

Non-Surgical Periodontal Therapy: An Aspect Frequently Overlooked

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Abstract: *Non-surgical periodontal treatment was common 3000-4000 years ago according to analysis of Egyptian hieroglyphics and medical papyri. Even today, scaling and root planing (SRP) remains an essential part of successful periodontal therapy. SRP remains the 'gold standard' to which more recently developed therapeutic modalities must be compared. Inherent to the clinical evaluation of SRP are such concerns as manual versus sonic and ultrasonic instrumentation, control of sub-gingival bacterial populations, and removal of calculus, root smoothness and changes in various clinical parameters, e.g. probing depth, attachment levels, bleeding on probing and gingival inflammation. Local drug delivery is used as an adjunct to scaling and root planing. It refers to devices/composition and methods for treating diseases of the oral cavity using non bio degradable devices/composition which are biocompatible but are not bioerodable for releasing drugs in and around a periodontal pocket or a gingival sulcus[1] This review approaches scaling and root planing and the main delivery systems for the administration of drugs to the periodontal pocket, their usefulness, and the advancement of these systems effectiveness as an adjunct to scaling and root planing in the non surgical periodontal therapy.*

Keywords: Scaling and root planing, local drug delivery, perioecol, periochip

1. Introduction

Periodontal disease is the number one chronic infectious disease in the world being the leading cause of tooth loss. It begins as painless infection in the gums that is caused by buildup of bacterial plaque. The treatment modalities that exist for the treatment of gingivitis and Periodontitis depends on the extent and severity, but the primary objective is to restore the gingival health by removing the local factors namely plaque, calculus etc. that provoke inflammation. Non-surgical periodontal therapy or NSPT is one of the management of gingival infection with scaling, root planing, antibiotics and other non surgical means [2]

Periodontitis is an inflammatory reaction of the tissues surrounding a tooth, usually resulting from the extension of gingival inflammation induced by the bacteria residing in the plaque biofilms on the subgingival tooth surface. This causes long junctional epithelium loss in the normally healthy sulcus, thereby developing periodontal pockets resulting in connective tissue attachment loss, formation of intrabony defects and ultimately the possibility of tooth loss. This multi factorial disease affecting up to 30-50% of the adult population, is associated with local as well as systemic symptoms. The chronic nature, as well as the complexity and variety of the associated subgingival bacterial biofilms, are responsible for the numerous virulence factors and inflammatory markers characteristic of chronic periodontitis. Mechanical removal of the biofilms has been the conventional approach to periodontitis therapy. Various local and systemic antibiotic regimens have been utilized in the treatment of periodontitis, but in most cases only slight improvements over mechanical debridement have been noted, along with concern about the development of increasing antibiotic resistance.[3] It has been shown over many studies that standard mechanical debridement can achieve about a one millimeter mean reduction in pocket depth, clinicians also need to consider other factors when

treating patients with nonsurgical therapy, including the efficacy of plaque removal. Studies have shown that there is a decreasing efficacy in plaque removal with increasing pocket depth and this is associated with a corresponding decrease in treatment efficacy. [3] Use of local drug delivery devices as a monotherapy remains controversial since root planing alone often achieves a similar result. In general, use of local drug delivery devices should be reserved for sites in patients who fail to respond to mechanical instrumentation. There should be a balance in the use of antibiotics considering the risk of increasing antibiotic resistance. [3]

Local delivery of antimicrobials has been investigated for the possibility of overcoming the limitations of conventional therapy. The use of sustained release formulations to deliver antibacterials to the site of infection (periodontal pocket) has recently gained interest. These products provide a long-term, effective treatment at the site of infection at much smaller doses.

Biodegradable polymers are extensively employed in periodontal drug delivery devices because of their abundant source, lack of toxicity, and high tissue compatibility. A major advantage of natural polymers is that they do not affect periodontal tissue regeneration. [4]

A controlled release drug delivery system for placement in the periodontal pocket comprises of micro particles or micro capsules, herein after referred to as micro particle, suspended in a pharmaceutically acceptable carrier medium. The micro particle is between 10 and 500 microns in size, and consists of an active agent dispersed within or encapsulated by a rate-controlling polymer matrix. Micro particles of this specification can be prepared by a variety of well-established techniques, for example solvent evaporation or spray-drying. The active agent may be one of a broad spectrum of drugs, including, antibiotics, anti-inflammatory agents, local anesthetics and so on. The polymer matrix may

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be chosen from a range of medically suitable materials and varied to provide the required release rate or the drug involved. Embodiments employing biodegradable polymers can limit the life of the micro particles to a month or two and prevent micro particle entrapment in the periodontal pocket for excessive periods of time. The carrier medium may be an aqueous solution, paste or gel.

