

Laser, Ultrasound and Surgery - a Five-Step Combined Procedure for Scar Revision

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ABSTRACT

Cutaneous scarring following trauma or surgery frequently causes patients to complain about pain, soreness, itching, restriction of movement, compromised aesthetic appearance and reduced quality of life. In this case series we propose a 5-step method that can be used for a primary or a secondary procedure (e.g. revision after previous surgery). It consists of excision, wound cleansing with ultrasound, haemostasis improvement, Er:YAG laser deepithelization and wound closure with sutures. We have been using this combined technique for about 10 years with great success and patient satisfaction. In our experience using this method greatly improves the aesthetic outcome in the case of primary surgery or with scar revision.

Key words: Er:YAG laser, scar revision, ultrasound.

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I. INTRODUCTION

Cutaneous scarring following surgical procedures, deep burns or skin trauma is unavoidable.

Patients are frequently concerned about pain, soreness, itching, restriction of movement, compromised aesthetic appearance and reduced quality of life following trauma or surgery [1,2]. In order to achieve the best possible result and patient satisfaction, a surgeon should close the wound with minimal tension, align and evert the wound edges and place the scar parallel to the skin's tension lines. Shortening the time it takes for the wound to close also leads to a better aesthetic outcome. In 1994 Nussbaum [3] showed that ultrasound therapy can improve and shorten healing time. Since then many authors proved the benefit of US therapy [4,5] including this author [6].

Despite our best efforts, some post-operative scars are less than cosmetically appealing. Many different problems can occur such as scar depression or elevation and color or texture mismatch on the two

sides of the scar. In situations like this, a surgeon has many options to choose from when it comes to improving the scar, including topical treatments, intralesional injections, dermabrasion, ablative or non-ablative laser revision, microneedling, cryotherapy, soft-tissue fillers, radiotherapy and surgical revision (excision with meticulous repair) [1,7–12]. A skilled surgeon can improve almost any kind of a scar, no matter if it is many years old or relatively new.

The traditional concept of scar management has seldom considered the possibility of early intervention in cases of cosmetic concerns. Intervention was carried out sooner (2-3 months) only if there was functional impairment [7]. However, the time of intervention does influence the level of improvement that can be achieved, and there has been a paradigm shift in scar treatment, with early intervention now recommended for prophylactic scar prevention prior to maturation [13]. This is in line with what Strauss and Kligman reported in 1956 on the use of dermabrasion to the wound edges to improve the final appearance of the wound [14]. The same was reported by Caver 40 years ago [15].

With the technological advancements in the last 20 to 30 years, ablative laser resurfacing is replacing dermabrasion in order to minimize tissue damage. Some researchers showed that resurfacing can and should be performed intraoperatively directly after placing intradermal sutures [16] or just before the placement of superficial sutures [17] to get optimal results. In this case series we are proposing a 5-step method that can be used for a primary as well as a secondary procedure (e.g. revision after previous surgery). It includes different techniques that have all proven beneficial on their own in order to get the best possible aesthetic results (excision, wound cleansing with ultrasound, haemostasis improvement, Er:YAG laser deepithelization and wound closure with sutures).

II. MATERIALS AND METHODS

Five-step procedure performed in one session:

a) 1st step: Scar or lesion excision

Infiltrative anaesthesia with 4% ultracain applied.

The scar or lesion is excised with a scalpel. The surrounding tissue and/or skin graft are prepared in a way to allow a good approximation of the wound edges and minimal tissue stretching after suturing.

b) 2nd step: Wound cleansing

Antiseptic solution (chlorhexidine or Miramistin) is applied on a sterile cotton gauze ball and placed onto the wound bed. The tip of the handpiece of the ultrasound device (VarioSurg, NSK, Japan) is placed in contact with the cotton gauze ball. Ultrasonic treatment intensifies the anti-microbial action of antiseptics (patent for an invention №2180248 dated 10.03.2002).

c) 3rd step: Hemostasis improvement

If there is bleeding in either the wound bed or wound edges, Nd:YAG laser (SP Dynamis, Fotona, Slovenia) is used to coagulate the blood vessels. In most cases, vessel occlusion can be achieved with one shot of Nd:YAG laser with 140 J/cm², 25 ms pulse and 4 mm spot size, but if bleeding persists more shots can be done. After hemostasis is achieved, mobility of the wound edges should be checked and improved if there is tension when the edges are brought together. If needed, additional dissection of the wound edges should be considered.

