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Use of antibiotics in treatment of periodontal disease, is it the best choice?

Introduction

Prior to antibiotics era, high mortality from bacterial infection was common worldwide ¹. Following discovery of antibiotics at early 20th century, treatment of bacterial infections, previously considered fatal conditions, dramatically improved ². Optimism about antibiotics in the scientific community, during 1950s and 1960s, raised to a degree that some researchers predicted complete eradication of pathogenic bacteria towards the end of 20th century ³. However, extensive use of antibiotics not only as medical prescriptions but also in our food resulted in bacteria managed to evade the effect of antibiotics by developing resistance against these drugs ². Furthermore, drug-resistant mechanism in bacteria evolved to a degree that certain species nowadays cannot be treated even with the most potent antibiotics ⁴. According to World Health Organization, the cost of hospitalization due to antimicrobial resistance in USA is about \$20 billion each year ⁵. In addition, anti-bacterial drugs suffered from other drawbacks such as undesirable side-effects and contraindication in certain cases including renal failure, pregnancy and patients suffering from impaired immune defense which further limits their use ⁶.

Periodontal disease, which encompasses group of inflammatory conditions affecting soft and hard tissue apparatus of the teeth ⁷, normally treated by mechanical debridement which targets removal of dental biofilm that consider as a primary etiologic agent responsible for initiation and progression of inflammation ⁶. Minimizing bacterial load in periodontal pockets helps to restore health status of periodontal tissues. However, in certain cases, such as aggressive periodontitis, the indication of antibiotic as adjunctive treatment is unavoidable to eliminate pathogenic bacteria deeply invading connective tissue that potentially re-colonize root surface resulting in recurrence of disease ⁸.

Pathogenesis of periodontal disease

The response of immune system to the bacteria in periodontal pocket is the key-factor in the initiation and progression of periodontal disease⁹. The severity of the disease can be aggravated by systemic conditions and local factors⁹. Dental biofilm develops initially from scanty layer of Gram-positive aerobic bacteria that gradually matures to thicker layer supragingivally which is associated with change in the composition of the flora. Later, this biofilm advances subgingivally where the environment favours the growth of Gram-negative anaerobic rods, designated by Socransky and Haffajee as orange and red groups, which are well-known for their high pathogenicity¹⁰. The complexity of dental biofilm at advanced stages of periodontal diseases add further restriction for the action of antibiotics as these drugs will only affect the most superficial layer of the biofilm that form a well-organized solid mass that provides a shelter for bacteria at deeper layer¹¹. For this reason, dental biofilm should be disrupted by mechanical methods prior to administration of antibiotics¹².

Recent studies suggest that orange and red complex periodontal pathogens potentially affecting the epithelial-phenotype of pocket lining, mostly associated with chronic inflammation, thereby compromising the epithelial barrier function¹³. This process consists of downregulation of epithelial proteins involved in cell-cell and cell-basement membrane attachment that maintain the coherence of epithelial layer¹⁴. Subsequently, loss of epithelial cells attachment results in ulceration of pocket epithelium which is manifested clinically by bleeding upon probing that facilitates the invasion of bacteria to deeper tissues which extends the destructive-inflammatory process to connective tissue and bone¹⁵.

Is there any alternative to antibiotics?

Recently, many attempts emerged to substitute antibiotics with other treatment modalities. One of these methods is photodynamic therapy (PDT) which is minimally-invasive treatment modality that can eliminate bacteria, viruses, and fungi¹⁶. The principle of PDT depends on activation of photosensitizing agent by low power visible light of certain wavelength to produce cytotoxic reactive oxygen species that target pathogenic bacteria¹⁷. Mechanical periodontal treatment associated with single session of PDT resulted in significant reduction in bleeding compared with sites treated with scaling and root planing alone¹⁸. In addition, meta-analysis of several studies showed beneficial effect of PDT in treatment of aggressive periodontitis¹⁹.

Popularity of lasers in periodontal treatment start to increase nowadays, use of diode laser showed encouraging results in decreasing number of pathogenic bacteria in gingival tissue that could represent a potential choice to replace prescription of antibiotics ²⁰. Another treatment approach based on the use of vitamins and antioxidants, diet including sufficient amount of these factors may prevent onset of periodontal disease ²¹. Antioxidants play crucial role in maintaining integrity of epithelium, cell signaling and host defense mechanism ²². Despite of limited data about use of antioxidants as adjunctive periodontal therapy; however, available studies suggest promising results to use these agents for the prevention and treatment of periodontal diseases ^{23, 24}.

Till now, the use of antibiotics, despite of many disadvantages, remains the most popular and effective adjunctive to mechanical periodontal treatment. Better understanding of the nature of periodontal diseases will provide the opportunity for the usage of other treatment modalities for periodontal pathologies in the future.

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