

# 1060 nm Diode Hyperthermic Laser Lipolysis: The Latest in Non-Invasive Body Contouring

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## ABSTRACT

Non-invasive body contouring is becoming increasingly popular in the United States. Using the 1060 nm diode laser to achieve hyperthermic temperatures within the adipose tissue with subsequent lipolysis is one of the most recent advancements in this field and is the first of its kind. This wavelength was carefully chosen to effectively target the unwanted adipocytes while sparing the overlying skin and adnexae. Appreciable results are achieved after a single treatment, and these results are comparable to other non-invasive technologies. The 25-minute procedure is well tolerated among patients, with no downtime required. This versatile system allows for treatment of multiple body sites, which can be customized for a particular patient's needs. Herein, we discuss in detail the mechanism of action, efficacy, and safety of 1060 nm diode hyperthermic laser lipolysis. Amongst the various body contouring modalities available today, the 1060 nm diode hyperthermic laser is a worthy addition providing a safe, quick, and effective non-invasive fat reduction option for patients.

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## INTRODUCTION

Non-invasive body contouring continues to gain popularity in the United States and the field is advancing at a fast pace. In fact, it is the fastest growing category among dermatologic procedures. In 2014 alone, over 207,000 body sculpting procedures were performed by American Society for Dermatologic Surgery (ASDS) members.<sup>1</sup> While this includes tumescent liposuction, the vast majority of cases are using non-invasive methods. This is a dramatic 53% increase from 2012, and a 16% increase from 2013.<sup>1</sup> Many factors can play a role in a patient's decision to have a cosmetic procedure. The 2015 ASDS Consumer Survey revealed that dermatologists have the most influence on patients, ranking above plastic surgeons, primary care physicians, friends, websites, and other factors.<sup>2</sup> Therefore, dermatologists have a responsibility to be well-informed and familiar with the fast growing category of non-invasive body contouring technologies.

Various technologies exist today including cryolipolysis, radiofrequency, ultrasound, injection lipolysis, and laser. The concept of the direct action of lasers on adipose tissue, termed laser lipolysis, was first pioneered by Apfelberg in 1992.<sup>3</sup> At this time, laser lipolysis was introduced as an adjunct to traditional surgical liposuction. It wasn't until 2006 that the FDA approved the first laser lipolysis device, which was an Nd:YAG 1064 nm laser. Laser-assisted liposuction led to superior fat reduction, decreased blood loss and ecchymoses, and improved skin tightening. These benefits are due to adipocyte membrane disruption, coagulation of blood vessels, and collagen

remodeling.<sup>3</sup> It is generally accepted that these effects are primarily due to the heat generated by the laser.

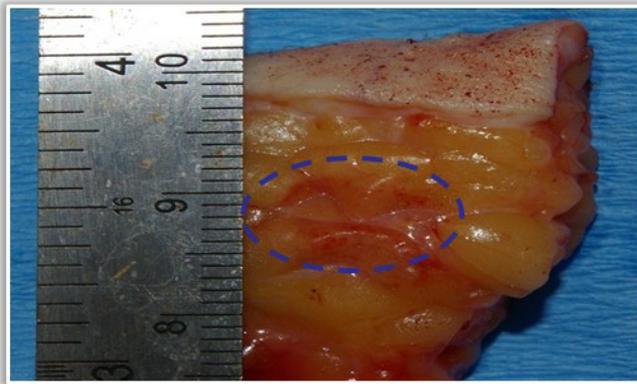
When advancing to a non-invasive approach to laser lipolysis, an external device is required. However, when creating an external device that uses heat as its mechanism of action, there is a risk of thermal injury to the skin causing discomfort or more significant side effects. Therefore, the initial application of lasers to the fields of noninvasive body contouring was with low-level laser therapy or "cold laser." This modality creates temporary microscopic pores within the cell membrane of the adipocytes, through a cytochrome oxidase interaction, allowing the triglyceride contents to leave these damaged cells.<sup>4</sup> There is no measurable rise in temperature of the treated tissue.

