfactants, oxygenating agents, natural products, urea, amino alcohols, saliflour, and agents that increases the redox potentials
• III generation: Effective against specific periodontogenic organisms
• IV generation: Probiotics are incorporated in mouthwashes.

Antibiotics In Periodontics

Periodontium usually harbors a constellation of putative pathogens rather than a single species. Any effect produced in the sulcus; a systemically administered antibiotic will produce antimicrobial effects in other areas of the oral cavity. This additional effect will reduce bacterial counts on the tongue and other mucosal surfaces, thus potentially aiding to delay in re-colonization of subgingival sites by the offending bacteria. Winkel et al. showed that combination of metronidazole and amoxicillin has been found to produce more pocket depth reduction than control medication. Most commonly used antibiotics for periodontal organisms are metronidazole, amoxicillin, tetracycline, clindamycin, azithromycin, ciprofloxacin, and augmentin

Local Drug Delivery

Local drug delivery (LDD) of antimicrobial agents in periodontology implies antimicrobial agent placed directly in the localized subgingival region. The term local delivery is synonymous with specific or targeted delivery of an agent.

The pivotal study by the Goodson group in 1988 led to FDA approval of tetracycline fibers (Goodson et al. 1991a, b). They employed tetracycline fibers and SRP, with or without chlorhexidine mouth rinsing, to complete the treatment of the subjects.

A meta-analysis performed by Bonito et al., on eight studies of locally applied minocycline, all appearing between 1993 and 2002, is highly supportive of its use as an adjunct to SRP than studies of other local chemotherapeutic agent. The mean effect size was a statistically significant 0.49 mm reduction in PD and 0.46 mm gain in CAL favoring use of local minocycline as an adjunct to SRP.

Results were reported by Ratka-Krüger et al., who showed that the addition of subgingival instillation of a 14% doxycycline gel to SRP resulted in pronounced reduction of periodontal pathogens (Actinobacillus actinomycetemcomitans, T. forsythensis, P. gingivalis, T. denticola) after 3 months and stabilizing results up to 6 months after therapy.

The meta-analysis performed by Hung and Douglass evaluated the treatment effect of 25% metronidazole gel treatment in 11 studies and one study that tested the effect of 15% metronidazole gel. Although the metronidazole gel treatments alone did not show a better improvement than SRP, most studies observed that there was an additional benefit from combined treatment of 25% metronidazole and SRP.

Host Modulatory Therapy

The primary goal of host modulation therapy is to enhance the body's natural defense mechanisms and reduce the destructive inflammatory response to bacterial pathogens.

HMT includes systemically or locally delivered pharmaceuticals that are prescribed as adjuncts to other forms of periodontal treatment. In 2005, a narrative review on host modulating agents identified six targets for adjunct intervention along with NSPT, namely arachidonic acid metabolites, lipoxins, metalloproteinase, bone remodelling, cytokine receptors and nitric oxide synthase activity (Salvi and Lang, 2005b). Clinical advantages were demonstrated when using non-steroidal anti-inflammatory drugs (NSAID) and sub-antimicrobial dose doxycycline (SDD)

Host modulation therapy may involve the use of various agents or treatment approaches, including:
• Anti-inflammatory agents: Medications that reduce inflammation and the release of inflammatory mediators, such as nonsteroidal anti-inflammatory drugs or specific host-response modulating drugs
• Host-modulating antibiotics: Some antibiotics, in addition to their antimicrobial effects, have been found to have host-modulating properties, helping to suppress the inflammatory response
• Growth factors: Certain growth factors can be used to promote tissue repair and regeneration in the periodontal tissues.
• Low-level laser therapy (LLLT): LLLT has been investigated for its potential host-modulating effects, including anti-inflammatory and tissue regenerative properties.

Probiotics

WHO has defined probiotics as live organisms, which, when administered in adequate amounts, confer health benefits to the host. Probiotics repopulate beneficial bacteria which can help to kill pathogens. These produce antioxidants that prevent calculus formation by neutralising the free electrons that are needed for the mineral formation. A majority of strains of L. salivarus were shown to suppress the growth of A. actinomycetemcomitans, P. gingivalis and P. intermedia. Probiotic strains included in periodontal dressings at optimal concentration of 108 CFU/ml were shown to diminish the number of most frequently isolated periodontal pathogens.

