Effects of Human Cryopreserved Adipose Tissue Allograft Implantation on Tissue Oxygenation in Diabetic Neuropathic Patents with Plantar Ulcers

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Aim

This study evaluates the impact of human cryopreserved adipose tissue allograft (hCAT) implantation on tissue oxygenation in diabetic neuropathic patients with plantar ulcers.

Introduction

Plantar ulcers, common in diabetic neuropathic individuals with fat pad atrophy, account for nearly half of all foot ulcers and are a leading cause of limb amputations, with rates exceeding 80%. High plantar pressure due to fat pad loss plays a key role in ulcer formation, poor healing, and recurrence. Human cryopreserved adipose tissue allograft (hCAT) has emerged as a promising approach for managing fat pad atrophy.[1]

Methods & Technology Description

This retrospective case series included 3 patients (2 males, 1 female) with multiple comorbidities, including diabetes, and plantar ulcers that failed to respond to previous treatments. The ulcers varied in size (0.6–3.4 cm²). A comprehensive wound management approach included the application of 3.0 mL of hCAT (Liposana®, Britecyte , Inc., MD, USA) to address fat pad defects. Tissue oxygenation and visual light images were captured using a mobile near-infrared spectroscopy imaging device (MIMOSA Pro, MIMOSA Diagnostics, Inc., ON, Canada).[2] Imaging was performed at various time points, from 7 to 108 days prior to hCAT implantation, continuing up to 181 days post-implantation. Follow-up intervals were tailored to individual cases. The primary outcomes included the rate of wound closure and kinetics of tissue oxygenation after hCAT implantation.

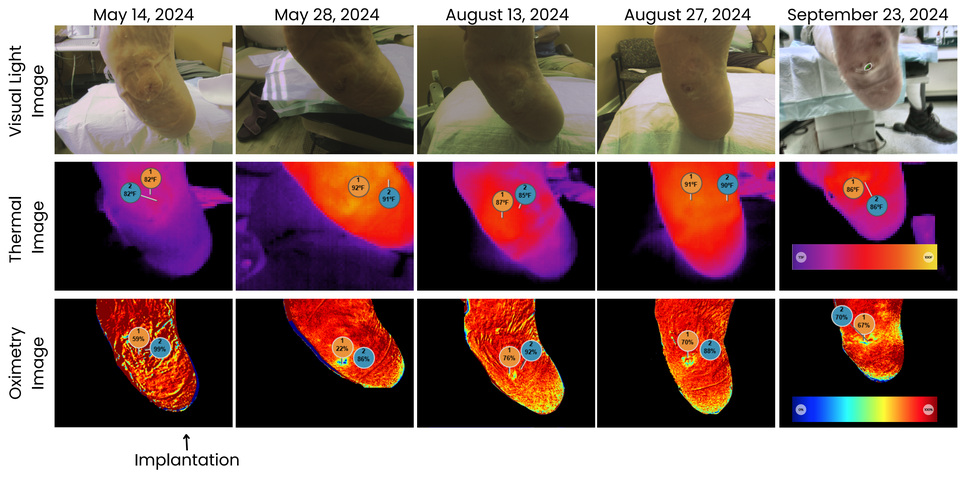
Discussion & Conclusions

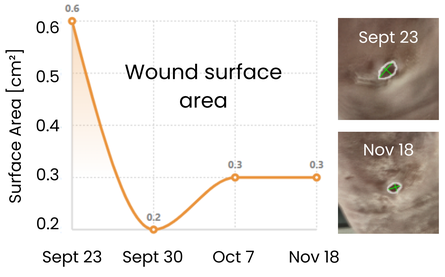
This is the first study to measure tissue oxygenation after hCAT implantation in diabetic neuropathic patients with plantar ulcers. Our findings highlight hCAT's potential in plantar ulcer management, with larger studies needed to validate these results and optimize treatment protocols. NIRS demonstrated a correlation between improved oxygenation and wound closure.

Results

Pre-implantation peri-wound oxygenation was 85% ± 16% and wound oxygenation was 67% ± 24%. Following hCAT implantation, a drop in oxygenation occurred, with peri-wound oxygenation decreasing to 72% ± 20% and wound oxygenation to 54% ± 20%. Over the next 18–64 days, oxygenation improved, with peri-wound oxygenation reaching 84% ± 15% and wound oxygenation 78% ± 15%. Improvements in oxygenation correlated with reductions in wound surface area: Case 1 showed a 66% wound area reduction by 181 days, Case 2 closed by Day 63, and Case 3 showed over 50% reduction by Day 49.

