REVIEW

Systemic antibiotics in Periodontics: Right use and misuse

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ABSTRACT:

Conflicting reports exists in relation with the usage of antibiotics in Periodontics. With the advanced knowledge and changing concepts of therapeutic approach to plaque biofilm, the usage of antibiotic even as an adjunct to non surgical periodontal therapy seems to be unjustified. A review is attempted here to venture into the present trends of antibiotic usage in periodontal practice with special emphasis on most prescribed antibiotics. The various aspects of action of antibiotics against plaque biofilm and its usage following periodontal surgeries are dealt separately.

Key words: Antibiotics, periodontal treatment, current trends in antibiotic therapy, biofilm

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INTRODUCTION

With the recognition of microbial origin of periodontal disease, it led to an increased interest in the use of antibiotics in periodontal therapy. But there exists conflicting reports on the administration of antibiotics in the management of periodontal disease. This is because of their intensive abuse, both over-prescription and also administration for inappropriate reasons which has led to the worldwide problem of bacterial resistance. This review aims to provide with an update on the current literature evidence regarding the use of systemic antibiotics in periodontal therapy. The study was initiated with the thought provoking news (CDC's antibiotic resistant threats in the United States, 2013) that, infections from multi drug resistant organisms are responsible for more than 14000 deaths per year and affecting the health of at least 2 million people every year. The present article will be limited to the usage of antibiotics related to periodontal non surgical and surgical therapy.

Are antibiotics effective against the biofilm?

It is not surprising that a wide range of systemic antibiotics have been used as part of periodontal treatment aimed at targeting potential pathogenic bacterial species within the periodontal bio film, but their exact role in destroying the pathogens have been questioned. This is essentially because of the complex biofilm structure providing added

benefits to the microorganisms residing in it, in resisting the action of antibiotics compared to the same species in a planktonic state. [1] The mechanical debridement has always been considered as the initial line of treatment in the management of periodontitis by disrupting the biofilm.

Bacteria inside the oral cavity are exposed to constant threats from various environmental factors, chemicals, antibiotics etc. They also have to compete with the beneficial organisms found inside the oral cavity. But the biofilm can act as a protective barrier to some extent against these microorganisms. There are microbes outside the biofilm also. It was found that after antibiotic therapy, the microbes outside the biofilm offer lesser resistance than those residing inside the biofilm. How does these microorganisms acquire antibiotic resistance is not completely understood. Because the mechanism of resistance differ from species to species, the understanding of the same is very difficult. It appears that the microbes inside the biofilm grow slowly compared to micoorganisms in planktonic state and this renders them less susceptible to antibiotics. Within the biofilm, there exists a difference in environmental condition between the deeper cells and cells in the periphery. As already stated, lowering the growth renders the microbes less susceptible to antibiotics, the survival rate of the deeper cells increases as there is a decline in the rate of growth when exposed to antibiotics, when compared to cells in the periphery.

The biofilm have an exo-polymer matrix which can't prevent but retard the diffusion of antibiotics by acting as an ion exchanging resin which will remove chemically reactive agents. The slow growing cells in the deeper part of biofilm show increased synthesis of exo-polymer thereby increasing the bacterial resistance. Positively charged hydrophilic antibiotics are destroyed by various enzymes that are concentrated in the extracellular matrix like â-lactamase, formaldehyde lyase etc. Since this mechanism affects hydrophilic antibiotics, hydrophobic antibiotics like macrolides are unaffected. The genetic expression also differs among the species of biofilm community which enables them to retain the antibiotic resistance even when they are removed from the biofilm. The antibiotics that act by blocking the cell wall synthesis are removed from the cells by multi drug resistance pumps which extrude the chemical from the cells. Considering the fact that the biofilm contains a large variety of pathogenic organisms which are protected from body's defense mechanisms and antibiotics, sometimes it may be necessary to employ combination of therapies to treat periodontal infections. The effectiveness of antibiotics against microorganisms were studied on microorganisms in planktonic state rather than biofilms, the application of this knowledge in the treatment of periodontitis is questionable [2]

Can antibiotics be effective as mono therapy?

Two studies however showed similar clinical results for scaling and root planing as for antibiotics (amoxicillin plus metronidazole) prescribed as a monotherapy. [3,4] Haffajee et al. in a systematic review addressed the question, whether antibiotics prescribed as a monotherapy, with no mechanical debridement are efficacious in the treatment of periodontitis stated that the effect of the antibiotic alone was minimal and short term. Studies evaluated the role of metronidazole alone or metronidazole combined with amoxicillin as monotherapy, showed inferior results in terms of probing depth reduction, clinical attachment level gain and reduction in bleeding compared with scaling and root planing. Therefore mechanical debridement ensuring adequate disruption of the biofilm continues to be regarded as the first appropriate treatment approach when prescribing systemic antibiotics.

Periodontitis being a mixed infection, single drug regimen is often insufficient. Various drugs have been used for the treatment of periodontitis. Several studies support the use of combination of metronidazole and amoxicillin which effectively reduce the numbers of Aggregatibacter actinomycetamcomitans and the members of the red complex. Being a tissue invading microbe, Aggregatibacter actinomycetamcomitans is not affected by subgingivally applied tetracyclines as they cannot penetrate sub gingival connective tissue. Apart from metronidazole and amoxicillin combination, another combination which is effective in periodontitis is metronidazole and ciprofloxacin combination.[5]

Are systemic antibiotics needed after nonsurgical periodontal therapy?