Koll klais et al demonstrated that the prevalence of lactobacilli was more in healthy individuals as compared to chronic periodontitis patients. Vivekananda et al conducted a study on patients and evaluated the use of lactobacillus lozenges combined with SRP on periodontitis. More pocket reduction and CAL was obtained in probiotic group when compared to control

Kang et al reported that W. cibaria could inhibit production of volatile sulphur compounds produced by F. nucleatum. Burton et al 2006 reported a reduction in halitosis after consumption of gum or lozenges containing L. salivarius.

Ozone Therapy

Ozone is a powerful oxidizer- it effectively kills bacteria, fungi and parasites at a dramatically lower concentration than chlorine with none of the toxic side effects.

1) ANTIMICROBIAL- Causes damage to the cell membrane, oxidation of cellular contents
2) IMMUNO-STIMULATING- Activates cellular and humoral immune system and activation of antioxidants
3) ANTI-HYPOXIC- Detoxicating and causes activation of aerobic processes
4) BIOSYNTHETIC- Activates protein synthesis, enhances cell metabolism.

Photodynamic Therapy

Utilizes a photosensitizing agent and light of a specific wavelength to generate reactive oxygen species that destroy periopathogens.

Benefits- targeted bacterial elimination, reduces inflammation, tissue regeneration and can be alternatives to antibiotics

Andersen et al. found that SRP combined with photo-disinfection leads to significant improvements of the investigated parameters over the use of SRP alone. De Almeida et al. reported that PDT may be an effective alternative for control of bone loss in furcation areas in periodontitis.

Christodoulides et al. reported failure in additional improvement in terms of PD reduction and clinical attachment level (CAL) gain with a single episode of PDT to SRP, but it resulted in a significantly higher reduction in bleeding scores compared to SRP alone.

Hyperbaric Oxygen Therapy

This method was used to treat diabetics and the complications associated with it like delayed wound healing and ulceration- HBOT increases solubility of oxygen in plasma- better oxygen diffusion- preserving tissue viability. It supplies oxygen at high pressure to hypoxic tissues causes flushing out of toxic gases and stimulates fibroblast proliferation and neo vascularization

Full-Mouth Instrumentation Protocols

The first full-mouth instrumentation protocol described by Quirynen et al. (1995) comprised two sessions of SRP within 24 hours, each covering half of the dentition. However, the total time used for subgingival instrumentation in this approach did not differ from that of the traditional quadrant-wise approach.

As already mentioned, the benefit of this treatment protocol was suggested to be a reduced risk of re-infection of treated sites from the otherwise untreated sites, as well as a potential boost to the immunologic response by inoculation of periodontal bacteria into the local vasculature. From the patient's perspective, a tangible benefit of the full-mouth treatment protocol is that fewer appointments, but not necessarily less chair-time for treatment, are required.

Protocol

- Scaling and root planning of all teeth within 24 hours to reduce number of subgingival pathogenic microorganisms
- brushing the dorsum of the tongue for 1 minute with 1% CHX gel,
- rinsing twice with 0.2% CHX solution for 1 minute,
- spraying the tonsils four times with a 0.2% CHX solution,
- three subgingival irrigations with 1% CHX gel (repeated after 8 days),

❖instructing the patient to rinse twice daily with a 0.2% CHX solution for 2 weeks.

The protocol was later modified by adding the instruction that patients should rinse the mouth and spray the tonsils twice daily with a 0.2% CHX solution for a period of 2 months after the SRP (Mongardini et al. 1999).

The comparison between full-mouth disinfection and quadrant-wise SRP performed in the Cochrane review (Eberhard et al. 2015), based on data from six trials, failed to find a statistically significant difference between the two treatment protocols overall regarding probing depth reduction, but found some differences in favour of full-mouth disinfection in specific subgroups, such as deep sites at 6 months follow-up for single and multirooted teeth. Corresponding analyses in a systematic review by Lang et al. (2008) showed outcomes of similar magnitude in favour of the full-mouth dis-infection approach. However, none of the systematic reviews found any significant differences for the clinical outcome variables between full-mouth disinfection and full-mouth instrumentation, not supporting the extensive use of CHX adopted in these protocols.

Occlusal Therapy And Splinting

Occlusal therapy is a comprehensive approach to address occlusal discrepancies and malocclusions that may contribute to dental problems and temporomandibular disorder. It involves the evaluation, diagnosis, and treatment of the occlusal relationships between the upper and lower teeth.