The application of the 1060 nm diode laser for fat reduction is the first and only FDA cleared hyperthermic laser for non-invasive body contouring. This device successfully and safely uses the thermal effects of an external laser to non-invasively destroy adipose tissue. Herein we will describe the mechanism of action, efficacy, and safe nature of this novel modality.

### Mechanism of Action

The 1060 nm diode laser leads to injury of the adipocytes through direct heating of the tissue. Energy delivered by the laser creates movement within the molecules of the exposed tissue, which then generates heat. A controlled temperature of 42-47 °C must be maintained at the site of the adipocytes. At this hyperthermic temperature, the cell membranes of the

**FIGURE 1.** Abdominal skin following a single treatment displaying targeting of the adipocytes within the subcutaneous layer, approximately 1 cm below the surface of the skin, and sparing of the dermis. Photo Credit: Decorato et al, ASLMS 2014.<sup>6</sup>



targeted adipocytes lose their structural integrity. This loss of cellular structure leads to delayed cell death.<sup>5</sup> The standard power used for this device is 1.1 W/cm<sup>2</sup>, which can be adjusted according to patient feedback.

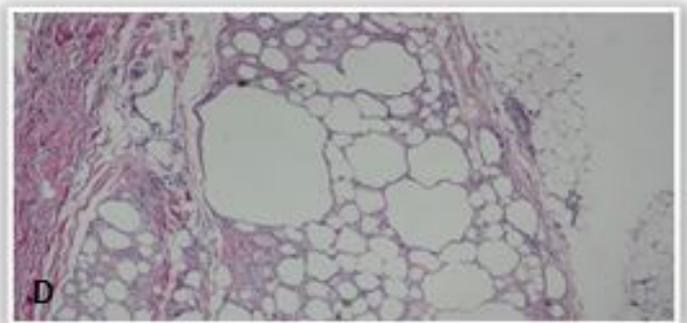
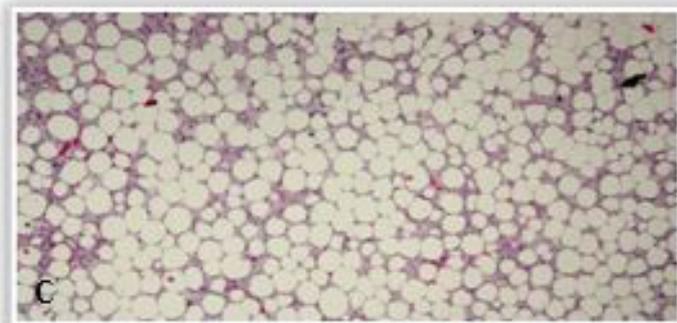
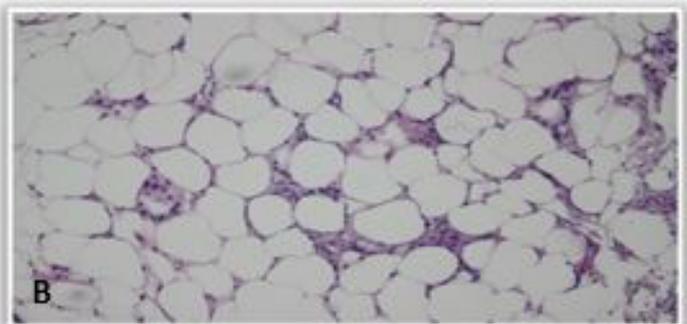
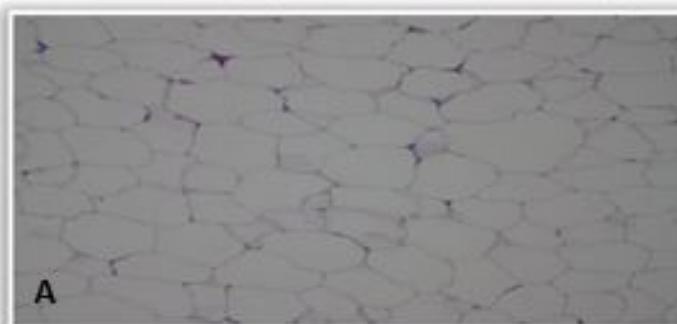
While heat is the primary mechanism leading to adipocyte destruction, the selected wavelength is vital to the success and safety of the device. The 1060 nm wavelength has particular

