Laserlipolysis

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Diego Schavelzon, Guillermo Blugerman, Anastasia Chomyszyn

48.1 Introduction

Laserlypolysis is derived from the terms laser (light amplification by stimulated emission of radiation), lipo, which refers to fat, and lysis, which means destruction. The procedure consists in using the light emitted by a laser to selectively produce lysis of the fat cell.

In the 1980s, Illouz [1], Fournier, and Fischer presented the traditional liposuction procedure treating fat mechanically. Laserlipolysis like other procedures destroys the fat in situ before it is evacuated from the human body and has been used since 1998. The authors have treated over 2,215 patients with this procedure using a painless ambulatory method and the results have been most satisfactory. Supported by a peristaltic pump that injects the tumescent anesthesia, this procedure benefits both the patient and the practitioner because of its comfortable application.

48.2 Nd:YAG Laser

The Nd:YAG laser is a solid laser formed by a granite aluminum yttrium crystal (the YAG) [2] contaminated with an unusual soil (the neodymium) that emits IR radiation of 1,064 nm. The authors use the EN060 model made by Deka Laser in Italy. It is a pulsed laser with 200-μs pulses. The energy is 30–150 mJ and the frequency is 10–40 Hz. The fluence is 0.3–6.0 W, it is air-refrigerated and controlled by a microprocessor.

This special laser operates by contact because the laser light is transmitted through a 300-μm silica/silica fiber optic. The penetration into soft tissue is approximately 1.4 mm. Because of its low penetration, it does not produce distant trauma, and acts locally, facilitating the progression of a very thin probe.

The laser operates through a twofold mechanism known as selective photothermolysis: photomechanical and photothermal. The photomechanical effect produces mechanical destruction of the fat cell, which can be achieved via coagulation and vaporization because of local heating. The photohyperthermia acts selectively on the proteins in the fat cell membrane producing necrosis by coagulation and denaturalization by the effect of heat on these proteins. The thin cell membrane contains a large vacuole full of liquid lipids that sheds its content into the extracellular space (Fig. 48.1).

The photothermal effect is the destruction of the fat cells that involves rapid thermal expansion [3] and causes violent cavitation from shock waves. This is produced in an indirect manner. When the lipids absorb the laser energy, the light is turned into caloric energy, causing a sudden rise in the temperature inside the fat cell and ending in its rupture.

The fatty emulsion produced remains and it is immediately identified by the immune system in order to restore the damaged tissue [4]. To reabsorb the rest of the fat cells of the oily emulsion, the immune system produces nodular lipophagic vacuoles [5].

Following the levels of triglycerides and cholesterol in the blood of ten patients, we observed no significant increase in the amount of these elements over the 10 days after surgery [6]. Apparently most of the triglycerides are eliminated through the kidneys and the rest reach the liver, where they becomes lipoproteins.

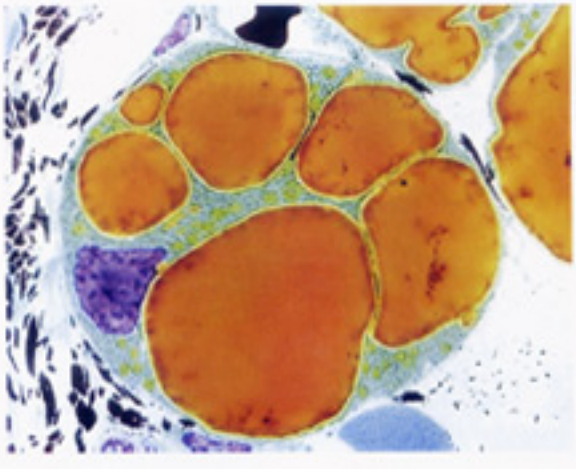

Fig. 48.1. Large vacuoles full of liquid lipids

48.3 Histological Studies

Comparative histological studies were made with the fat that was drained out through cannulas from a patient who gave her consent to be treated in one leg with tumescent liposuction and with laserlipolysis in the other leg at the same surgical time.

In conventional liposuction with tumescent anesthesia, studies show areas of involution of fat tissue with piknotic hyperchromatic nucleus and sectors in acidophilic lysis, with thickening of the cells membrane (Fig. 48.2). In the sample of fat tissue treated with laserlipolysis there was fat necrosis with loss of nucleus and large sectors of total adipose lysis (Fig. 48.2).

In another patient histological studies were performed 30 min after laserlipolysis from a piece of tissue resected in a dermolipectomy. It was possible to observe areas with necrobiotic adipose tissue with accumulation of lipophagic macrophages cells forming granulomatous lipophagic nodules.

Twenty-five days after laserlipolysis it was possible to observe adipose tissue with breakage of the cell walls surrounded by histiocytes with foamy cytoplasm. There were also areas with scar fibrosis, and the nerve threads were intact (Fig. 48.3). The use of the laser causes a destruction of the fat cell specifically protecting the nerves, while in a tumescent liposuction the fat cell is evacuated intact. The remaining tissue is immediately phagocytized by the macrophages and the immune system while fibrosis covers and retracts the empty spaces.

48.4 Surgical Technique

Laserlipolysis is an ambulatory technique supported by tumescent anesthesia. On the basis of the patient's weight, doses of tumescent anesthesia must be calculated up to 50 mg/kg. All patients are treated on an ambulatory basis.

The patient receives sublingual premedication of 2 mg lorazepam 1 h before surgery. In the operating theater 10 min before tumescent infiltration, 1–2 ml of a mixture of medications is given intravenously: 5 mg midazolam, 0.8 mg fentanyl, and 10 mg metoclopramide.

The next step consists of injecting tumescent anesthesia with a solution including [7, 8] 1,000 ml saline solution containing 30 ml of 2% lidocaine with

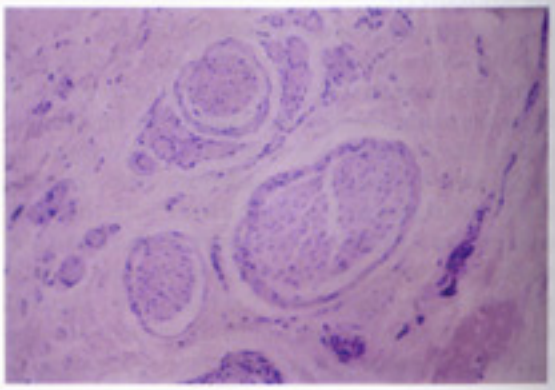

Fig. 48.3. Intact nerves following laserlipolysis (M/E stain)

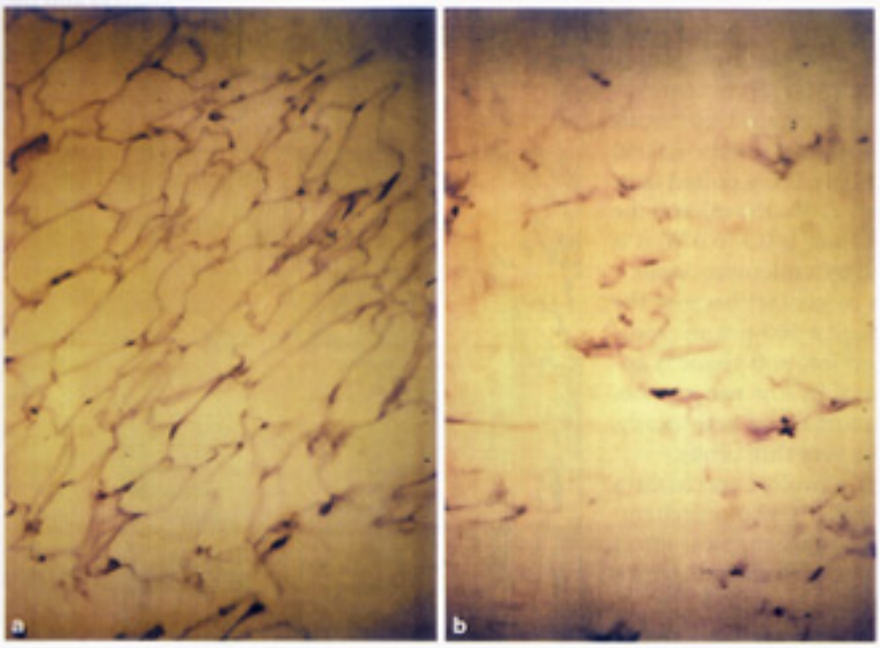

Fig. 48.2. **a** Fat removal without laserlipolysis showing intact fat cells. **b** Fat removed following laserlypolysis showing disruption of the cell walls

patients (Table 48.1). Gynecomastia (Fig. 48.6), double chin, and hump were also treated with this method.

Most areas of the body were treated and most often patients had three body areas treated in one procedure (Tables 48.1, 48.2). Also six to nine areas were treated and a maximum of 4 l of fatty emulsion was drained, always in an ambulatory setting. Complications were infrequent, 0.041% (Table 48.3).

48.6 Conclusions

Laserlipolysis is safe, simple, and seems to be advantageous for the patient and for the surgeon. The advantages for the surgeon are that it softens areas with hard or compact adiposity, which results in less fatigue, less force is necessary, and it also allows a softer and more relaxed surgery. More areas can be treated at the same time with the same physical effort. Correction of secondary flaws is simplified. It provides visual control through transillumination. On the other hand, it is possible to treat areas with little adiposity with less risk of overresection.

For the patient, the preservation of the fibroelastic septum is an advantage. Also fatty tissue selectivity with preservation of the nerves was demonstrated histologically. That implies less postoperative pain because it maintains the innervation integrity. Smaller incisions are necessary and there is better skin retraction in a homogenous manner owing to the delicate tunneling of the laser. Fewer ecchymoses occur.

