Photodynamic inactivation of important periodontopathogens with Zn-phthalocyanines

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Introduction: P. gingivalis (red complex) and P. intermedia (orange complex) play an important role in the etiology of periodontal disease. Mechanical removal of plaque, good oral hygiene and antimicrobial agents are the most common treatments for periodontitis. Nevertheless, the limited access of topical agents to the plaque and the development of antibiotic-resistance create the necessity for alternative strategies to control plaque and to treat gingivitis and periodontal diseases. Photodynamic therapy (PDT) is a medical treatment that utilizes light to activate a photosensitizing agent (photosensitizer) in the presence of oxygen. The exposure of the photosensitizer to light results in the formation of oxygen species, causing localized photodamage and cell death.

Materials and methods:

Bacteria: planktonic cultures of reference strains P. gingivalis and P. intermedia. Photosensitizers: water soluable phthalocyanines O-ZnPc, S-ZnPc, n-ZnPcMeS and octa-ZnPcMeS with concentration 5μM.

Photodynamic inactivation: Bacteria were incubated with photosensitizer for 5 min and then exposed to light for 5, 12 and 20min. The same was performed with each microbial species with different photosensitizers. For each experiment controls were prepared: light control (LC) - without photosensitizer, but illuminated; dark control (DC) - with photosensitizer, but no light (for dark toxicity); bacteria control (BC) - only bacterial suspension (no photosensitizer, no light). Determination of microbial counts was used as effect assessment method.

Results and discussions: There was no statistically significant difference between the controls. The photodynamic effect was light dose dependent. The highest viability reduction /4log/ of P. gingivalis was obtained in presence of 5 μM and 20 min light exposure (363 μM). There was almost no effect /1log/ when octa-ZnPcMeS was used. Full inactivation of P. intermedia was obtained in presence of O-ZnPc, S-ZnPc, n-ZnPcMeS and 20 min light exposure.

Photodynamic effect seems to be dependent on the chemical structure of phthalocyanines, microbial species as well as on the light dose.

Conclusions: The oral cavity is colonized by complex, relatively specific, and highly interrelated microorganisms, including aerobic and anaerobic Gram-positive and Gram-negative bacteria, fungi, mycoplasma, protozoa and viruses. In the biofilm, bacteria exhibit increased resistance to antibiotics, environmental stresses, and the host immune defense mechanisms. The proposed tree of four photosensitizers have shown good in vitro effect against both P. gingivalis and P. intermedia but further studies on biofilms and in vivo are required to confirm their treatment potential of dentistry.

Keywords: photodynamic inactivation; P. gingivalis; P. intermedia; Zn-phthalocyanines

References


Preliminary studies for the application of Thymbra capitata essential oil as potential antimicrobial agent in Bacterial Vaginosis

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Abstract

Bacterial vaginosis (BV) is the most common gynecological clinical condition in women in reproductive age, and has been associated with an increased risk of development of preterm labor, spontaneous abortion, and several sexually transmitted diseases such as HIV [1]. BV is not only a condition that involves excessive growth of anaerobic microorganisms, but also involves the presence of an adherent biofilm [2]. Despite its high prevalence, the aetiology of BV remains unknown, but frequently Gardnerella vaginalis is the main microorganism associated with this disorder [3], that is often the main species in biofilms presented in BV [4]. These results led to the theory that the microorganisms that form biofilms may be relevant for the aetiology of BV [5]. Traditionally, the treatment of BV involves the antibiotics metronidazole, clindamycin or tinidazole [6]. However, the recurrence rate remains high and this can be related to the biofilm-forming ability of G. vaginalis [5]. In this context, recently it was reported that natural compounds, such as Thymbra capitata essential oil, can reduce the activity of biofilms [7]. To test if T. capitata could be used in the treatment of BV, we determined the biofilm-forming ability and the effect of essential oil in seven strains of G. vaginalis isolated from women with BV. Thus, the biofilm-forming ability was assessed under anaerobic conditions for 48 hours, allowing each strain to form biofilm. These assays revealed that in fact, G. vaginalis strains produced moderate to tenacious biofilm. We then determined the sensibility of the tested bacteria to the common antimicrobics used to treat BV. Not surprisingly, most of strains were resistant to metronidazole and tinidazole which are more commonly administered. However half of strains were sensitive to clindamycin. We then evaluated the antibacterial activity of essential oil upon G. vaginalis strains, determining minimum inhibitory concentration (MIC) and minimum lethal concentration (MLC). The T. capitata essential oil exhibited a potent anti-G. vaginalis effect, which was confirmed by the low values of MIC (0.16 μL.mL-1) and MLC (0.16 - 0.31 μL.mL-1). To conclude, these results showed that T. capitata essential oil presents a strong antibacterial activity upon antibiotic resistant and biofilm forming of G. vaginalis strains, reinforcing the potential interest of this essential oil as antimicrobial agent in the treatment of BV.

Keywords: Bacterial vaginosis; Gardnerella vaginalis; essential oils; novel antimicrobial agent

References


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