Review Article

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Role of Low Level Laser Therapy on Full Thickness Skin Graft

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Abstract

Low level laser therapy (LLLT) has been used in different fields, including healing of chronic ulcers like diabetic and pressure ulcers. Here we are using this method to look for role in FTSG donor site. Full-thickness skin grafts include full thickness of the epidermis and dermis where as split-thickness skin grafts (STSG) include the entire epidermis and only partial dermis. LLLT improves tissue perfusion and fibroblast proliferation, with increases in collagen synthesis accelerating wound healing. In this case report we highlight the role of Low level Laser therapy (LLLT) as a adjuvant agent for accelerating healing of full thickness skin graft recipient site.

Keywords: Low level Laser Therapy; Full Thickness Skin Graft; Post Burn Contracture.

INTRODUCTION

Full thickness skin grafts are most common procedure done in plastic surgery for the skin defects. Full-thickness skin grafts (FTSGs) consist of complete epidermis and dermis, where as partial thickness skin grafts (PTSG) include the entire epidermis and only partial dermis. Some areas that are particularly useful for skin harvest are the pre- and postauricular areas, clavicular skin, and inner arm among others. Sites in which grafts are most commonly useful include the nasal tip, dorsum, ala, and sidewall as well as the eyelids and the ears. Full thickness skin graft sites are closed usually by suturing of the wound. Full thickness skin grafts can provide skin coverage in wounds in which healing by second intention, primary closure, or flap repair would not be optimal. LLLT is believed to affect the function of connective tissue cells[2] (fibroblasts), accelerate connective tissue repair and act as an anti-inflammatory agent. Low level laser therapy helps in accelerating the wound healing process by stimulating microcirculation and collagen deposition in the wound. In this case report we assess the role of low-level laser therapy in full thickness skin graft recipient site for better and faster healing.

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MATERIALS AND METHODS

This study was conducted in the department of Plastic Surgery at tertiary care center after getting the departmental ethical committee approval. Informed written consent was taken from the

patient. The details of the patient in study are as follows. 21-year-old male presented to the hospital with post burn contracture to the left little finger with Metacarpal phalangeal joint subluxation. Patient had fire flame injury wherein, he inserted his hand in the hot firewood at 2 years of age, now presented with chief complaints of left hand little finger functional deficit and painless deformity (Fig. 1). Patient was admitted with the above symptoms

Fig. 1: Post burn contracture left litter finger with metacarpophalangeal joint subluxation

and evaluated. He underwent Contracture release followed by full thickness graft from left groin. Pre-op X-ray shows Metacarpal-phalangeal joint subluxation. K-wire fixation of left little finger under fluoroscopic guidance. Once joint is fixed and raw area is created, it was grafted with full thickness graft taken from the right groin. after the full thickness skin graft was applied (fig. 2)

Fig. 2: Full thickness skin graft and k-wire fixation of contracture

followed by low level laser therapy session (fig. 3) for ten minutes in immediate post-operative period and second session of Low level laser therapy was given after 10 days on 10th post operative day and third session after day 20.

Gallium Arsenide (GaAs) diode red laser (wave

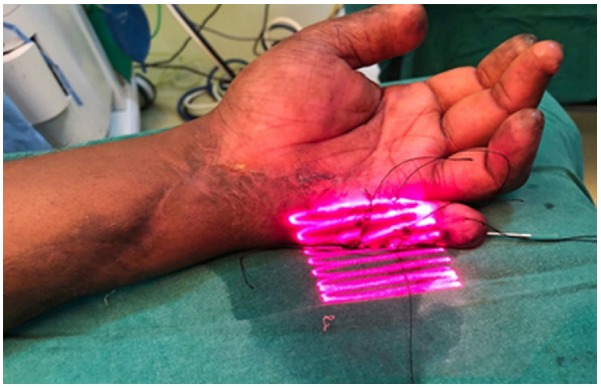

Fig. 3: Low level laser therapy

length 650 nm, frequency 10 kHz and output power 100 MW) was used as a source of Low level laser therapy. It is a continuous beam laser with an energy density of 4 J/cm.^{2} Machine delivers laser in scanning mode (non-contact delivery) with 60 cm distance between laser source and wound. In each session, the wound was given laser therapy for duration of 10 minutes followed by non-adherent absorbent dressing.