affinity for adipocytes. This wavelength is also able to penetrate to an appropriate depth in order to adequately target the adipocytes, while having very low absorption within the dermis (Figure 1). Through proprietary energy modulation, this device is therefore able to specifically heat and subsequently destroy the unwanted adipocytes, while leaving the overlying skin and adnexal structures unharmed. Lastly, melanin is minimally targeted with this wavelength, and this device can be safely used in all skin types.

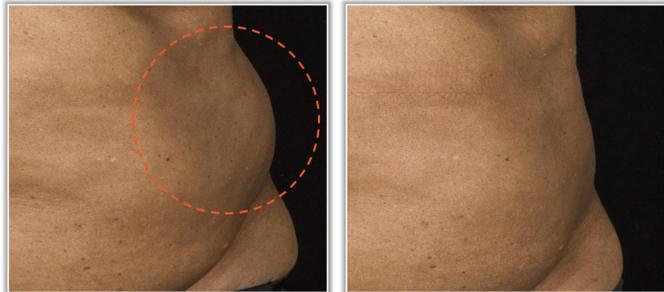
Decorato was the first to examine and document the histologic effects of this thermal injury to the adipocytes after treatment of abdominal tissue<sup>6</sup> (Figure 2). He demonstrated that in the first two weeks after treatment, an inflammatory infiltrate, composed primarily of lymphocytes and few macrophages, surrounds the injured adipocytes. Between one and three months lipophages predominate, forming cystic spaces at the sites of previously engulfed adipocytes. These cystic spaces then become larger, lipid-filled vacuoles. Six months after treatment there is evidence of new collagen deposition with a decreased inflammatory response.<sup>6</sup>

Upon cell injury and subsequent death, the body naturally eliminates the contents of the adipocytes with results appreciated at 6 weeks and optimal at 12 weeks. While there are no long-term studies completed, the reduction in fat is thought to be permanent. Results at 6 months indicate prolonged fat reduction.

**FIGURE 2.** Histologic changes after a single treatment. (A) Control tissue with normal adipocytes (x400 magnification). (B) Two weeks after treatment revealing an infiltrate of primarily lymphocytes (x400 magnification). (C) Cystic spaces forming secondary to macrophage infiltration and adipocyte engulfment four weeks after treatment (x100 magnification). (D) Twelve weeks post-treatment showing larger vacuoles within the adipose tissue (x100 magnification). Photo Credit: Decorato et al, ASLMS 2014.<sup>6</sup>



**FIGURE 3.** Appreciable fat reduction noted 3 months following a single treatment of the left flank. Photo Credit: Doherty and Katz, ASLMS 2015.<sup>7,8</sup>



### Efficacy and Results

As mentioned, initial clinical studies by Decorato confirmed that the 1060 nm diode laser can non-invasively and reliably raise the temperature of the subcutaneous adipose tissue and subsequently cause injury to the adipocytes.<sup>6</sup> Appreciable results are obtained after a single treatment (Figure 3). In multicenter studies, Katz revealed a 13% reduction in fat thickness of the flanks while Bass and Doherty revealed a 16% reduction in fat thickness of the abdomen 12 weeks post treatment.<sup>7,8</sup> These results were obtained via ultrasound measurements, which has now been formally validated as reliable method for measuring fat reduction<sup>9</sup> (Figure 4). Although the 1060 nm diode laser is currently only FDA cleared for body contouring of the abdomen and flanks, there are studies showing significant fat reduction of the thighs and back as well.<sup>10</sup> The quantitative results of these studies have all correlated with blinded evaluators identifying improvement among high-quality photographs. In addition, there is patient satisfaction of at least 90% in all studies.<sup>7,8,10,11,12</sup>

