

LOCAL DRUG DELIVERY IN PERIODONTICS

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ABSTRACT

In Indian perspective, the periodontal diseases are major cause of tooth loss during adulthood of population irrespective of sex and age. Various treatment modalities have been available to the dental profession. Scaling polishing along with self administered plaque control instructions is the most commonly practised by general dentist for prevention and control of early periodontal diseases. Root planning and soft tissue curettage procedures are added to it for treatment of moderate type periodontal diseases. In some cases, it has limited success and therefore, local applications of some antibacterial drugs by topical application or local drug delivery in the periodontal pockets have been tried. Periodontal pockets provide natural reservoir bathed by gingival crevicular fluid that is easily accessible for the insertion of a delivery device. Controlled release delivery of antimicrobials directly into periodontal pockets has received great interest and appears to hold a sound promise in periodontal therapy. Both topical drug delivery and controlled drug release have been termed as local drug delivery. It does not substitute the local instrumentation but acts as an adjunct to it. The periodic use of local drug delivery in minimizing bleeding, stabilizing attachment levels and thereby reducing probing depth, would allow better control and management of periodontal disease. Various drugs have been under investigation for more than 3 decades promising encouraging results. The rationales of using antibacterial drugs through local delivery into the periodontal pockets have been discussed.

INTRODUCTION

Recent developments in science and technology have revolutionized the basic outlook and approach to the management of periodontal disease. Earlier it had been assumed that periodontal problems were invariably progressive and its morbid effects increased with passage of time assuming that they were age related. Periodontal diseases are infections of the periodontium. Once there is an immune response to a bacterial challenge, then the process is referred to as an infection. Usually the host response contains the bacterial challenge and there are no signs of inflammation. However, if tissue destruction occurs, then the condition is considered a disease. The most common form of periodontal disease is referred to as chronic periodontitis.

Chronic periodontal disease describes a group of related inflammatory reactions resulting in destruction of the tissues that support tooth in its socket. It results usually from extension of the inflammatory process initiated in the gingiva to the supporting periodontal tissues. There are several types of periodontal diseases (periodontitis) and are classified by the American Academy of Periodontology, although they all have the same characteristic features. The clinical findings include increased probing depth (PD),

bleeding on gentle probing (BOP), loss of clinical attachment level (CAL) and alteration in the physiologic contour of the gingiva. Unfortunately, periodontitis cannot be cured, but it can be arrested. It can be localized or generalized and depending on the amount of clinical attachment loss, the severity of the disease process can be labelled as mild (< 3 mm), moderate (3 to 4 mm), or severe (≥ 5 mm). It has been determined that approximately 30% of the adult population develops chronic periodontitis.

The immediate goal is to prevent, control or eliminate periodontitis and to restore the form, function, aesthetics and comfort of dentition. Periodontal therapy has been directed at altering the periodontal environment to the one, which is less conducive to retention of bacterial plaque in the vicinity of gingival tissue. Active phase of the disease can be reversed dramatically by reducing plaque levels. Classic regimen to achieve this aim includes:

- 1) Instructions in self administered plaque control measures.
- 2) Periodontal prophylaxis for removal of calculus, debris and stains.
- 3) Correction of restorative inadequacies.
- 4) Root planning and soft tissue curettage.

- 5) Surgical elimination of periodontal pockets if required.

Scaling and root planing or ultrasonic debridement is effective mechanical therapies for periodontitis. However, in deep or tortuous pockets or sites that do not respond to conventional therapy, it may be beneficial to use adjunctive antimicrobial therapy. For local chemotherapy (drug delivery) to be effective, it must meet 3 requirements: (1) reach the site of disease activity namely the base of the pocket, (2) be delivered at a bacteriostatic or bactericidal concentration, and (3) remain in place long enough to be effective.

LOCAL DRUG DELIVERY

Recently, a new approach using local drug delivery containing antimicrobial agents has been introduced. Such therapeutic intervention provides long-term retention of a highly concentrated drug within the target tissue after local delivery. It produces more constant and prolonged concentration profiles in the local area. Both topical drug delivery and controlled drug release have been termed as local drug delivery. The term local drug delivery and site-specific drug delivery are sometimes used synonymously. The potential therapeutic advantage of local drug delivery approach has been claimed to be several fold. Local drug delivery devices are systems designed to deliver agents locally into periodontal pockets but without any mechanism to retain therapeutic levels for a prolonged period of time. The periodic use of local drug delivery in minimizing bleeding, stabilizing attachment levels and thereby reducing probing depth, would allow better control and management of periodontal disease.

The effectiveness of this form of therapy is that it reaches the base of periodontal pocket and is maintained for an adequate time for the antimicrobial effect to occur. Periodontal pockets provide natural reservoir bathed by gingival crevicular fluid that is easily accessible for the insertion of a delivery device. Controlled release delivery of antimicrobials directly into periodontal pockets has received great interest and appears to hold a sound promise in periodontal therapy.

