Non-Surgical Chemotherapeutic Treatment Strategies for the Management of Periodontal Diseases

Joe W. Krayer, DDS, MS[a], Renata S. Leite, DMD, MS[a,c], Keith L. Kirkwood, DDS, PhD[b,c,*]

KEYWORDS

- Periodontics • Antibiotics • Antiseptics
- Host-modulatory agent

Periodontal disease is a chronic infection of the periodontium affecting soft and mineralized tissues surrounding the teeth. Periodontal disease progression is associated with subgingival bacterial colonization and biofilm formation that provokes chronic inflammation of soft tissues, degradation of collagen fibers supporting the tooth to the gingiva and alveolar bone, and resorption of the alveolar bone itself. The fundamental role of microorganisms as the cause of periodontal disease was systematically demonstrated some 40 years ago, and research efforts have long focused on identifying the pathogenic microorganisms and their virulence factors.[1] The search for these putative microorganisms was driven, in part, by knowledge indicating that colonization of the oral cavity by commensal bacteria and the presence of dental biofilm is normally associated with health, similar to the colonization of the colon. In contrast, the microflora associated with periodontal disease was found to differ, with the biofilm dominated by anaerobic bacteria and spirochetes. To treat periodontal diseases as an infectious disease, numerous therapeutic strategies aimed at eradication of

This work was supported by P20RR017696 and R01DE018290 from the National Institutes of Health.

[a] Department of Stomatology, College of Dental Medicine, Medical University of South Carolina, 30 Bee Steet – room 115, Charleston, SC 29425, USA
[b] Department of Craniofacial Biology, College of Dental Medicine, Medical University of South Carolina, 173 Ashley Avenue, BSB 449, Charleston, SC 29425, USA
[c] Center for Oral Health Research, Medical University of South Carolina, 30 Bee Steet – room 115, Charleston, SC 29425, USA
* Corresponding author. Department of Craniofacial Biology, College of Dental Medicine, Medical University of South Carolina, 173 Ashley Avenue, BSB 449, Charleston, SC 29425.
E-mail address: klkirk@musc.edu (K.L. Kirkwood).

Dent Clin N Am 54 (2010) 13–33
doi:10.1016/j.cden.2009.08.010 **dental.theclinics.com**
0011-8532/09/$ – see front matter

periodontal pathogens have been studied for many years, including local and systemic delivery of antimicrobial and antibiotic agents. This review provides an update on the chemotherapeutic agents used adjunctively to treat and manage periodontal diseases.

In the current paradigm of periodontal disease, specific periodontal pathogens are necessary for disease initiation; however, the extent and severity of tissue destruction are largely dependent on the nature of the host-microbial interactions. These interactions are dynamic, because both the microbial composition of the dental biofilm and the competency of host immune responses can vary, in the same individual, with time. This concept was developed in parallel to the advances on the understanding of the immune response, and research on periodontal disease has focused on the mechanisms of host-microbial interactions to understand the disease process and for the development of novel therapeutic strategies. For the past 2 decades, the host response to the bacterial challenge originating from the dental biofilm has been considered to play a major role on initiation of the disease and on the tissue destruction associated with its progress.[2] The importance of host-microbial interactions is reinforced by epidemiologic data indicating different susceptibilities to periodontal disease among individuals, despite the long-term presence of oral biofilm.[3–5] Other studies showing increased susceptibility and greater severity of periodontal disease in individuals with impaired immune response caused by systemic conditions also indicate the significance of the host response to the bacterial challenge.[6,7] Past and future directions of host-modulatory agents are addressed here to provide the dental practitioner with a broader prospective on the use of chemotherapeutic agents used to manage periodontal diseases.

SYSTEMIC ANTIBIOTICS

Traditional periodontal therapies have focused on the mechanical debridement of the root surfaces to maintain a healthy sulcus or produce an environment suitable for new attachment. The inability of mechanical treatment to always produce a desirable root surface coupled with the nature and complexity of the subgingival biofilm has fueled the search for adjunctive treatment regimens that increase the likelihood of successfully management of periodontal diseases.

Although more than 700 bacterial species may be present in the gingival sulcus, it is clear that only a subset of bacterial species are consistently found to be associated with diseased sites. These findings make the prospect of targeted antibiotic therapy an attractive goal. A thorough review of the microbiology of periodontal diseases is beyond the scope of this article; the reader is referred to the many reviews on this topic.[8]

Systemic antibiotic therapy has the obvious advantage of generally conventional and acceptable delivery, especially if oral administration is used. Shortcomings to oral administration include issues of patient adherence to dosing recommendations and the variable absorption of the antibiotic from the gastrointestinal tract. Moreover, it is difficult to be certain that the antibiotic chosen will be effective against the periodontal pathogens present in the sulcus unless culture and sensitivity tests have been completed. Culture and sensitivity tests are particularly useful for those cases that do not respond well to conventional mechanical therapy and/or commonly chosen antibiotic regimens. Another factor that is often overlooked is that systemic antibiotics do not penetrate the subgingival biofilm to kill bacteria. **Table 1** provides an overview of some orally active systemic antibiotics commonly used in clinical periodontics.