Laser Lipolysis

Fat Melting and Skin Tightening

BY CLIFFORD ALBERT

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According to the most recent statistics available from the American Society for Aesthetic Plastic Surgery (ASAPS), liposuction ranks as the most commonly performed surgical procedure. Given the current obesity epidemic and the global preoccupation with the treatment of excess adipose tissue, it is expected that the demand for both non-surgical and surgical treatments will increase dramatically in the coming years. The ideal device should demonstrate four characteristics. First, the device removes excess fat without damaging the overlying skin. Second, the overlying soft tissue envelope contracts around the area of aspirated tissue. Third, the device is safe and can be used on patients under local, tumescent anesthesia. Fourth, the device results in minimal bruising and swelling, leading to a more rapid return to normal activities.

History of Fat Removal

In 1921, Charles Dujarrier described the use of a sharp uterine curette in a windshield wiper fashion to treat the calves of a Folies Bergeres dancer. The procedure produced successful fat removal, yet resulted in amputation of the limb due to laceration of the femoral artery. In 1972, Temourian, an American surgeon, described a tunneling technique using slender sharp cannulas. The treatment of adipose tissue deposits was plagued by a high complication rate which included bleeding, hematomas, seromas, necrosis, lack of skin contraction and contour deformities. In 1982, Illouz introduced the novel concept of blunt tip cannulae with suction which limited complications. Fournier subsequently incorporated the use of smaller diameter cannulae between 2.4 and 5 mm further improving the technique. However, the most important advance came in 1987 with the introduction by Jeffrey Klein of the Tumescent Technique which revolutionized liposculpture. Utilizing a dilute solution of 0.05%–0.1% Lidocaine with epinephrine resulted in decreased bleeding, more focused fat removal, and a faster recovery. This now strictly outpatient procedure has had no deaths reported when only strict local anesthesia was used.

Further advancements have followed. Ultrasound Assisted Liposuction (UAL) involves the use of a cannula vibrating at 16kHz producing an oscillating sound wave leading to cavitation and cellular fragmentation. Drawbacks include high equipment costs, large incisions, and risk of thermal burns. Power Assisted Liposuction (PAL) (1998), introduced a vibrating cannula. Although less labour intensive than traditional liposuction, it too involved high equipment expense and the vibration produced was transmitted to the surgeon's upper extremity which could cause prolonged discomfort. Realizing the importance of skin tightening resulted in the introduction of Radiofrequency Assisted Liposuction, (RFAL) which combined simultaneous suction with RF for tissue contraction.

In 2003, Blugerman, Schavelzon, and Goldman first described the use of a 1064 Nd:Yag for laser lipolysis. The device utilized a 1 mm laser fibre within a cannula which liquefied adipose cells. Kim and Geronemus, in 2006, using MRI analysis, documented a 17 percent volume reduction, while patients noted a 37 percent reduction at 3 months. They concluded that laser lipolysis resulted in rapid recovery and good skin contraction. McBean and Katz, in 2008, utilized a mixed 1064/1320 nm laser and India ink tattoo maps, demonstrating an 18 percent decrease in surface area. Histological analysis showed new collagen and myofibroblasts, supporting the occurrence of skin tightening.

Current Technique

At the current time, most laser lipolysis technology utilizes 1–2 mm cannulae, through which a 600micron laser fibre is introduced into the adipose tissue. The procedure results in less trauma, less fibrosis, and less bleeding due to coagulation of blood vessels. This in turn leads to less pain with resultant more rapid recovery. Tissue contraction is achieved with a skin temperature of 36–40°C. Histological studies have confirmed the lysing of adipocytes, collagen remodeling and the coagulation of lymph and blood vessels. Considerable debate exists as to the optimal wavelength for laser lipolysis. Morden et al, 2008, compared 980 nm diode vs. 1064 nm Nd:Yag and concluded that the heat level obtained which is proportional to the energy accumulated is more important than wavelength for the lysis of fat and skin retraction. Wassmer et al 2010, compared multiple wavelengths (920, 980, 1064, 1320, 1440) and showed similar tissue

penetration and similar volume of fat destroyed. They estimated that 3750J/4 cm^3 are required for lipolysis. Theorized mechanisms are photoacoustic, photomechanical, or photothermal effects, however the transmission of heat is the primary stimulant for lipolytic and skin tightening effects.

