

Photodynamic Therapy in the Treatment of Periodontal Disease

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The aim of the conventional periodontal therapy is to eliminate periodontal pathogens, thus avoiding progression of the inflammation with continuous attachment loss. However, no consensus has been reached on whether conventional periodontal therapy can eliminate periodontal pathogens [1-3]. Thus, laser irradiation and photodynamic therapy (PDT) may provide a potential benefit in the treatment of periodontal diseases by reducing and eradicating periodontopathogenic species in inaccessible sites [4-8].

PDT is a new treatment modality that has been developing rapidly within various medical specialties since the 1960s. It has been defined as "the light induced inactivation of cells, microorganisms, or molecules". PDT is a technique combining diode laser energy with a photosensitizer to produce free radicals to destroy targeted cells. PDT is based on the principle that a dye, as a photosensitizer or photoactivatable agent (i.e, Toluidine Blue-TBO, Methylene Blue, Malachite Green and Indocyanine Green-ICG), binds to the target cells and is activated by light of an appropriate wavelength. By changing the energy status of the molecules in the photosensitizer, free radicals of singlet oxygen are formed, which are toxic to the cell by destroying the membrane [7-10]. Organisms absorb a dye (photosensitizer) and by irradiation with light in the visible range of the spectrum, the dye will be excited to its triplet state, whose energy is transferred to molecular oxygen. The reaction product formed is highly reactive singlet oxygen, which induces cell damage or cell death. Despite of its short half-life time, singlet oxygen exerts strong cytotoxic effects, destroying cellular constituents such as organelles, proteins, nucleic acids, cholesterol, etc. Microorganisms are killed by singlet oxygen, which include viruses, bacteria, protozoa, and fungi [8,10].

While PDT has been evaluated by many clinical studies, the recent studies have reported controversial results about the benefits of the PDT for periodontal treatment. Some current studies showed that a number of the periodontal pathogens are susceptible to low level laser in the presence of photosensitizer, suggesting that PDT is advantageous for conventional periodontal therapy [11-17], whereas others reported that adjunctive use of PDT showed no significant benefits [18-20].

The some systematic reviews and meta-analyses conclude that the inclusion of the PDT as an adjunct to conventional periodontal treatment seems to be therapeutically useful [7-10]. Therefore, PDT when used as an adjunct to conventional periodontal therapy kills more bacteria than when conventional periodontal therapy is used alone. Further studies are required to explore its extensive novel clinical applications.

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