

Comparative study of the temperatures reached at the surface, 10mm and 20mm depths when performing the non invasive Venus Freeze® on the lower abdomen.

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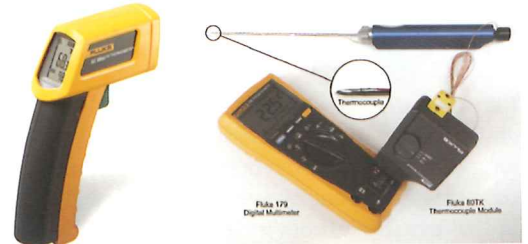
INTRODUCTION

Invasive Energy Assisted Procedures for skin tightening and fat reduction are commonly used by many physicians. At our practice we had two types of energy assisted procedures that we have used to achieve optimal temperatures for skin tightening and fat reduction.

1. Laser Assisted
2. Radiofrequency Assisted

The common aim is to reach external temperatures of 41-43°C and/or a sub dermal temperature of 45-47°C for skin tightening. When performing invasive skin tightening or fat reduction with energy assisted procedures, internal and external temperature devices do not always give accurate endpoints. When using temperature monitoring devices and aiming for a temperature endpoint alone when performing energy assisted procedures overtreatment can occur with the formation of hard raised nodules and internal scarring. Overtreatment can also occur if any brief interruption results in a reduction in temperature which then increases the amounts of joules required reaching the optimal temperature, so at our practice we prefer to use temperature as a guide along with energy density delivered.

In order to successfully treat a patient less invasively by using an alternative method to that of energy assisted procedures we first need to know what is the correct energy density/temperature elevation needed to achieve results? To answer this question lets go back to some basic physics. Firstly, the specific heat of fat is 2.47 J/cm³/C and the specific heat of water (the main component of collagen) is 4.186 J/cm³/C. This means that it takes 2.47 joules per cubic centimeter of fat to raise the temperature by 1 degree Celsius and that it takes 4.186 joules per cubic centimeter of water to raise the temperature by 1 degree Celsius. Secondly, the sub dermal temperature at which collagen remodelling occurs is approximately 45-47°C, therefore an 8-10°C rise in body temperature is needed in the dermis to cause optimum skin tightening.



Energy assisted procedures, as the name suggests, are dependent on the amount of energy delivered to an area to achieve optimal skin tightening and fat lysis. In the experiment outlined the results show how temperatures previously only reached using internal invasive energy assisted procedures can now also be achieved when using the non invasive Pulsed magnetic fields and multi polar radiofrequency of the Venus Freeze®. It also shows that the optimal clinical endpoint of the increase and maintenance of the ideal temperature can be achieved, thus delivering the major factor determining the optimal clinical outcome.

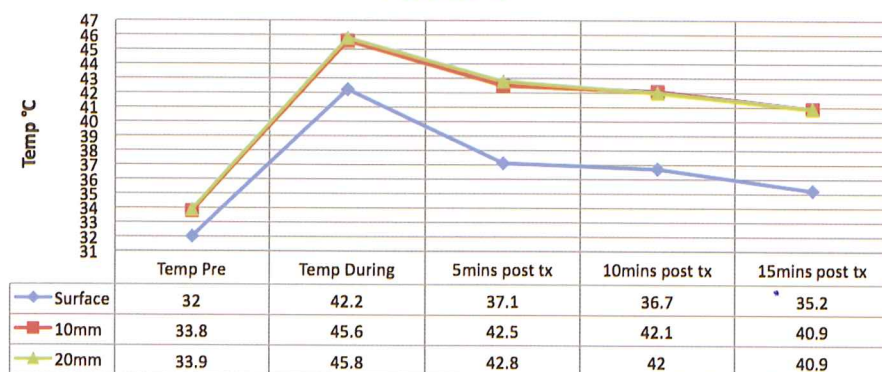
We have shown that with the Venus Freeze® we have reached the ideal external temperature of 41-43°C, and a sub dermal temperature of 45-47°C required for optimal skin tightening, and that it is possible that the non invasive Venus Freeze® can externally achieve the same temperatures as its predeceasing and more invasive energy assisted counterparts. However, this study focuses on skin tightening alone and fat reduction were not considered. However, according to PhD Walfre Franco's study¹ reaching temperatures in the Subcutaneous Fat of 45°C or more and if the temperature is maintained it will lead to a significant reduction in the ability for the fat cell to survive which would predict a reduction in fat volume over time.'