In general the properties required are that it should be pharmaceutically acceptable (non-toxic and non-allergenic), promote good adhesion in the periodontal pocket, and have a high permeability for the active agent involved. An object of the invention is to provide a system to deliver a drug or other active agent to the periodontal pocket at a steady dosage level which can be sustained for a period of days or weeks. Another object of the invention is that the said system should be comfortable in use, should not interfere with the normal oral functions and should not be easily dislodged by the patient. A further object is that the said system should be capable of insertion in a simple manner, and should not require the use of undue time or exceptional expertise on the part of the dentist or physician involved. [1]

Scaling and root planing

Scaling and root planing, otherwise known as conventional periodontal therapy, non-surgical periodontal therapy, or deep cleaning, is the process of removing or eliminating the etiologic agents – dental plaque, its products, and calculus – which cause inflammation, [8] thus helping to establish a periodontium that is free of disease. Rabbani et al. reported that a single episode of scaling did not completely remove subgingival calculus and that the deeper the periodontal pocket, the less complete the calculus removal. [9]

Various instruments are used for scaling and root planing namely periodontal scalers, curettes, ultrasonic and sonic instruments.

Local Drug Delivery

Goodson et al in "Local Drug Delivery---Periocol" In Periodontics in 1979 first proposed the concept of controlled delivery in the treatment of periodontitis. This new approach using local delivery systems containing antimicrobials produces more constant and prolonged concentration profiles. Both topical delivery system and controlled release system have been termed as local delivery. The term local delivery and site-specific delivery are sometimes used synonymously.

Drugs used for local drug delivery

Different drugs used for local delivery are tetracyclines including doxycycline and minocycline, metronidazole and Chlorhexidine. [5] Curcumin and aloe vera gels are also used nowadays.

Tetracyclines

Tetracycline's are bacteriostatic for many pathogens at concentrations found in the gingival crevicular fluid after systemic administration (3-6 microgram/ml). However, local delivery of such agents provides high concentrations which are bactericidal. However the local application of tetracycline's has been associated with minimal side effects.

Chlorhexidine

It has been considered as the most effective topical antimicrobial agent was introduced in U.S in 1986. Its efficacy as a topical rinse to inhibit dental plaque and gingivitis has been well established in study periods for 2 years without evidence of development of any bacterial resistance. (Rindom Schiott, Briner, Loe). It has been found to be effective against subgingival bacteria when delivered through a sustained release device. The microbial effect was evident for up to 11 weeks after treatment and clinical efficacy up to 2 years in terms of reduced probing depth, gain in attachment levels and reduction of bleeding. Chlorhexidine has been shown to be an effective agent in plaque inhibition (Loe et al 1976) because it is well retained in the oral cavity, reacting reversibly with receptors in the mouth due to its affinity for hydroxyapatite and acidic salivary protein (Rolla, Loe and Schiott 1970). Two daily rinses with 10 ml of a 0.2% aqueous solution of Chlorhexidine digluconate almost completely inhibited the development of plaque, calculus and gingivitis in the human model for experimental gingivitis. Chlorhexidine has very low systemic toxic activity in humans and has not produced any appreciable resistance to oral microorganism and has not been associated with any teratogenic alterations. Chlorhexidine is safe, clinically effective in reducing plaque and gingivitis, has substantivity, affects the pathogenic flora and is acceptable in terms of taste, cost and ease of use. [5]

Periochip

Introduced in 1998, Periochip, the controlled subgingival delivery of Chlorhexidine, is a 5 mm x 4 mm 0.3 mm film weighing 7.4 mg contains 2.5 mg of Chlorhexidine gluconate which is incorporated in a biodegradable matrix of hydrolyzed gelatin cross linked with glutaraldehyde. The matrix also contains glycerin and purified water. Soskolne et al conducted an in vivo estimation of the Chlorhexidine release profile of the Periochip in the GCF, plasma and urine in 1998. Release profile of Periochip cross linked hydrolyzed gelatin matrix into the gingival crevice was evaluated in a 10 day pharmacokinetic study and the results indicate that periochip can maintain clinically effective levels of Chlorhexidine in the gingival crevicular fluid of periodontal pockets for over 1 week with no detectable systemic absorption. [5]

