International Journal of Surgery Research
www.surgeryjournal.in
Online ISSN: 2664-6056, Print ISSN: 2664-6048
Received: 28-09-2021; Accepted: 15-10-2021; Published: 29-10-2021
Volume 3, Issue 2, 2021, Page No. 28-30

Role of low level laser therapy in take of full thickness skin graft in post burn contracture

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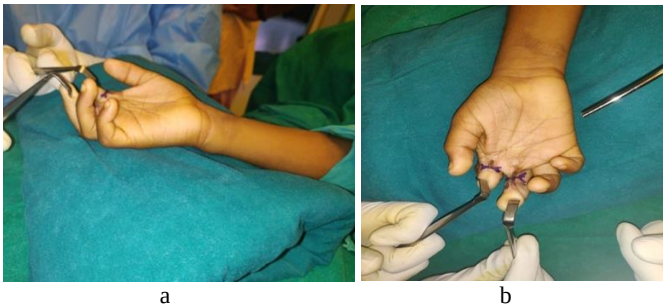
Abstract
All deeper burns i.e. second degree deep dermal and full thickness heals by scarring that causes restrictions in the movements and aesthetics issues for patients. Burn reconstructive surgery requires that the defects after release should be replaced with donor tissues which have matching texture and colour like autologous skin grafting or flap surgeries. Low-level laser therapy (LLLT) has been used in different fields, including healing of, diabetic and pressure ulcers. Here we are using this method to look for role in take of FTSG post burn contracture.Full-thickness skin grafts include full thickness of the epidermis and dermis whereas split-thickness skin grafts (STSG) include the entire epidermis and only partial dermis. The main complication of this procedure is risk of graft failure. LLLT improves tissue perfusion and fibroblast proliferation, with increases in collagen synthesis accelerating wound healing. The purpose of this case report is introducing LLLT as a therapeutic method for accelerating take of FTSG in post burn contracture with better prognosis.

Keywords: LLLT, FTSG, post burn contracture

Introduction
Burn trauma constitutes the second most common cause of trauma-related deaths after vehicular accidents, in both developing and developed country. An extensive burn is the most devastating injury that human being had to suffer. After immediate concern for survival in victim, restoration to pre-injury status, and return to daily activities becomes important for victim and treating team [1]. A healed burn patient may be left with scars with varying degrees of functional issues and cause social stigma among victims.

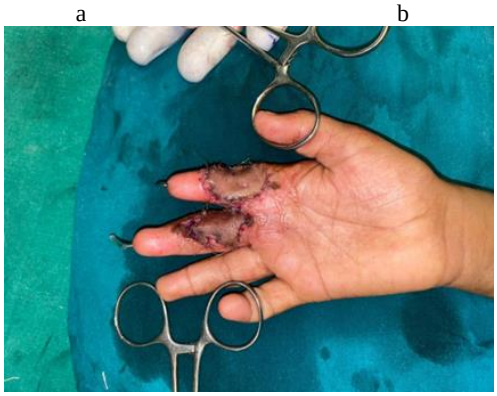
Materials and Methods
This study was conducted in Plastic surgery department in a tertiary care center in the month of September-October 2020. Written informed consent was taken from the patient parents as patient was below 18. The study subject was a 7 year old boy with no known co-morbidities with post-surgical post burns recurrent band like constriction of the right index and middle finger with restriction of daily activities (figure 1). On evaluation of right hand, the thumb, ring and little finger are in extended position. Index and middle finger have flexion deformity with contractural band extending from MCP joint to DIP joint in the index and middle finger. The band is hyperpigmented non-blanching supple with only soft tissue involvement and no bone involvement. MCP joint of all the fingers have normal ROM .Capillary refill time for all fingers <3 sec. Thumb has normal ROM at all joints
Release of post burns contracture with FTSG (figure 2) with LLLT with Autologous platelets rich plasma (APRP) application with K-wire fixation was done. As an adjunct treatment modality LLLT was applied over released site (figure 3). FTSG was harvested from patient groin. We used gallium arsenide (gas) diode red laser of wavelength 650nm, frequency 10khz and output power 100mw, which was 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 FTSG. FTSG was given laser therapy for duration of 125 second every time for 15 minutes (figure 5).



a b

Fig 1

a b



c

Fig 2

Fig 3

a b

Fig 4

Fig 5

Postoperative period was uneventful.

Results

Application of LLLT helped in achieving better FTSG uptake.

Discussions

FTSG works well for reconstruction of burns contracture when performed by experienced team. LLT helps in take up of FTSG 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. LLT has been found to be safe and beneficial in few case reports for uptake of FTSG post burn contracture but randomized controlled trials had yet to be done.

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 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 [4].

As per literature, low-energy photo-emissions 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 [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].
- Liberate mediator of inflammation- histamine, serotonin and bradykinin and hence activate macrophages.
- Regenerate lymphatic vessels.

Conclusions

In our study we found that LLLT was useful in promoting FTSG uptake. The limitation of the study includes that it is a case report with a single centre study with no statistical analysis. Further randomised controlled studies are required to validate the efficacy of the LLLT in the uptake of FTSG post burn contracture.

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