Because it is an ambulatory treatment, recovery is quicker, hospitalization costs are lower, and no working days are lost. Retraining of the staff is necessary for the adequate use of this technique. Even though the results are promising, more clinical long-term follow-up and histopathologic studies are necessary. Besides it is a new challenge in the treatment of gynecomastia, hyperhidrosis, and cellulite [5], which has already shown good results.

Acknowledgement Portions of this work are reprinted from Blugerman et al. [11]. with permission from the *International Journal of Cosmetic Surgery and Aesthetic Dermatology*, Mary Ann Liebert, Inc.

Table 48.1. Areas and number of patients

Area	Number of patients
Trochanteric	428
Inside of thighs	394
Knees	350
Waist	314
Lower abdomen	281
Upper abdomen	231
Hips	220
Arms	94
Anterior upper leg	74
Back of thigh	48
Back	44
Buttocks	40
Gynecomastia	39
Ankles	26
Arm pits	20
Double chin	20
Hump	5
Breast	4

Fig. 48.6. Gynecomastia treated with laserlipolysis. **a** Before, **b** after

Table 48.2. Number of bilateral areas in each surgery

Surgery	Number of bilateral areas
1	63
2	52
3	160
4	88
5	52
6–9	39

Table 48.3. Complications in treated areas were low (0.041%)

Complication	Number of areas	Complication rate (%)
Seroma	26	0.009
Asymmetry	40	0.015
Hypocorrection	40	0.015
Hypercorrection	2	0.0007
Burn	1	0.0003
Iction	1	0.0003

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Fat Shifting for the Treatment of Skin Indentations

53

Melvin A. Shiffman, Guillermo Blugerman

53.1 Introduction

Saylan [1] was the first to describe a technique called "liposhifting" as a safe and simple method to treat liposuction irregularities. This method moves fat from around the indentation into the depressed area by injecting tumescent solution consisting of 1 l of normal saline containing 1 mg epinephrine and 12.5 mEq sodium bicarbonate. A 3–4-mm Becker cannula is moved in a crisscross fashion through multiple incisions to loosen the fat globules. The fat is then pushed into the defect by rolling a 6–10-mm cannula toward the indentation. A tape dressing is then applied to keep the fat in position. It takes about 4–7 days for the fat globules to become vascularized [2].

53.2 Technique

The area that is depressed and the surrounding elevated regions are marked prior to surgery.

The injection of Klein's solution containing 1 l of saline (or lactated Ringer's solution) with epinephrine, lidocaine, and sodium bicarbonate is not necessary if general anesthesia is use. In that instance a solution of 1,000 ml saline with 1 mg epinephrine is used. Local tumescent anesthesia can be utilized with or without sedation. The solution that is least painful for a patient under local tumescent anesthesia is 1 l of lactated Ringer's solution with 1 mg epinephrine, 300 mg lidocaine, and 12.5 mEq sodium bicarbonate.

The fat is loosened around and under the defect with a cannula by not applying suction and obstructing the open end with the finger or plug. Some cannulas may be more aggressive than the blunter tipped cannula but crisscross and fan-shaped patterns with multiple layers should be utilized. The subdermal tissues in the area of the defect are treated in the same manner as the surrounding fat utilizing tunnels and no sweeping motion. Subcision may be required if there is scar attachment of the skin to the underlying tissues.

Special instruments devised by Blugerman can obtain predictable fat grafts and comprise a spatula (Fig. 53.1) and a tubular "scalpel" with a solid handle (Micro Graft Fat Cutter; Laser Point, Nordkirchen, Germany) (Fig. 53.2). These are produced as reusable or disposable instruments. The spatula is utilized to create tunnels in multiple layers (Fig. 53.3), which can reduce the incidence of hematoma. If more fat mobilization is necessary, the instruments can be utilized again to produce more fat grafts.

Fig. 53.1. Blugerman spatula

Fig. 53.2. Tubular "scalpel" with solid handle (Micro Graft Fat Cutter)

The fat in the surrounding tissues is moved or "shifted" into the defect by rolling a 6–10-mm cannula over the tissues with moderate pressure until the defect is at least flat (Fig. 53.4). Fat can be mobilized by massage maneuvers as well. Blugerman has devised a roller pin that is more efficient in shifting the fat. Absorption of the tumescent solution will result in a loss of any excess fullness within a few days.

The incisions are not sutured. The area is sprayed with tincture of benzoin and then stretch tape is applied around the repaired depressed area to hold the fat in its intended position (Fig. 53.5). A foam pad may be used under the stretch tape to reduce bleeding. Compression is maintained for 24 h. If blisters occur on the skin, the tape should be removed and any open blisters covered with antibiotic ointment daily until the skin has healed. Tincture of benzoin helps to prevent blisters but is not 100% effective.

The patient is placed on antibiotics, administered either orally starting the day before surgery or intravenously at least 30 min before the start of surgery. The oral administration of the antibiotic is continued for at least 5 days postoperatively.

Fig. 53.3. The spatula is used to create tunnels in multiple layers

53.3 Complications

There may be bruising as with any liposuction procedure. Bruising will reduce the amount of fat survival. If the surgeon is too aggressive with the undermining, hematoma can occur.

Blisters from the tape can be irritating to the patient but if treated timely by removal of the tape, there will be no residual scarring or pigment loss. Blisters that are unbroken can be treated with protective dressings and observation. Open blisters are treated with antibiotic ointment.

Infection would be devastating to fat survival and is treated by increasing the dose or changing the antibiotics. Culture and sensitivity may be required if the infection does not respond readily to the antibiotics. This may require needle aspiration to obtain a specimen if there is no drainage. Incision and drainage is rarely necessary.

Undercorrected defects may require repeat lipo-shifting procedures. This can be performed after 3 months, when there is no longer fat reabsorption.

53.4 Discussion

The fat globules or "pearls" receive their new blood supply in 4 days with new blood vessel formation in

Fig. 53.4. **a** Fat shifted with a large cannula. **b** Fat shifted with manual massage. **c** Fat shifted with a large roller

the periphery of the globule [2]. The center of the globule will be reabsorbed. The amount of fat that survives will be permanent after 4 months.

The technique is easy to learn and has not been associated with any major complications. The procedure can be used for any depression, whether or not it is associated with prior liposuction. The depression may need subcision if a scar or fibrosis is involved. The face is not a good area to use liposhifting since there is not enough fat to move into a defect and the underlying bony structure makes shifting more difficult. However, a technique with a small diameter, short tube to roll the fat into place into a small depression may very well be developed.

Reduction of surrounding elevated areas and elevation of depressed areas can be obtained in a single procedure (Figs. 53.6–53.8).

Fig. 53.5. Stretch tape with foam applied around the fat-grafted area of the depression

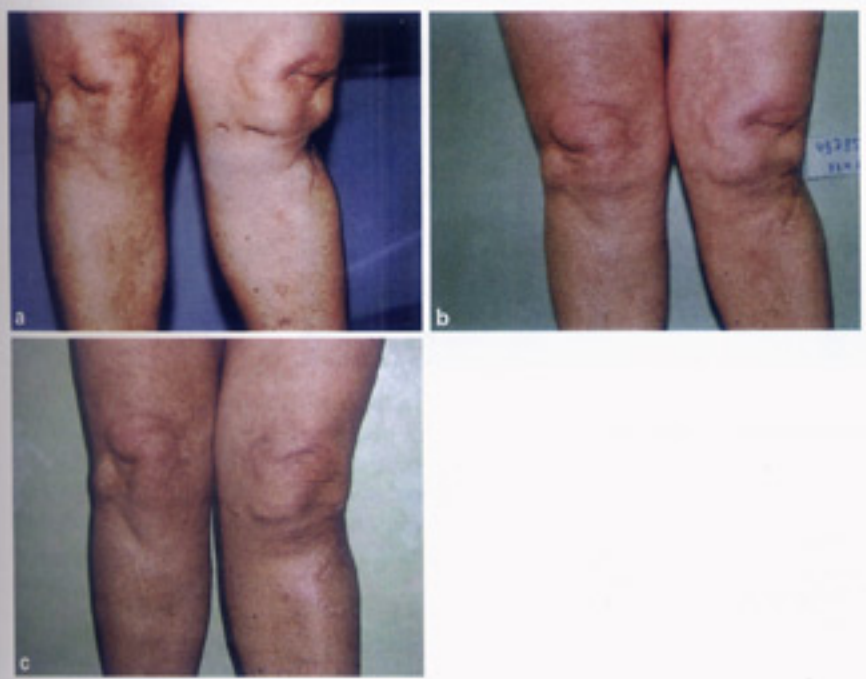


Fig. 53.6. **a** Traumatic depression of the left knee area. **b, c** Progressive filling of defect with liposhifting

Laser-Assisted Suction of Axillary Sweat Glands and Axillary Epilation

Martin Klöpper, Gosta Fischer, Guillermo Blugerman

77.1 Introduction

Axillary hyperhydrosis (sweating) commonly causes discomfort and unpleasant body odor, both of which can lead patients to feel socially handicapped. Current treatment options for this condition leave much room for improvement:

- Conservative treatment with drugs is in most cases unsatisfactory.
- Botox therapy is expensive and only helps for a few months.
- Endoscopic transthoracic sympathectomia bears considerable risks.
- Suction in tumescent anesthesia with a blunt cannula alone is less successful than Botox treatment.

Therefore we set out to find a better treatment for this condition. The general approach tested here was to combine suction treatment with subdermal Nd:YAG or diode laser application in tumescent anesthesia.