METHOD

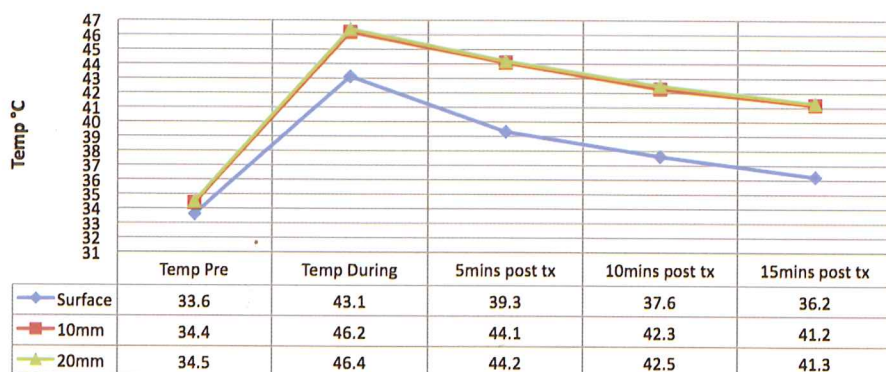
Standard treatment procedure was followed. The comparative study was performed on 3 patients that were treated with the Venus Freeze device on the lower abdomen. Age and gender being irrelevant, internal and external



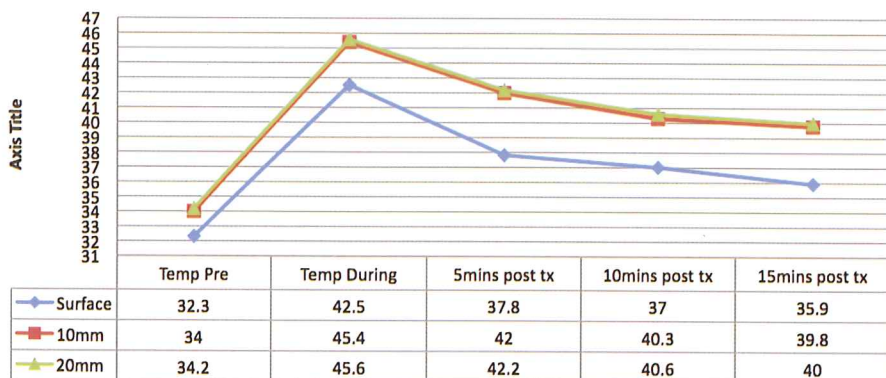
Patient 1



Patient 2



Patient 3



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temperature were monitored throughout and recorded at set intervals, being before treatment, during treatment, 5 minutes post treatment, 10 minutes post treatment and 15 mins post treatment. The depth of internal monitoring of 20mm was determined by the rule of thumb as suggested by Dr. Schlomit Halachmi in her discussion on (MP)² Academic and Clinical Experience. Stating that the depth of RF penetration is half the distance between electrodes, so when using the OctiPolar applicator where the distance between the two furthest electrodes is 5.5cm indications are that 3D penetration can be reached at a depth of up to 27mm.

The appropriate treatment head was used for this area (OctiPolar applicator). The treatment area was cleansed and glycerine was applied. The Octipolar applicator was applied to the skin and treatment commenced using the recommended "figure 8", "swirls", "snakes" and "wave" shaped movements without stopping. All patients underwent 25 minutes of active treatment. The treatment started at an energy level of 80% for 3 minutes or until an optimal external temperature of at least 42°C was achieved, then the remainder of the treatment or 22 minutes at an energy level of 70% to maintain the optimal external temperature of between 42-45°C. All patients tolerated these settings and adjustments where not required. When performing energy assisted procedures, we use a Fluke 62 mini IR thermometer, which has proved to give accurate readings. Internal temperatures were measured using the Fluke Digital multimeter with Thermocouple module which at our practice has been proven to again give accurate readings.

An internal Infrared thermometer was used to measure the epidermal temperature. We used the same external temperature device as we use when performing laser lipolysis.

When temperature is a primary endpoint it is extremely important to continually monitor and use equipment with proven accuracy to avoid complications and burns. Results can be seen in the graphs on the previous page.

RESULTS

The results showed that the temperature was significantly higher (up to 5°C) 20mm down than on the surface, inferring that the bulk of the heat delivered by the Venus freeze to depths of 10mm to 25mm, means that the elevation of temperature on the surface is caused by the

heat that is radiating up and out from within. The results also show that there is not much difference in temperature at 10mm and at 20mm deep, thus indicating a Homogenous distribution of the heat at these depths.