It has been well documented that the majority of patients with chronic periodontitis can be successfully treated with mechanical debridement, adequate oral hygiene and regular supportive maintenance care. Many microorganisms are often seen to be located deep in the gingival tissue; therefore limiting the treatment to mechanical debridement will result in the continued progression of the disease. The pathogens causing periodontitis are not exclusive to periodontal pockets, they are found in colonies on even other part of oral mucosa like cheek and dorsum of tongue .Therefore, even after the removal of these microorganisms from the periodontal pocket, there are chances that they can recolonize and cause reinfection by translocation from these sites to gingival sulcus. There lies the importance of administration of systemic antibiotics as an adjunct to mechanical debridement. It removes pathogens including Aggregatibacter atinomycetamcomitans that are still remaining after non- surgical therapy from the periodontal pockets and also from other sites of oral cavity.[5]

A systematic review by Hererra et al. concluded that systemic antibiotics used in conjunction with scaling and root planing

can offer an additional benefit over scaling and root planing alone in terms of probing depth reduction and clinical attachment level gain in deep pockets.[4] Haffajee et al, in 2002 reported similar findings and stated that systemically administered antibiotics can improve clinically determined periodontal attachment level beyond that achieved by nonsurgical therapy alone.[4]

Do antibiotics offer any advantage when prescribed after periodontal surgery?

Haffajee et al. reported an additional clinical benefit in attachment level gain when systemic antibiotics were prescribed as an adjunct to surgical mechanical debridement in deep pockets.[1] However, in a literature review by Hererra et al. concluded that there was insufficient data as to whether adjunctive antibiotics were beneficial when combined with periodontal surgery.[4]

How to make the right choice of antibiotic?

The literature reports a wide range of antibiotics used in conjunction with non-surgical and surgical mechanical debridement for the treatment of periodontitis. The most commonly employed antibiotics include tetracyclines, penicillins (amoxicillin), metronidazole, macrolides (spiramycin, erythromycin, azithromycin), clindamycin and ciprofloxacin.[6]

Periodontitis, being a mixed microbial infection makes the choice of antibiotic regimen difficult. Different antibiotics target specific parts of the biofilm. Metronidazole mainly targets the gram-negative strict anaerobes whereas amoxicillin has a broader spectrum of action lowering counts of gram negative anaerobes as well as decreasing the counts and proportions of Actinomyces species during and after antibiotic therapy.[6] Conflicting reports exists on the beneficial effects of azithromycin when used as adjunct to mechanical debridement in the treatment of mild/moderate chronic periodontitis, aggressive periodontitis or in smokers. However, it has been observed that metronidazole+amoxicillin combination produced more pronounced beneficial change in the subgingival microbial profile than azithromycin.[7] Moreover this antibiotic combination was able to increase three beneficial species (Actinomyces gerencseriae, A. naeslundii and Streptococcus sanguinis).

A major concern in prescribing antibiotics is that micro-organisms can be intrinsically resistant to antimicrobials or can develop acquired resistance by emergence of resistant strains of bacteria that would otherwise be considered to be sensitive to the antimicrobial. It is evident that the literature does not provide a clear indication of the superiority of one antibiotic regimen over another and the choice of antibiotic should be made on an individual basis.

What is the ideal duration, dosage and timing of the recommended antibiotic?

Feres et al. suggested that the adjunctive use of the metronidazole+ amoxicillin combination for 14 days, irrespective of the metronidazole dosage, offers short-term clinical and microbiological benefits over scaling and root planing alone in the treatment of advanced periodontitis.[7]

The dosage and duration of the antibiotic prescribed also varies widely among studies and there is no consensus on the ideal regimen. It is important to prescribe an antibiotic in sufficient dose for adequate duration as they have a direct impact on the desirable and undesirable effects of these drugs.

Another important clinical question is when to start the antibiotics in relation to the mechanical phase of treatment. Indirect evidence suggests that antibiotic intake should start on the day of debridement completion and debridement should be completed within a short period of time. However, Feres et al. suggested that no important differences were observed in the clinical and microbiological parameters when adjunctive metronidazole+amoxicillin therapy started together or immediately after scaling and root planning.[7]

CONCLUSION

This review suggests that systemic antibiotics can help in the management of periodontitis, though the optimum method of employment has not been clearly defined. However, there is no single universal protocol that can be followed while prescribing these drugs and are often seen to be one of major misused group of drugs. Thus it has become clear that, the administration of systemic antibiotics for the management of periodontal infections should be strictly based on scientific data and not on individual biases. Though they can be used in severe or recurrent periodontitis, the right antibiotic should be selected based on microbiological analysis. Thus these valuable and life-saving drugs can only retain its position in both medicine and dentistry if used with care and prescribed appropriately. Reminding the famous quote of Sir Alexander Fleming in 1945 after discovering penicillin “The thoughtless person playing with penicillin treatment is morally responsible for the death of the man who succumbs to infection with the penicillin-resistant organism”

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