All patients agreed to be part of this clinical study, were informed about alternative treatment options, and signed an informed consent form. All surgeries were performed on an ambulatory basis.

77.2 Patients

All patients included in this study (n=64, 36 women, 28 men) had been suffering from hyperhydrosis axillaris for years. All had tried sprays, powders and other conservative options. In most cases, hyperhydrosis began during adolescence, although in some patients the onset was in the early twenties. A total of 154 axillae were treated because some patients with recurrence in 2002 and 2003 had to be treated up to three times. The age of our patients varied between 19 and 61 years with a clear peak in the late twenties.

77.3 Method

Two preoperative appointments for oral and written consent and a sweat test were mandatory. If there were significant medical risk factors a checkup by a general physician was required. Contraindications were similar to the ones for liposuction. An intravenous line or sedation (midazolam) was only necessary in very sensitive individuals and was not routinely administered. It should be noted that both the patient and the surgeon must wear protective glasses during laser treatment!

Axillary hair should not be shaved. We start with a second simple sweat test (iodine/starch) because sweat production may vary (Fig. 77.1).

Significant differences in the size of sweat-producing areas were observed in different patients. One patient may produce high amounts of sweat in an area of around 8 cm^2, whereas another patient may produce the same amount of sweat in an area of 50 cm^2. A remarkable number of patients had less sweat production after the second preoperative talk in comparison with the test just before surgery. This emphasizes how significant the psychological component of unwanted sweating can be.

The area of concern and an additional 5 cm in diameter around the hairy zone is marked with iodine solution (spray) and dried with a hair dryer. Powdering with corn starch follows. Areas of active sweat production turn black and are outlined with a marker pen (Fig. 77.2).

After surgical disinfection of the skin and sterile draping, Klein's solution is infiltrated at about 200–350 ml per axilla with an infiltration pump. There is no need for deep infiltration. The goal of infiltration is anesthesia, firmness of the tissue and constriction of the vessels to prevent hematoma; however, care must be taken to avoid unwanted deep infiltration, as this may provoke a plexus anesthesia of the arms and hands (Fig. 77.3).

Subdermal dissection is performed with a blunt Blugerman spatula. The tip of the cannula is always directed towards the skin (Fig. 77.4).

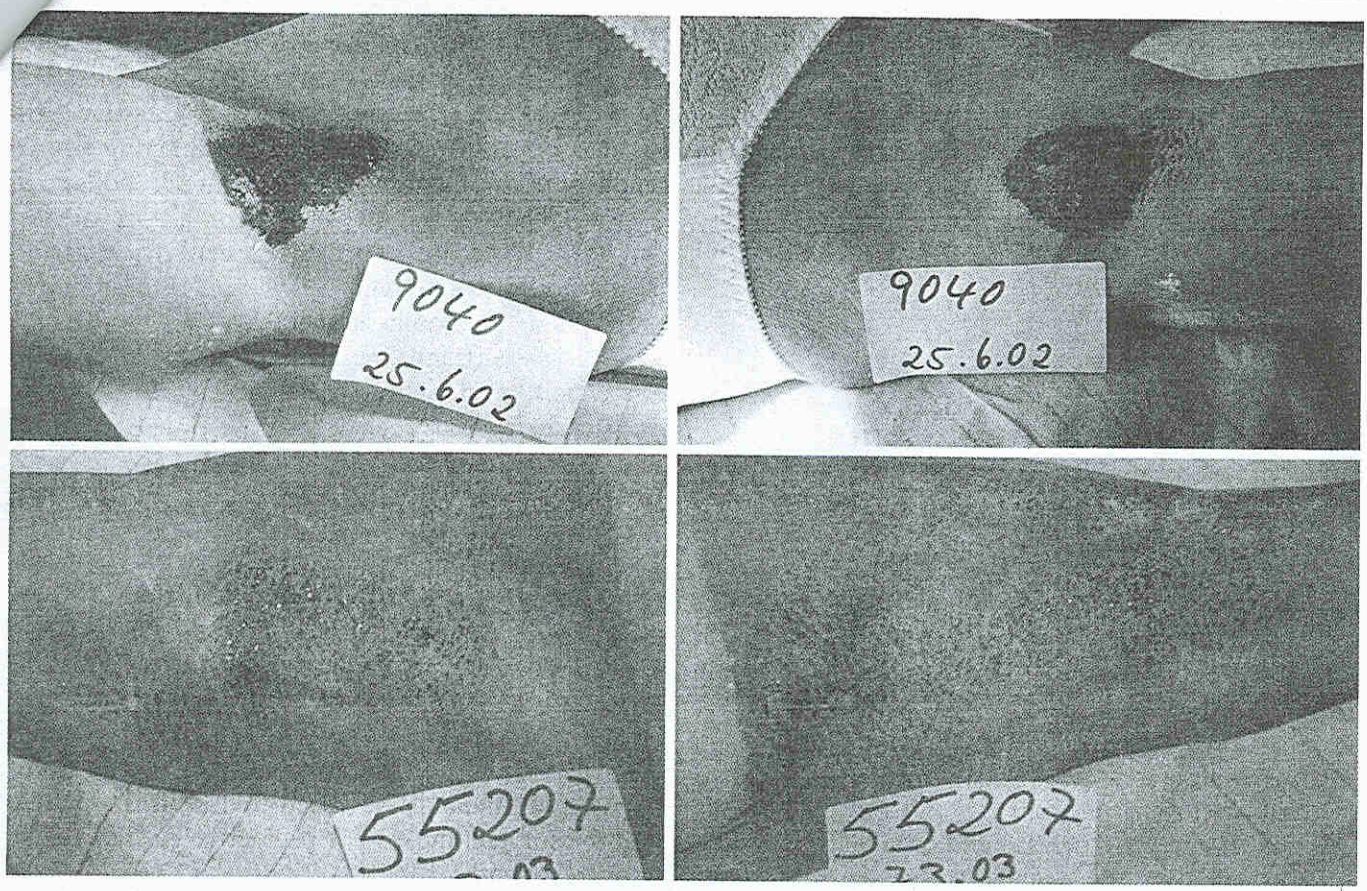


Fig. 77.1. Different patterns of sweat gland distribution. Concentration of sweat glands (*upper*). The scattered type of alignment (*lower*) (iodine/starch test)

Fig. 77.2. Painting the axilla with iodine solution should be done generously so as not to miss ectopic sweat glands

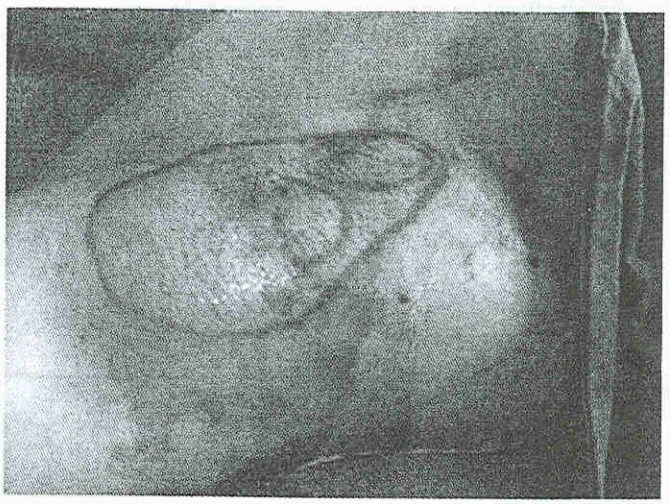


Fig. 77.3. Infiltration of the axilla with Klein's solution. Pronounced tumescence is necessary for laser treatment and suction

From our past experience, plain suction of sweat glands in tumescent anesthesia alone with a blunt common cannula is definitely not an optimal solution. Although plenty of suctioned sweat glands can be found in the aspirate after suction with a blunt cannula, clinical experience and follow-up analysis tells a different story. Even though patients might be happy with the outcome for a few weeks, only a very small reduction of sweat production in sweat tests was seen in these patients several months after surgery with a blunt cannula.

Progress could be achieved by means of a Becker tip cannula with a rough configuration of the edges of the aspiration holes. This type of cannula serves to nick and "rasp" the subdermis in a manner that exposes both sweat glands and hair follicles to the laser treatment that follows suction (Fig. 77.5).

When should rasping of the subdermis be stopped? After subdermal dissection with the blunt Blugerman spatula a thin layer of subdermal fat remains. During suction two fingertips should always be positioned aside the tip of the cannula following the crisscrossing movement from all stab incisions. The skin becomes thinner and thinner. Stop when you feel the rough edges of the aspiration opening of the cannula in between your fingertips.

Afterwards the laser fiber (0.6 mm in diameter) is introduced into a 2-mm infiltration cannula whose tip was cut and fixed by a fiber lock at the proximal end of the handpiece. It is imperative that the tip of the fiber protrudes from the end of the cannula by 2 mm (Figs. 77.6, 77.7).

Should the tip of the fiber slip back into the open end of the cannula, this can lead to intense heat development, which in turn can burn both the fiber and the cannula. Should this occur, bright flashes can be observed under the skin and the laser must be switched off immediately to reposition the tip of the fiber for reasons of safety. Otherwise overheating can occur without any of the desired effect on the sweat glands or hair follicles. This can happen quite often, mainly in cases of recurrence with fibrotic subdermis.