SUMMARY

When performing Laser Assisted or Radiofrequency Assisted procedure temperature monitoring alone is not recommended as a sole endpoint but in combination with energy density delivered to help avoid overtreatment and unwanted complication.

The Venus Freeze has proven to be able to externally reach the optimal temperatures required for successful skin tightening. So, with the non invasive (MP)² Technology now available with Venus Freeze we are able to safely reach the same ideal surface temperatures of 41-43°C and internal temperatures of 45-47°C needed to achieve visible skin tightening as is achieved during invasive Laser Assisted or Radiofrequency Assisted procedures.

Even though the non invasive (MP)² Technology of the Venus Freeze can achieve optimal temperatures it is not meant to replace the more invasive internal procedures such as Laser Assisted or Radiofrequency Assisted liposuction. These procedures still are able to easily reach and surpass the optimal internal temperatures of 45-47°C required and can still be the first point of call for the patient, thus allowing for a more significant change to collagen remodelling and permanent fat reduction. I believe that both invasive and non invasive procedures can be used in conjunction with one another to give the patient the instant result that they want to see and then follow up with a gentler procedure to enhance for optimal results.

The non invasive Venus Freeze is still an ideal option for patient not wanting to take the time and recovery of the more invasive procedures, but they have to be prepared to achieve a satisfactory, progressive result.

This external non invasive treatment now allows the practitioner to safely treat and visibly monitor the point of contact whilst successfully reaching dermal temperatures at which collagen remodelling and skin tightening occurs.

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New trends in abdominoplasty using liposuction

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INTRODUCTION

Although abdominoplasty is a procedure that has been evolving over the past century, there have been significant improvements as recently as in the last five years. Consequently, today, abdominoplasty and other body contouring procedures have become amongst the most commonly requested operations in cosmetic surgery.

There are two major groups of patients that benefit from abdominoplasty: recently pregnant women and those achieving massive weight loss. The weight loss group has expanded significantly in the past 10 years due to the evolution of various weight loss operations such as laparoscopic banding and gastric stapling.

EVOLUTION OF SURGICAL TECHNIQUE

Panniculectomy and umbilical resection

The first abdominoplasties were very simple, involving straight resection of panniculus with no or minimal undermining. This was described by Kelly around 1900^(1,2).

Traditional abdominoplasty

From 1960-1980 there were a number of improvements that became the basis for the traditional abdominoplasty performed today. A number of authors from this era described different techniques and variations of abdominoplasty, including Pitanguy⁽³⁾, Regnault⁽⁴⁾, Grazer⁽⁵⁾ and Callia⁽⁶⁾.

It is interesting to note that the lower abdominal incision over this time changed according to the prevailing bikini fashion: very low-waisted bikini (Saint Tropez style), French-line bikini (with a very high cut leg) and, lately, bikinis with very low waistlines have become more popular again. Consequently, the incisions have varied over time to provide results that are able to be hidden away in the prevailing bikini line.

To improve the waist, Psillakis⁽⁷⁾ suggested plication of the internal oblique to the rectus sheet.

The technique that emerged from this period is the standard or traditional abdominoplasty technique. The basic principles of traditional abdominoplasty⁽⁸⁾ include:

- Wide, direct undermining to costal margins for abdominal flap advancement



Figure 1: Laxity gained after performing deep and superficial liposuction.

- Abdominal skin laxity primarily in a vertical direction from xiphoid to the pubis. This assumption leads to the most amount of tension being in the midline and looseness laterally
- Transverse lower abdominal incision
- Tightening of abdominal musculature
- Resection of redundant abdominal flap with maximum resection centrally
- Umbilical transposition
- Skin closure with hips flexed

High lateral tension abdominoplasty

In 1995, Lockwood⁽⁹⁾ described the high lateral tension abdominoplasty. This technique is a complete paradigm shift in abdominoplasty. The thinking introduced by Lockwood has led to the safe implementation of later liposuction-assisted abdominoplasty techniques.

Lockwood challenged two of the assumptions forming the basis for traditional abdominoplasty. The first assumption is that wide undermining is needed to advance the flap. By performing limited undermining and discontinuous undermining, he demonstrated that significant flap advancement can be achieved in addition to preserving blood flow. The second assumption is that the skin excess occurs mainly in the vertical distance. This assumption is only accurate in the lower abdomen. With age and weight fluctuation, the main excess is in the horizontal direction, requiring more skin to be excised laterally and not centrally.