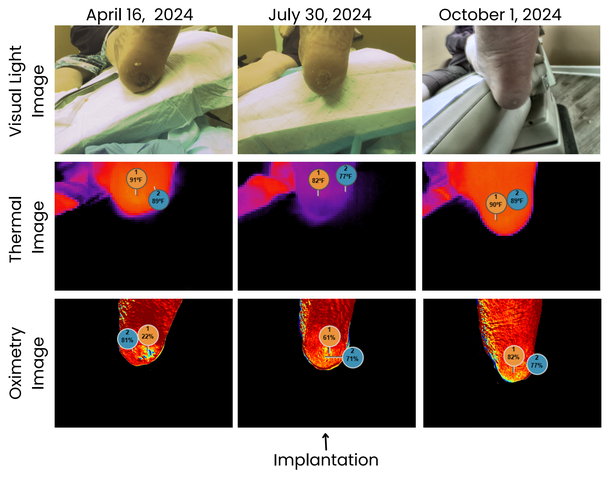
Patient 1 – A male patient with a chronic wound on the right plantar foot, who underwent implantation on May 21, 2024. The patient was followed up from May 14, 2024, to November 18, 2024.

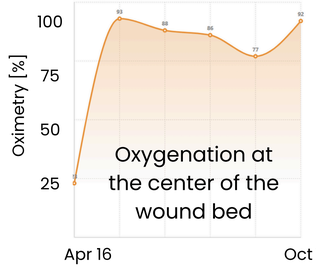




Before implantation, wound bed oxygenation was 62% ± 33%, briefly dropping to 57% within a week before rising to 75% by two months post-implantation. A transient temperature increase was observed but returned to baseline within the same period. These trends align with wound size reduction, indicating a positive healing response.

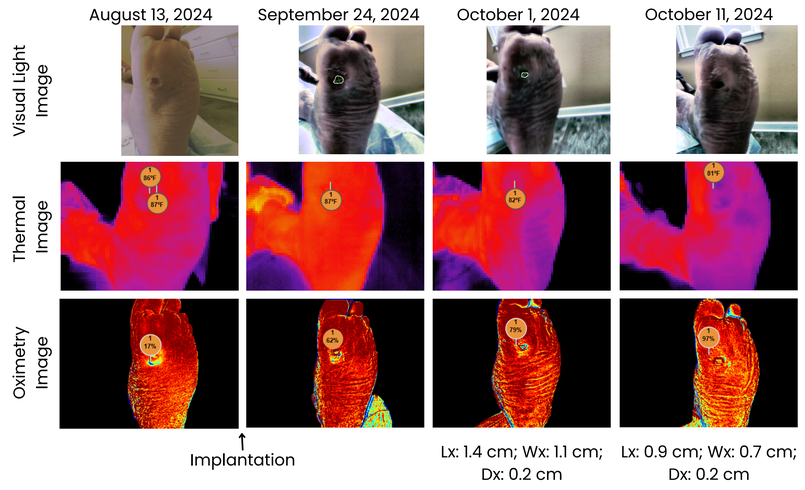
Patient 2 – A female patient with a chronic wound on the left plantar foot near the heel underwent implantation on 30 Jul 2024, with follow-up from 16 Apr 2024 to 1 Oct 2024.

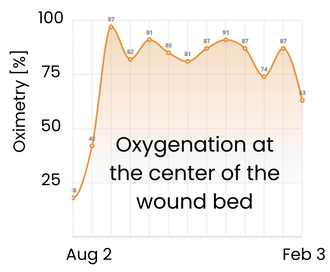




Positive healing trajectory: Mean wound bed oxygenation increased by 13% post-implantation.

Patient 3 – A male patient with a chronic wound on the left plantar foot near the first metatarsal underwent implantation on 23 Aug 2024, with follow-up from 7 May 2024 to 3 Feb 2025.





Positive healing trajectory: Increased wound bed oxygenation correlated with a 59% reduction in wound surface area between 24 Sep 2024 and 11 Oct 2024.

Bibliography

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2. Rickards, T. et al. Using Near-Infrared Spectroscopy and Education to Support Older Adults with Diabetic Foot Ulcers to Age-in-Place: A Case Series. Adv Skin Wound Care 37, 422–428 (2024).