

Role of Low-Level Laser Therapy in Wound Bed Preparation in Necrotizing Fasciitis

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ABSTRACT

Necrotizing fasciitis is an infection of subcutaneous tissue and fascia which may spread rapidly to deeper tissue and surrounding tissue which may cause damage to the tissue and present as a localized infection and fulminant septic shock with high mortality rate. Low-Level Laser therapy has been found to be effective in wound bed preparation. This study highlights our experience in wound bed preparation using Low Level Laser therapy as an adjuvant in a case of necrotizing fasciitis.

Keywords: Low level laser therapy; Wound bed preparation; Necrotizing fasciitis.

INTRODUCTION

Necrotizing soft tissue infections (NSTIs) include necrotizing forms of fasciitis, myositis, and cellulitis. These infections are characterized clinically by fulminant tissue destruction, systemic signs of toxicity, and high mortality.¹ Accurate diagnosis and appropriate treatment must include early surgical intervention and antibiotic therapy. Several different names have been used to describe the various forms of necrotizing infections; this is related in part to naming based on clinical features rather than surgical or pathologic findings. The degree of suspicion should be high since the clinical

presentation is variable and prompt intervention is critical. The lay press has referred to organisms that cause NSTI as flesh eating bacteria.² There is sufficient evidence to conclude that healing of necrotizing fasciitis is accelerated by LLLT. Though it is well established therapy in the armamentarium of wound management, its role in wound bed preparation before cover by skin graft or flap has not been studied well. LLLT has been found to be effective in wound bed preparation but has not been reported in literature for necrotizing fasciitis. This study highlights our experience in wound bed preparation using Low level Laser therapy in a case of necrotizing fasciitis.

Materials and Methods

This study was conducted in the department of plastic surgery in a tertiary care center after obtaining the departmental ethical committee approval. Informed written consent was taken from the patient. The study is a prospective observational type done on a 60-year-old male with known co-morbidities including hypertension & coronary artery disease with ejection fraction of 25%. Patient presented with raw area (fig. 1) over left lower limb & perineum of one month

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duration. He was apparently well one month back when he developed multiple blebs over left lower limb & perineum which ruptured leaving raw area with rapid progression of wound infection with foul smelling discharge. He was diagnosed with clinically as a case of necrotizing fasciitis. He underwent multiple debridement in referral surgery department after that he was referred to department of plastic surgery for further wound care. There are various modalities of regenerative wound care out of which here we used low level laser therapy (fig. 2) as a regenerative modality for wound care. We used gallium arsenide (gas) diode red laser of wave length 650nm, frequency 10khz and output power 100mw, which was a continuous beam laser with an energy density of 4 j/cm².

Machine delivers laser in scanning mode (non-contact delivery) with 60 cm distance between laser source and raw area. Raw wound area was given laser therapy (fig. 3) for duration time for 15 minutes twice weekly for 3 consecutive cycles. Till wound bed got ready cadaveric human skin (allograft) was used as biological dressing. Wound bed was reassessed every weekly till wound bed got ready for cover by skin graft or flap.

Results

After 3 weeks, the wound bed got ready with appearance of healthy granulation tissue (fig. 4). The future plan is to cover the raw area with skin grafting once patient becomes fit for



Fig. 1: At admission with extensive necrotizing fasciitis of left lower limb & perineum



Fig. 2: Low-Level Laser machine



Fig. 3: Application of Low-Level Laser Therapy



Fig. 4: Wound bed with healthy granulation tissue with allograft in position

anesthesia.

Discussion

Necrotizing fasciitis is a life threatening condition, with a high mortality rate (median mortality 32.2%) that approaches 100% without treatment. Numerous conditions are associated with this pathology, such as diabetes mellitus, immunosuppression, chronic alcohol disease, chronic renal failure, and liver cirrhosis, which can be conducive to the rapid spread of necrosis, and increase in the mortality rate. The diagnosis of NF is difficult and the differential diagnosis between NF and other necrotizing soft

tissue infections. The delay in diagnosis can be fatal, and septic shock is inevitable if the disease remains untreated. The characteristic of NF is the clinical status change over time. The early clinical picture includes erythema, swelling, tenderness to palpation, and local warmth; once the infection develops, the infection site presents skin ischemia with blisters and bullae. The diagnosis of NF can be secured faster with the use of laboratory based scoring systems, such as the LRINEC score or the FGSI score, especially in cases of Fournier's gangrene. However, the diagnosis is definitely established by performing explorative surgery at the infected site.¹

Management of the infection begins with

antibiotic treatment. In the majority of cases with NF (70–90%) the reasonable pathogens are two or more, suggesting the use of broad spectrum antibiotics. The value of antibiotic treatment in NF is relatively low, and early and aggressive drainage and debridement is required. In NF of the extremities, the clinician should consider amputating the infected limb, although this will not reduce the risk of mortality. Finally, post-operative management of the surgical wound is important, along with proper nutrition of the patient.²

The use of LLLT therapy in wound management has greatly improved the results of post-operative management. LLLT helps in take up of FTSG and thus decreases morbidity related to necrotizing fasciitis. The acronym LASER abbreviated as “light amplification by stimulated emission of radiation”, are defined by a power density at $<1500 \text{ mW/cm}^2$.³ Energy used in LLLT is much less than the one used for cutting, and ablation therapy. LLLT is a form of phototherapy that employs electromagnetic radiation, that is capable of generating enough energy for interacting with living tissues. It produces photochemical and photophysical effects without generation of heat, with consideration of re-establishing cell homeostasis. Essentially, light energy is delivered topically in controlled way which is absorbed by photo absorbers (chromophores) that transform it into chemical energy.⁴

Positive effects include increased formation of granulation tissue and acceleration of tissue repair, wound contraction, inflammation, modulation, and pain reduction. As per literature, low energy photo emissions given at a wave length range of 600nm to 900nm accelerate cell proliferation and promote wound healing.⁵ Its action is thought to:

- Stimulate respiratory chain components promoting ATP synthesis,⁶ and hence increase rate of mitoses and fibroblast numbers.⁶
- Stimulate collagen and elastin production.⁷
- Stimulate microcirculation with dilatation of the capillaries and neovascularisation.^{8,9}
- Liberate mediator of inflammation histamine, serotonin and bradykinin and hence activate macrophages.
- Regenerate lymphatic vessels. In our study we found Low level Laser therapy (LLLT) as an effective adjuvant therapy in the wound bed preparation.

Conclusion

In our study we found that LLLT was useful in promoting granulation and Wound bed preparation. The limitation of the study includes that it is a case report with a single center study with no statistical analysis. Further randomized controlled studies are required to validate the efficacy of the LLLT in the Wound bed preparation of necrotizing fasciitis wound.

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