



PERIODONTAL INSTRUMENTATION AND NON-SURGICAL PERIODONTAL THERAPY- A REVIEW!

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ABSTRACT

Periodontal diseases are inflammatory diseases caused by primarily accumulation of bacterial plaque and calculus. The toxins present in the bacteria causing periodontal disease causes an immune-inflammatory reaction in the individual which results in periodontal tissue loss. Therefore mechanical debridement is the cornerstone of periodontal therapy for removal of the etiological factor. Periodontal instrumentation is carried out in the non surgical, surgical and maintenance phases of periodontal therapy. Hence periodontal instruments comprise the essential tools for a periodontist for periodontal therapy. This article reviews the various instruments- manual and ultrasonic used in treatment of periodontal diseases with a brief discussion on non-surgical versus surgical periodontal therapy.

KEYWORDS : Instrument, Calculus, Plaque, Biofilm, Endotoxin

Introduction

Periodontitis is characterized by bone and attachment loss which is caused by an immune-inflammatory response generated by an array of periodontal pathogens that are dwelling in the bacterial plaque.¹ Although periodontitis is multifactorial disease whose rate of disease progression can be affected by environmental factors such as smoking, stress, oral hygiene habits, presence of any systemic disease, obesity, genetic variation etc. apart from bacterial plaque.² Subgingival debridement is defined as gentle mechanical subgingival instrumentation carried out to disrupt and/ or remove the acquired biofilm.³ This subgingival debridement can be a part of initial cause related therapy, surgical therapy as well as supportive periodontal therapy. The rationale of non-surgical periodontal therapy is to reduce the microbial load by removing the biofilm associated with the tooth surfaces that consists of harmful substances such as endotoxins, enzymes, antigens and other substances that are tissue destructive.⁴

Dental plaque is a structured resilient yellow greyish substance that adheres tenaciously to the intraoral hard surfaces including removable and fixed appliances. It is comprised of a community of microorganisms found on the surface of the tooth as biofilm, embedded in a matrix of polymers of host and bacterial origin.⁵ The advantages for the microorganisms to reside in a biofilm are enhanced pathogenicity and reduced susceptibility to antimicrobial agents.⁶ Calculus is a mineralized dental plaque and acts as a gingival irritant by keeping the plaque in close contact with the gingival tissues. Also morphologically calculus has internal channels as well as external irregularities which can act as a reservoir for periodontopathogens and toxic substances causing inflammation.⁷ Thereby it is an important but secondary etiology after plaque for the causation of gingival inflammation.⁸ Periodontal instruments including hand instruments and ultrasonic scaling instruments are specifically designed for this goal of removal of plaque and calculus which help in rendering the tooth surface hard, smooth and clean for compatible attachment of the junctional epithelium.

Available techniques for non-surgical periodontal therapy

Hand scaling- Hand instrumentation is the gold standard for non-surgical therapy as it provides good tactile sensation and control over the instrument. Hand instruments are of various types such as sickle scalers, surface scalers, jacquette scalers, curettes, hoe, chisel and file. The design and use is different for each of the instrument. Parts of the instrument include handle, shank and working end or blade.⁹ Working end has two cutting edges, tip or rounded toe, face, lateral surface and back of the blade.

Ultrasonic instrumentation- Sonic/ultrasonic instrumentation have become an alternative or an addition to hand instrumentation

since their invention in 1960. Difference between sonic and ultrasonic instruments is in the frequencies of vibration. Sonic devices are driven by air pressure to create mechanical vibration with a frequency ranging from 2000 to 6000 Hz. Ultrasonic devices convert electric current into mechanical energy with frequency ranging from 18,000 to 45,000 Hz.¹⁰ There are three types of ultrasonic power driven instruments that include magnetostrictive, piezoelectric and Vector system. Difference between magnetostrictive and piezoelectric system is the pattern of vibration of the tip, magnetostrictive has an elliptical pattern and piezoelectric has a linear pattern of vibration. Vector system has a different cooling system that is a water based medium with polishing particles.¹¹

Laser and photodynamic therapy- An ablative laser device produces coherent electromagnetic radiation, characterized by a well-defined wavelength and a low divergence of the radiation beam. Laser therapy is reported to have bactericidal and detoxification effects and to be capable of removing biofilms. Neodymium doped yttrium aluminum garnet (Nd:YAG) and diode lasers have been described to have quite good bactericidal and soft-tissue debridement properties.¹² However, they always have to be used in combination with mechanical instrumentation. Because of less effective removal of deposits, as well as the considerable thermal damage on the root surface that they might produce, these lasers cannot be used as a replacement for mechanical instruments in root debridement procedures.¹³ Erbium-doped yttrium aluminum garnet (Er:YAG) laser is a capable laser for root surface debridement, which can effectively remove biofilm and calculus. The energy produced by an Er:YAG laser is absorbed by water and organic components. This will raise the temperature and convert water into vapor, thereby increasing the internal pressure within the deposits. Because of this expansion, the deposit can detach from the root surface. Other properties of Er:YAG laser include bactericidal effect, ablation of root surface and effective removal of toxins from the root surface.

