Subsurface Laser and Radiofrequency for Face and Body Rejuvenation

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KEYWORDS

• Side firing • Cellulite • 1440 nm • Lasers through fibers • Neck rejuvenation • Skin tightening • Platysma muscle

KEY POINTS

- Laser and radiofrequency energy can be delivered below the skin.
- Small (1 mm) incisions are used to enter the subdermal space.
- Temperature levels play a key role in minimally invasive energy procedures.
- Significant skin and muscle tightening effects are possible.
- Healing time is minimized because external skin is not affected.

INTRODUCTION

Before 2006, energy delivery, in particular laser energy, was delivered through the skin. If higher energies and subsequently higher temperatures were required for deeper penetration, the available parameters were larger spot sizes, longer wavelengths, and surface cooling to protect the skin surface from overheating and complications. There was no other method of deeper delivery or higher energies until the advent of the delivery of laser energy through a subdermal fiber in 2006. This original device, marketed under the name of Smartlipo (Cynosure, Westford, MA), was originally low power (6 W) and delivered through a small fiber diameter of 300 μm. This device was improved over 6 generations until the current device, which is 46 W, has 1000-μm fibers, and 2 other uses to be detailed later (**Fig. 1**). Three initial studies were performed by this author to substantiate the physics and safety profiles,[1] the skin tightening phenomenon,[2] and the blinded comparison of skin tightening and change in elasticity compared with suction lipolysis alone.[3] Findings for skin tightening were significant at a temperature of 47°C, as measured 5 mm deep by a thermistor, with 62% on the laser side compared with 5% on the laser control side.

Subsequent developments of the same platform were produced in 2010 and 2011. The next challenge had been insurmountable for years; namely a significant improvement of cellulite with a single treatment, with long-lasting results (>3 years) and US Food and Drug Administration (FDA) approval. Women were affected only because of the subsurface architecture; cellulite was poorly understood in its anatomy and specific defects. With no clear understanding of the problem, a clear path to treatment was elusive as well. Final conclusions as to the anatomy were based on 3 specific defects (**Fig. 2**). It was determined that the raised areas were caused by excessive areas of

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Fig. 1. Minimally invasive laser device. (Cynosure, Westford, MA.)

subdermal adipose, the depressed areas by fibrotic vertical septae pulling down, and the surface orange-peel appearance from fat globules herniating into the thin dermis, as seen in all patients with cellulite (**Fig. 3**). A side-firing laser was developed using a 1440-nm wavelength to achieve results (Cellulaze, Cynsoure, Westford, MA). This unique wavelength forms microbubbles at the tip of the fiber, thus creating a glass-air interface, thereby allowing the laser light to bend. This phenomenon is unique to this wavelength. A step-by-step summary of the procedure is provided later. The initial details are in the preliminary report by this author,[4] followed by the multicenter confirmatory trial used by the FDA for clearance, and longer-term data from the multiple centers.[5]

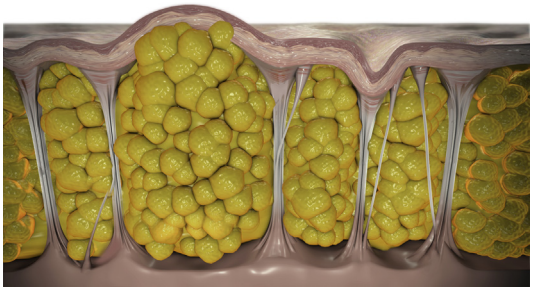

Fig. 2. The anatomy of cellulite.

Once side firing was a proven entity showing results otherwise achieved by forward firing laser fibers, the fiber was then reduced in size to 800 μm. This device, which was a software/hardware upgrade to the original device, was known as Precision Tx (Cynosure, Westford, MA). The smaller diameter allowed treatment of fat and skin defects in areas such as the neck[6] and knees, treatment of hyperhidrosis, and specialty uses such as treatment of moderate to deep acne scarring.[7]

More recently, subdermal treatment has extended to minimally invasive radiofrequency (RF) treatments.[8] Still using a small probe in the 1-mm range, energy is delivered at different levels to achieve effects in skin and fat, and nerve effects on muscle. This device is marketed under the brand ThermiRF (Thermi, Irving, TX). Unique to this system is accurate temperature monitoring both below the skin with a thermistor and above the skin with a thermal camera.[9] Skin tightening is achieved at a subdermal temperature range of 55°C to 65°C, whereas fat disruption occurs at 70°C. The process called Thermirase maps out specific nerves with a nerve stimulator before applying a temperature of 85°C for 1 minute. There is a learning curve to these procedures and proper training is imperative.

PATIENT SELECTION

Patient selection varies according to the minimally invasive procedure described. Starting with laser-assisted liposuction, these patients often present as standard liposuction patients. The subgroup most indicated for this procedure has mild to moderate fat excess and has some degree of mild to moderate skin laxity as well. Patients are often in the age range of 35 to 60 years old, although some are younger or older. If skin excess is too severe, then a surgical excision of the skin is more warranted. Typical areas are abdomen, medial thighs, and arms.

All forms of cellulite are able to be treated with Cellulaze, including dimples, horizontal streaks, as well as orange-peel appearance. Formally, these are in the range of all grade II and grade III mild and moderate as per the modified Nurnberger-Muller Scale. Patients with grade III severe need a combination of liposuction and fat grafting before the cellulite procedure.

Necks can be treated with laser subdermally with a mild to moderate presentation of fat excess