RESULTS

The application of Low level laser therapy over full thickness graft donor site aided in the healing of the wound (Fig. 4). No complications noted post-operatively. Patient discharged successfully.

Fig. 4: Full thickness skin Graft on day 10

DISCUSSION

Full thickness skin graft works well for reconstruction of burns contracture. low level laser therapy helps in healing at full thickness skin graft donor site and thus decreases morbidity related to burn contracture. Contracture causes physical and aesthetics consequences and appropriate treatment is very essential for day-to-day activities of victim post trauma. Proper site selection should be made to decrease donor site morbidity. low level laser

therapy has been found to be safe and beneficial in few case reports for uptake of full thickness skin graft post burn contracture but randomized controlled trials had yet to be done. The term Laser is the acronym for Light Amplification by Stimulated Emission of Radiation. A laser light is monochromatic, collimated, and coherent. A laser is a device that produces such a light. low level laser therapy is a non-invasive light source treatment that generates a single wavelength of light. It emits no heat, sound, or vibration. It is also called photobiology or biostimulators.

Mechanism of action

The acronym LASER abbreviated as "light amplification by stimulated emission of radiation", are defined by a power density at <l500 MW/cm^2.[2,3] Energy used in Low level laser therapy is much less than the one used for cutting, and ablation therapy. Low level laser therapy is a form of phototherapy that employs electromagnetic radiation, that is capable of generating enough energy for interacting with living tissues. It produces photo chemical and photo physical 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.[4]

As per literature, low energy photoemissions given at a wavelength 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, 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]
- Liberate mediator of inflammation histamine, serotonin and bradykinin and hence activate macrophages.
- Regenerate lymphatic vessels.

CONCLUSION

In our study we found that low level laser therapy was useful in promoting wound healing at FTSG recipient site without any complications. Large randomized control trials are required for identifying the other advantages and disadvantages of low level laser therapy.

REFERENCES

1. Goel, Arun, and Prabhat Shrivastava. "Post-burn scars and scar contractures." Indian journal of plastic surgery: official publication of the Association of *Plastic Surgeons of India vol*. 43, Suppl (2010): S63-71.
2. Karo TI. Low-power laser therapy. In: Vo-Dinh T, editor. *Biomedical photonics handbook*, vol. 48. London: CRC Press, 2003. p. 7–20.
3. Baxter CD. Therapeutic lasers. Theory and practice. Churchill, *Living stone*, 1994.
4. Andrade FSSD, Clark RMO, Ferreira ML. Effects of Low level laser therapy on wound healing. *Rev Colégio Brasileiro Cirurgiões*. 2014;41(2):129–33.
5. Lichtenstein, D., Morag, B. Low level laser therapy in ambulatory patients with venous stasis ulcers. *Laser Therapy* 1998; 11: 71-78.
6. Karo, T. Molecular mechanism of therapeutic effect of low *intensity laser irradiation Do kl Akad Nauk* SSSR 1986; 291:1245-1249.
7. Saperia, D., Glassberg, E., Lyons, R.F. et al. Demonstration of elevated type I and type III procollagen mRNA levels in cutaneous wounds treated with helium-neon laser. Proposed mechanism for enhanced wound healing. *Biochem Biophys Res Commun* 1986; 138:1123-1128.
8. Schendel, A., Schendel, M., Schendel, L. *et al.* Increased dermal angiogenesis after low-intensity laser therapy for a chronic radiation ulcer determined by a video measuring system. *JAm Acad Dermatol* 1999;40: 481-484.