Subcutaneous Laser Treatment of Axillary Osmidrosis: A New Technique

Kota Ichikawa, M.D.
Muneo Miyasaka, M.D.
Yoshiyuki Aikawa, M.D.
Kanagawa, Japan

Axillary osmidrosis, also referred to as bromidrosis, is a distressing condition that can pose significant social embarrassment, especially in Japan and other Asian countries. Conservative treatments such as topical agents, systemic agents, and botulinum toxin are only temporarily effective and may lead to surgical treatment.[1–3] However, surgical interventions using gland excision or liposuction have associated downtimes and complications that may be unacceptable for the treatment of a benign condition.[1–3]

The following is a report of a new technique for resolving problems in the management of axillary osmidrosis. We describe subcutaneous application of pulsed neodymium:yttrium-aluminum-garnet laser for ablation of the sweat glands.

PATIENTS AND METHODS

In a 1-year period, 17 patients (14 women and three men; age range, 19 to 44 years; mean age, 24.5 years) underwent this procedure for severe bilateral axillary osmidrosis. Five of them also had axillary hyperhidrosis. The procedures were performed by the last author (Y.A.) at the Shonan Beauty Clinic on an outpatient basis with local anesthesia. All subjects gave informed consent for the Shonan Beauty Clinic Institutional Review Board–approved protocol, which was based on the Declaration of Helsinki.

The hair-bearing area of the axilla was marked in the supine position with the arms abducted. Optionally, in a learning period, grid pattern markings with 2 × 2-cm square were used to reduce an uneven distribution of the laser energy (Fig. 1).

From the Department of Plastic Surgery, Tokai University School of Medicine.
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We used the SmartLipo laser (DEKA, Florence, Italy), which is a pulsed neodymium:yttrium-aluminum-garnet, 1064-nm laser system. The laser light is conveyed through a microcannula with a diameter of 1.0 mm into which an optical fiber of 300 μm is inserted (Fig. 2). A 100-μs pulsed laser at 40 Hz and 150 mJ was used for all subjects.

After routine tumescent anesthesia, two small punctures were made with an 18-gauge needle at the anterior and distal border of each axilla. The cannula was inserted into the target layer of the dermal-subdermal junction. Position and depth of the cannula tip were controlled by transcutaneous guidance with a red helium-neon light (Fig. 3, *above*). A larger size of the transcutaneous illumination indicated deeper positioning of the tip. This monitoring was very important to prevent damage of deeper structures such as brachial plexus and blood vessels. The laser was applied to the tissue with repeated cannulation in a criss-cross manner. Exposure was controlled with a foot switch. To ensure that excess energy was not administered in any one location, the laser was only applied with an extracting motion of approximately 5 to 15 mm/second. Explosive sounds of laser exposure indicated the condition and depth of the laser tip. The endpoint of exposure was 200 to 300 J for each grid, depending on the skin thickness and hair density. Cold packs were applied to the treated area to prevent heat injury of the skin during the operation. No suture was needed. The procedure in one side took 5 to 15 minutes. Compressive dressing was applied for 24 hours postoperatively.

RESULTS

Twelve patients were followed over 6 months postoperatively (range, 7 to 11 months; mean, 8.8 months). All of them were satisfied with their results in terms of effectiveness and minimal postoperative limitation to their social activities. Results are summarized in Table 1. Malodor

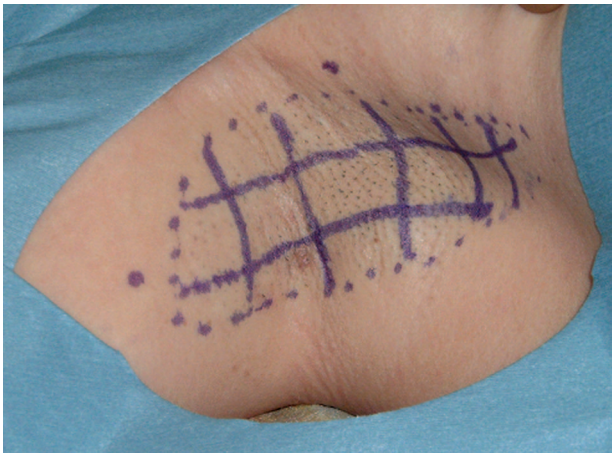

Fig. 1. Grid pattern markings in the axilla.