Indications for laser lipolysis include removal of localized fat, lipomas, axillary hyperhidrosis, gynecomastia, facial sagging, and cellulite. Multiple systems have been introduced utilizing either single or multiple wavelengths in combination. Reynaud et al in a study of 534 patients, demonstrated significant adipolysis and skin tightening with average accumulated energy of between 8100 j–24 600 j with larger areas requiring the higher dosages. The procedure involves introducing the cannula and laser fibre in a tunneling fashion through the adipose tissues at a tempo much like a violin bow at about 5 cm/sec which is confirmed via the HeNe beam emitted at the tip and visible through the skin. The adipose cells are methodically liquefied and can be heard sizzling beneath the skin.

Goldman et al, (2009), demonstrated significant lipoma reduction in 20 patients treated with 1064 nm Nd:Yag followed by aspiration, with 4 partial recurrences. Stebbins, in 2011, showed significant reduction with multiple lipomas treated via laser lipolysis.

In hyperhidrosis, Goldman et al (2008), demonstrated excellent symptom reduction in 10 patients. Histology showed necrosis of the eccrine glands.

Laser lipolysis demonstrates distinct advantages in the treatment of gynecomastia due to its ability to more easily penetrate fibrous tissues. Goldman et al (2002), showed that laser lipolysis was significantly better for these especially fibrous areas. This was supported by the work of Trelles et al (2012) who showed both a reduction of gynecomastia and skin tightening.

Sasaki and Tevez, demonstrated effectiveness of 1064/1320 nm in the treatment of facial sagging. This was further confirmed by Holcomb et al, in a study of 478 patients treated with 1444 nm Nd:Yag.

Cellulite, a notoriously difficult condition to treat comprised of pockets of adipose tissues separated by fibrous bands improves significantly with laser lipolysis. DiBernardo, using 1440 nm in a study of 10 patients, demonstrated improvements in the skin's irregularity and elasticity.

Despite the well documented evidence of skin retraction, even more direct proof can be found in a study by DiBernardo (2010), who compared laser lipolysis on the left abdomen vs. tumescent liposculpture on the right abdomen. This study demonstrated 54 percent higher cutaneous retraction on the laser side. Furthermore, Goldman et al using 1064 nm Nd:Yag vs. tumescent liposculpture in arms demonstrated skin retraction of 11.4 percent on the laser treated side. With regards to the necessity of performing aspiration of the liquefied adipose tissue, legislation has mandated that it be performed in certain jurisdictions and not in others. Currently, the evidence does not support an increased risk of complications if no aspiration is performed, as long as the wound sites are left permeable for proper drainage.

Figure:

Patient Selection

As with all cosmetic procedures, proper patient selection is essential. Patients, must be in good general health with good skin elasticity (using pinch test). Patients with liver disease, previous chemotherapy, or anti-retroviral medications are at increased risk due to impaired lidocaine metabolism and toxicity. In addition, SSRI's and anti-fungal agents inhibit cytochrome p450 and can decrease lidocaine metabolism.

Laser lipolysis results in high patient satisfaction and in the author's experience almost all patients would repeat the procedure. Unsatisfactory results are associated with low levels of accumulated energy, unrealistic expectations, and improper indications. Studies have documented retreatment rates of 3.5 percent with laser lipolysis vs. 12–13 percent for liposculpture. Katz et al (2008), in a study of 537 cases, demonstrated no adverse systemic events, 4 cases of superficial burns, and 1 case of local infection (0.93% adverse events).

In conclusion, laser lipolysis is a novel procedure that has a learning curve, yet presents unique advantages. The treatment administration time is longer in duration, than standard liposculpture, but is less strenuous for the surgeon. The equipment represents significant initial investment, yet demonstrates proven skin retraction. As physicians striving to promote the best results for our patients, it is important to present our patients with options that are less invasive, offer more desirable results, and result in faster recovery. A properly informed patient can then decide with the physician what is best. ▲

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