**Role of Low-level LASER therapy** **in Z-plasty**

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Abstract

A commonly done procedure in plastic surgery is Z-plasty. One important complication that the surgeon is worried about is flap necrosis. Various precautions have been described to prevent this complication. There have been various studies done to identify the role of LLLT in local flap survival. We would like to discuss the role of low-level LASER therapy (LLLT) in Z-plasty.

Key words

Low-level LASER therapy (LLLT), Z-plasty

Introduction

Z-plasty, a technique introduced by Denonvillers in 1856, is a common procedure done by plastic and reconstructive surgeons (1). It is the transposition of two inter digitating triangular flaps (1).

One of the most common complication is tip necrosis. This could be due to angle of flaps, the thickness of the flap, the location where it is being done, tissue handling and the surrounding skin laxity. Tension in the flaps can invariably lead to tip necrosis. There have been various modifications described and various precautions explained to prevent this complication.

We have used a low-level LASER therapy (LLLT) during the Z-plasty to prevent this complication. On literature review we have not found any similar reports and we wanted to share our experience.

Methodology

This patient was admitted in plastic surgery deapatment in a tertiary care centre. Our patient, a 24 year female had history of thermal burn following which she developed a band contracture extending across the distal interphalangeal joint crease of left ring finger with apparent defect of 0.5cms and true defect being 0.75cms. Two adjacent Z-plasty with two limbs of 1cm each leading to four transposition flaps were used. Single Z-plasty would require a longer limb length, hence multiple Z- plasty was used.[figure 1]. The little finger was treated by soft tissue distraction using JESS fixator.

Intra operatively, LLLT was given to the flaps. Gallium Arsenide (GaAs) diode red laser with frequency 10 kHz, wavelength of 650nm and output power 100 mW was used. It was a continuous beam laser. Energy density used was calculated as 2.5 J/cm2. This machine give non-contact delivery of laser in scanning mode. The distance between laser source and wound is 60cms. The Z-plasty flaps were given laser therapy for duration of 125 seconds every time [2]. Regular dressing of the suture line done. Regular LLLT was given once every three days [figure 2] for a total of 5 times. Suture removal done on POD-10. Flaps re-checked at 3 weeks [figure3].

Results

All the flaps healed well. No complications noted at 3 weeks.

Discussion

Z-Plasty is a surgical procedure in which there is transposition of two interdigitating triangular flaps. Z-plasty will produce change in direction of scar and also gain in length along the direction of the common limb of ‘Z’[3]. Various contractures like oral commissure contracture, cicatricial bands hindering joint mobility and axillary burn synechiae Z-plasty can be treated by Z-plasty. The angles of the flap can range from 30 to 90 degrees. With angles of less than 30 degrees tip necrosis may be seen. Flaps greater than 75 degrees are difficult to rotate, with increased tension and produce dog-ears as well. Certain defects require variations in the traditional Z-Plasty using unequal flap angles.

One of the known complications of Z-plasty is tip necrosis. This leads to healing by secondary healing and further scarring. There are various methods of prevention including meticulous handling, proper planning and, surrounding tissue laxity.

Our patient has scarred skin surrounding area due to burns for which we planned multiple Z-plasty. As the scar tissue might cause reduced transposition of flaps and the suture line will be in tension and hence, we have decided to use LLLT as an adjunctive procedure to help prevent flap tip necrosis.

LLLT, phototherapy or photobiomodulation refers to the use of photons at a non-thermal irradiance to alter biological activity [4]. The role of LLLT in wound healing is established by various in vivo and in vitro studies. Its role in stimulating hair growth in alopecia has also been widely studied.

There are various mechanisms by which the desired effect is obtained with the use of LLLT. At low dose, proliferation of fibroblasts [5-8], keratinocytes [9], endothelial cells [10] and lymphocytes [11, 12] is shown to be enhnaced. The mechanism of proliferation is thought to result from increase in growth factors due to the upregulation of transcription factors and activation of signalling pathways in mitochondria by photo-stimulation [5, 13–16]. Neovascularization is enhanced , angiogenesis is promoted and collagen synthesis increases with LLLT which aids in acute [17] and chronic wound healing [18-20]. All the properties of LLLT might be put to use in the prevention of complication of local flap failure.

There have been various animal studies done to identify the role of LLLT in local flap survival and it was proven to improve the microcirculation leading to good results [21].

Conclusion

We proposed that LLLT can be used in Z-plasty, as an adjunctive therapy to improve flap survival as it improves microcirculation. However large randomized control trials are required for establishing its role.

