

**Vaccination against periodontitis—myth or reality?**

By Professor Lior Shapira, Hadassah Medical Center, Hebrew University, Israel

- Prevention of disease, in this case chronic periodontitis, is always better than cure. In many cases, vaccination has turned out to be an easy and inexpensive way to prevent the emergence of disease in individuals and the community.

- Developing a vaccine for periodontitis has been a hot subject for periodontal researchers. After 30 years of searching for a periodontal vaccine, where do we stand today?

  Let me explain briefly how vaccination works. We expose the body to a weak or dead pathogen, or even to peptides derived from the pathogen, which activates B and T cells that are exposed to the pathogen. This can help to kill the pathogen, T helper cells produce specific clones, also called cytokines, and there are anti-inflammatory cascades aimed at killing the pathogen. It is basically a network of cells and molecules that protects the body from invaders.

- The old dogma was that the role of vaccination is to induce a humoral immune response, meaning protection by the production of memory B cells and antibodies against the pathogen. This is however too simple. Recent evidence suggests that immunization can modulate the host response and shift the response, a key element in successful protection. The evidence suggests that immunization is to induce a human microbiome.

- Modern molecular analyses and during disease. Many molecular microbial analyses and during disease. Many molecular microbial analyses have revealed using traditional (Sanger) sequencing methods and the bacteria present in the oral microbiome, the present study in which several orders of magnitude (i.e. millions) bacterial 16S DNA codes were analysed, it became clear that so far we had only explored the tip of the iceberg.

- In the past two years, several laboratories have used NGS techniques to identify the pathogenic microbiomes that cause periodontitis, peri-implantitis and other oral infections and have compared these with the oral microbiomes of healthy subjects to understand the ecological shifts that accompany the transition from a healthy state to disease. During the presentation at Europerio 7, the advantages and challenges of using NGS techniques (in comparison with more traditional techniques) in studying oral microbial infections, as well as recently obtained new insights into the complexity of these polymicrobial infections, will be presented.

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**New insights into the complexity of microbial infections**

By Wim Crielaard, Academisch Centrum Tandheelkundige Amsterdam, the Netherlands

- Modern molecular analyses and in particular next-generation sequencing (NGS) techniques have revolutionised oral microbiology. Owing to the fact that bacteria, relatively cheaply, analyse millions of (bacterial) DNA sequences within a few days, we now have the capability to, for the first time in history, to identify and isolate virulence factors from the pathogen as candidate antigens. The candidate vaccine should be tested first in preclinical models followed by safety and efficacy tests in humans. Two years ago, scientists at the University of Melbourne and a biopharmaceutical company announced that they had developed a vaccine to treat periodontitis (British Dental Journal, 2010, Vol. 208, Issue 5). They claimed to have identified candidate vaccine antigens for periodontitis and that the new vaccine targets Porphyromonas gingivalis.

- What is the process of developing a vaccine? First, we have to identify the key pathogens, and then identify and isolate virulence factors from the pathogen as candidate antigens. The candidate vaccine should be tested first in preclinical models followed by safety and efficacy tests in humans. Two years ago, scientists at the University of Melbourne and a biopharmaceutical company announced that they had developed a vaccine to treat periodontitis (British Dental Journal, 2010, Vol. 208, Issue 5). They claimed to have identified candidate vaccine antigens for periodontitis and that the new vaccine targets Porphyromonas gingivalis. Is this new? Or is this old news? Are we almost within striking distance of a vaccine?

- In the last 40 years, the key pathogens for periodontitis were identified and the short list includes no more than five to seven pathogens. Porphyromonas gingivalis plays an important part. Research by Hajishengallis et al. on animal models suggested that this low-abundance pathogen is needed only to initiate the process and open the door for other bacteria to induce disease (Cell Host & Microbe, 2011, Vol. 10, Issue 5). This is a very interesting and attractive hypothesis. However, preventing P. gingivalis from inducing this environmental change will influence the clinical outcome positively.

- Eighteen years ago, a research group headed by Roy Page from Seattle was the leader in periodontal vaccination research (Infection and Immunity, 1994, Vol. 62, Issue 3). They vaccinated primates with whole-cell P. gingivalis, and demonstrated partial protection against experimental periodontitis. Interestingly, they found that the levels of specific antibodies against P. gingivalis were high in all animals that were exposed to the bacteria, immunized and non-immunized, and antibody production was not able to explain the protection achieved. They also tested levels of specific molecules that are secreted by inflammatory cells in the gingival crevicular fluid and found that vaccination was successful in modifying the host response to the infection. They concluded that no more than five to seven key pathogens, and then identify and isolate virulence factors from the pathogen as candidate antigens. The candidate vaccine should be tested first in preclinical models followed by safety and efficacy tests in humans. Two years ago, scientists at the University of Melbourne and a biopharmaceutical company announced that they had developed a vaccine to treat periodontitis (British Dental Journal, 2010, Vol. 208, Issue 5). They claimed to have identified candidate vaccine antigens for periodontitis and that the new vaccine targets Porphyromonas gingivalis. Is this new? Or is this old news? Are we almost within striking distance of a vaccine?

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