

1000 Consecutive Cases of Laser-Assisted Liposuction Utilizing the 1440 nm Wavelength Nd:YAG Laser: Assessing the Safety and Efficacy

Christopher T. Chia¹ · Mark G. Albert³  · Sharon Del Vecchio² · Spero J. Theodorou¹



Received: 10 June 2017 / Accepted: 17 August 2017

© Springer Science+Business Media, LLC and International Society of Aesthetic Plastic Surgery 2017

Abstract

Background Liposuction remains one of the most popular aesthetic surgery procedures performed today, and it has undergone continuous refinements over the past four decades. Advancements in anesthesia, improvements in instrumentation, better understanding of fluid dynamics and the addition of energy to liposuction have led to better outcomes with improved safety and efficacy.

Objectives The purpose of this study is to review 1000 consecutive laser-assisted liposuction (LAL) cases utilizing the 1440 nm wavelength. Emphasis was placed on complication rates and the need for revision procedures.

Methods The charts of 611 patients who underwent 1000 consecutive LAL operations were reviewed. All cases were performed either under general anesthesia or under local with sedation, and the cases were performed alone or in conjunction with other procedures. All patients went to presurgical testing and had preoperative laboratory and additional clearance by a specialist when indicated. Before

and after medical photographs were obtained of all patients. All operations were done in an accredited office-based operating room. Demographic information, tumescent volume, aspirate volume, surgical time, complications and other data were reviewed.

Results There were one minor complication and no major complications such as burns, hospitalizations or mortalities. One patient developed a small hematoma, which was likely caused by the patient self-aspirating edema fluid during the immediate post-op period. The hematoma resolved with non-surgical management. The average laser energy applied was 15,756 J with an average total aspirate volume of 1256 cc. Fourteen anatomic areas were treated with LAL, and 59 operations were combination cases.

Conclusion Energy-assisted liposuction using the 1440 nm wavelength has been shown in this series to have a very low complication rate when performed alone or in combination with other aesthetic operations under local and general anesthesia.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Laser · Liposuction · Assisted · Body contouring

✉ Mark G. Albert
MAlbert520@gmail.com

Christopher T. Chia
<http://www.bodysculpt.com/>

Spero J. Theodorou
<http://www.bodysculpt.com/>

¹ Department of Plastic Surgery, Aesthetic Plastic Surgery Fellowship, Manhattan Eye, Ear and Throat Hospital, 128 Central Park South, New York, NY 10019, USA

² Translational Research Institute Australia, University of Queensland, Brisbane, Australia

³ Department of Plastic Surgery, Aesthetic Plastic Surgery Fellowship, Manhattan Eye, Ear and Throat Hospital, 960 Park Avenue, New York, NY 10028, USA

Introduction

Suction-assisted lipectomy (SAL) is among the most commonly performed aesthetic surgical procedures globally, and it has undergone continuous refinements in technique which has led to better safety and outcomes since

it was first introduced in the 1980s [1]. A better understanding of fluid dynamics [2] and tumescent fluid composition [3, 4], as well as the trend away from the use of general anesthesia for SAL [5], has increased the safety profile of this common procedure. In 2006, the United States Food and Drug Administration (FDA) approved the first laser-assisted lipolysis device [6] and started the era of laser-assisted lipectomy (LAL). The use of laser [7], ultrasound [8], radiofrequency [9], power-assist and other methods in conjunction with liposuction has led to benefits including emulsification of fat, soft tissue tightening [10], decreased blood loss [11], decreased postoperative pain and reduced operator fatigue.

Previous studies have shown that LAL utilizing 1064 and 1320 nm wavelengths can be done safely and effectively [12]. The 1440 nm wavelength has a purported higher specificity for water and fat chromophores and is therefore more efficient than other wavelengths. This allows for fat emulsification with less unintended heat dispersion, and therefore a decreased risk of burns. The purpose of this study is to present the complication rate associated with LAL using a 1440 nm wavelength in 1000 consecutive cases of LAL alone or combined with other aesthetic procedures.

Methods

A retrospective chart review of 1000 consecutive LAL procedures in 611 patients between January 2011 and October 2014 was performed. Four hundred twenty-six (69.7%) women and 185 (30.3%) men underwent LAL using the 1440 nm wavelength Nd:YAG laser with tumescent technique. The ages ranged from 18 to 71 with a mean of 36.8 years, and the average body mass index (BMI) was 25.6 kg/m² for females and 29.4 kg/m² for males. All patients underwent preoperative evaluation by a primary care physician to deem patients medically fit for LAL. Patients who were pregnant, had a history of malignancy, had allergies to medications used, had unrealistic expectations, excess skin laxity or severe comorbid medical conditions were not deemed fit to undergo LAL. Preoperative photographs were taken, and patients provided written informed consent. All procedures were performed by the two senior authors (CTC/SJT) in an AAAASF (American Association for Accreditation of Ambulatory Surgery Facilities, Inc., Gurnee, IL)-accredited office-based operating room.