Stab incisions are left open for drainage and are covered with sterile swap pads. The stab incisions are

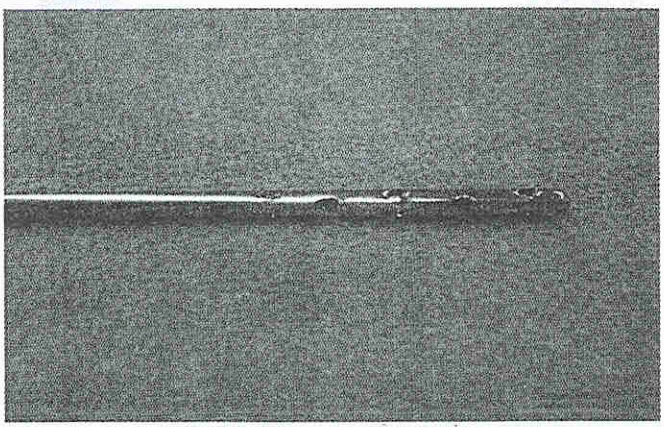


Fig. 77.5. Becker tip cannula with rough suction holes

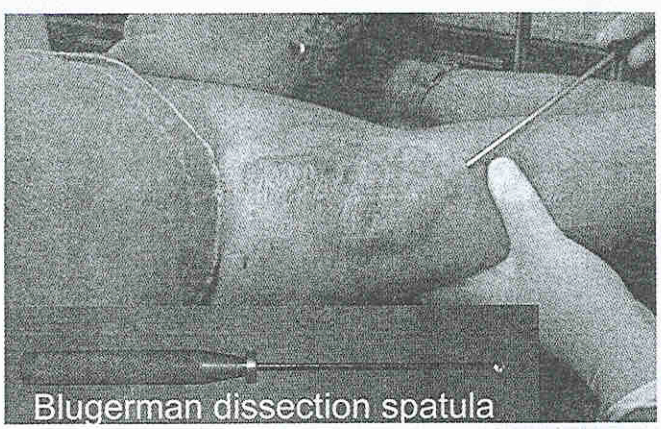


Fig. 77.4. Dissecting the skin from the subcutaneous tissue with a blunt spatula. Blugerman dissection spatula (*inset*)

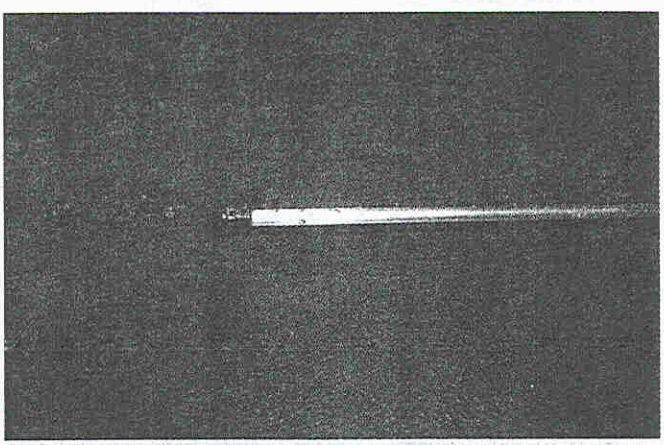


Fig. 77.6. Laser fiber protected in a 2-mm infiltration cannula with cut tip

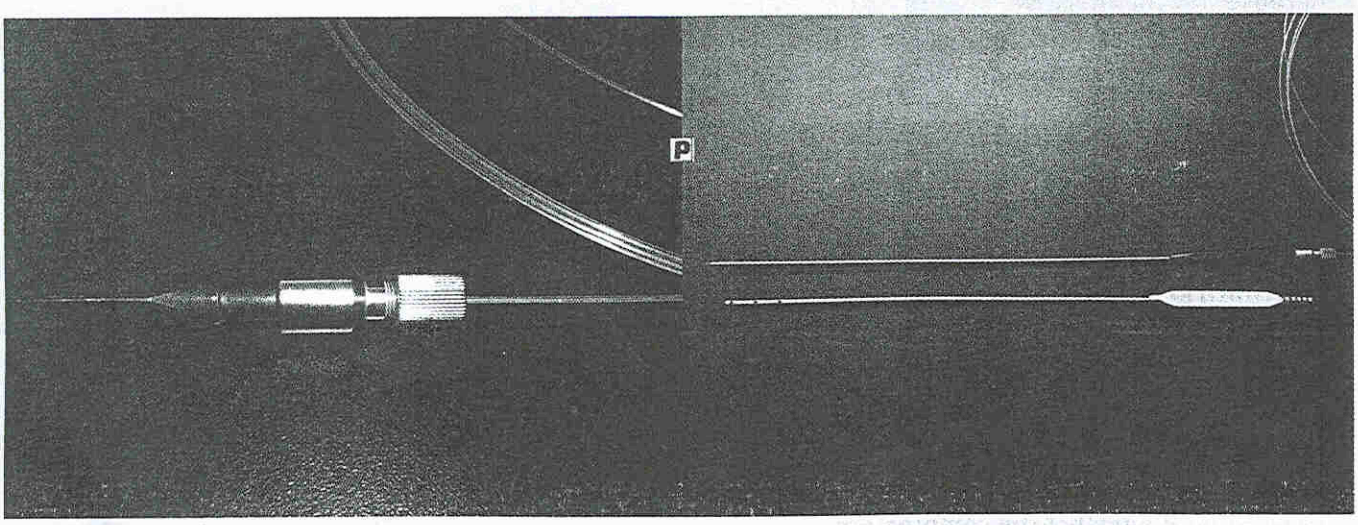


Fig. 77.7. Fiber lock at the proximal end of the infiltration cannula and both cannulas in total view

...losed 2 days postoperatively with waterproof suture strips to allow showering.

Clinical examination as a routine is arranged after 2 days, 1 week, 3 months and 6 months or at any time in the case of trouble.

77.4 Objective for Laser Treatment

Sweat glands and hair follicles are situated in the deep dermal layer (Fig. 77.8).As epilation from "outside" is possible, why not apply a Nd:YAG or a diode laser from underneath to destroy both sweat glands *and* hair follicles?

Our objective is a direct approach for removal of both sweat glands and hair follicles. We started applying 6 W at 10 Hz and an impulse width of 20 ms with an cumulative energy of about 0.5 kJ per axilla. The tip of the cannula was elevated against the surface of the skin from underneath at an angle of about 20–30° and moved around in a crisscrossing manner from at least two—better three—stab incisions (Figs. 77.9, 77.10).

Subsequently we increased the applied energy in increments of 5 W. In every case we took a punch biopsy from each side. Later we took the second specimen 10 days after surgery or later and noted a much more intense destruction of our targets, since histologic manifestation of damage needs time to become visible in sections.

Up to 40 W with an impulse width of 20 ms was applied. The maximum total energy applied per axilla was 7.8 kJ in this phase and the first partial dermal necrosis was observed at 450 J/cm^2 on the right side and at 525 J/cm^2 on the left side in very small axillae. Because of temporary loss of sensitivity the patient did not suffer from pain (Fig. 77.11).

This damage was treated for 4 weeks without further complications or complaints.

Because of the massive rise in skin temperature above 30 W of laser power we introduced a skin-cooling device to prevent further skin damage (Fig. 77.12).

77.5 Laser Treatment *and* Suction or Laser Treatment Alone? Which Approach is Superior?

For a few months in 2003 we studied two groups of patients. Group 1 received laser treatment plus suction; group 2 received laser treatment alone. Specification of the data is in Tables 77.1–77.4 and Figs. 77.13–77.15.

There is no doubt that the combination of suction and laser bears fewer risks, is more comfortable for the patient and renders better results. We stopped laser treatment without suction immediately after evaluating the results of the treatment of the two groups (the data were published at the AACS meeting in St. Louis, 2004).

77.6 Safety Measures

- Air cooled to 5°C was applied from a distance of about 25 cm to prevent damage to the skin.

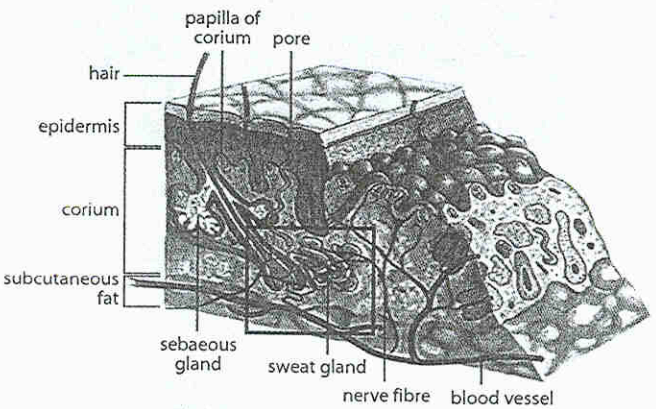


Fig. 77.8. Where is the target of the treatment of hyperhydrosis? The position of the sweat glands and the hair follicles is located in the deep dermis

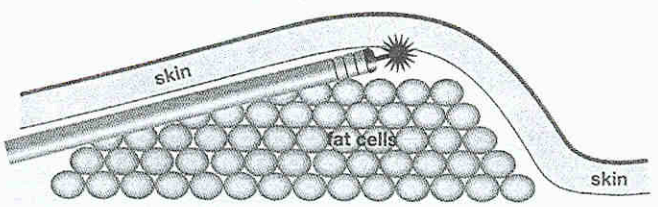


Fig. 77.9. Bare fiber in subdermal position. The tip of the hand piece is elevated, and the skin is struck at an angle of about 30°

