The Use of Continuous Topical Oxygen Therapy in Combination with Cellular, Acellular and Matrix-like Products to Treat Complex, Chronic Wounds: A Retrospective Case Series

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Introduction

Clinical studies typically focus on the effectiveness of a singular treatment. However, routinely chronic wounds are treated with various topical therapies.

The goals of topical wound management include supporting tissue repair, preventing infection, reducing pain, eliminating devitalized tissue, creating a moist environment, and decreasing edema.[1,2]

Optimisation of the wound environment using good standard of care with adjunctive therapies to overcome barriers to healing can help achieve these goals and prepare the wound bed for advanced products if required.

The objective of this case series is to investigate chronic wound progress when a continuous topical oxygen therapy (cTOT) device was used to optimize the wound environment prior to application of a cellular, acellular and matrix-like product (CAMP).

Methods

- A single-center case study was conducted to examine the outcomes of chronic wounds treated with a combination therapy algorithm consisting of 3 weeks of wound optimization with cTOT* followed by CAMPs application.
- Four patients and a total of five wounds were included in this report
- Prior to study enrollment all patients provided written informed consent to publish the case details and associated de-identified image assessments.
- No compensation was provided for participation.
- Subjects had a variety of chronic wound aetiologies including both VLUs and DFUs
- All wounds were considered non-healing prior to inclusion as they had failed to achieve at least 50% wound area reduction after at least 4-weeks treatment with standard of care.
- All wounds were negative for clinical signs and symptoms of infection.
- Patients were seen weekly for wound evaluation, assessments, standard photographs, measurements, and near-infrared spectroscopy (NIRS) imaging.

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Case Example

Clinical History	Notes
Demographics	76 y Male
Medical History	Pacemaker, Pancreatic dysfunction, NIDDM Coronary disease, Squamous cell carcinoma
Wound Etiology	VLU LLE
Wound Duration	12 weeks
Previous Treatments	Antibiotics, topical antimicrobials, debridement, tubigrip for compression

Baseline Wound Characteristics

Size (cm): L 5.0 x W 3.2 x D 0.2

Assessment: Non-healing wound of LLE

Wound had been treated for 6 weeks with Cadexomer iodine and gentian violet/methylene blue foam, Increasing granulation

Treatment: Cleanse wound, debridement, apply cTOT, cover with adhesive foam, compression dressing, follow-up 1 week.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Size (cm) (l x w)	4.4 x 3.7	3.9 x 3.3	3.5 x 3.0	1.5 x 1.1	0.5 x 0.4	0.0 x 0.0 HEALED
Assessment	Moderate drainage, new epithelium, beefy red granulation tissue base	Wound improving, edges contracting, slight hyper-granulation	Smaller size, Less edema Better quality of granulation tissue	Greater epithelization Wound contracting Less exudate	Thin epithelization	The wound was closed Clinically there was epithelium No exudate
Treatment	Cleanse, debridement, cTOT, skin protectant to peri-wound, adhesive foam, compression, follow-up 1 week	Cleanse, debridement, cTOT, skin protectant to peri-wound, adhesive foam, compression, follow-up 1 week	Cleanse NS 1st application of CTP	Cleanse with NS 2nd application of CTP	Cleanse NS Application of collagen compression	Lotion, compression

Wound Area Reduction

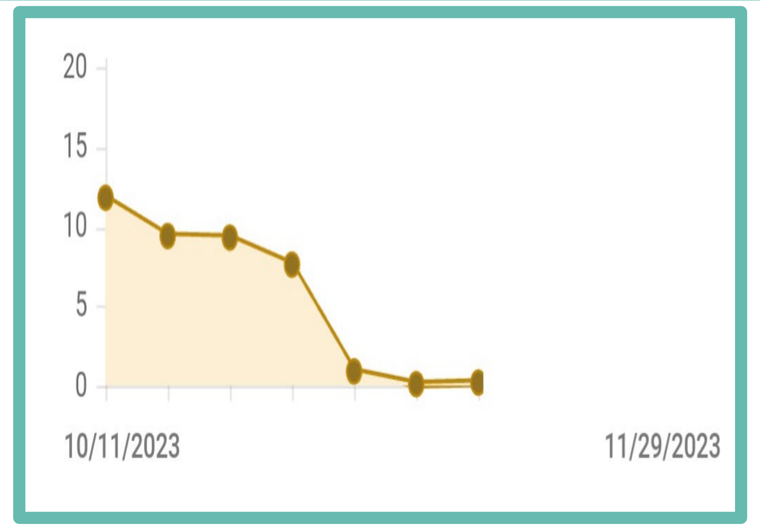

Figure 1. Wound area over time for Case 3, Non-healing VU, (cm^2)