Objectives- change in pattern and degree of forces, lessening of excessive mobility, beneficial change in pattern of chewing, multidirectional mandibular pattern, multiple simultaneous contact – occlusal stabilization

The primary goals of occlusal therapy include:
a. Occlusal adjustment: The selective grinding or reshaping of tooth surfaces to achieve proper occlusal contacts and improve the distribution of forces during biting and chewing
b. Equilibration: Balancing the biting forces across the teeth and minimizing any excessive pressure points or interferences in the bite
c. Interceptive orthodontics: In some cases, occlusal therapy may involve limited orthodontic treatment to address specific malocclusions and prevent further complications
d. Restorative dentistry: Occlusal therapy may include the placement of crowns, bridges, or other dental restorations to restore the proper alignment and function of teeth
e. Temporomandibular joint (TMJ) management: Occlusal therapy can help alleviate symptoms of TMJ disorders by reducing stress on the joint and surrounding structures.

DENTAL SPLINT: An appliance designed to immobilize and stabilize loose teeth. (Glossary of Periodontal Terms, 2001)
RATIONALE: ♦ It prevents mobility which interferes with function. ♦ It helps in favourable force distribution to the remaining periodontium.
Splinting serves two purposes: * Provides rest during periodontal wound healing * Provides comfort/support in performing function, in cases of reduced/weakened periodontium.

A number of treatment considerations must be considered to treat trauma from occlusion. This includes one or more of the followings:
♦ Occlusal adjustment ♦ Management of parafunctional habits ♦ Temporary or long-term splinting ♦ Orthodontic treatment. ♦ Occlusal reconstruction. ♦ Extraction of selected teeth.

Tooth mobility can be reduced by occlusal adjustment and/or splinting. For selection of the treatment modality, the reasons for increased tooth mobility must be recognized - whether the cause is a widened periodontal ligament due to periodontal disease/trauma from occlusion, reduced height of the supporting tissues, or a combination of these factors.

Splinting in periodontal treatment plan:
♦ Teeth may be temporarily splinted as part of initial phase or Phase I therapy, before periodontal surgery.
♦ Permanent splints may be placed as part of the restorative phase of therapy or Phase III therapy.

Diagnosable occlusal trauma warrants occlusal adjustment. So, Occlusion should be stabilized before splinting. If one tooth in a splint is in a traumatic occlusal relationship, the periodontal tissues of the remaining teeth may also be injured.

Occlusal forces applied to splints are shared by all teeth within the splint, even if the force is applied to only one section of the splint. (Glickman I, Stein S et al. 1961).

Effects of Nonsurgical Therapy on the Periodontal Tissues

1. Changes in gingival inflammation

Several investigators have demonstrated higher probability of periodontal breakdown and the range of reduction of the occurrence of bleeding after probing after the 1st month was 6–64%, 12–80% at 3 months

posttreatment, 12–87% at 6 months and 37–87% at 12 months after completion of the nonsurgical periodontal treatment.

It was concluded that supragingival plaque control can help resolve signs of inflammation associated with gingivitis but does not predictably alter the bacterial composition in pockets >5 mm. Therefore, subgingival debridement is necessary in addition to personal oral hygiene to achieve periodontal health.

2. Changes in probing pocket depth and clinical attachment level

For nonmolar sites, with initial PD between 1 and 3 mm, the amount of gingival recession was approximately 1 mm, and with moderately deep (4–6 mm) or deep (7 mm or more) PD at baseline, the gingival recession were 1.2 mm and 1.9 mm, respectively. There was significantly less gingival recession at the molar furcation sites than nonmolar sites. No significant changes were seen when hand instruments or ultrasonic instruments were used.

Proye et al. reported reduction in recession after 1 week and a gain of clinical attachment by 3 weeks after a single episode of SRP.

3. Reduced efficacy in molar furcation defects

Nordland et al. reported similar pocket reduction and gain of clinical attachment in molar or nonmolar sites, but there was a tendency to recur in furcation defects within a year. In addition, the reduction of anaerobes was only 2-fold at furcation defects, whereas there was a 100-fold reduction at other sites.

4. Changes in alveolar bone structures

Renvert and Egelberg reported that probing bone levels increased by 0.6 mm after surgery and there was virtually no bone fill after root planing. Isidor et al. found that surgery resulted in 0.5 mm coronal growth of bone in angular defects and no changes following root planing.

5. Single versus repeated instrumentation

Badersten et al. reported reduction of approximately 2 mm in mean PDs with single instrumentation and no further improvement was achieved with repeated instrumentation. Magnusson et al. reported reduction in mean PDs after a single scaling episode from 7.2 mm to 6 mm within 16 weeks and a second instrumentation decreased pockets to 4.9 mm.