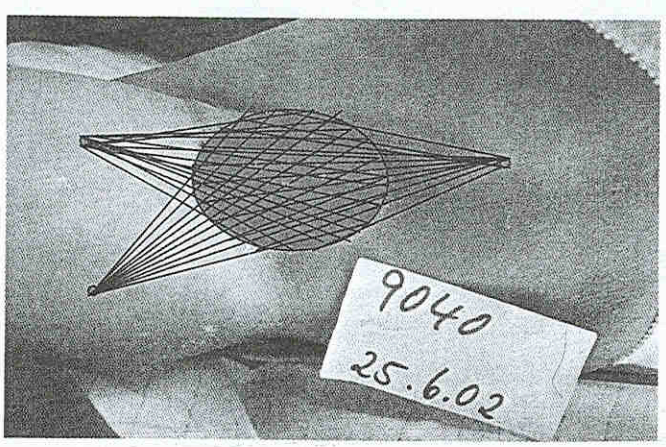


Fig. 77.10. Positioning of stab incisions. No suctioning, no laser application outside the *green ellipse* to avoid irregularities of the surface and skin necrosis

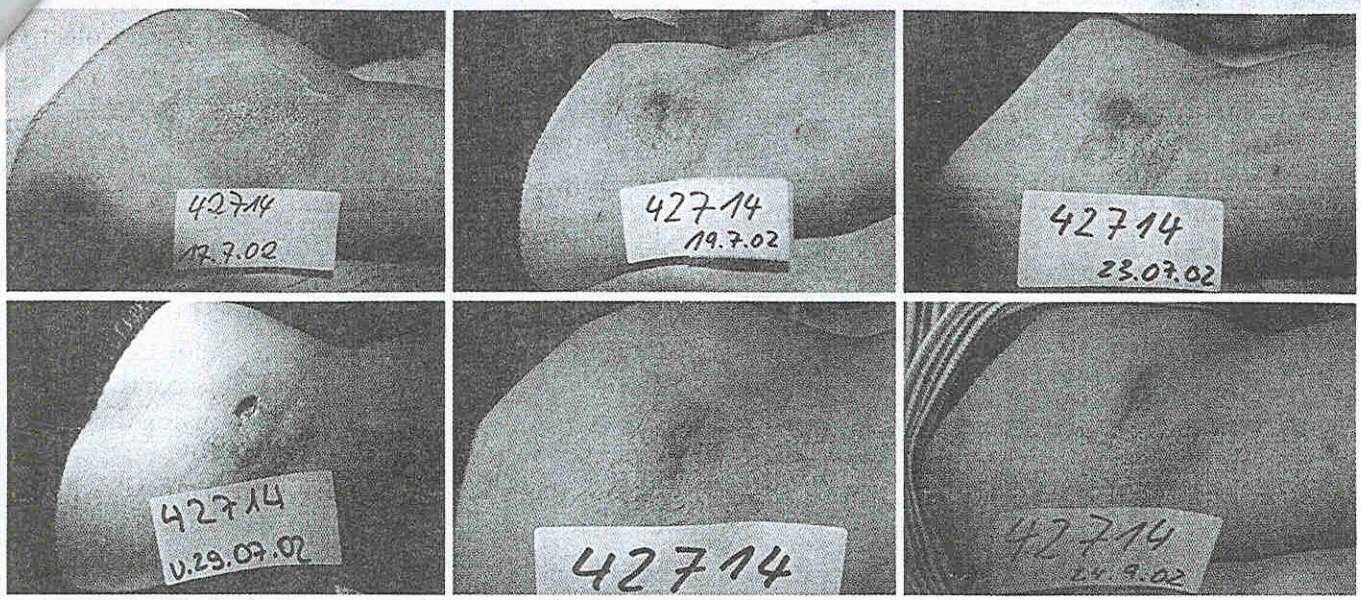


Fig. 77.11. Pitfalls: skin necrosis and healing. First surgery in March 2001, applying 15 W and 1.0 kJ/axilla with limited success for about 2 months. The left axilla is pictured after applying up to 575 J/cm^2. **a** After surgery in March 2002 (2.0 kJ/axilla). **b** Two days after second surgery (4.6 kJ/axilla). **c** Emerging central necrosis. **d** Necrosis after 12 days. **e** Three weeks postoperatively. **f** After 9 weeks

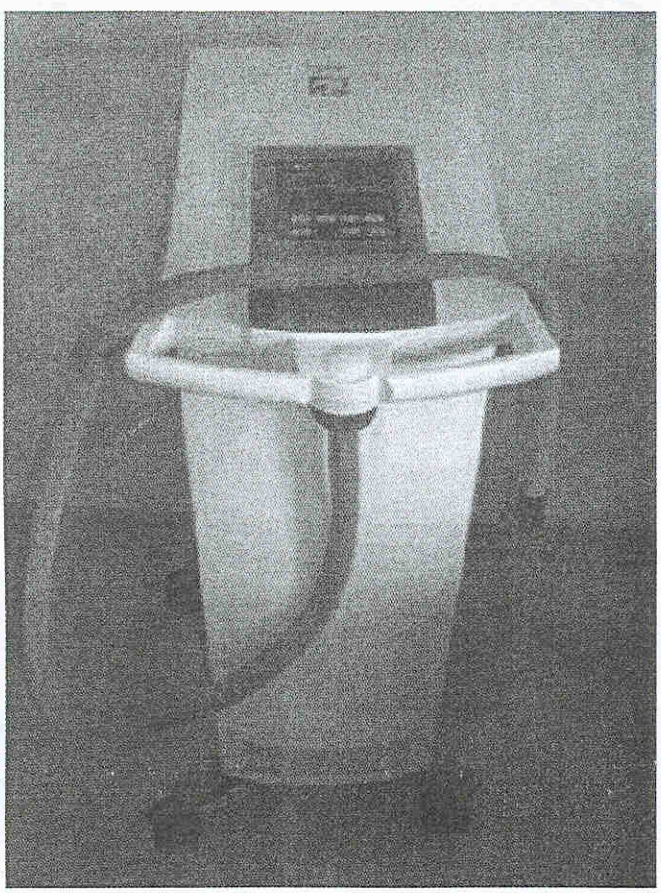


Fig. 77.12. The tolerance of the skin to laser treatment is limited. Skin cooling helped to prevent more damage to the skin

Table 77.1. Patient group information

Group 1: suction and laser	Group 2: laser alone
13 patients	12 patients
12 female, 1 male	8 female, 4 male
Average age 33.4 years	Average age 31.4 years
Standard deviation 9.2	Standard deviation 7.4

Table 77.2. Applied energy per square centimeter (Nd:YAG laser)

Group 1: suction and laser	Group 2: laser alone
98 J/cm^2	142 J/cm^2
Standard deviation 42	Standard deviation 30
Settings	Settings
30 W	40 W
20-ms impulse duration	20-ms impulse duration

Table 77.3. Months since surgery

Group 1: laser and surgery
Mean value of control period 15.5 months
Standard deviation 2.46
Group 2: laser only
Mean value of control period 13.75 months
Standard deviation 3.34

- Another key point was the manner of administering laser energy to the skin. Stab incisions must be placed at least 4 cm away from the outlined area. Lasering should be stopped at the rim of the target area. If you do not do this, you risk skin necrosis next to the stab incision because of cumulated laser

energy next to the incision. The remaining treatment can be administered from the opposite side.

- Laser energy has to be applied only while *retracting* the laser fiber. Applying laser energy while moving the laser fiber forwards can easily cause perforations of the skin. Moreover, as the patient often likes to watch the procedure, she or he must wear special protective glasses, as the risk of injury to patients' eyes is high if they do not wear protective glasses as demonstrated in Fig. 77.16.

Table 77.4 Side effects and complications

	Group1	Group 2
Seroma	1	1
Hematoma more than 25 cm^2	1	1
Small necrosis of the skin	1	3
Restricted mobility of the shoulder for 4 weeks		1
Recurrence of sweating after 1 week		1

There are big differences in the size of the active sweating area that has to be treated. Thus, we measured approximately the size of the "hairy axilla" in square centimeters. Following our experience we decided how much energy per square centimeter should be applied. A simple multiplication of this dose with the number of square centimeters yields the total energy that should be applied. Reliable control of applied energy can only be obtained by using the energy "counter" in the laser control panel.

Less than half of the energy per square centimeter that caused the first skin damage was used in the following cases. Nevertheless we had one partial necrosis of the skin in a Fitzpatrick type 1 patient at 180 W/cm^2.

Safe doses of laser energy per square centimeter should be about 100 J/cm^2 in Fitzpatrick type 1

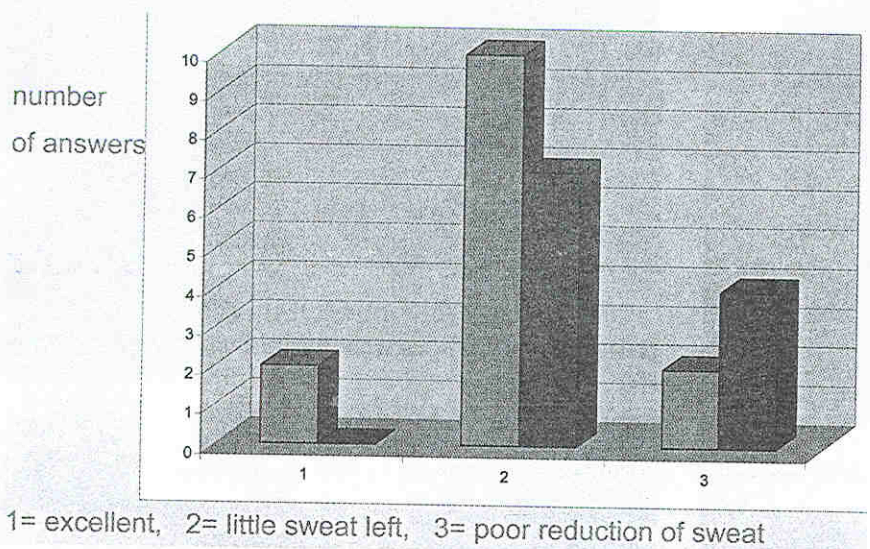


Fig. 77.13. Sweat reduction after 14 months (mean values). Laser and suction, *blue bars*; laser alone, *purple bars*

