Photodynamic Therapy: Role in Periodontics

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Abstract:

Introduction: Photodynamic therapy (PDT), also known as photoradiation therapy, phototherapy, or photochemo-therapy, involves the use of a photoactive dye (photosensitizer) that is activated by exposure to light of a specific wavelength in the presence of oxygen. The transfer of energy from the activated photosensitizer to available oxygen results in the formation of toxic oxygen species, such as singlet oxygen and free radicals. These very reactive chemical species can damage proteins, lipids, nucleic acids, and other cellular components. Applications of PDT in dentistry are growing rapidly: the treatment of oral cancer, bacterial and fungal infection therapies. It is also used in the field of periodontics for elimination of various microorganisms responsible for causing periodontal disease.

Objective: The objective of the study was to determine the growing role of photodynamic therapy in dentistry as general with emphasis on the role in the field of periodontics.

Material and Methods: Materials used for photodynamic therapy are the different photosensitizers such as phenothiazine dyes, chlorines, porphyrins, xanthenes and the different lasers used to activate the sensitizers are argon lasers, diode lasers etc. Method of using the therapy requires two components – a light source and a photosensitizer (photoreactive drug) capable of binding to the targeted cell. It involves the use of low power lasers with appropriate wavelength to kill cells or microorganisms previously treated with a photosensitizer drug. The excited photosensitizer reacts with the substrate, mostly oxygen or water, to produce highly reactive oxygen species, as free radicals and/ or singlet oxygen. These compounds cause injury and death of microorganisms.

Results: Photodynamic therapy is used for the treatment of oral cancer, bacterial and fungal infection therapies. Phoyodynamic diagnosis (PDD) of the malignant transformation of oral lesions is also now been applied as use of PDT. In the field of periodontics, it is used as a
athermal alternative approach to mechanical means and antibiotics in eliminating periopathogenic bacteria for the treatment of periodontitis. It eliminates various types of bacteria such as Porphyromonas gingivalis, Fusobacterium nucleatum, Aggregatibacter actinomycetemcomitans, Capnocytophaga gingivalis and Prevotella intermedia. It is also used in the cases of Aggressive Periodontitis, for periodontal maintenance, during periodontal surgery and in the cases of peri-implantitis. It can also provide improved dentin hypersensitivity, reduced inflammation of the tissues surrounding the teeth, and allows tissues to repair faster.

**Discussion and Conclusion:** While many articles on PDT begin by stating that PDT is new or experimental treatment for cancer and many other diseases, the fact is that it has rapidly matured over the past 15 years to the point where PDT can be considered acceptable standard treatment for several conditions and has been approved for use by the U.S Food and Drug administration (FDA) and numerous other health agencies throughout the world. These conditions include various cancers (for example, esophageal and lung cancers) as well as various non-cancerous ones such as age related macular degeneration (AMD) and actinic keratosis. PDT application has an adjunctive benefit besides mechanical treatment at sites with difficult access (e.g. furcations, deep invaginations, concavities). Necessity for flap operations may be reduced, patient comfort may increase and treatment time decrease. PDT removes the biofilm in residual deep pockets during maintenance; no more root substance is removed by mechanical retreatment. Thus the patient may experience less dentinal hypersensitivity. If the resistance against antibiotics may become worse, PDT may be a valuable alternative for most indications in which hitherto antibiotic drugs were administered. The concept of PDT is plausible and could foster new therapy concepts for periodontal disease. The available knowledge should enable and encourage steps forward into more clinical oriented research and development.

**Keywords:** Photodynamic Therapy, Photosensitizer, Lasers, Bacteria, Peri-implantitis, Photosensitivity.