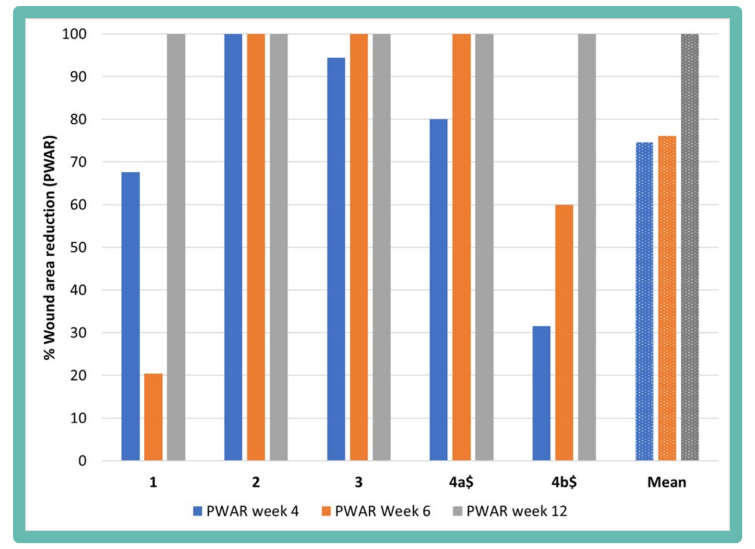

Figure 2. Percentage wound area reduction (PWAR) within the 12-week period across all five wounds.

* cTOT Device: NATROX® O_2

Results

- Four male subjects (five wounds) with an average age of 71.8 years were included in this case review.
- Wound types; 3 DFUs and 2 VLUs. – mean duration 9.4 weeks.
- All patients had an ankle-brachial index > 0.9 mmHg, but not >1.3mmHg.
- Mean percentage wound area reduction following therapy with cTOT and subsequent CAMPs was 74.7% and 76.1% at four and six weeks respectively.
- All patients went on to complete wound resolution by week 12.
- The mean time to wound closure = 8 weeks.
- Mean number of CAMPs applications = 6.
- No adverse events were noted.

Discussion

- Wound healing should be approached in a systematic algorithmic way for wound bed optimization.[1,2]
- cTOT is a novel therapy that should be included in the wound bed optimization pathway.[3,4]
- Changing the oxygen gradient in the wound bed via cTOT helps recruit fibroblast, and epithelial cells to support tissue repair and regeneration.[3,4]
- cTOT bolsters immune system functions to recue anaerobes and aid in phagocytosis leading to clearing and disruption of bacteria in the wound bed and peri-wound.[3,6,7]
- The authors believe that this combination of topical methods might have synergistic effects and improve wound healing, and the results of this study support this assumption.
- With looming limitations in the number of CAMP applications permitted under various LCD/LCA policies, as well as the constraints in accessing certain CAMPs, finding innovative methods to improve wound healing will have great value across all clinical settings.

References

1. Dissemond, J. *et al.* M.O.I.S.T. Concept for the Local Therapy of Chronic Wounds: An International Update. Int J Low Extrem Wounds (2024) doi:10.1177/15347346241245159.
2. Schultz, G. S., Barillo, D. J., Mozingo, D. W. & Chin, G. A. Wound bed preparation and a brief history of TIME. Int Wound J 1, 19–32 (2004).
3. Sen, C. K. Wound healing essentials: Let there be oxygen. *Wound Repair and Regeneration* 17, 1–18 (2009).
4. Frykberg, R. et al. Use of Topical Oxygen Therapy in Wound Healing. *J Wound Care* 32, S1–S32 (2023)
5. Cole *et al*. The use of a topical oxygen therapy system to promote healing in Chronic wounds. Poster SAWC Fall (2020)
6. Hunter, P., Greco, E., Cross, K. & Perry, J. Topical Oxygen Therapy Shifts Microbiome Dynamics in Chronic Diabetic Foot Ulcers. *Wounds* 32, 81–85 (2020).
7. Asmis, R., Qiao, M. & Zhao, Q. Low flow oxygenation of full-excisional skin wounds on diabetic mice improves wound healing by accelerating wound closure and reepithelialization. *Int Wound J* 7, 349–57 (2010).