
DISCUSSION & SUMMARY

LipoLite's strongest benefit over other LAL devices is precision control of pulse energy, pulse length and repetition rate. Its SelectPulse technology has variable pulse durations to provide both the photothermal and the photomechanical impact on adipose tissue using less power. Moreover, efficacious treatment is a function of peak pulse power, and no other device delivers the peak pulse power (up to 800 mJ/pulse) that LipoLite can deliver. LipoLite has been designed with both patients' comfort and physicians' convenience in mind. For both patients and surgeons, the main advantage of LipoLite over traditional liposuction procedures is its less traumatic impact on the body. This important feature is brought by the interaction between the laser and the adipocytes causing a liquifaction effect, immediate lipolysis, and an overall reduced number of necessary back and forth movements of the cannula, minor

mechanical impacts and reduced operator fatigue. The laser also has the important added benefits of coagulating small blood vessels and shrinking collagen fibers; which reduce intra- and post-operative bleeding and swelling and induce skin tightening. Overall, there is considerably less pain and downtime in comparison to other liposuction techniques

LipoLite treatment, either alone for the smaller areas or in combination with other liposuction techniques, improves aesthetic results. Patients having sagging skin may benefit from combining LipoLite with Velashape treatment. For many patients who could not previously be treated safely and effectively, particularly those with delicate or fibrous areas that are contraindicated for conventional liposuction procedures, LipoLite treatment is the preferred solution.

REFERENCES

1. American Society for Aesthetic Plastic Surgery. Cosmetic Surgery National Data Bank Statistics, 2007. <http://www.surgery.org/download/2007stats.pdf>
2. Toledo LS, Mauad R. Complications of body sculpture: prevention and treatment. Clin Plast Surg 2006;33(1):1-11.
3. Coleman WP 4th, Hendry SL 2nd. Principles of liposuction. Semin Cutan Med Surg 2006;25(3):138-144.
4. Mann MW, Palm MD, Sengelmann RD. New advances in liposuction technology. Semin Cutan Med Surg 2008; 27(1):72-82.
5. Prado A, Andrades P, Danilla S, Leniz P, Castillo P, Gaete F. A prospective, randomized, double-blind, controlled clinical trial comparing laser-assisted lipoplasty with suction-assisted lipoplasty. Plast Reconstr Surg 2006; 118(4):1032-1045.
6. Suthamjariya K, Farinelli WA, Koh W, Anderson RR. Mechanisms of microvascular response to laser pulses. J Invest Dermatol 2004;122(2):518-525.
7. Schmults CD, Phelps R, Goldberg DJ. Nonablative facial remodeling: erythema reduction and histologic evidence of new collagen formation using a 300-microsecond 1064-nm Nd:YAG laser. Arch Dermatol 2004;140(11):1373-1376.

Laser-Assisted Lipolysis with a 1064 nm Nd:YAG System with SelectPulse™

TALMAGE RAINE, M.D.

Hinsdale Center for Plastic Surgery, Hinsdale, IL

W. TRACY HANKINS, M.D. & SAMUEL M. SOHN, M.D.

Ariana Cosmetic Surgery & Laser Center, Las Vegas, NV

INTRODUCTION

Traditional suction-assisted lipoplasty (liposuction) is reportedly the most common plastic surgery procedure performed in the United States for both men and women, with a total of 456,828 cases in 2007.¹ In spite of various improvements and safety measures, the procedure still carries associated discomfort for both patients and surgeons accompanied by a prolonged recovery. Due to the nature of the technique, it involves vigorous manual operation, considerable edema and hemorrhaging, post-operative pain and patient downtime. Moreover, liposuction sometimes results in significant surface irregularities, clearly an undesirable result for an aesthetic procedure.² There are cases which are clinically contraindicated for conventional liposuction – areas of irregular contour and laxity, areas that are too small for

the operating cannulas, fibrous and cellulite-affected anatomical areas, areas of high vascularity, and areas that have already undergone liposuction in the past.³ Alternative procedures for traditional liposuction include ultrasound-assisted liposuction (UAL) and power-assisted liposuction (PAL), both of which allow removal of large fat volumes with less physician exertion. However, these developments still share most of the disadvantages associated with the classic liposuction procedure. As the demand for body contouring continues to grow, the search also continues for new techniques or modalities aiming to overcome these limitations. Laser-assisted lipolysis (also referred to as lipoplasty),⁴ using a device called LipoLite™, manufactured by Syneron Medical Ltd., Yokneam, Israel, is the subject of this report.