Patients either had the procedure performed under tumescent local anesthesia with oral sedation (10 mg diazepam, 5 mg hydrocodone/325 mg acetaminophen, 500 mg cephalexin or 500 mg ciprofloxacin) or under general anesthesia/IV sedation with supplementary use of

tumescent local. General anesthesia was predominantly reserved for patients having concomitant procedures performed. Patients elected for local sedation were infused with 0.10% lidocaine and 1:750,000 epinephrine with 10 meq sodium bicarbonate, and the general patients were infused with 0.04% lidocaine with 1:1,000,000 epinephrine.

The 1440 nm wavelength Nd:YAG laser (Cynosure Corp., Westford, MA) was used to emulsify the deep and intermediate layers of subcutaneous fat following tumescent infiltration. After application of the laser, patients underwent SAL. Power-assisted liposuction cannulas of 3.0 and 4.0 mm diameter with blunt tips and double Mercedes style openings were used. Manual blunt tip Mercedes style cannulas of 3.0, 2.7, 2.4 and 2.0 mm were used for smaller regions. Fourteen different anatomic areas were treated. For cases using local anesthesia alone, patients were safely discharged within 20 min of the conclusion of the operation. In combination procedures, LAL was performed before the concomitant procedure(s), and the patient was recovered in the PACU according to standard protocol for liposuction and the secondary operation.

Results

In 1000 consecutive LAL with 1440 nm wavelength procedures, there were no mortalities and one (0.01%) complication which occurred following a LAL procedure under local anesthesia. The complication was a hematoma of the lower abdomen in a male patient who was self-aspirating the treated area 5 days post-op using an 18-gauge needle and syringe. This was done without the surgeon's knowledge in a misguided attempt to mitigate normal postoperative swelling. The resulting hematoma was aspirated once by the surgeon and resolved without further intervention. There were no burns, other fluid collections or soft tissue injuries in the remainder of the cohort.

The average BMI was 25.6 kg/m² for females and 29.4 kg/m² for males, and the mean surgical time for the 1000 operations was 93 min. The average tumescent volume injected was 2110 cc, and the total volume aspirated

Table 1 Total intraoperative energy applied (in kJ) to patients undergoing LAL

Minimum energy	250
Median energy	14,000
Maximum energy	95,000
Mean energy	15,756
SD	9882

was 1256 cc. The average amount of laser energy applied was 15,756 J (Table 1). Fourteen anatomic areas were treated by LAL and included the neck, triceps, axilla, male chest, bra roll, flanks, hips, abdomen, mons pubis, inner thighs, outer thighs, knees, calves and ankles (Table 2). There were 87 touch-up procedures (8.7%) to remove more fat. Nine hundred and seventeen (91.7%) procedures were performed under local anesthesia, and 83 (8.3%) cases were done under intravenous sedation or general anesthesia. All local anesthesia patients were discharged within 20 min of the completion of the procedure. These patients returned to normal daily activities, except vigorous exercise, in 2 days. Fifty-one patients underwent 57 concomitant procedures. Patients who underwent LAL with other procedures were recovered per protocol in the PACU and discharged. In those patients, return to daily activities depended on the type of concomitant procedure performed.

Discussion

Over the last four decades, advancements in liposuction, in particular LAL, have led to improved safety, aesthetic outcomes and ability to return to normal activities for patients. One of the most significant technical improvements is the addition of energy to assist with fat emulsification and removal. Various wavelengths have been shown to be safe and efficacious in both local and general anesthesia cases [13].

Laser-assisted liposuction received FDA approval in October of 2006 and has undergone multiple platform

changes regarding wavelength, power and safety features. In a 2008 study by Katz et al., they described a complication rate of 0.93% for a cohort of 537 consecutive LAL cases at a single center using a 1064-nm neodymium:yttrium-aluminum-garnet (Nd:YAG) laser. A previous report by senior authors of this paper of 1000 consecutive cases using 1064 and/or 1320-nm Nd:YAG demonstrated a complication rate of 0.007% [7]. In the current series of 1000 consecutive LAL cases, the complication rate has decreased to 0.001%. The purported benefit of the 1440 nm wavelength includes a high affinity for fat as a chromophore. This results in selective photothermolysis and lipocyte cell death without excessive and unnecessary heat production. The platform used in this study (SmartLipo™, Cynosure Corp., Westford, MA) includes safety mechanisms such as an internal thermostat and accelerometer. These features disable the laser at a predetermined maximum temperature, or if the handpiece stops, in order to prevent thermal injury. In these 1000 consecutive cases, no thermal injuries occurred. This can be partially attributed to operator experience, as well as the aforementioned safety parameters.