Periocol

Periocol a new sustained release Chlorhexidine in fish collagen membrane was developed by Eucare Pharmaceuticals, Chennai, which is similar to Periochip. It has two contents Chlorhexidine and collagen. This chip is prepared by incorporating 2.5mg Chlorhexidine from a 20% Chlorhexidine solution in collagen membrane. Size of the chip is 4x5 mm and thickness is 0.25 - 0.32 mm and 10 mg wt. The chip is sterilized by gamma irradiation at 2.5 mega rads. Application of this chip in chronic periodontitis as an adjunct to scaling and root planing procedures has shown reduction in probing pocket depth, gingival bleeding and clinical attachment level compared to scaling and root planing. [5]

Curcumin

Curcumin, both available as chips and gels produced a significant reduction on the inflammatory infiltrate and increased collagen content and fibroblastic cell numbers. Elburki et al. demonstrated that chemically modified curcumin prevented alveolar bone loss and lowered production of IL-1 β and matrix metalloproteinase (MMPs) in rats. In an in vitro and in vivo study comparatively evaluated the adjunctive efficacy of curcumin, and traditional nonsurgical methods for treating periodontal pockets. At 24 hours, the in vitro release pattern showed that 70% of turmeric was released compared to 78% for curcumin chips. At 72 hours, these levels had increased to 78% of turmeric and 80% of curcumin. By the end of 80 hours, 100% of drug release had taken place. In a study conducted by Behal et al. proposed that local drug delivery system containing 2% whole turmeric gel can be used as an adjunct to scaling and root planing as it significantly reduced trypsin-like enzyme activity of "red complex" microorganisms: [6]

Aloe vera

Aloe vera, along with the healing and anti inflammatory properties is also anti bacterial, anti fungal and anti viral. Aloe vera available in chips and gel form is used in local drug delivery system in the recent years. Various studies have proves that the use of aloe vera locally in the periodontal pockets as an adjunct to scaling and root planing has significantly reduced pocket depth, increased clinical attachment gain thereby reducing the extent of inflammation. According to a study conducted by Davis et al in 1989, use of aloe vera gel improve the wound healing by increasing the blood supply and oxygenation to the affected tissue. [7]

2. Comparison of Local Delivery Systems

With SRP with Combined therapy.[SRP+LDD]

Table 1

Drug	Reference	No. of patient	Probing depth reduction	Clinical attachment level gain	Probing depth reduction	Clinical attachment level gain	Study period
Chlorhexidine chip	Jeffcoat et al	447	0.65mm	0.58mm	0.95mm	0.75mm	9 months
Chlorhexidine chip	Soskolne et al	118	0.70mm	0.31mm	0.16mm	0.47mm	6 months
Tetracycline fibre	Newman et al	405	1.08mm	-----	1.81mm	-----	6 months
Doxycycline polymer	Polson et al	179	1.30mm	0.80mm	1.7mm	1.00mm	9 months
Minocycline	Vansteenberget al	103	1.4mm	0.8mm	2.64mm	0.8mm	3 months
Minocycline	Graca et al	26	2.30mm	1.56mm	2.64mm	1.95mm	3 months
Metronidazole	Ainamo et al	206	1.30mm	-----	1.30mm	-----	6 months

[Divya P.V et al. Local drug delivery –Periocol in Periodontics. *Trends Biomater. Artif. Organs*, Vol 19(2), pp 74-80 (2006)]

3. Conclusion

Scaling and root planing should always be the initial step towards planing the treatment in periodontitis. Local drug delivery systems incorporating a variety of drugs can improve periodontal health as an adjunct to scaling and root planing and in some cases can give positive outcomes avoiding the need for surgery. SRP and LDD are the frequently underestimated modalities in treatment planing. Local drug delivery is minimally invasive, viable and an inexpensive option for common man and can be incorporated as a treatment modality in day-to-day life.

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