elimination was graded as either good, fair, or poor. A good result indicates that neither patient nor physician nor persons nearby were aware of malodor. Fair was defined as a malodor much reduced but occasionally noticeable to the patient when sweating. A poor result required that the patient and those nearby were aware of the malodor. Compared with manual shaving surgery, the patients seemed to feel symptom relief early in the postoperative period. Postoperative pain was mild. Ecchymosis usually resolved within a week (Fig. 3, *center*). Skin erosion was seen in two patients during our learning period and healed with conservative treatment. No recurrence of malodor was observed in the follow-up period. Axillary hair remained in most cases, but partial hair loss of the treated area was seen postoperatively, with the degree depending on the laser energy. No hematoma, infections, skin necrosis, or hypertrophic scar occurred (Fig. 3, *below*).

DISCUSSION

A variety of surgical interventions have been used to treat axillary osmidrosis, including manual excision of axillary tissue,[4–14] liposuction,[9,15–20] thoracoscopic sympathicotomy,[21–23] carbon dioxide laser vaporization,[24,25] and ultrasound-assisted suction with skin incision.[16,24,26] Because of a number of potential complications and recurrence, they reported that the use of these techniques should be reserved for only severe cases that remain unresponsive to conservative therapy.[1–3]

The method we reported is axillary application of the laser system used for laser liposculpture, which is a relatively new technique and still under development. Laser lipoplasty with the SmartLipo laser, also called interstitial laser lipolysis, has been reported to be widely used in Europe and Latin America, where the possibility of laser lipoplasty without liposuction was also

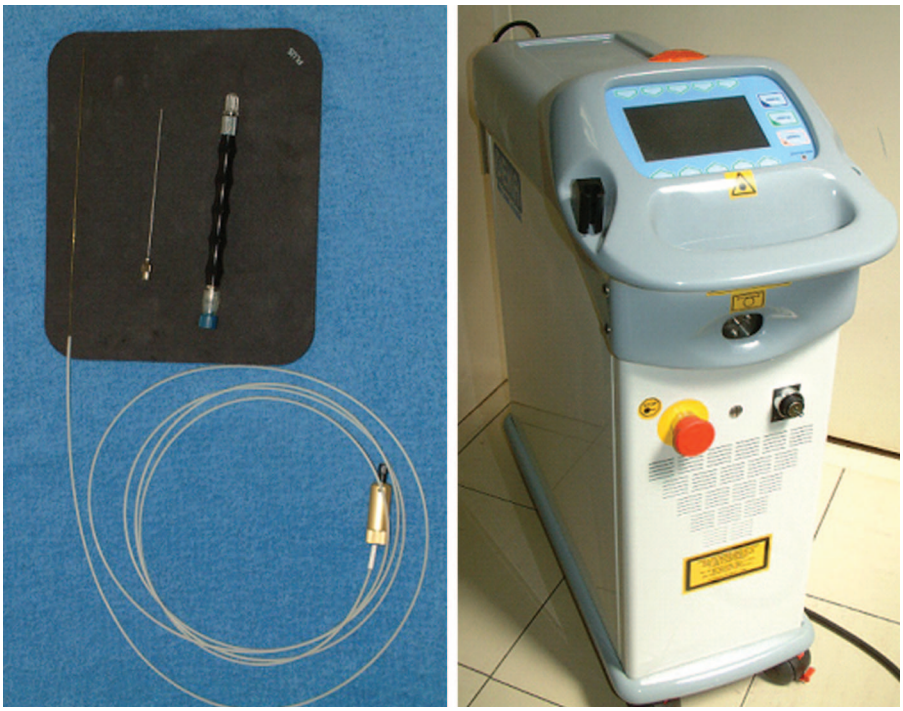

Fig. 2. (*Left*) An optical fiber, a microcannula with a diameter of 1.0 mm, and a hand piece. (*Right*) A pulsed 1064-nm neodymium:yttrium-aluminum-garnet laser apparatus.