d) 4th step: Laser deepithelialization and fractional drilling

Deepitelization is done using Er:YAG laser (SP Dynamis, Fotona, Slovenia) with a circular spot size ranging from 2 to 3 mm, 15 Hz, 7 J/cm² and MSP pulse. Multiple passes until the resurfaced area starts to turn “yellowish” are performed. Fractional resurfacing using the FS01 handpiece (81 micro columns, each around 250 um in diameter), 50 J/cm², and 1 Hz and 3 passes are done so that the resulting coverage is around 15% of the whole area. This “drilling” allows improved tissue fluid drainage and creates a protective pseudo membrane on the wound surface.

e) 5th step: Wound suturing

The wound is closed either with regular interrupted or with subdermal sutures using Ethilon 6-0 and antiseptic, and soothing ointment (e.g. Bepanthen, Bayer Germany) is applied over the resurfaced area. It is important to discourage the patient from removing the pseudo membrane film that forms over the next 24 hours on the area where laser resurfacing was performed.

After about a week, reepithelization will occur from the edges and the wound/scar will start to “sink” into the surrounding. The area should be covered with silicone plaster for the next 1-3 months and protected against sun (SPF 50 cream) especially with skin of color.

III. CASES

a) Case 1

A 27-year-old female patient came to the clinic with complaints about a scar and lesion on her forehead. She had a similar looking lesion at the same place on her forehead about 2 years ago and had it removed at another clinic, but it now recurred. The lesion was elevated, round, about 1 cm in diameter, mobile and painless. A whitish scar was also present on each side of the lesion. A diagnosis of atheroma recurrence was established. A 5-step procedure as described above was performed. Sutures were removed on the 10th day after the procedure, and then silicone plaster during the night for 4 months was recommended. One year after the procedure, considerable improvement of the scar and an absence of atheroma were observed.

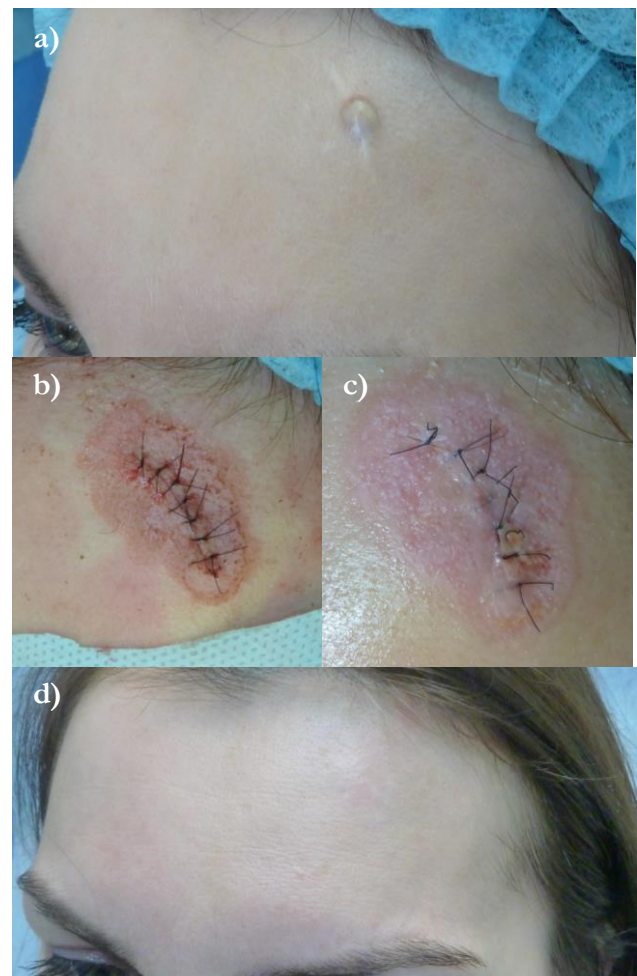


Fig. 1: Patient A, 27 years old: a - before, b - right after the surgery, c - before suture removal (scars “sink” in the epithelium), d - one year after the correction.

b) Case 2

A 24-year-old female patient came to our clinic with complaints of a scar and traumatic tattoo in her facial area, which was a result of a car accident 6 months prior. At that time she received primary

surgical treatment at the emergency department. Upon closer examination a normotrophic scar in the right infraorbital area was noted. The scar was about 1.5 cm in length, had uneven edges, and was partly elevated with fragments of crushed asphalt that presented as a traumatic tattoo.



Fig. 2: Patient B., 24 years old: a - before scar tissue correction, b - right after laser abrasion, c - one year after laser abrasion, d - right after application of the combined technique, e - before suture removal, f - 1 year after the combined correction.

