Scientific Report - Comparison of Treatment Uniformity of Laser Assisted Liposuction (LAL) and Radiofrequency Assisted Liposuction (RFAL)

Amir Waldman Ph.D., Israel

Introduction

Recently, LAL, specifically Smartlipo™ has gained a great deal of attention based on expectations of ~~a~~ skin tightening caused by laser thermal effect on collagen and connective tissue. LAL is based on manual scanning of the adipose tissue treatment volume with a cannula delivering laser radiation through a very small fiber with a 600 micron~~s~~ diameter.

Due to the manual delivery during LAL and the relatively small size of the laser radiation source questions are raised about treatment uniformity. Hot spots in the treatment area may lead to a dermal injury while undertreated areas reduce uniformity of the treatment, potentially compromising the overall result including soft-tissue contraction.

The development of a Radiofrequency Assisted Liposuction system (Bodytite™, Invasix Ltd.), which delivers high power radiofrequency to adipose and connective tissue while continuously monitoring all parameters including temperature allowed an opportunity to compare RFAL heating characteristics with LAL.

Materials and Methods

We used the most advanced LAL device - SmartLipo MPX (Cynosure Inc.) combining 20W of 1064nm and 12W of 1320nm laser radiation. A motion sensor (Smartsense™) was assembled to the hand piece to avoid over delivery of laser energy. A Raytek IR thermometer was used to monitor the skin surface temperature. Treatment of thermal zone was stopped when measured temperature reached 40^{o}C.

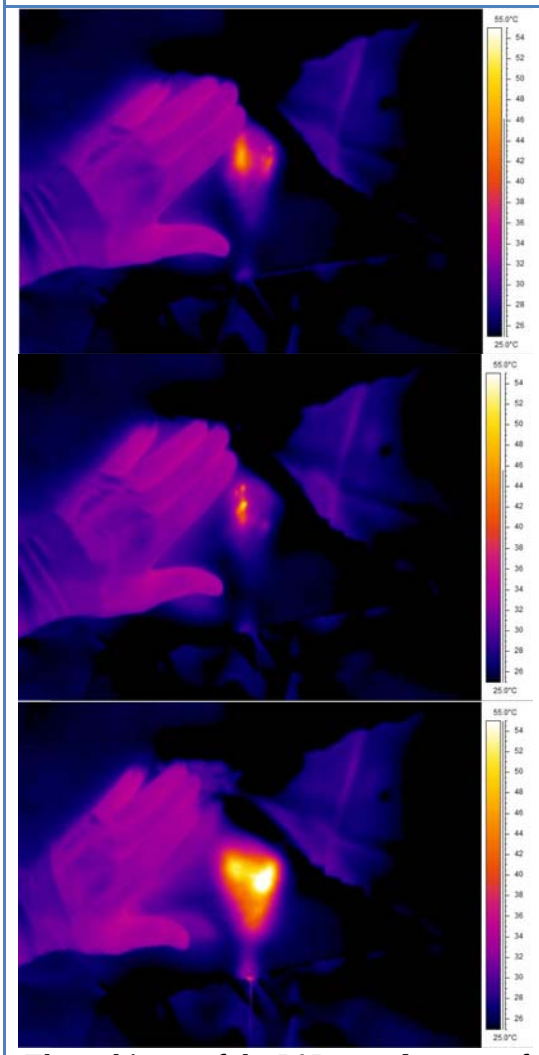
The RFAL procedure was performed with the BodyTite^{TM} system (Invasix Ltd.). The BodyTite device uses a bipolar RF hand piece to deliver RF current and heat internally to the adipose tissue. Bodytite™ also provides online, continuous skin temperature measurement~~s~~ with a negative feedback loop control of power. During the treatment the parameters of the BodyTite device were set so the system would reach 40^{o}C and maintain that target temperature consistently for a prolonged period of time.

In the current study we compared the two technologies and their ability to create a uniform temperature distribution over the treated area assuming the importance of thermal effects for lipolysis and skin tightening. Comparison of technologies was conducted for treating two sizes of thermal zones: 5x5cm and 10x15cm. For both devices skin temperature was monitored by a thermal camera FLIR A320. The uniformity of temperature distribution was analysed using thermal images and software Researcher 2.9 of FLIR Systems.