There are several clinical endpoints that can help point toward the efficacy of a single treatment. These include thermal sensations experienced by the patient during treatment, post treatment tenderness lasting 1-3 weeks, and an apparent

signal change of the subcutaneous fat on ultrasound one week post-treatment.<sup>13</sup> As with other noninvasive body contouring devices, a satisfactory reduction in fat volume is not always correlated with a reduction in weight. Patients' weights may increase slightly, decrease, or remain stable.<sup>7,8</sup>

Patients can undergo multiple treatment sessions, spaced at least four weeks apart, to achieve additive and optimal results. Weiss, et al demonstrated the success of creating customized treatment plans of up to 3 treatments on the flanks and/or abdomen.<sup>11</sup>

Initial clinical studies by Decorato showed that hyperthermic laser lipolysis produced comparable results to other non-invasive body contouring modalities. When treating the flanks, Decorato revealed that the 1060 nm laser can lead to a 24% reduction in fat volume, while cryolipolysis led to a 22% reduction, as measured by ultrasound and magnetic resonance imaging.<sup>14</sup> This difference was not statistically significant.

As this technology is relatively new, there are no substantially long term follow up studies to assess the permanency of this fat reduction. However, a mean reduction of 4.31 +/- 1.79 mm and 2.72 +/- 1.82 mm of the flanks and abdomen, respectively, was maintained at six months after a single treatment.<sup>12</sup>

### Safety and Adverse Events

The 1060 nm diode hyperthermic laser lipolysis procedure is extremely well tolerated. Minimal discomfort during the procedure and mild to moderate tenderness after the procedure are the most common side effects reported. Weiss et al recorded a mean discomfort score of 3.6/10 in clinical studies, which is considered mild.<sup>11</sup> This tenderness typically lasts between one and three weeks post treatment and is described by patients as having "worked out" abdominal muscles. The device has a contact cooling system in place during the procedure to help limit the thermal discomfort and prevent any damage to the surface of the skin.

**FIGURE 4.** The application of ultrasound images to reliably measure the thickness of fat at baseline (left) and its subsequent reduction at 3 months (center) and 6 months (right) following a single treatment. Photo Credit: Decorato, ASLMS 2014.<sup>14</sup>