Photodynamic therapy is based on the principle that a photosensitizer binds to the target cells and is activated through light of a certain wavelength. In turn, singlet oxygen and other reactive agents are produced, which are extremely toxic to certain cells and bacteria.¹⁴

Air polishing- The ability of a jet of air, powder and water to remove biofilm relies on a combination of cutting, fatigue and brittle fracture of the various materials. To produce the abrasive slurry of particles, the powder inside the powder chamber is stirred up by pressurized air.¹⁵ This is then transported to the tip of the air polishing nozzle by airflow and is mixed with water. However, scaling and root planning by hand instruments or ultrasonic

instrumentation is preferred over air polishing.

Factors influencing the outcome of non-surgical therapy¹⁶

- Pocket depth exceeding 4 mm
- Root proximity
- Concavities and depressions
- Molars with furcation involvement
- Crowding/rotation/tilting of the tooth
- Poor compliance to oral hygiene regimens and failure to return for maintenance care
- Incomplete debridement
- Presence of systemic diseases such as diabetes mellitus
- Genetic susceptibility to periodontal disease
- Smoking

Non-surgical versus surgical periodontal therapy

Surgical periodontal is indicated when there is a need for accessibility to the underlying bone and root surfaces for better visualization of calculus and plaque, pocket depth exceeding 5 mm, regenerative and resective therapy, irregular bony contours and defects, furcation involvement, correction of mucogingival problems and preparation of periodontium for restorative or prosthetic treatment.

Studies on the outcomes non-surgical periodontal therapy

- Waerhaug J et al 1978¹⁷ demonstrated that complete calculus removal in pockets deeper than 5 mm is possible only 11% of time.
- Jones WA et al 1978¹⁸ suggested that the efficacy of removal of endotoxin from the root surface by root planing procedures is questionable.
- Morrisson et al 1980¹⁹ suggested that in shallow (1–3 mm) sites, scaling and root planing leads to mean probing depth reductions of less than 0.5 mm, as well as slight amounts of attachment loss
- According to Philstrom et al. 1984²⁰, sites with probing depth of 4–6 mm associated with non molar teeth demonstrated greater probing depth reduction following scaling and root planing than those sites associated with molar teeth.
- Greenstein G et al 1992²¹ proved the efficacy of non-surgical periodontal therapy in terms of reduction in bleeding on probing and gingival index scores.
- Hujoel et al 2000²² suggested that non-surgical periodontal therapy reduces tooth loss by up to 58% with time.
- Ehnevdi & Jansson et al 2001²³ reported that probing depth reduction by non-surgical periodontal therapy was 0.5 mm less in treated sites adjacent to molars with furcation invasions of degree 2 or degree 3 compared with sites adjacent to molars with furcation invasions of degree 1 or less.
- A comprehensive meta-analysis by Hung HC et al 2002²⁴ of nonsurgical treatment studies reported that for patients with chronic periodontitis, following scaling and root planing at sites with probing depths of 4–6 mm, clinicians should expect a mean reduction in probing depth of about 1 mm and an average gain in clinical attachment level of approximately 0.5 mm (43). At deep sites (probing depth \geq 7 mm), the probing depth reduction should average approximately 2 mm and the gain in attachment level about 1 mm.

Studies on the outcomes of surgical periodontal therapy

- Glickman et al 1956²⁵ studied the results of gingivectomy in a clinical trial comprising 250 patients with varying degrees of disease severity. Patients were followed from 3 months to 7 years, and gingival health, with sulcus depths of up to 2 mm, was maintained. Relapse was noted only in patients who experienced inadequate calculus removal or curettage, those with overhangs or food impaction and those with poor plaque control.
- Knowles et al. 1979²⁶, in a split-mouth design, evaluated root planing with subgingival curettage, modified Widman flap

surgery and pocket elimination surgery (either by gingivectomy or by apically positioned flap and osseous surgery). Periodontal maintenance was performed every 3 months. Modified Widman flap and pocket elimination surgery resulted in greater pocket reduction than curettage, especially at deeper sites. All procedures resulted in clinical attachment level gain; however, the modified Widman flap resulted in the greatest attachment gains after 8 years.

- Serino G et al 2001²⁷ suggested that surgical treatment demonstrated better results in terms of pocket closure and preservation of teeth.
- Hom Lay Wang et al 2001²⁸ in his article on surgical periodontal therapy has evaluated the outcomes of surgical and non-surgical periodontal therapy and concluded that the pocket depth reduction is higher with modified Widman flap procedure than scaling and root planing.
- Von Troil B et al 2012²⁹ and Watchel H et al 2003 suggested that surgical periodontal therapy is particularly useful in sites associated with furcation involvement or intrabony defects.
- Heitz-Mayfield et al 2013³⁰ et al reported that surgical periodontal therapy is suitable for periodontal pockets exceeding 6mm.
- Aljateeli M et al 2014³¹ compared the outcomes of surgical periodontal therapy with and without initial scaling and root planing. He concluded that combined scaling and root planing and surgery yielded greater probing depth reduction as compared to periodontal surgery without initial scaling and root planing.

Conclusion

It is clear from the literature that scaling and root planing plays a pivotal role in the elimination of causative factors of periodontal disease throughout periodontal therapy, including the nonsurgical, surgical and maintenance phases. Various nonsurgical and surgical options are available to treat periodontal disease. No periodontal treatment has shown clear superiority over any other periodontal treatment. Treatment of periodontitis involves a fine balance of highly developed and skilled techniques, which together decrease the risk of disease progression.

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