LASER-ASSISTED LIPOLYSIS (LAL) USING THE Nd:YAG: MECHANISM OF ACTION

LAL is based on minimally invasive insertion and movement of a cannula-fiber apparatus in the subcutaneous adipose tissue. During movement the laser energy is conducted via a 550-micron core diameter optical fiber and delivered to the tissue through a 1.2 mm diameter cannula, where it is emitted from the fiber's edge in close proximity to the fat tissue. The combination of energy accumulation in the form of non-specific heating and the cannula movement destroys small areas of fat tissue by coagulation and rupturing of adipocytes.⁵

The 1064 nm optical energy does not have a specific chromophore in the skin and therefore generates non-specific heating. LipoLite acts on tissue water, the fat cells, the extracellular matrix adjacent to it and the microcirculation to produce both reversible and

irreversible impacts on tissue. Two alternate mechanisms mediate LipoLite effects on tissue: 1) A photothermal effect – derived from the absorption of accumulated laser energy (i.e., photothermolysis) heating the tissue from within. 2) A photomechanical effect – derived from very short pulses when necessary, resulting in the conversion of the optical energy to mechanical energy. The demarcated heating that is formed around the fiber's edge results in the following phenomena: 1) An increase in the fat cells' temperature, expanding their volume until the point of membrane rupture and reducing the viscosity of cell membrane and cell content. This phenomenon renders the fat cells more vulnerable to the mechanical impact and shear stress induced by the cannula's motion, further facilitating both the movement of the cannula and the aspiration. 2) Coagulation of

broken capillaries, leading to reduction of bleeding, fewer hemodynamic repercussions, less edema and less overall trauma.⁶ 3) Shrinkage of adjacent collagen fibers in addition to long-term collagenesis and synthesis of elastin fibers due to local inflammation and wound repair processes in deeper dermal layers which lead to tightening of the overlying skin.⁷ Overall, LipoLite's

mediated photomechanical and photothermal effects result in the reduction of small, unwanted areas of fat in comparison to traditional liposuction, UAL, PAL or LAL with other devices. The process involves a very limited downtime and also leads to tightened and contracted skin, representing some of the major advantages of this procedure over other liposuction techniques.

LIPOLITE – DESCRIPTION OF THE DEVICE AND THE PROCEDURE

Syneron's LipoLite is a stand-alone, compact and lightweight surgical laser system, composed of: a system console, which is operated with a footswitch for increased safety, and a control panel with a user-friendly interface. The system includes an ergonomic handpiece and a fiber support mast to further increase user comfort during treatment. The laser fiber is inserted from the proximal end of the handpiece and passes through it until protruding 1-2 mm from the cannula's distal end at the front of the handpiece. From a 550 µm diameter fiber (which enables the use of a 1.2 mm diameter cannula), the 1064 nm Nd:YAG laser energy is delivered into the tissue with energy of up to 800 mJ per pulse at a repetition rate of up to 50 Hz and power of up to 12 Watts on tissue. Notably, LipoLite offers the highest level of pulse energy at a peak power of 800 mJ among existing LAL devices, resulting in faster tissue heating and therefore shorter treatment durations. The use of different pulse modes (producing photothermal and photomechanical effects) also assist in enhanced treatment.

The LAL procedure aims to achieve high levels of patient comfort through the use of local anesthesia and a small incision. Common areas for LipoLite treatment are buttocks, hips, knees, thighs, flanks, abdomen, back, arms, axilla, gynecomastia, submental and other facial areas. Following the initial tumescence procedure, the cannula-fiber apparatus is inserted into the anesthetized

skin through the incision hole. The aiming beam at the end of the fiber enables the operator to determine the exact subcutaneous location of the distal end of the cannula. The cannula is moved back and forth in the fat layer as the laser emits optical energy directly to the target tissue. The device has been designed to optimize the treatment in each layer with its unique SelectPulse™ technology. SelectPulse features shorter pulses with lower energy of 50 Hz and 270 mJ (photomechanical impact) that are used when treating very deep layers or resistant (fibrous) tissues, while pulses of longer duration and higher energy such as 15 Hz and 800 mJ (the previously discussed photothermal effect) should be administered as a second pass to deeper layers or to more superficial sub-dermal layers. Following this step, aspiration is generally performed with a cannula that is at most 3 mm thick so that it does not cause mechanical damage.* The standard post-liposuction care applies to this procedure as well, although there is very minimal downtime, if at all, and limited bruising or edema. Patients are usually seen for follow up within a week after treatment, at which time some skin shrinkage is already apparent. Several weeks or even 2-3 months later, further improvement in skin tightening and texture is observed, particularly if the LAL procedure is followed by treatment with a non-invasive contouring device like VelaShape™, especially in patients with sagging skin; for example, in post-partum abdominal areas.

