To Determine The Rate At Which Laser Therapy Will Heal Chronic Leg Ulcers: A Self-Control Service Evaluation

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INTRODUCTION

Chronic leg ulcers (CLU) greatly impair quality of life and can require amputation in severe cases. Affects 3-5% of people over 65 (1), causing pain and certain morbidities. Women are twice more vulnerable to developing a CLU (2). A 2017-18 study showed that the NHS spent £5.6 billion annually on non-healing wounds.

Class IV laser therapy (using K-Cube® 4 by K-Laser™) offers a potential solution by delivering non-invasive, painless, multi-wavelength light therapy that stimulates cellular response

•**Class IV Laser**: Includes 4 wavelengths (660, 800, 905, 970 nm) targeting hemoglobin, water, and cytochrome-C oxidase.

•**Aim:** To assess the effectiveness of Class IV laser therapy in healing of chronic leg ulcers non-responsive to traditional therapies

OBJECTIVES

The objective was to determine at which rate Class IV laser therapy reduces chronic lower leg ulcers of different aetiologies by determining mean daily Percentage Area Reduction (PAR), changes in wound bed, surrounding tissue state, reduction of edema and pain, and improvement of overall wound condition

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MATERIALS AND METHODS

This study involved 19 patients with chronic leg ulcers unresponsive to standard treatments for at least 6 weeks

•**Inclusion Criteria**:

- Ulcers below the knee and unresponsive to treatment for >6 weeks
- Initial size <10x10cm²
- ABPI > 0.5 or TBPI > 0.6
- Aged >18
- Varied ulcer etiologies

•**Study Design**: Self-controlled

•**Procedure**: After 4 pre-trial weeks, patients received once or twice weekly laser therapy for up to 12 sessions, with a 4-week post-treatment follow-up. Medications and dressing materials were kept consistent

•**Data Collection**: 4 weeks before the 1st laser therapy session, continued weekly or biweekly during the intervention period, and 4 weeks post-trial. Wounds were measured manually and photographed throughout the trial. Mean daily PAR with standard deviation (SD) was calculated after the end of trial.

RESULTS

•**Group 1:Twice-Weekly Treatment (13 patients):**
•Percentage area changes before treatment: ulcers increased by 0.559% per day.
•PAR during treatment: -1.118% per day (SD = 1.0078).
•**Group 2: Once-Weekly Treatment (6 patients):**
•PAR before treatment: -0.329% per day.
•PAR during treatment: -0.604% per day (SD = 1.348).
•**General Findings:**
•SD indicates that group 1 showed more consistency to treatment meanwhile group 2 had high variations in data which was not normally distributed
•Twice-weekly treatments resulted in a faster healing rate
•Smaller ulcers healed faster than deeper ulcers
•89.47% of patients showed significant improvement

Figure 2: Rt medial gaiter ulcer with hemosiderin deposit and venous eczema initially (lt) and wound of the same patient at 4th week post-trial follow-up (rt)

Chart 1: Comparison Between Wound areas of 19 patients during different phases of treatment

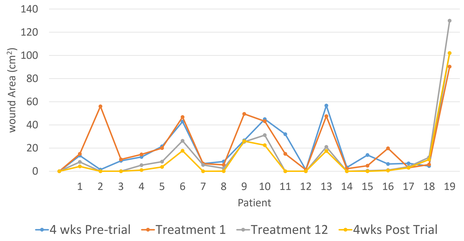


Chart 1: This chart shows the wound areas of each patient during different phases of treatment. The overlapping lines indicate that the healing rate was not very high for some of the patients.

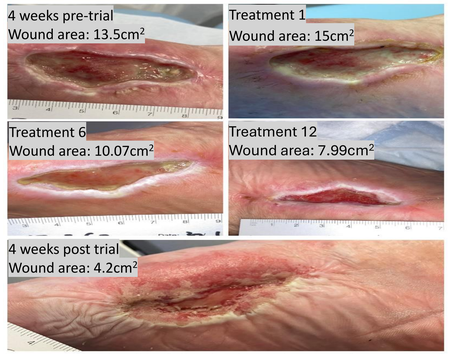


Figure 1: Ulcer healing following laser therapy of a patient with arterial ulcer who received twice weekly treatment

Graph 1: Daily Percentage Area Changes Of Patients Who Received Laser Therapy

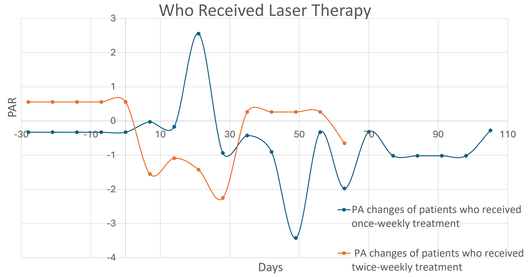
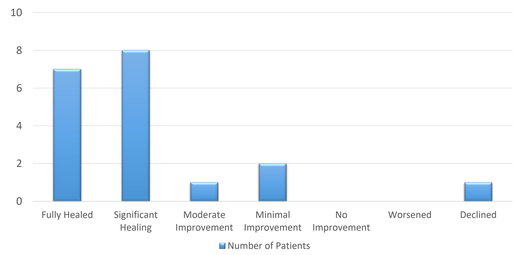


Chart 2: Final results based on the PAR of ulcer size from 4wks pre-trial and after 4th week post trial F/Up



DISCUSSION

The study indicated that daily PAR was a major treatment success indicator. Twice weekly sessions reduced ulcer size faster. 17 patients had a satisfactory result. Laser therapy was proved to be safe for open superficial to deep ulcers with no adverse effects. Infected ulcers showed healthy granulation tissue beds indicating bactericidal effect of Class IV laser and patients could continue with routine wound management. Ulcers showing increase-decrease pattern in same patient specifies biostimulatory properties. The ulcer diameters varied between people, suggesting that healing wasn't linear, owing to ulcer depth, underlying health conditions, age, and supplemental therapy compliance.

LIMITATIONS

•Small sample size
•All patients of same ethnicity
•Manual measurement leads to misclassification bias
•Cost analysis could not be determined

CONCLUSION

- To summarize, in this study Class IV laser therapy has demonstrated promising outcomes in the treatment of leg ulcers by drastically improving wound healing
- More large-scale, randomized controlled trials are required to create standardized techniques and fully comprehend the long-term benefits and hazards

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FUTURE DIRECTIONS

•**Larger, Diverse Trials**: Randomized controlled trials with expanded population size and diversity
•**Optimized Protocols**: Standardize frequency, power, and wavelength
•**Cost-Effectiveness**: Compare laser therapy costs with other treatments
•**Long Term Follow Up and Outcome Measurements**
•**Mechanistic Studies**: Explore cellular effects and biomarkers

REFERENCES

1. Mekkes et al. 2003
2. O'Brien, 2000
3. Guest, Fuller, Vowden 2020

ACKNOWLEDGMENTS

Stephen Barabas
Derek Tillotson
Lydia D'Ancey