Original

Clinical effect of diode laser to improve fair take of the grafted skin

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Abstract

By random irradiation with a gallium-aluminum-arsenide diode laser, ten cases of unexpected multiple hematoma formation under grafted skin found on the 5th to 8th postoperative day showed marked improvement of survival and color match of the skin graft.

To present time no side effects have been noted.

Key words: laser, skin graft, hematoma, irradiation, color match

Introduction

There are to date no effective ways to improve the take of grafted skin once it has been disrupted by the formation of multiple hematoma, particularly if the resulting hematomas are greater than 5 mm in diameter.

It is our policy to leave a tie-over dressing in place until the 5th (to 8th) postoperative day, at which time fair to poor take of the grafted skin may already be observed. Recently, Kami1 and Kubota2 reported increased survival in areas of skin flaps exposed to a low power gallium-aluminum-arsenide diode laser (laser power 15 mw, wave length 830 nm) probably due to an observed proliferation of blood vessels and an increase in blood flow around the irradiated points. Expecting the same biological mechanism to occur, we irradiated grafted skin using a low power diode laser in ten cases
where the quality of take was only fair and found it was successful in improving graft survival. This paper presents our representative cases in details.

**Specification of the diode laser system**

A gallium-aluminum-arsenide diode laser (made by National Electric Company) with the following specifications was used: power 60 mW, wave length 830 nm, irradiation area ca. 0.03 cm² (elliptical), and mode continuous wave (Fig. 1).

![Gallium-aluminum-arsenide diode laser](image)

**Fig. 1** Gallium-aluminum-arsenide diode laser (made by National Electric Company, Japan)
Specifications: power 60 mW, wave length 830 nm, irradiation area ca. 0.03 cm² (elliptical) and mode continuous wave.

**Case reports**

**Case 1**

A 67 year-old male presented with a congenital portwine stain involving the right side of his forehead, upper eyelid and nose. Within the past year, the lesion had become markedly enlarged. He came to our clinic because the upper eyelid lesion obstructed his eyesight and he wanted it removed.
A 67 year-old male with a portwine stain, involving the forehead, upper eyelid and nose.

A) Preoperative view. B) 8th postoperative day with multiple hematoma formations under the graft. C) 12th postoperative day. Some improvement by diode laser irradiation. D) 33rd postoperative day. Satisfactory take of the grafted skin without loss and a good color match despite transplantation from the groin region.
A 14-year-old girl with burn scar on the forearm.

A) Immediately after a split thickness skin graft. B) 8th postoperative day after removal of tie-over dressing. Large hematomas under the graft. C) 27th postoperative day with some improvement. D) 45th postoperative day. Skin graft transplanted from the groin shows a good color match and is well healed except for the spot which healed by scar formation.
Fig. 4  A 50 year-old female with radiation dermatitis on the right of the face.
A) Preoperative view. B) 5th postoperative day. Marginal hematoma was observed. C) 9th postoperative day. Some improvement of the graft is already seen. D) 23rd postoperative day. Complete absorption of hematoma and good color match are obtained.
A 54 year-old female with radiation dermatitis on the left arm. A) Preoperative view. B) 5th postoperative day. Tie-over dressing was removed. Markings are the points of irradiation. C) 9th postoperative day. D) 3 months postoperatively. Good texture match and no scar formation were obtained.
On February 27, 1985, the lesion on the upper eyelid and the nose were removed under general anesthesia.

The wound was covered with a full thickness skin graft from the supraclavicular region. On 8th postoperative day, the tie-over dressing was removed and the grafted skin showed multiple hematoma formations around the margin.

Using the diode laser, the grafted skin was irradiated with 0.5-2.0 J/cm² of energy density on the 8th, 12th, 15th, 19th, 22nd and 26th postoperative days. One and half months after surgery, all crusts had spontaneously dropped off. The graft showed a satisfactory take with good color match (Fig. 2).

Case 2

A 14 year-old female visited our clinic seeking a revision of a burn scar on her left forearm. On March 15, 1985, under general anesthesia, the scar was excised and the wound was closed with split thickness skin graft from the buttock. The skin graft was approximated with 7-0 interrupted subdermal suturing, reinforced with Steri-strips.

On the 8th postoperative day, the dressing was removed and grafted skin showed large marginal hematoma formation. The grafted skin was irradiated with 0.5-2.0 J/cm² of energy density, using the diode laser on 13 occasions (on the 8th, 9th, 10th, 11th, 12th, 13th, 14th, 17th, 20th, 24th, 31st, 48th and 59th postoperative days).

The final outcome showed a good color match and take of the grafted skin, except for one spot where healing occurred with scar formation (Fig. 3).

Case 3

A 50 year-old female with radiation dermatitis on the right side of the face underwent full thickness skin grafting from the supraclavicular region on October 25, 1985. Tie-over dressing was removed on the 5th postoperative day and marginal hematoma formation was revealed. In this case, we irradiated the graft with 0.6 J/cm² of the diode laser from the 5th to 9th postoperative day. On the 23rd postoperative day, hematoma was completely absorbed and good color match was observed. In this case we marked the point of irradiation 1 cm apart from each other on the graft (Fig. 4).

Case 4

A 54 year-old female with radiation dermatitis on the left arm had split thickness skin grafting from the buttock on September 18, 1985. On the 5th postoperative day, tie-over dressing was removed. Some marginal hematoma was observed. Using the diode laser with the energy density of 0.6 J/cm², the grafted skin was irradiated for 5 days. As in case of 3, marking of the radiation point was done prior to irradiation. Satisfactory result was observed at three months' follow-up (Fig. 5).
Diode laser to graft skin

Discussion

We are sometimes surprised to find these unexpected hematoma formations under the grafted skin, particularly after careful hemostasis intraoperatively and the use of tie-over dressing. If hematoma formation is anticipated the dressing will be opened earlier in the postoperative period and if any hematomas have formed they will be mechanically removed at that time. Thus, the grafted skin might be saved. In those situations where the dressing is removed in the usual postoperative period, there is no way to improve the take of the grafted skin except to adopt a wait-and-see policy. It is a well known fact that a hematoma smaller than 5 mm in diameter will not disrupt the grafted skin due to a bridging phenomenon of capillary growth. If the hematoma is larger, it will prove troublesome, especially of located on exposed areas such as the face and hands.

Clinical application of diode laser irradiation to grafted skin showing fair to poor take several days after surgery testified to an improved survival area and a good color match contrary to natural postoperative course in our clinical cases, even though still few in numbers.

The frequency and total time of diode laser irradiation vary in our cases; we have not as yet no definite hard data on the best application of this treatment. Nor do we know the exact mechanism, which is now under investigation.

At present, we feel it safe to say that any application of the diode laser is clinically effective and noninvasive.

Researches of the effect of diode laser on hematoma absorption are being undertaken and findings will be reported near future.

References