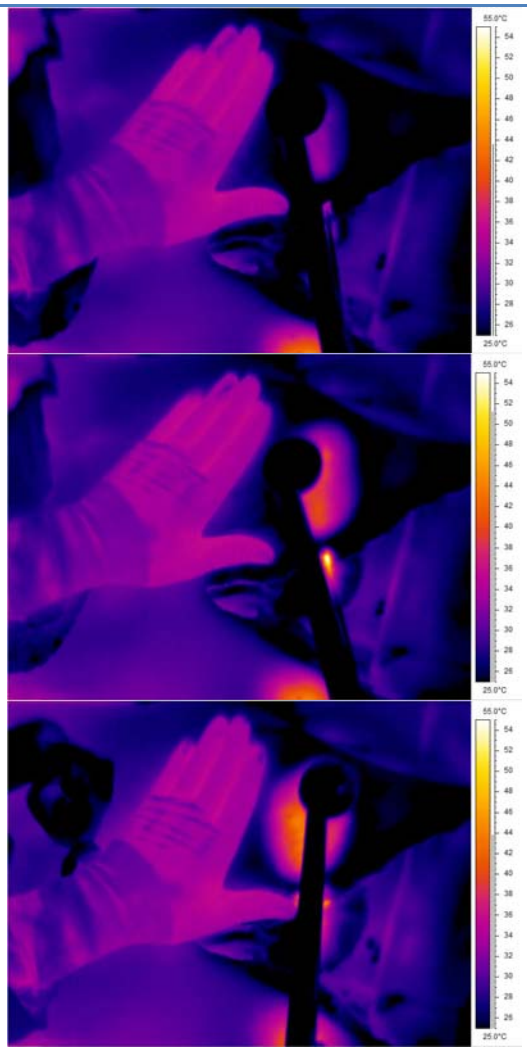
The treatments were performed on two post abdomenoplasty specimens , with a fat layer of about 30mm.

Results and Discussion

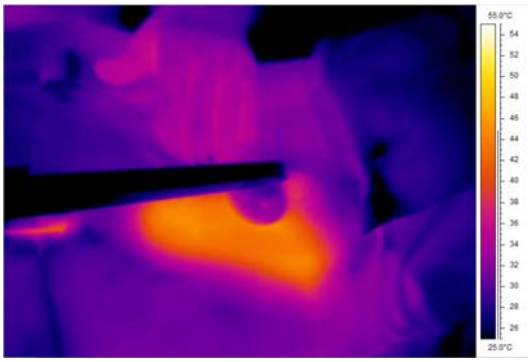
LAL – small zone	RFAL – small zone
The maximal laser power of 32W was used. Laser energy was applied superficially to each 5x5 cm thermal grid, at a depth of 3mm to 10mm, until the target temperature of 40 degrees centigrade was reached. We determined the end point by measuring the skin surface temperature with the IR thermometer. It required approximately 3-5 min to achieve the target temperature for each grid. Figure below shows the skin temperature during the treatment after 30sec, 60 sec and 170sec.	We treated an identical thermal zone of body as we did with LAL, with an RFAL device. The RFAL device used a power of 40W. Temperature of 40 degrees centigrade was reached in 60sec. After this time period we continued the treatment of the zone for additional 2 minutes. During this maintenance period, the BodyTite device adjusted RF power automatically to maintain skin temperature at predetermined level. Figure below shows thermal images of skin surface during the treatment.



Thermal image of the LAL treated zone at after 30sec (top), 60sec(center) and after 170sec (bottom).



Thermal image of the RFAL treated zone at after 30sec (top), 60sec(center) and after 180sec (bottom).

LAL – large zone	RFAL – large zone
Treatment of a large zone (10x15cm) with LAL technology was not effective. Relatively low treatment power and power energy utilization did not allow us to reach the desired thermal end point despite a reasonable period of treatment time. We found that the IR thermometer provided an average temperature from quite a large area even when kept at a distance of 3-4'' from the skin surface. As a result, it indicates average treatment temperature in the thermal zone but does not protect the user from developing small hot spots.	In contrast to LAL, the RFAL device was effective and easy to use. After 6 min the temperature of the zone reached end point of 40-42^{o}C. Figure below shows thermal image of treated area 6 min after the beginning of the treatment.  ***Thermal image of the RFAL treated zone at after 6 min.***

Conclusion

The presumption in energy assisted liposuction technologies (laser, RF) is that heat will result in adipose and vascular coagulation leading to more gentle aspiration and less bruising, swelling and pain. The advantage of LAL has been demonstrated in a randomized, double blinded trial . The second and perhaps most clinically significant advantage of heat generating energy assisted liposuction, in the enhanced skin contraction that should theoretically occur when the thermal energy is applied to the collagen of dermis and connctive tissue. Therefore, it would be an advantage and essential that the ideal heat generating energy assisted liposuction device, be able to do so quickly and uniformly and be able to do so safely by continuously monitoring temperature and regulating power output to maintain the desired thermal environment.

In this study we witnessed some significant advantages using RFAL technology in comparison to LAL including its ability to heat uniformly in both small and larger thermal areas. LAL, without continuous temperature monitoring is at high risk of focal "hot spots' and subsequent focal dermal necrosis. The relatively small thermal surface areas of a laser fiber, regardless of their specific adipose, water or vascular absorption spectra, heat relatively minimal volume of fat and do so quite slowly. By contrast, RFAL demonstrated higher heating speed with greater uniformity and a ability, through feedback monitoring to maintain the desired thermal level for a prolonged period of time. As skin contraction will be dependent upon not just a critical temperature, but maintaining that temperature for a critical duration and applying this heat uniformly throughout the tissue, the new BodyTite™ RFAL device displays some critical safety and efficacy features that position this device as the most valuable energy assisted liposuction system on the market today.