We initially attempted to remove all the scarred and tattooed tissue with a combination of full beam and fractional resurfacing with Er:YAG (Fig 2). The scar improved cosmetically, but there were still fragments of asphalt embedded deeper in the tissue. Therefore, a

second session was scheduled. We used our multi-step procedure and this time excised all of the tissue that had asphalt fragments in it. At a one year follow-up, dramatic improvement was observed; there were no more visible asphalt fragments and scar was barely visible.

c) Case 3

A 37-year-old patient came to our clinic with cosmetic complaints about the scar on her left cheek. The scar was the result of a large perforated wound that was treated at the emergency department after an accident at home. The scar was about 12 cm in length, depressed and poorly mobile. There was also paresis of the left facial nerve (r. Labialis superior). The treatment for this patient consisted of 5 sessions and took about 1.5 years all together. In the first stage the 5-step procedure previously described was performed. In the second stage, 4 sessions of full-beam and fractional Er:YAG resurfacing, subcision and PRP application were performed. Each session was between 1 and 2 months apart, depending on the healing process. A considerate improvement in the appearance of the scar was observed 1 year after the last treatment session.

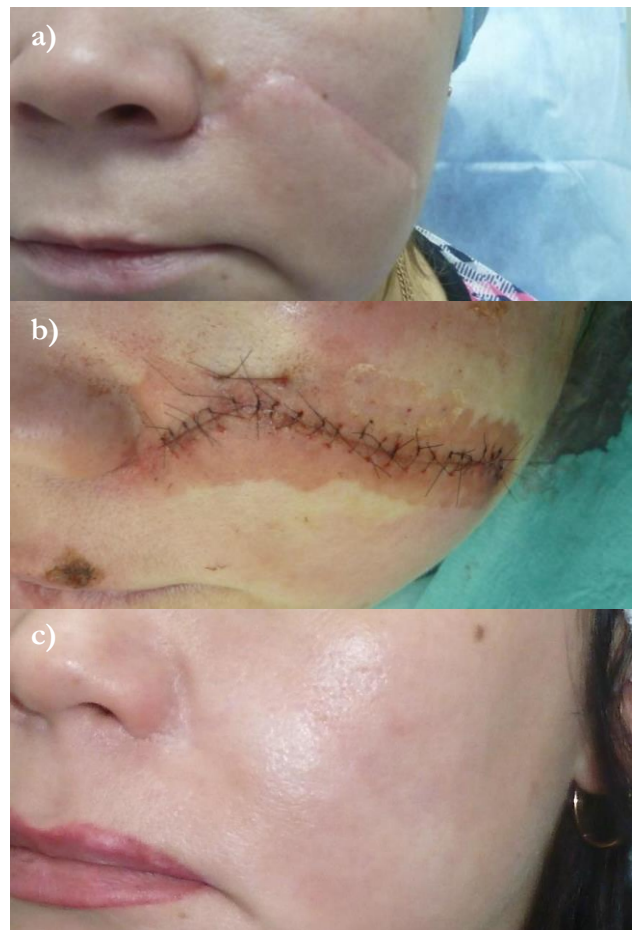


Fig. 3: Patient C, 37 years old: a - before correction, b - right after the surgical excision of the scar, ultrasonic and laser treatment, c - 1.5 years after the start of therapy.

IV. DISCUSSION

Some amount of scarring is inevitable as soon as the epidermis and /or dermis is broken or cut. Throughout history, and in the last few decades especially, surgeons have been trying to figure out and employ many different methods and techniques to optimize the cosmetic appearance of scars. Proper surgical technique (cuts parallel to skin tension lines, perfect alignment of properly undermined wound edges, W or Z plasty, etc.) is the basis for good cosmetic outcomes [1]. Nonetheless some results are cosmetically poor despite the surgeon's best efforts, so additional techniques have to be used. Dermabrasion, chemical and laser peel (resurfacing) have all been used and proved beneficial. Most authors recommend these procedures postoperatively (a few weeks to months after surgery) [1,7,12], but lately based on the works of Kligman [14] and Caver [15], some surgeons have started using various techniques intraoperatively [13,16,17]. However, if the healing time of the wound is prolonged due to, for example infection, the cosmetic outcome might be hindered despite all proper techniques and procedures having been used. In order to prevent wound infection, improve healing and shorten healing time, US therapy can be used [3–6]. We have been using this combined technique for about 10 years with great success and patient satisfaction. According to internal unpublished data, partial dehiscence of the wound happened in about 1-2% of the cases, which may be attributed to inflammation, improper wound after care or forced crust removal by the patient. The disadvantage of this technique is the need for two additional devices, which increases the costs for the surgeon and consequently for the patient. The procedure also takes longer and there is a learning curve in order to get the best possible outcome. Nevertheless, this method can greatly improve the aesthetic outcome either with primary surgery or scar revision.

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