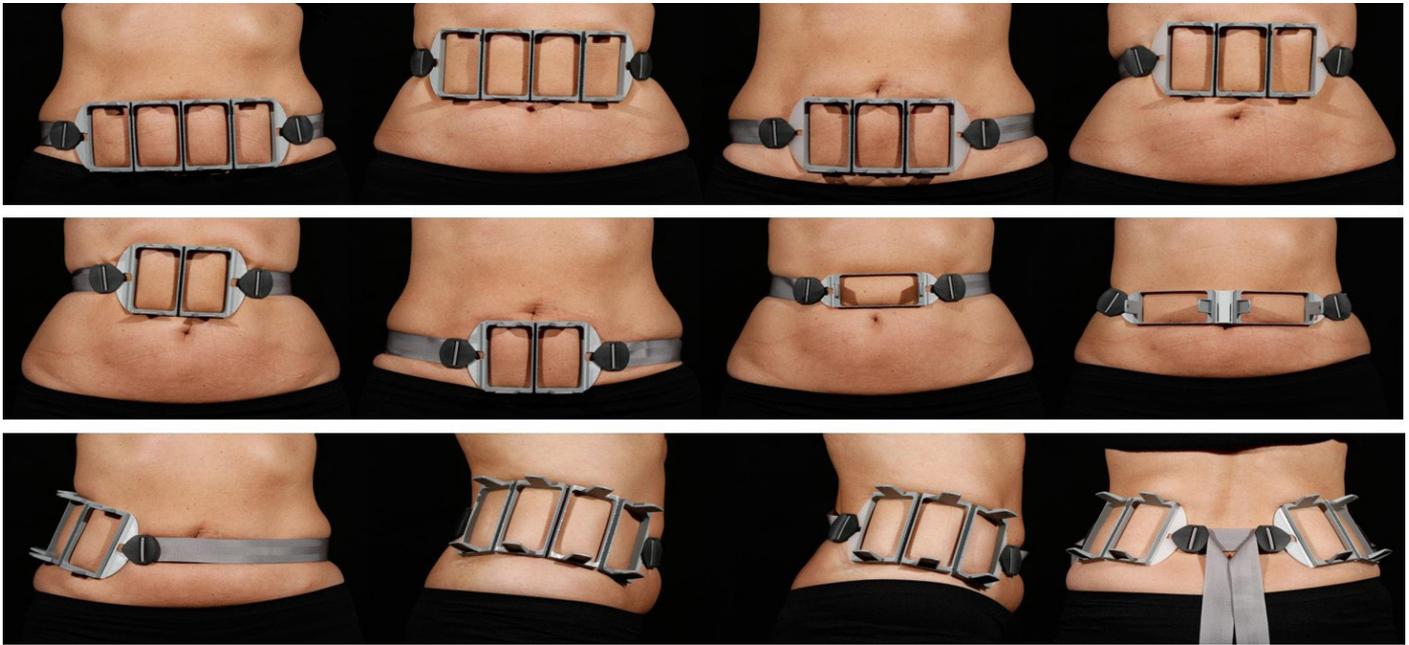


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**FIGURE 5.** The four non-suction applicators can be applied in a number of different configurations allowing a customizable treatment for patients. Photo provided by Cynosure Clinical.



As described above, the 1060 nm wavelength adequately targets the subcutaneous adipose tissue. As such, there have been no undesired side effects seen within the dermis of treated tissue. In addition, early clinical studies by Decorato demonstrated no significant changes in serum lipid profiles or liver chemistries after hyperthermic laser lipolysis.<sup>6</sup> When adipocyte contents are released and naturally recycled by the body, this can be a concern.

### Patient Selection and Nature of the Procedure

Proper patient selection and setting realistic expectations is the first step to achieving optimal and desired results. Ideal candidates are non-obese, with a maximum body mass index of 30, wishing to remove stubborn areas of adiposity that are resistant to diet and exercise. Fortunately, patients of all skin types can undergo the 1060 nm hyperthermic laser lipolysis. As mentioned above, this particular wavelength does not target melanocytes to a significant degree, and thus no pigmentation side effects have been noted.

The device itself is very versatile and customizable. There are four flat, non-suction applicators that can be applied to the patient in a variety of configurations (Figure 5). This even allows for multiple sites to be treated at one time, if applicable to the patient. Each applicator provides a treatment area of 35 cm<sup>2</sup>. Studies have shown that there is a gradual “feathering of heat” beyond the skin in contact with the applicator.<sup>15</sup> This enables the treatment zone to be continuous and without gaps when using adjacent applicators. While the device is only FDA cleared

for treatment of the abdomen and flanks, the size of the applicators allows for potential treatment of the thighs, back, arms, and potentially submental as well.

Once the desired configuration is determined, the applicators are placed on the patient, ensuring adequate contact with the skin surface. The total length of the treatment is 25 minutes long. It takes 4 minutes for the device to achieve stable fat target temperature of 42-47 °C, which is then followed by a 21-minute period of effective treatment using proprietary cooling/heating cycles. This is an advantage over other non-invasive body contouring devices, which until recently have taken 60 minutes or more for each treatment area.

As mentioned above, the patient will be able to feel the thermal effects of the device, which may cause some discomfort. This is counteracted by a contact cooling plates. No post-procedure massaging is required. While there may be mild to moderate tenderness noted after the procedure, there is no downtime required before resuming normal activities of daily living. Of the several hundred patients treated to date, no one has reported severe pain requiring potent pain medications. Patients may continue his or her standard diet and exercise regimen, as no changes are required.

### CONCLUSION

Hyperthermic laser lipolysis with the 1060 nm diode laser is an effective device for non-invasive body contouring. It satisfies the public demand for a quick and safe procedure with no

downtime, while providing comparable results to other body contouring modalities currently in use.

## DISCLOSURES

Drs. Saedi and Weiss are consultants and are on the Speakers Bureau for Cynosure. Dr. Weiss receives research funding from Cynosure. Dr. Schilling has no significant interest with commercial supporters. There are no other conflicts of interest.

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