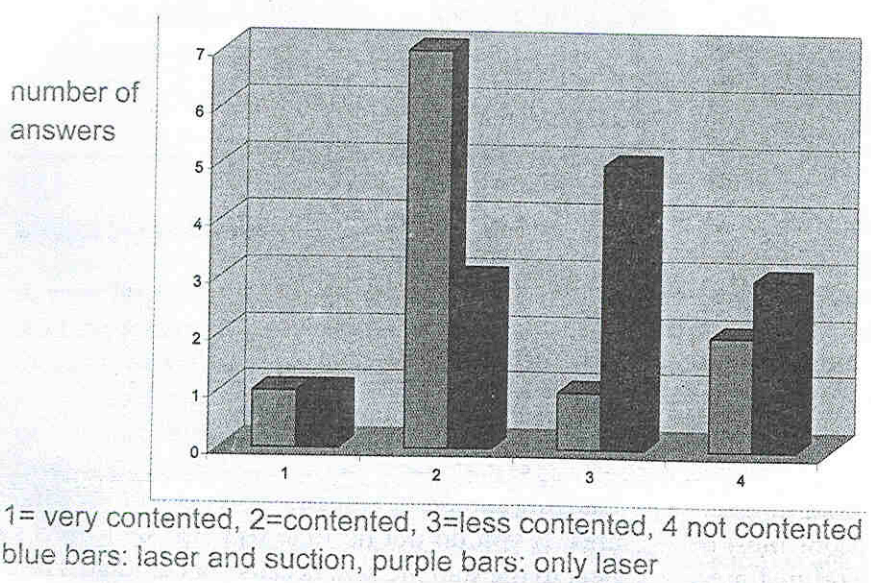


Fig. 77.14. Patient satisfaction postoperatively

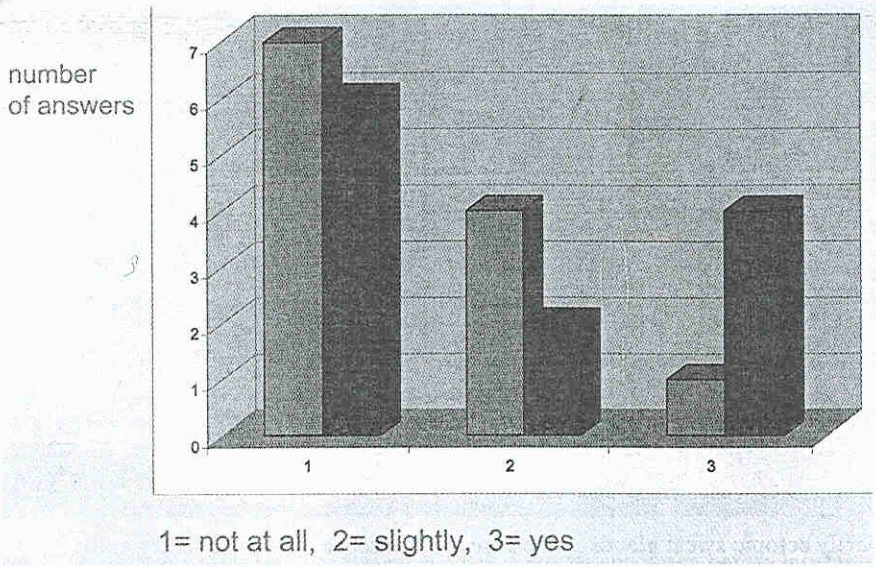


Fig. 77.15. Did surgery bother you? Laser and suction, *blue bars*; laser alone, *purple bars*

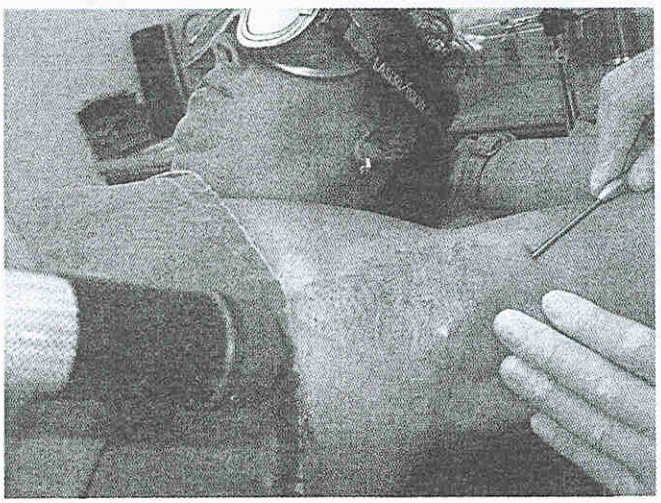


Fig. 77.16. Subdermal laser treatment with protected 0-6-mm bare fiber and cooling of the skin

patients and up to 180 J/cm^2 in Fitzpatrick type 4 patients. While the optimal doses are not definitively established, they represent the current state of our knowledge.

77.7 Ectopic Sweat Glands

A very important cause of recurrence of sweat production was revealed when we started to mark 5 cm more of the axillary skin around the "hairy" area with iodine solution. We found that significant numbers of "ectopic" sweat glands may be located outside the presumed area that were not detected in earlier cases with recurrence (Fig. 77.17).

77.8 Epilation

High energy levels resulted in subtotal epilation of the central axilla. Loss of axillary hair is demonstrated and was often reported by patients (Fig. 77.18).

As mentioned before we used a Nd:YAG laser in most cases. Five months ago we started laser treatment with a diode laser with the same settings of energy application. Three patients have been treated to date, and no complaints or side effects have been reported. The results seem to resemble those obtained with the Nd:YAG laser. Further studies will be performed to compare results obtained with these different types of lasers.

77.9 Histologic Observations

To date, 64 histologic specimens of axillary skin have been examined by G.F. The effect of laser energy is power-dependent. The following histologic observations in sweat glands and hair follicles were made (Figs. 77.19–77.22):

- Intracellular edema
- Intracellular vacuoles
- Desquamation
- Cell rupture
- Destruction

77.10 Clinical Results

Patients treated since February 2002 have reported a decrease in sweat production of 80–90% and subtotal

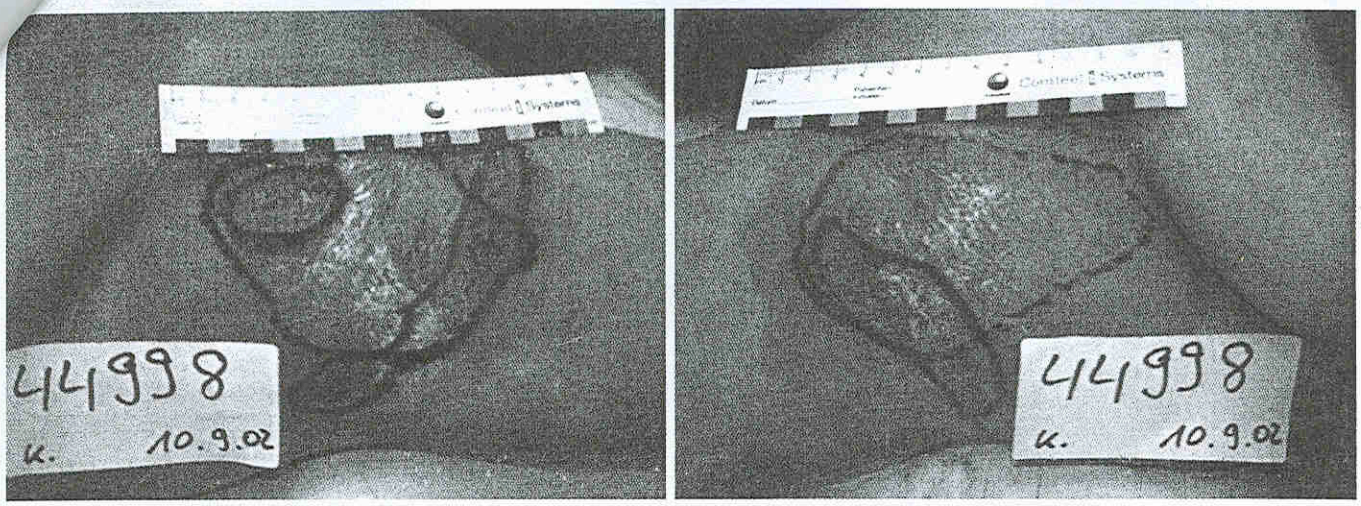


Fig. 77.17. *Blue line*, axillary hair. *Green line*, partly ectopic sweat glands in the case of recurrence outside the hairy axilla