It was concluded the efficacy of a single course of SRP will be affected by the skill of the clinician, time allocated for procedures, inflammatory status of tissues, anatomy of roots, etc. In general, after a single instrumentation, treated areas need to be reevaluated for further treatment.

Microbiologic Outcomes Following Various Approaches To Pocket/Root Instrumentation

Removal of subgingival plaque and calculus deposits through subgingival debridement in combination with efficient self-performed supragingival infection control alters the ecology of the pockets through reduction in the quantity of microorganisms, resolution of the inflammation, and a decrease in pocket depth, and species that may have flourished in the subgingival environment of the diseased pocket may find the new habitat less hospitable. A decrease in the total bacterial count for sites of >3mm depth, from 91×105 to 23×105, has been observed immediately following subgingival debridement (Teles et al. 2006).

Furthermore, a decrease in the mean counts and number of sites colonized by Porphyromonas gingivalis, Aggregatibacter actinomycetemcomitans, Prevotella intermedia (Shiloah & Patters 1994), Tannerella forsythia, and Treponema denticola (Haffajee et al. 1997; Darby et al. 2005) and an increase in proportion of streptococci (e.g. Streptococcus gordonni, Streptococcus mitis, Streptococcus oralis, and Streptococcus sanguinis) and Actinomyces spp., Eikenella corrodens, and Gemella morbillarum were observed several weeks following subgingival debridement. An increase in the pro-portions of Gram-positive aerobic cocci and rods is associated with periodontal health (Cobb 2002).

In a study comparing the microbiologic outcome of full-mouth instrumentation and quadrant-wise SRP (Quirynen et al. 2000), it was demonstrated by phase-contrast microscopy and culturing techniques that both treatment approaches reduced the total number of facultative and strict anaerobic species, as well as the number of black-pigmented bacteria, spirochetes, and motile rods in subgingival samples, but also that the reductions were more pronounced following the full-mouth instrumentation. Other studies comparing the microbiologic outcomes following the two treatment approaches using polymerase chain reac-tion (PCR) techniques (Apatzidou et al. 2004; Koshy et al. 2005; Jervøe-Storm et al. 2007) also reported reductions in presumptive periodontal pathogens, but no detectable differences between the approaches.

More favorable microbiologic changes have been reported following full-mouth disinfection as compared with quadrant-wise SRP with respect to decreases in the total amount of motile organisms and spiro-chetes, total number of facultative or strict anaerobic bacteria, black-pigmented bacteria, as well as

frequencies and levels of "red" and "orange" microbial complexes detected using differential phase-contrast microscopy, culturing, and DNA–DNA hybridization technique (Quirynen et al. 1999, 2000; De Soete et al. 2001). By contrast, Koshy et al. (2005) could not detect any added microbiologic benefits as recorded by PCR following their modified full-mouth dis-infection approach compared with quadrant-wise instrumentation.

Healing

Predictable outcomes include- healing of the epithelium, resolution of inflammation, formation of long junctional epithelium, recession and repopulation of pockets by less pathogenic bacteria

Less predictable outcomes are- regeneration of new bone, new connective tissue attachment and new cementum on root surfaces

Re-Evaluation Following Initial Non-Surgical Periodontal Treatment

An increased resistance of the periodontal tissues to probing and absence of bleeding are signs of resolution of the inflammatory lesion related to a sufficient removal of biofilm/calculus. Thus, clinical end points of treatment success may be defined as (1) no bleeding on pocket probing and (2) "pocket closure", that is a PPD of ≤4mm. PPD change is a combined result of recession of the gingival margin and decreased probe penetration into the pocket due to resolution of the inflammatory lesion in the bordering soft tissues.

The marked difference in probability of pocket closure noted between smokers and non-smokers (e.g. 36% versus 63% for 7mm deep pockets) places the focus on smoking as a significant factor influencing treatment outcome following non-surgical periodontal therapy. Smoking is proven to negatively affect the outcome of all modalities of periodontal therapy (Labriola et al. 2005; Heasman et al. 2006) and hence, if the patient is a smoker, inclusion of a smoking cessation program should be considered as an adjunctive measure.

II. Conclusion

NST is superior for preventing attachment loss in shallow pockets and offers comparable or better clinical attachment gains in moderate pockets. It delivers significant improvements in pocket depth, with long-term stability.

The field of periodontology is continually changing. Dentists and hygienists must be updated with the latest research discoveries in periodontal treatments in order to offer the most comprehensive therapy for patients.

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