CLINICAL CASES

Case 1: A 43-year-old woman was interested in moderate abdominal fat removal and was found suitable for LipoLite treatment (Figure 1). Treatment was done using short low-energy pulses in the deep plane (6,000 J at 50 Hz and 240 mJ per pulse) and long high-energy pulses in the superficial plane (6,000 J at 15 Hz and 800 mJ per pulse), with a total energy administration of 12,000 J and fat removal of 1,400 cc. One week following treatment, the abdomen is flatter and the skin does not appear to sag; the patient was pleased with the results, and reported feeling a tightening sensation without any post-operative discomfort or complications.

Case 2: LipoLite treatment (6,000 J at 15 Hz and 800 mJ per pulse and 4,000 J at 50 Hz and 240 mJ per pulse) was performed on a 26-year-old woman for removal of relatively small fatty areas in her flanks. Overall, 10,000 J of energy were administered to both sides and 2,200 cc of fat were removed. A shapely appearance and lengthening of the waist area can be seen one week following treatment (Figure 2). The patient had no downtime following the procedure and was very pleased with her new proportions.

Case 3: LipoLite was chosen as the optimal treatment for a 43-year-old woman with skin sagging and some accumulation of fat pockets in the neck and jowls region. Treatment was administered using long pulses (15 Hz), but with only 600 mJ per pulse since the treatment area was smaller and the heat accumulates faster. A total of 5,000 J (3,000 J at 15 Hz and 600 mJ per pulse and 2,000 J at 50 Hz and 150 mJ per pulse) of energy were used with 30 cc of fat removed. A week after treatment (Figure 3), the patient already sensed some skin tightening in the treated area, yet there was still some edema, but no bruising was observed, which is notable considering the vascularity of the treated area.

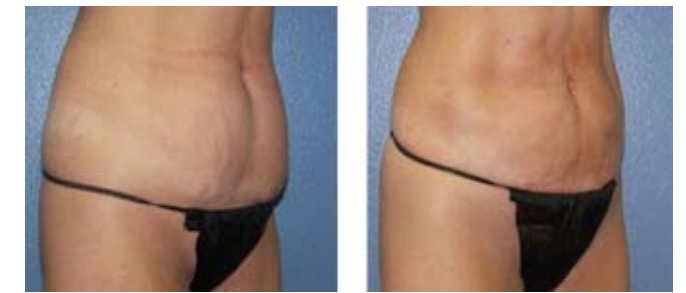


Figure 1: Post-pregnancy abdomen with fat and sagging skin before (left) and one week after (right) a single LipoLite™ treatment followed by aspiration. Photos courtesy of Tracy Hankins, M.D.



Figure 2: Flanks before (left) and one week after (right) a single LipoLite™ treatment followed by aspiration. Photos courtesy of Samuel Sohn, M.D.

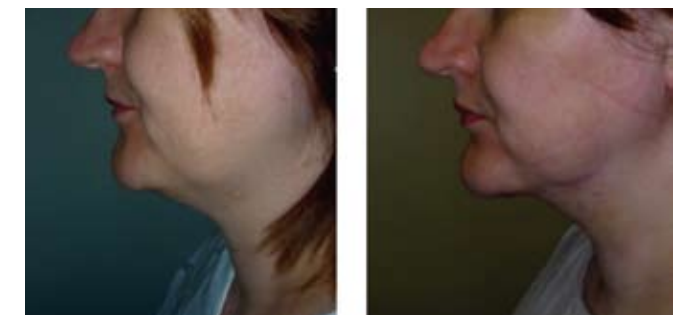


Figure 3: Neck and jowls with small fat pockets and sagging skin before (left) and one week after (right) a single LipoLite™ treatment followed by aspiration. Photos courtesy of Talmage Raine, M.D.

*There are cases where laser-assisted liposuction is combined with traditional liposuction for a more comprehensive treatment.