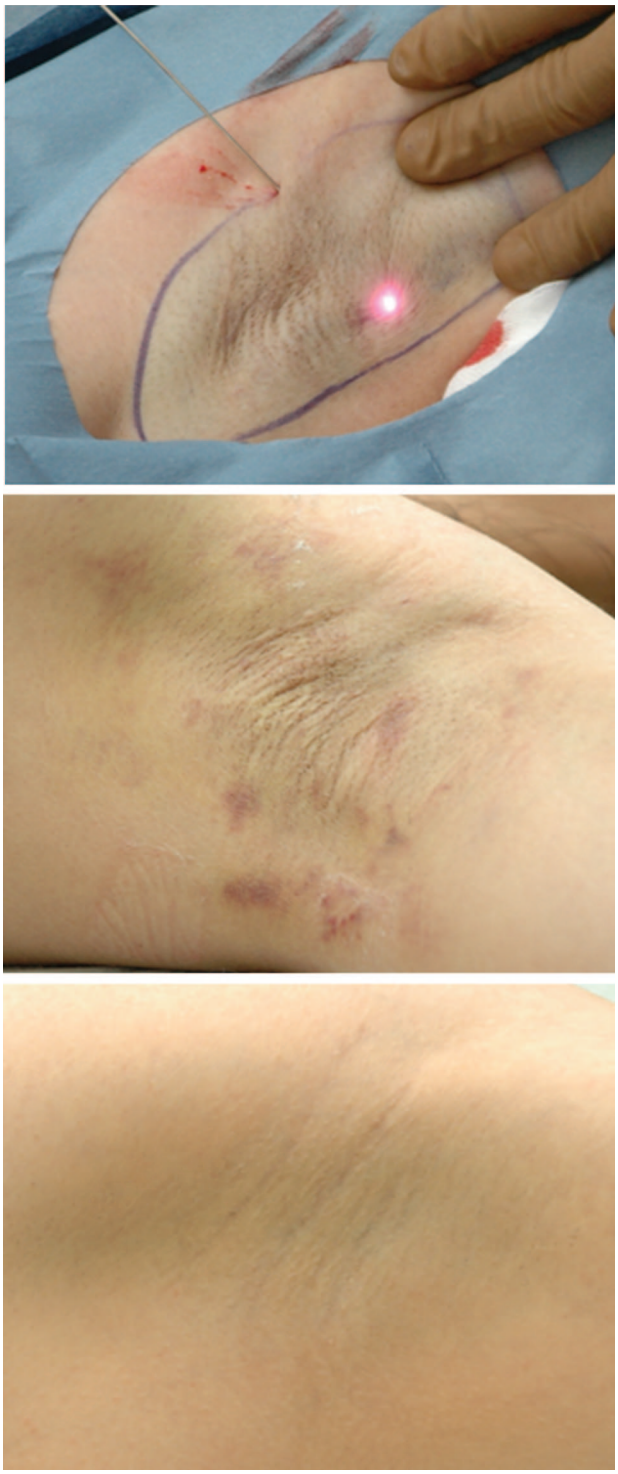

Fig. 3. Subcutaneous laser application to the axilla. (*Above*) The laser light is conveyed through a microcannula with a diameter of 1.0 mm. Position and depth of the cannula tip were controlled by transcutaneous guidance with a red helium-neon light. (*Center*) Ecchymosis 24 hours after irradiation. (*Below*) Result after 6 months.

Table 1. Postoperative Evaluation of 12 Patients

Variable	No.
Malodor elimination	
Good	4/12
Fair	8/12
Poor	0/12
Sweating elimination	
Significant	2/5
Improved	3/5
No change	0/5
Reduced hair	
Much (>75%)	0/12
Moderate (50–75%)	0/12
Mild (<50%)	3/12
No change	9/12
Complications	
Skin erosion	2/12
Hematoma	0/12
Skin necrosis	0/12
Scar contracture	0/12
Shoulder movement limitation	0/12
Brachial nerve injury	0/12

reported.[27,28] The system has recently been introduced in Japan and the United States, but citations in the English language literature are few. The authors recently reported histologic evaluation with scanning electron microscopy,[29] where they observed that human adipocytes were effectively destroyed and tissues were coagulated with laser irradiation. This system is designed to use features of the neodymium:yttrium-aluminum-garnet laser that is conveyed through a small fiber, has tissue permeability, and permits irradiation of the target directly using a skin-penetrating cannula. The high-density energy in short pulses has an explosive effect on atoms within the target tissue. The fine microcannula with a diameter of 1.0 mm is superior to usual cannulas used in liposuction regarding noninvasiveness and fewer complications, especially in treating superficial layers.

