

Efficacy of Combined Therapy with Electroactivated Super-oxidised Water and Hydrogel in the Treatment of Chronic Infected Ulcer: A Case Study



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INTRODUCTION

An ulcer located on the middle third of the right leg has been present for over 6 months, displaying a necrotic background with no exudate, raised edges, and signs of critical colonization. The initial therapeutic approach involved using Silver Sulfadiazine cream to reduce septic signs, along with hyaluronic acid ointment and antiseptic gauze for necrotic tissue debridement. Surgical debridement was also performed to manage the necrosis, and a low-voltage double-layer cohesive bandage was applied to control limb edema. *Candida albicans* infection was confirmed through analysis of two culture swabs.

OBJECTIVE

To evaluate the efficacy of combined therapy with electro-activated superoxidised water and bacteriostatic hydrogel in the treatment of a chronic *Candida albicans*-infected leg ulcer in patient with AOCF IV stage Lariche Fontain.

IN VITRO STUDY ANALYSIS

A study by Krishnen and Muniandy (2023) on the efficacy of EASW<sup>1</sup> against fungal infections demonstrated a remarkable fungicidal effect, achieving the minimum threshold for fungicidal activity (2-log reduction) against all six tested fungal species and reducing microbial counts by 99.9999% (as shown in Table 1).

Table 1. Effect of Super-Oxidized Solution Exposure Against Selected Fungi as per ASTM E2315-16 (Source: Krishnen et al., 2023)

| Microorganism                      | Initial Microbial Count(Log <sub>10</sub> ) | Exposure Time: 1 Minute                   |                             |             |
|------------------------------------|---------------------------------------------|-------------------------------------------|-----------------------------|-------------|
|                                    |                                             | Final Microbial Count(Log <sub>10</sub> ) | Log <sub>10</sub> Reduction | % Reduction |
| <i>Candida albicans</i>            | 9.4354                                      | 3.0000                                    | 6.4354                      | 99.9999 %   |
| <i>Candida auris</i>               | 6.5238                                      | 0.0000                                    | 6.5238                      | 99.9999 %   |
| <i>Candida tropicalis</i>          | 6.3222                                      | 0.0000                                    | 6.3107                      | 99.9999 %   |
| <i>Candida parapsilosis</i>        | 6.4771                                      | 0.0000                                    | 6.4226                      | 99.9999 %   |
| <i>Sporothrix schenckii</i>        | 9.0170                                      | 3.0000                                    | 6.0170                      | 99.9999 %   |
| <i>Trichophyton mentagrophytes</i> | 8.8808                                      | 3.0000                                    | 5.8808                      | 99.9999 %   |

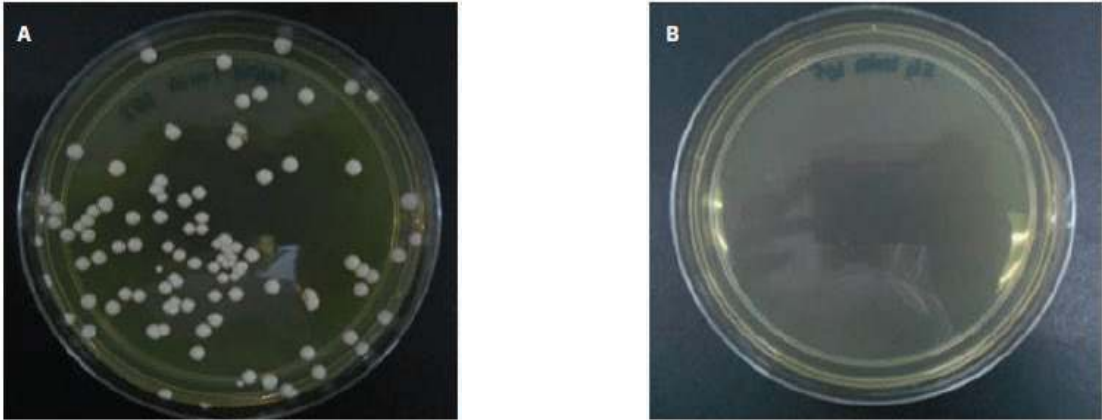


Image 1: Growth of *Candida albicans* colonies is completely abrogated following exposure to super-oxidized solution. The *C. albicans* strain was cultured on sabouraud dextrose agar plates for 24 to 72 hours at 30 °C ± 2 °C before incubation for 1 minute in (A) phosphate buffered saline or (B) super-oxidized solution. (Source: Krishnen and Muniandy, 2023)

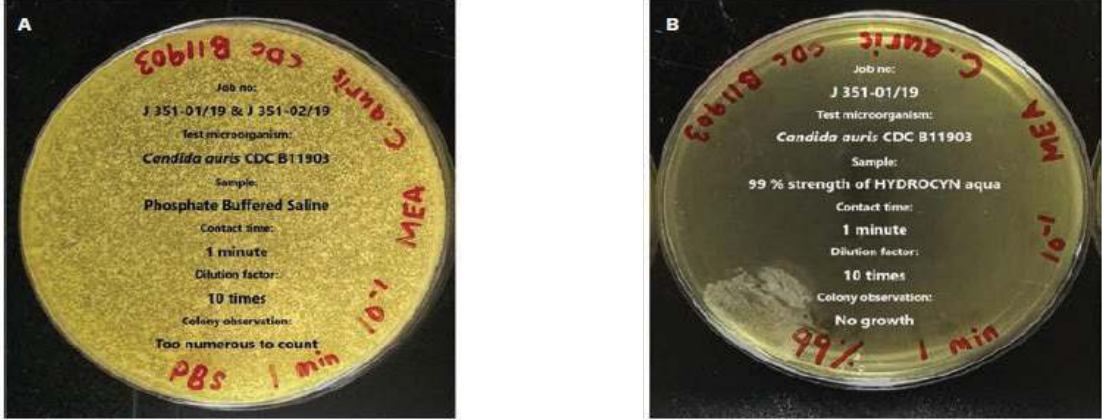


Image 2: Growth of *Candida auris* colonies is completely abrogated following exposure to super-oxidized solution. *C. auris*, derived from CDC B11903, was cultured on MEA plates for 24 to 72 hours at 27.5 °C ± 2.5 °C before incubation for 1 minute in (A) phosphate buffered saline or (B) super-oxidized solution.