The fat emulsification effect of the laser allowed the use of smaller diameter suction cannulas in this study. Using smaller cannulas may have improved the aesthetic outcome, while not compromising the amount of fat removed or adding to the operative time. Although the application of laser energy is an added step in the liposuction procedure, it is our opinion that the benefits of the laser are worth any additional time. Throughout this series, the approach to applying energy to the tissue did not change as more patients were treated. The end point of applying laser energy was emulsification of fat. Some treated areas are more fibrous than others (e.g., flanks and back more than medial thighs, or secondary cases more than primaries), and therefore additional time was spent in those areas to ensure emulsification.

The only complication in the study was a hematoma that was self-inflicted by a patient. While this hematoma accounts for the final complication rate of 0.001%, it can be considered to be not directly related to the laser itself. No seromas, contour deformities, skin injuries or other complications were seen. All anatomic areas that would have been previously treated with traditional liposuction technique were treated with the laser as well.

The addition of the 1440 nm laser was found to be safe in cases where combination procedures were performed. When autologous fat transfer was involved, the laser was not used during fat harvesting to preserve the lipocyte viability. In those cases, laser was applied following harvesting and before the removal of fat for final contouring. In every case, the LAL portion of the procedure was performed first and the additional procedure followed. No

Table 2 Anatomical areas treated with LAL

Area	Number treated
Neck	33
Triceps	2
Axilla	18
Male chest	13
Bra roll	8
Flanks	190
Hips	13
Abdomen	293
Mons pubis	12
Inner thighs	3
Outer thighs	7
Knees	6
Calves	1
Ankles	4
2 or more areas	390

complications were reported in any combination operations.

Conclusion

Energy-assisted liposuction represents a critical refinement and improvement in the continuously evolving field of body contouring surgery. To our knowledge, this is the first and largest series of laser-assisted liposuction using the 1440 nm wavelength Nd:YAG laser. The addition of the 1440 nm wavelength Nd:YAG laser to liposuction provides another tool in the aesthetic surgeon's armamentarium that has been shown to be safe given the extremely low complication rate in this series of 1000 consecutive cases.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

References

- Hait P (1994) History of the American Society of Plastic and Reconstructive Surgeons, Inc. 1931–1994. *Plast Reconstr Surg* 94(4):1A–109A
- Iverson RE, Lynch DJ (2004) American Society of Plastic Surgeons Committee on Patient Safety. Practice advisory on liposuction. *Plast Reconstr Surg* 113(5):1478–1490 (**discussion 1491–1475**)
- Pace MM, Chatterjee A, Merrill DG, Stotland MA, Ridgway EB (2013) Local anesthetics in liposuction: considerations for new practice advisory guidelines to improve patient safety. *Plast Reconstr Surg* 131(5):820e–826e
- Hanke CW, Bernstein G, Bullock S (1995) Safety of tumescent liposuction in 15,336 patients. National survey results. *Dermatol Surg Off Publ Am Soc Dermatol Surg [et al]* 21(5):459–462
- Klein JA (1993) Tumescent technique for local anesthesia improves safety in large-volume liposuction. *Plast Reconstr Surg* 92(6):1085–1098 (**discussion 1099–1100**)
- McBean JC, Katz BE (2011) Laser lipolysis: an update. *J Clin Aesthet Dermatol* 4(7):25–34
- Chia CT, Theodorou SJ (2012) 1,000 consecutive cases of laser-assisted liposuction and suction-assisted lipectomy managed with local anesthesia. *Aesthet Plast Surg* 36(4):795–802
- Rohrich RJ, Beran SJ, Kenkel JM, Adams WP Jr., DiSpaltro F (1998) Extending the role of liposuction in body contouring with ultrasound-assisted liposuction. *Plast Reconstr Surg* 101(4):1090–1102 (**discussion 1117–1099**)
- Paul M, Blugerman G, Kreindel M, Mulholland RS (2011) Three-dimensional radiofrequency tissue tightening: a proposed mechanism and applications for body contouring. *Aesthet Plast Surg* 35(1):87–95
- DiBernardo BE (2010) Randomized, blinded split abdomen study evaluating skin shrinkage and skin tightening in laser-assisted liposuction versus liposuction control. *Aesthet Surg J/Am Soc Aesthet Plast Surg* 30(4):593–602
- Nagy MW, Vanek PF Jr. (2012) A multicenter, prospective, randomized, single-blind, controlled clinical trial comparing VASER-assisted Lipoplasty and suction-assisted Lipoplasty. *Plast Reconstr Surg* 129(4):681e–689e
- Woodhall KE, Saluja R, Khoury J, Goldman MP (2009) A comparison of three separate clinical studies evaluating the safety and efficacy of laser-assisted lipolysis using 1,064, 1,320 nm, and a combined 1,064/1,320 nm multiplex device. *Lasers Surg Med* 41(10):774–778
- Katz B, McBean J (2008) Laser-assisted lipolysis: a report on complications. *J Cosmet Laser Ther Off Publ Eur Soc Laser Dermatol* 10(4):231–233