Photodynamic Therapy for Oral Candidosis: a new option?

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Abstract

Candida Albicans is a ubiquitous polymorphic fungus that is part of the normal microbiota of healthy individuals. This infection occurs in patients that have some risk factor such as the use of dentures, corticosteroid inhalers, cigarettes, broad-spectrum antibiotics, and immunosuppressive and chemotherapeutic agents. Patients with HIV, diabetes, and iatrogenic or autoimmune-induced dry mouth are also at substantial risk for Oral Candidosis [1].

Photodynamic Therapy (PDT) relies on the interaction between a photosensitizer, a light with the appropriate wavelength, and the presence of oxygen. Studies published in scientific literature on the use of PDT in oral candidiasis are mainly in vitro studies; very few are in vivo and clinical studies. We can say that the results in the literature show that PDT works, but we do not have a replicable protocol. Patient studies should have larger samples and with longer follow-up.

Introduction

Candida Albicans is a ubiquitous polymorphic fungus that is part of the normal microbiota of the gastrointestinal and reproductive tracts of healthy individuals. In order to colonize the oral mucosa C. albicans must adhere to the epithelial cell lining while avoiding being killed by host antimicrobial factors. This infection occurs in a diverse group of patients that have some risk factor such as the use of dentures, corticosteroid inhalers, cigarettes, broad-spectrum antibiotics, and immunosuppressive and chemotherapeutic agents. Patients with HIV, diabetes, and iatrogenic or autoimmune-induced dry mouth are also at substantial risk for Oral Candidosis [1].

Photodynamic Therapy (PDT) relies on the interaction between a photosensitizer, a light with the appropriate wavelength, and the presence of oxygen. The reaction between the 3 elements generates ROS in cells that take up the photosensitizer, causing cell death by necrosis or apoptosis, but spares the surrounding tissue [2]. PDT was used in literature for the treatment of oral disease, such as oral lichen planus [3], oral pre-cancerous lesions [4] and periodontal infections [5].

Studies published in scientific literature on the use of photodynamic therapy in oral candidiasis are mainly in vitro studies. In a recent work the authors aimed to determine the efficacy of a PDT method based on light curing units’ blue LEDs combined to a plaque-disclosing composition (5% erythrosine) against C. albicans in culture and in a murine model of oral candidosis [6]. The authors found that PDT completely inactivated C. albicans planktonic cells and biofilm [6]. Azizi et al. [7] found, in an in vitro study, that a combination of Indocyanine Green and laser light of 808nm was better than other light’s wavelength and Methylen Blue to kill oral Candidosis [7]. Pereira Costa et al. [8] showed in their work that C. albicans and C. dubliniensis were susceptible to erythrosine- and LED-mediated PDT, but the biofilms of both Candida species were more resistant than their planktonic counterparts [8]. Hosseini et al. [9] found that the photodynamic therapy effect on standard suspension of Candida species using 4 different sensitizer: methylene blue, aniline blue, malachite green and crystal violet, is the same, with great decrease in CFU [9]. Pupo et al. [10] in their in vitro work concluded that the number of viable C. albicans cells was reduced significantly after PDT using Methylene Blue or mainly Toluidine Blue associated to diode laser irradiation. Their data proved the efficacy of PDT against C. albicans cells, regardless of the photosensitizer used [10].

There are works in the literature on animal models. Carmello et al. [11] used Photodithazine (PDZ) as photosensitizer and the results of their study was that it was effective as Nystatin in the inactivation of C. albicans [11]. Another study underlined the effectiveness of Methylene Blue [12], meanwhile Kadhemi et al. [13] reported that in mice model there are no difference between concentrations and type of photosensitizer, but confirmed the effectiveness of PDT [13].
Curcumin-mEDIATE and rose bengal- and eosin Y-mEDIATE PDT is proposed for treatment of oral candidosis [14,15] and other in vitro and animal studies demonstrate that PDT was effective also with different types of illumination [16,17]. Very few clinical studies are written in scientific literature. The most important is that of Mima et al. [18] They compared the use of Nystatin and hematoporphyrin derivative (Photogem)-mediate PDT for treatment of patients with dentures stomatitis. Authors concluded that both treatments significantly reduced the CFU/mL at the end of the treatments and on day 30 of the follow-up period [18].

Recently a preliminary study reports five clinical cases of patients with denture stomatitis (DS) treated with PDZ-mediated a PDT [19]. They were submitted to PDT 3 times a week for 15 days. In each session PDZ gel was applied on the upper prostheses and on the palate of the patients for 20 minutes, then, illuminated by a light emitting diode at 660 nm. Three patients completely healed after a PDT treatment. One individual demonstrated reduction in palatal inflammation and another was refractory. The CFU/mL values obtained in the last microbiological collection were lower than those found before the treatment in all cases [19].

Conclusion

In conclusion we can say that the results in the literature show that PDT works, but we do not have a replicable protocol. Patient studies should have larger samples and with longer follow-up. I think PDT should be more interested by clinicians and deserve severe clinical trials. I believe that scientific literature should be more oriented in the search for a repeatable protocol for the treatment of a very frequent pathology such as oral candidosis.

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