**DECLARATIONS**

**Authors’ contributions**

All authors made contributions to the article

**Availability of data and materials**

Not applicable.

**Financial support and sponsorship**

None.

**Conflicts of interest**

None.

**Consent for publication**

Not applicable.

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Photos



Figure 1 Pre op marking for Contracture release of left middle finger

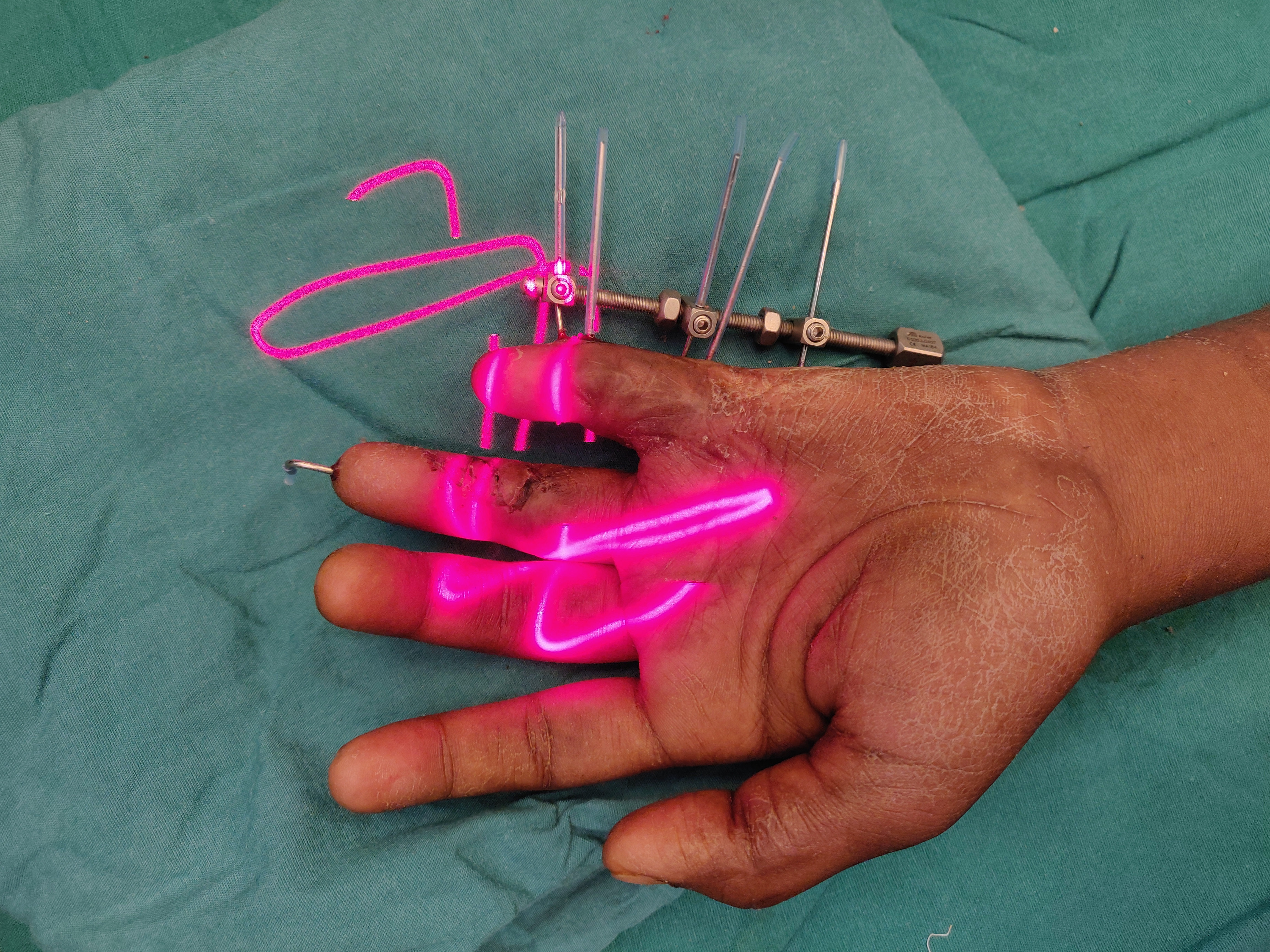


Figure 2 LLLT applied onto the transposed flaps



Figure 3 Post operatively at 3 weeks with well healed scar