IN-VIVO STUDY ANALYSIS

Pre-treatment situation



Following surgical debridement, the wound was found to be infected with *Candida albicans*, which was confirmed by two culture swabs taken due to the following symptoms: delayed healing, persistent necrotic background, non-viable edges, and absent exudate. The initial Wound Bed Score (WBS) value of 3 indicated a wound with abundant necrotic tissue and signs of local sepsis. The wound was measured to be 3.5 cm x 5 cm. in size.

Start of EASW treatment



The wound size showed a progressive reduction over time after initiating combined treatment. Approximately 60 days into treatment with EASW<sup>1</sup> and hydrogel<sup>2</sup>, the wound size decreased to 1.5 cm x 1.2 cm, indicating a significant improvement.



Throughout the treatment period, there was a consistent improvement in the wound. The final recorded WBS value of 16 demonstrated substantial depth reduction with granulation tissue formation and size reduction through re-epithelialization of the wound.

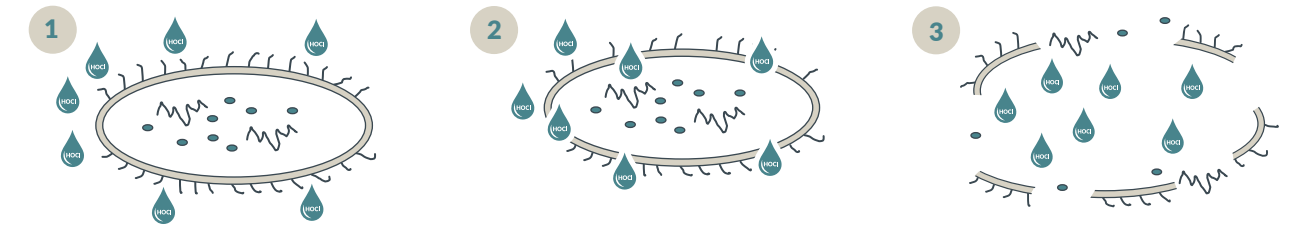
MODE OF ACTION

Electro Activated Superoxide (EASW) solution based on Hypochlorous Acid (0.003%) mimics the body's immune response without compromising safety while improving wound healing. EASW<sup>1</sup> creates an optimal environment for healing by reducing biofilm and bacterial load,

1. Rapidly eliminates bacteria, viruses and fungi within 60 seconds through hydrolysis.
2. Positive effects on fibroblast and keratinocyte migration, which is important for re-epithelialization and tissue regeneration.

EASW (0.003% HOCl) eliminates microbes by osmotic shock

HOCl penetrates the cell membrane of pathogens, causing a hypotonic effect that draws water into the cells to equalize the osmotic gradient.



RESULTS

The treatment demonstrated consistent healing effects, emphasizing the efficacy of EASW<sup>1</sup> and hydrogel<sup>2</sup> in promoting tissue regeneration and overall wound recovery. Importantly, no adverse effects or complications were observed during the treatment period, highlighting the safety and tolerability of this combined therapy.

CONCLUSIONS

Combination therapy with EASW<sup>1</sup> and bacteriostatic hydrogel<sup>2</sup> effectively improved a chronic leg ulcer with *Candida albicans* infection. It reduced the wound size, improved the wound bed score, and controlled the infection without adverse effects. It successfully healed a chronic open wound that had persisted for over a year in just three months. The present results show significant improvements compared to standard treatments for fungal wounds, highlighting the importance of this case study. In contrast to conventional antibiotic treatments, the use of EASW<sup>1</sup> reduces the risk of antimicrobial resistance, making it a promising alternative in the management of fungal infections (Gupta et al., 2021). This method addresses the increasing prevalence of fungal infections, challenges associated with hard-to-heal wounds, and the emergence of antimicrobial resistance in fungal pathogens (Ge and Wang, 2022). These findings offer important insights for future approaches to effectively manage fungal infections and associated complications. The results of this study are consistent with those reported by Krishnen and Muniandy (2023,) who suggest that the use of an electro-activated super oxidized solution could serve as an interesting approach in the prevention and management of fungal infections.

Reference: Ge Y, Wang Q. Current research on fungi in chronic wounds. Front Mol Biosci. 2022;9:1057766. doi:10.3389/fmolb.2022.1057766; Gupta AK, Renaud HJ, Quinlan EM, Shear NH, Piquet V. The Growing Problem of Antifungal Resistance in Onychomycosis and Other Superficial Mycoses. Am J Clin Dermatol. Mar 2021;22(2):149-157. doi:10.1007/s40257-020-00580-6; Krishnen, R., & Muniandy, S. (2023). Fungicidal effectiveness of super-oxidized solution in vitro: potential implications for wound care. Wounds: a compendium of clinical research and practice, 35(8), E243-E247.

<sup>1</sup> HYDROCYN aqua solution (Bactiguard (South East Asia) Sdn. Bhd., Penang, Malaysia.)  
<sup>2</sup> HYDROCYN aqua gel (Bactiguard (South East Asia) Sdn. Bhd., Penang, Malaysia.)