Treatment of clinical dermatosis and candida biofilms using a direct-current, atmospheric-pressure cold plasma micro-jet

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Résumé

Dermatophytes are the most common etiological agents, which invade into keratinized tissues (skin, hair, nails) of humans and animals causing dermatophytosis (also known as ringworm or tinea). Swimming pools, fitness centers, barber shops, beauty parlors, and saunas and steam baths are common places to pick up superficial fungal infections. Mycotic infections have become more important because of their tendency of chronic progression and deep-site or systemic infection. At present, therapeutic methods for candida biofilm infections are very limited. The presence of non-albican species (most of which are resistant to normal antifungal agents) has been raising in recent years, due to -among other reasons- the frequent prophylactic use of antifungal chemicals.

In this paper, a direct-current, atmospheric-pressure, He/O_2 (2%) cold plasma microjet (PMJ, as shown in figure 1) is applied to *Trichophyton rubrum* (the most frequent dermatophyte), *Candida* spp (which causes thrush and vaginal candidiasis). Effective inactivation is achieved both in air and in water within 5 min of plasma treatment. Same plasma treatment also successfully inactivated dermatosis biofilms (*C. glabrata*, *C. albicans* and *C. krusei*). The inactivation was verified by XTT test. Severely deformed biofilms were observed after PMJ treatment through SEM. Hydroxyl radical (•OH), superoxide anion radical ($\bullet O_2^-$) and singlet molecular oxygen ($^1O_2$) are detected by Electron Spin Resonance (ESR) spectroscopy. Optical emission spectroscopy show strong atomic oxygen emission at 777 nm in air and in water. The sessile minimal inhibitory concentrations (SMICs) of fluconazole, amphotericin B, and caspofungin against the *Candida* spp. biofilms were decreased to 2-6 fold dilutions in PMJ treated group in comparison with untreated controls. This novel approach may become a new tool for the treatment of clinical dermatosis.

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