Tracing the history of laser liposculpture, Apfelberg introduced laser-assisted liposuction with the yttrium-aluminum-garnet laser beam enclosed in a cannula,[30,31] but clear benefits over standard liposuction could not be demonstrated.[32] Recently, low-level laser therapy has been enthusiastically reported as an adjunct to clinical aspirative lipoplasty by Neira et al.[33] They stated that 99 percent of the fat was released from the adipocyte after 6 minutes of 635-nm, 10-mW diode laser exposure. They also reported 700 cases treated with external low-level laser-assisted lipoplasty.[34] However, in contrast, Brown et al. reported that no adipocyte structural differences were observed between low-level laser therapy and nonirradiated samples in their studies using the same methodology as that of Neira et al.[35]

Kunachak et al. reported external 532-nm laser exposure to axillary osmidrosis,[36] but questions about efficacy remain and this method has not come into common use. Although Kuwahara et al. recently discussed rupture of fat cells using laser-generated ultrashort stress waves,[37] few basic investigations exploring optimal power for fat destruction or effects on sweat glands have been reported. Basic research continues on the laser effect on catabolic activation, softening, and liquefying fat. Although penetration of the cell membrane, destruction, and vaporization may be achieved with high-power lasers, the cost of the equipment and responsibility for use of nonapproved devices should be taken into account. Technically, even energy distribution and local cooling are important for achieving an optimal result and preventing complications such as epidermal damage and recurrence of the malodor.

Ultrapulse carbon dioxide laser treatment for osmidrosis has been reported,[24,25,38] but it is necessary to incise and dissect the skin for laser exposure because of the large handpiece. Also, a high rate of clinical recurrence of osmidrosis after carbon dioxide laser treatment has been reported.

Manual excision, shaving, and ultrasonic suction with skin incision have been reported to be superior in terms of lower recurrence, but skin necrosis and wound dehiscence are major complications.[9,24,39] With manual excision and shaving surgery, one must consider social inconvenience caused by postoperative immobilization and risk of hematoma and infections.[9–12]

Subcutaneous laser treatment seems to be superior with regard to downtime and postoperative immobilization; however, surgeons must remember that direct laser application to the subcutaneous layer has a certain risk of major complications, depending on surgical techniques used. This procedure is surgical. Skin necrosis, hematoma, scarring, and neural injury should be considered and prevented. Speed-controlled laser application, cooling, depth management with a guide light and sounds, and even distribution of energy with grid patterns are fundamental for safe practice. Again, this procedure is surgical and should be performed by plastic surgeons who are experienced in manual surgery of axillary osmidrosis and skin laser practice.

The longevity of the procedure's effectiveness is unknown because this was a short-term study. Some gland tissues may recover from temporal damage and fibrosis, and work again after a year or longer. In terms of tissue removal, combination usage with suction seems to be theoretically more durable for malodor elimination. In a later period of the study, we applied the laser in combination with suction for axillary osmidrosis in other study groups who requested a more effective procedure than laser but with less downtime than excisional surgery. Compared with usual suction, laser-assisted suction in the axilla was more effective, suction was easier, and recovery was shorter. Of course, longer downtime was needed than with laser treatment without suction because of its invasiveness. We need more data to address this issue. Moreover, it is clear that subcutaneous laser treatment has various potential applications in plastic surgery, such as skin tightening of the aging face, among others. Further studies are required for basic research and long-term analyses. With adequate selection of patients, subcutaneous laser treatment can be a new option for treating axillary osmidrosis.

CONCLUSIONS

The trend in cosmetic medicine is noninvasiveness; however, effectiveness and durability are also required. Patients prefer shorter downtime, especially in cosmetic procedures or treatment of a benign condition. Internal subcutaneous laser treatment of axillary osmidrosis is expected to meet this demand. However, the SmartLipo has not been the subject of any controlled clinical studies in Japan and has not been approved by the Japanese government. The cost of the equipment, potential complications, and responsibility for use of nonapproved devices should also be taken into account. The procedure is surgical and should be performed by plastic surgeons who are experienced in manual surgery of axillary osmidrosis and skin laser practice. Histologic and quantitative studies of the effect of laser treatment are required for comparison with other surgical interventions and assessment of the efficacy in combination use. A larger sample is needed for evaluation of the effectiveness on axillary hyperhidrosis. Further investigations are required for basic research and long-term analyses.

Kota Ichikawa, M.D.
Department of Plastic Surgery
Tokai University School of Medicine
Bohseidai, Isehara-shi
Kanagawa 259-1193, Japan
ichikota@is.icc.u-tokai.ac.jp

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