Lockwood's principles for improving the safety and aesthetic results from an abdominoplasty include:

- Only vascular perforators that are essential for rectus muscle plication should be resected
- Performing discontinuous undermining of the upper flap to advance the flap
- Performing skin resection to place the majority of tension laterally, not centrally
- Superficial fascia system closure with permanent sutures
- Undertaking liposuction of the flank areas, as needed

LIPOSUCTION-ASSISTED ABDOMINOPLASTY

In the last decade there has been a lot of work to improve the abdominoplasty process even further. Liposuction can now provide significant flap advancement, as well as preserving the perforating blood vessels to the skin. This limits the need for extensive undermining and improves the safety of an abdominoplasty. It also allows a better result as abdominal fat contouring can be performed more extensively, thereby providing a thinner flap that matches the lower abdominal flap.

In the early 1990s, several authors described liposuction with excision of tissue with no undermining. These techniques were limited in how much flap advancement could be performed^(10,11).

Matarasso^(12,13) was one of the first authors to investigate the safety of performing liposuction combined with an abdominoplasty. He defined four zones of safety in performing liposuction. The safe zones were lateral, while the zone to avoid was in the central abdomen. He also limited undermining to only the skin to be excised. Although this provided a safe procedure, it was limited regarding how much excess skin could be removed, as well as to the extent of liposuction that could be performed.

Since these authors, a number of surgeons have pushed the envelope even further by demonstrating that it is safe to liposuction the whole abdomen and perform full abdominoplasty with a modified technique^(14,15).

SAFETY ISSUES: LIPOABDOMINOPLASTY VERSUS TRADITIONAL ABDOMINOPLASTY

Abdominoplasty is a large operation and, as such, patient safety and minimising complications are vital considerations; and there are both common complications as well as serious but rare complications that are relevant when comparing different techniques. The complications that will be discussed further include: wound dehiscence and flap necrosis, seroma formation and pulmonary embolus. Local complications, such as skin necrosis, haematoma, seroma, wound dehiscence, and skin necrosis can occur in up to 30 per cent of non-smokers and up to 50 per cent of smokers. It is therefore important to look at all options that can reduce these complications. Of note is that there is currently no standardised lipoabdominoplasty procedure as this technique is still evolving.

Pulmonary embolus

This serious complication has been described in 0.8 per cent of cases⁽¹⁶⁾. This complication is thought to be directly related to the severity of plication of the rectus fascia, which can cause intra-abdominal hypertension.

The key to preventing this is to only repair true divarication and not over-tighten the repair. It has been demonstrated that over-tightening the repair will cause a high degree of failure of this repair. It is important to follow all the relevant DVT prevention guidelines, including using heparin or low molecular weight heparin, compression stockings, calf compressors and early ambulation.

Wound complications

Perhaps the greatest debate between performing abdominoplasty with or without liposuction has been in relation to the surgical flap viability. Worries relate to the potential for reduction of the blood supply to the abdominal flap and subsequent skin necrosis.

There are several studies comparing the wound-related complication between lipoabdominoplasty and more traditional abdominoplasties. The majority of these studies support the safety of liposuction techniques, with comparable or even better complication rates.

A study performed by Heller⁽¹⁷⁾ compares 114 patients in four groups – Group A (liposuction only); Group B (traditional W-pattern abdominoplasty); Group C (modified low transverse abdominoplasty); and Group D (combined liposuction and abdominoplasty). The liposuction abdominoplasty had significantly lower complication, dissatisfaction and revision rates respectively.

Summary of the results from the study:

Group A – Liposuction only

- Overall complication rate five per cent
- Two patients were dissatisfied (10 per cent) and underwent further revision with full abdominoplasty

Group B – Traditional W-pattern abdominoplasty

- Complication rate 42 per cent
- Dissatisfaction rate 42 per cent
- Revision rate 39 per cent

Group C – Modified low transverse abdominoplasty

- Complication rate 17 per cent
- Dissatisfaction rate 37 per cent
- Revision rate 33 per cent

Group D – Combined liposuction and abdominoplasty

- Complication rate nine per cent
- Dissatisfaction rate three per cent
- Revision rate three per cent

Brauman⁽¹⁵⁾ also reported on 337 consecutive patients who had circumferential liposuction and abdominoplasty. The complication rate was low with only 1.7 per cent marginal necroses that healed without ill-effect. Other studies have confirmed the safety of liposuction in conjunction with abdominoplasty⁽¹⁸⁾.

