Clinical Abstracts

The Clinical Abstracts section of JCDA features abstracts and summaries from peer-reviewed dental publications. It attempts to make readers aware of recent literature that may be of interest to oral health care workers. It is not intended to provide a systematic review of the topic. This month's selection provides an update on recent research on the role of immune mechanisms in periodontitis. The articles were chosen by Dr. Andy Y.-T. Teng, an associate professor in the division of periodontics at the Eastman Dental Center, Center for Oral Biology, and the department of microbiology and immunology at the School of Medicine and Dentistry, University of Rochester, Rochester, N.Y.

Commentary

Is Immunity the Key to Our Periodontal Well-Being?

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It seems perfectly logical to think that we are protected by our own immune system in daily assaults from invading microorganisms. Historically, it has been a tremendous challenge to understand the fundamental rules regarding the operation of our immune system at the cellular and subcellular levels. Recent advances in periodontal research suggest that periodontal immunity is a double-edged sword, with one side fighting invading pathogens and the other triggering tissue damage in the host. Thus, the concept that the underlying immune mechanisms associated with periodontitis are beneficial to the host requires reconsideration.

Many recent advances in the study of immune responses are built upon the development of biotechnology tools in cellular and molecular biology. For instance, use of genetic knockout and immunodeficient mouse strains has shown that the acquired immune response, in particular $CD4^+$ T cells, and the host's genetic make-up, play a key role in controlling ongoing periodontal immune/inflammatory responses and subsequent tissue destruction.[1,2] When the condition is right, a specific T-cell subset called Th1 cells (producing specific pro-inflammatory cytokines IFN-γ and TNF-α/β) can further skew periodontal immunity toward more tissue destruction by retaining and tuning microbe-specific T-cell response in gingival tissue.[3] In contrast, it is well known that microbe-specific B cells and the antibodies (Abs) they release can neutralize invading microorganisms and their toxins. However, Abs-mediated protection is suboptimal because it may not be capable of sterile eradication of the periodontal pathogens. As a result, Ab response usually precedes but does not prevent the onset or progression of periodontal tissue destruction and may eventually become crippled or degenerate, thus failing to halt the invading pathogens that trigger further immune/inflammatory responses associated with tissue destruction.[4] Moreover, the resulting Ab response may be coupled with some other tissue receptors, which together become associated with the risk of developing certain systemic disorders such as coronary heart disease.[5]

Recent evidence has shown that our innate immune system not only nonspecifically fights pathogens, but also bridges and turns on the adaptive immune system during infection. Special innate immune cells, called dendritic cells (DC), can influence the development of adaptive arms or effectors (i.e., $CD4^+$ T cells) depending on the cytokines they express. This suggests that the early interactions between the acquired immunity and different innate immune cells may have a drastic impact on the development of periodontal disease. We know that DC are the natural adjuvant for immune responses and that numerous DC are involved in various parts of infected periodontal tissues.[6] Changes in the local environment, such as cytokine development, may in turn reduce or shut down the immunopathology and tissue damage during microbial infection. Therefore, the role of innate immunity in the progression of periodontal disease clearly deserves further study. Despite the fact that some immune effectors trigger destructive immunity, we are hopeful that new molecular targets and reagents being developed, such as vaccines and osteoprotegerin ligand, will eventually have therapeutic value in preventing or treating periodontal disease. ◆

References

1. Baker PJ, Dixon M, Evans RT, and others. $CD4^+$ T cells and the proinflammatory cytokines gamma interferon and interleukin-6 contribute to alveolar bone loss in mice. *Infect Immun* 1999; 67(6):2804–9.

2. Teng Y-TA, Nguyen H, Gao X, and others. Functional human T-cell immunity and osteoprotegerin ligand control alveolar bone destruction in periodontal infection. *J Clin Invest* 2000; 106(6):R59–R67.

3. Kawai T, Eisen-Lev R, Seki M, and others. Requirement of B7 costimulation for Th1-mediated inflammatory bone resorption in experimental periodontal disease. *J Immunol* 2000; 164(4):2102–9.

4. Ebersole JL, Cappelli D, Holt SC. Periodontal diseases: to protect or not to protect is the question? *Acta Odontol Scand* 2001; 59(3):161–6.

5. Pussinen PJ, Jousilahti P, Alfthan G, and others. Antibodies to periodontal pathogens are associated with coronary heart disease. *Arterioscler Thromb Vasc Biol* 2003; 23(7):1250–4.

6. Jotwani R, Cutler CW. Multiple dendritic cell (DC) subpopulations in human gingiva and association of mature DCs with $CD4^+$ T-cells in situ. *J Dent Res* 2003; 82(9):736–41.