Controlled release local drug delivery in which

the antimicrobial is available at therapeutic level for several days have been evaluated in several forms using different antimicrobials. Controlled drug delivery are designed to release drug slowly for more prolonged availability and sustained action. These delivery systems are also called sustained release, controlled release, prolonged release, timed release, slow release, sustained action, prolonged action or extended action etc.

DRUGS USED FOR LOCAL DELIVERY

Common drugs used for local delivery are:

Tetracyclines including doxycycline and minocycline: Tetracyclines are bacteriostatic for many pathogens at concentrations found in the gingival crevicular fluid after systemic administration (3-6 microgram/ml). However, local delivery of these drugs provides high concentrations that are bacteriocidal. Local application of tetracycline has been associated with minimal side effects.

The tetracycline, tetracycline hydrochloride and doxycycline, are broad- spectrum antibiotics that are effective against anaerobes and facultative organisms. They are bacteriostatic against both Gram-positive and Gram- negative bacteria.

Chlorhexidine: Chlorhexidine is an antiseptic known to reduce gingivitis when used as a mouth rinse and also as a subgingival irrigant. It adheres to organic matter and demonstrates low toxicity when delivered locally and is not adsorbed well into the tissue. The chlorhexidine is used in chip form. The chip is easily placed into periodontal pockets greater than 5 mm and requires no retentive system. The body resorbs the chip in 8 to 10 days. The trial studies on the chlorhexidine chip demonstrate that it is a safe and effective adjunctive chemotherapy for the treatment of periodontal disease with minimal adverse effects.

Metronidazole: Metronidazole is another drug with spectrum of activity relatively specific for obligate anaerobes. It has also been tried with encouraging results.

Collagen membranes for local delivery: Different types of collagen based membranes have been under investigation for local drug delivery system.

AVAILABLE PREPARATIONS FOR LOCAL DRUG DELIVERY

The following are some common preparation available:

- Tetracycline fibers.
- Doxycycline polymer.
- Chlorhexidine chips, and
- Metronidazole and minocycline gels.

The supremacy of local drug delivery system is still inconclusive and controversies such as induction of bacterial resistant strains, the efficacy of systemic versus local drug delivery and whether local drug delivery should function as an alternative or as an adjunct to conventional treatment need more investigations.

REFERENCES:

1. Controlled drug release in Periodontics. A review of new therapies. *British Dental Journal* 1991;170:405-07.
2. Stabholz, W. Aubrey Soskolne, Michael Friedman, Micheal N. Sela. Use of sustained release delivery of chlorhexidine for the maintenance of periodontal pockets. A 2 year clinical trial. *J Perio* 1991;62:429-33.
3. William J. Killoy - Assessing the effectiveness of locally delivered chlorhexidine in the treatment of Periodontitis. *JADA*1999;130: 567-70.
4. Stabholz A, Sela M.N. Friedman M, Golomb G and Soskolne A - Clinical and microbiological effects of sustained release chlorhexidine in periodontal pockets. *J Clin Periodontol* 1986;13: 783-88.
5. Osterwaal PJM, Mikx FHM - Comparison of the antimicrobial effect of chlorhexidine gel, amine fluoride gel and stannous fluoride gel in debrided periodontal pockets – *J Clin Periodontol* 1991;18:245-51.
6. Lindhe, J. et al.: Local Tetracycline Delivery Using Hollow Fiber Devices in Periodontal Therapy. *J Clin Periodontol* 1979; 6:141.
7. Greenstein G, Polson A. The role of local drug delivery in the management of periodontal diseases: a comprehensive review. *J Periodontol.* 1998;69:507-20.
8. Stanford T W Jr. Local drug delivery in the treatment of periodontitis. *Tex Dent J.* 2001;118:978-83.
9. Lindhe J, Heijl L, Goodson JM, Socransky SS: Local tetracycline delivery using hollow fiber devices in periodontal therapy. *J Clin Periodontol* 1979; 6: 141-9.
10. Aziz-Gandour IA, Newman HN: The effects of a simplified oral hygiene regime plus supragingival irrigation with chlorhexidine or metronidazole on chronic inflammatory periodontal disease. *J Clin Periodontol* 1986: 13: 228-36.
11. Jolkovsky DL, Waki MY, Newman MG, et al: Clinical and microbiological effects of subgingival and gingival marginal irrigation with chlorhexidine gluconate. *J Periodontol* 1990; 61: 663-9.
12. Loe H, Silness J: Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontol Scand* 1963; 21: 533-51.
13. Killoy WJ: Assessing the effectiveness of locally delivered chlorhexidine in the treatment of periodontitis. *J Am Dent Assoc* 1999; 130: 567-70.