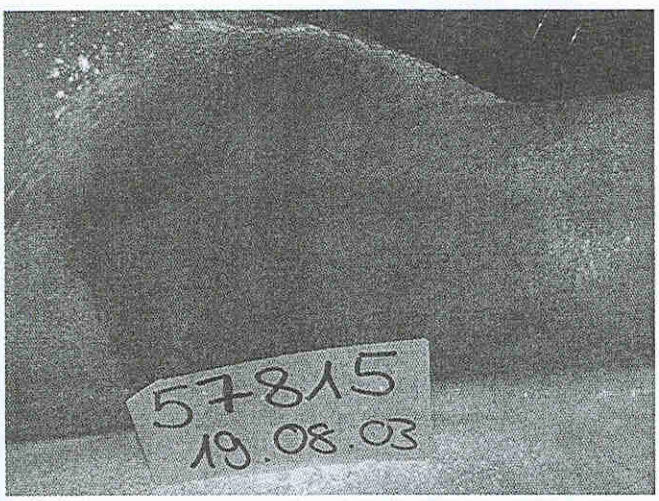


Fig. 77.18. Subtotal epilation of a left axilla 9 months postoperatively

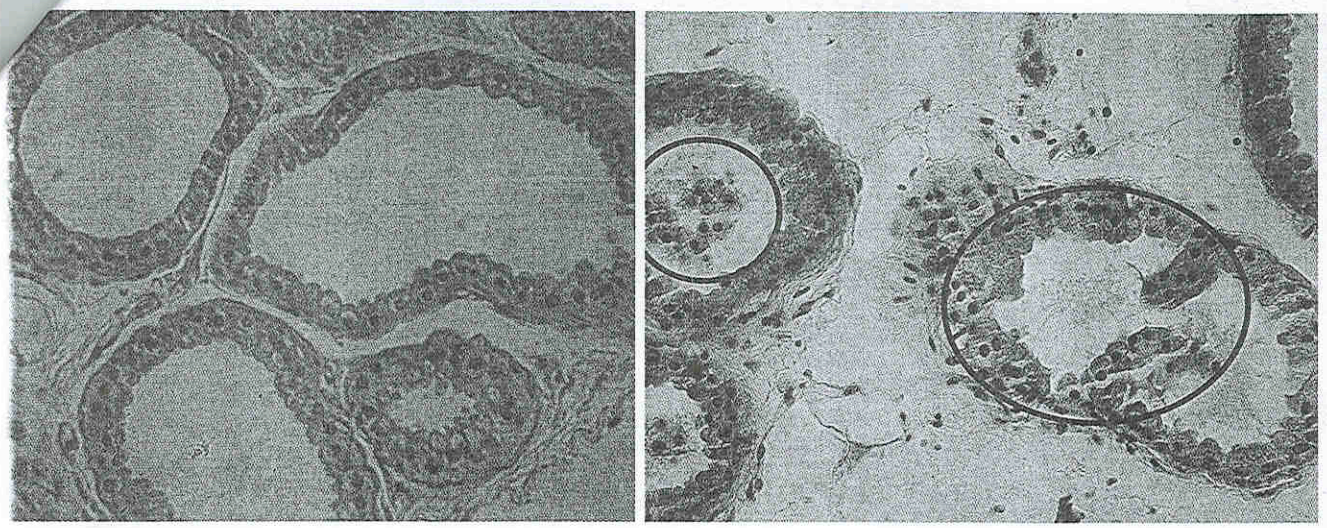
hair removal up to 40 months. These results were verified by examination with sweat tests where possible (n=54) or by a telephone survey (n=58). Six patients were not satisfied with the results of their treatment, perhaps because of the learning curve we had in applying this procedure since February 2002.

77.11 Observed Side Effects and Complications

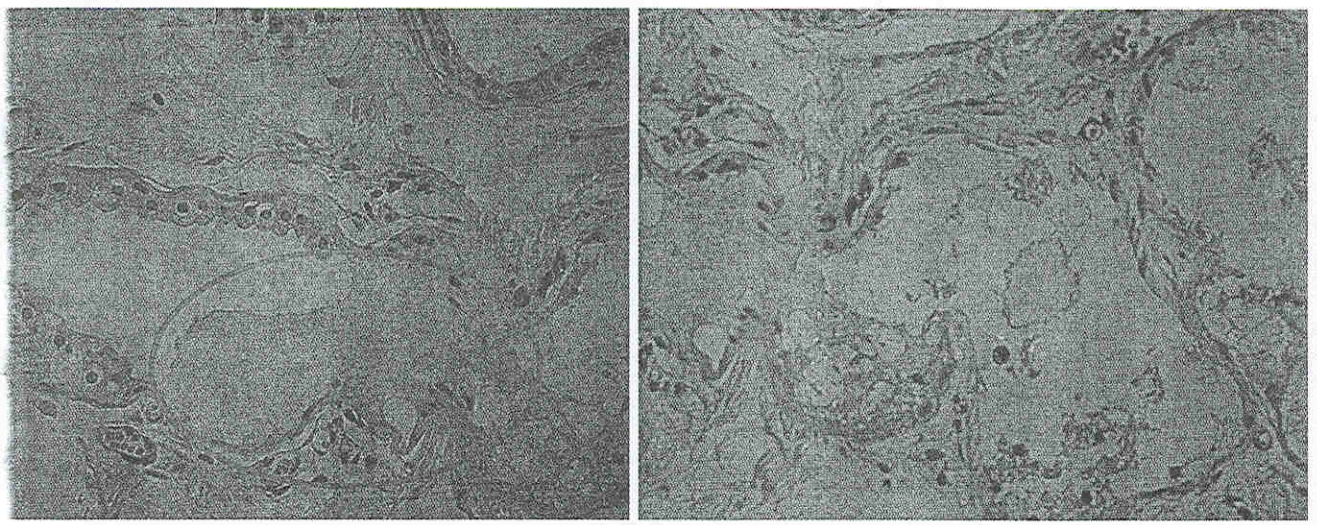
- Partial skin necrosis in four cases (6%) (Fig. 77.23).
- Seroma in six cases needed puncture and evacuation (9%) (Fig. 77.24).
- Subdermal fibrosis (to be treated successfully with subdermal injections of a mixture of 5-fluorouracil and corticoids) (Fig. 77.25).
- Restricted mobility of the shoulder for 4 weeks in one case.
- Recurrence of sweating after 1 week without explanation.
- Lack of sensitivity of axillary skin postoperatively for 4–6 weeks is normal and cannot be considered to be a side effect.

77.12 Conclusions

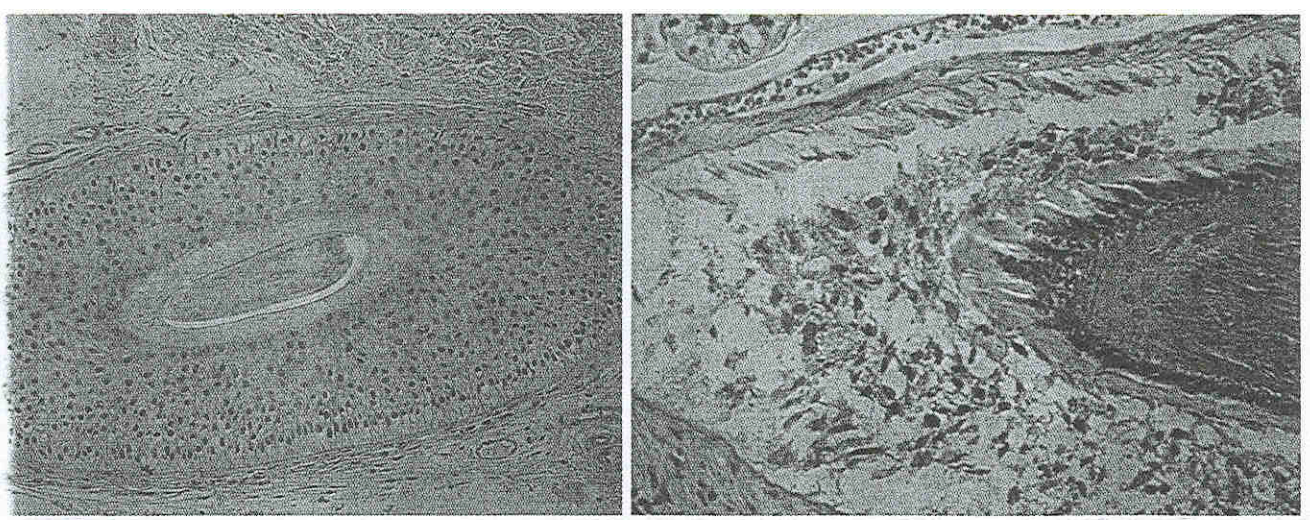
- Suction alone with a blunt cannula or a Becker tip cannula is only helpful for a few weeks and can therefore not be recommended. Indeed, it has proven to be less effective than Botox injections.
- Preoperative painting of the axilla should include adjacent areas because sweat glands may be located outside the presumed treatment area.
- The laser energy that is to be applied should be adjusted according to the surface of the axilla to avoid skin necrosis.
- Cooling of the skin is recommended for treatment of the axilla with high laser energy levels.
- Underskin laser treatment with energy levels of at least 140–J/cm^2 or more leads to loss of axillary hair.
- The safety guidelines outlined in the next section should be strictly adhered to.
- Tissue specimens for histological evaluation should be removed no earlier than 1–2 weeks postoperatively.
- Unwanted side effects seem to be more dependent on the applied laser energy than on mechanical stress to the skin.
- Too many unwanted side effects prohibit further increase of the applied energy per square centimeter of skin.



77.19. Damage after laser treatment at 15 W. Regular specimen before laser treatment (*left*). Desquamation and rupture of the ılar formation in the gland (100 J/cm^2) (*right*)



'7.20. The lower right of the sweat gland is destroyed at 40 W (*left*). Total destruction at 40 W and 150 J/cm^2 (*right*)



7.21. Regular hair follicle (*left*); totally destroyed perifollicular tissue at 40 W (*right*)

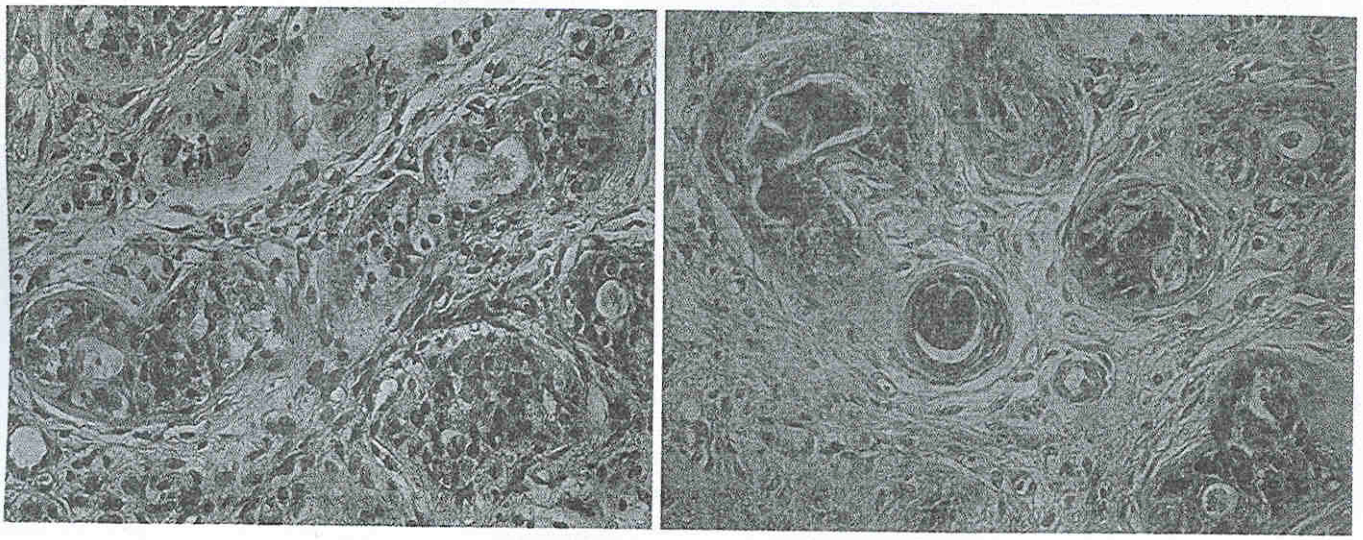


Fig. 77.22. Histological changes at 30 W and 105 J/cm^2 10 days after surgery. Remainder of an acute intraoperative bleeding. Hemosiderin (*left*, *brown*); positive Berlin blue reaction (*right*)

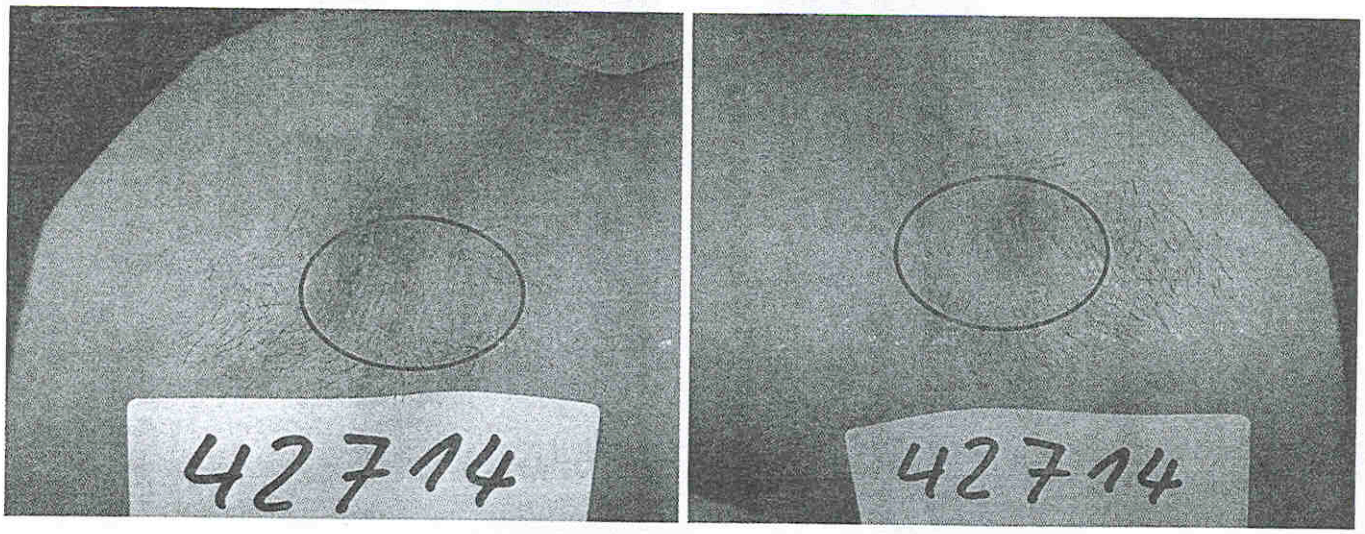


Fig. 77.23. Secondary healing after laser treatment. Note central epilation 2 weeks after surgery

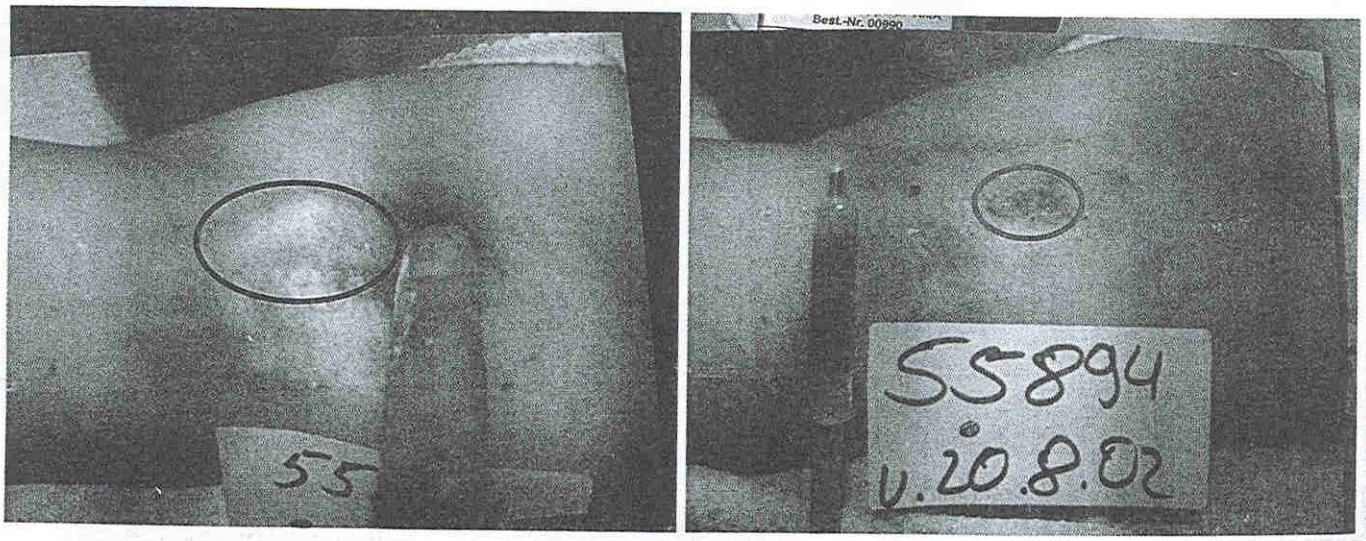


Fig. 77.24. Partial skin necrosis and seroma after laser at 180 J/cm^2 and suction

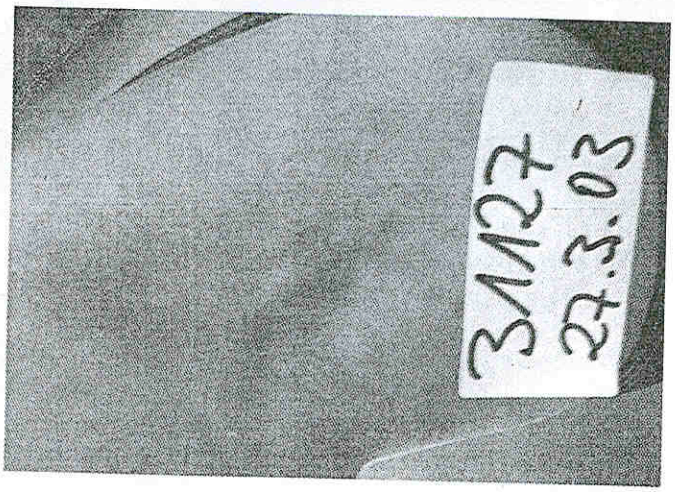


Fig. 77.25. Subdermal fibrotic "string" 3 months postoperatively

Because of the small number of cases in northern Germany a serious statistical evaluation is not yet reasonable. Our evaluation of this novel method is still in progress; however, a substantial number of successful procedures have been performed.

77.13 Safety Guidelines

- Tumescent solution should also be administered in an area extending 5 cm past the circumference of the "target zone."
- Patient and surgeon should always wear protective glasses during the laser procedure.
- Stop suctioning when you feel the rough holes of the cannula in between your fingers.
- Turn off the laser 4 cm before you reach the stab incision.
- Place the stab incision at least 4 cm outside the target area and never suction or laser outside the target area.
- Only switch on the laser when *retracting* the laser fiber, never when inserting it.
- Retract the laser fiber with a speed of about 1 cm/s.
- Cooling of the skin throughout the procedure is mandatory.

Fig. 53.7. **a** Preoperative depressions of medial thighs. **b** Postoperative improvement in the medial thighs following liposhifting

Fig. 53.8. **a** Preoperative defect of the right lateral buttock. **b** Postoperative improvement in the defect following liposhifting

References

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