Seroma

Seroma following abdominoplasty is one of the most common complications and has been reported to occur in up to 60 per cent of abdominoplasties. Some studies demonstrate that there is an increase in seroma rates when liposuction is used in abdominoplasty⁽¹⁹⁾ and other studies indicate a reduced rate of seroma formation. Many of

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these studies have small numbers of participants and the technique for abdominoplasty is not standardised, due to several surgeons performing the operation.

Many different techniques have been used in an attempt to reduce seromas, including drains, quilting sutures, compression garments and minimal handling of the skin flap.

Martino⁽²⁰⁾ performed a prospective study of 58 female patients divided into three groups: abdominoplasty without quilting sutures; abdominoplasty with quilting sutures; and lipoabdominoplasty. Ultrasound was performed in a standardised way on all patients between day 11 to 14 (Period 1; P1) and between days 18 to 21 (Period 2; P2). In this study, the seroma rate with traditional abdominoplasty was 38.1 per cent at P1 and 33.3 per cent at P2. There was no statistical difference between abdominoplasty with quilting sutures and lipoabdominoplasty. The seroma rate for lipoabdominoplasty was 10 per cent at P1 and zero at P2. In the abdominoplasty group, it was also demonstrated that clinical examination is not sufficient to detect all seromas. The rate for seromas determined by clinical examination was 23.8 per cent and by U/S 38.1 per cent.

As seromas develop in the second and third post-operative weeks, drains are unlikely to assist in reducing the rate. Also, drains are associated with a significant increase in infection rate.

Satisfaction with different procedures

Although patient safety must always be paramount when discussing aesthetic procedures, patient satisfaction is also crucial. Complaints from patients regarding the aesthetic outcome of more traditional abdominoplasties include:

- Fulness of the flanks and epigastric areas
- Lack of posterior lumbar curve
- Hanging skin over the incision line
- Visible scars over the flanks and beyond underwear or swimsuit coverage
- Mismatch of the inferior and superior abdominal incision

Liposuction-assisted abdominoplasty addresses many of these problems. By thinning out the flap and performing extensive liposuction of the flank and mons pubis, the final result is vastly improved. The studies in relation to patient satisfaction also demonstrate that this is much improved with the newer techniques.



Figure 2: Abdominal flap raised and epigastric tunnel performed for plication of the rectus.

MY CURRENT TECHNIQUE FOR LIPOSUCTION ABDOMINOPLASTY

Currently, I use a technique described in 2009 by Brauman and referred to earlier⁽¹⁵⁾ with some modification, in particular regarding the umbilical shaping. This is a technique combining the principles of high lateral tension abdominoplasty with liposuction. To limit any issues with blood supply, liposuction is performed deep to the Scarpa's fascia on the superior flap area. Although this technique is described well in Brauman's article, the main points are outlined below, namely:

- Releasing all skin-retaining ligaments
- Deep hydrodissection and liposuction throughout the abdomen, with the extent of liposuction depending on the individual patient's requirements
- Superficial liposuction on the inferior abdomen to separate Scarpa's fascia from the skin
- Making the incision in the lower abdomen
- Blunt dissection above Scarpa's fascia to leave this layer intact
- A midline tunnel can be created for any plication
- Some further discontinuous dissection can be performed to advance the flap further
- When repositioning the umbilicus, I like to de-epithelialize a heartshaped area and use 2/0 Vicryl to give further pull-down of the epigastric area



Figure 3 (left): The patient's significant adiposity in her epigastric and flank areas, as well as substantial intra-abdominal adiposity, made her unsuitable for traditional abdominoplasty while also limiting the results that could be achieved. Figure 4 (right): Four weeks after lipoabdominoplasty. Note the nice lift to the patient's lateral thigh post-surgery.

- I also perform extensive liposuction of the flanks, back rolls and mons pubis, as required to get a good result
- Closure of the superficial fascial system with permanent braided nylon sutures
- I do not use drains for any of my patients

CONCLUSION

Abdominoplasty has evolved substantially in the last 100 years. While starting out as a simple skin excision procedure, it has now advanced to liposuction-assisted techniques. The most recent literature demonstrates the safety of these later techniques and, in many cases, the complication rates are far below those of traditional (Pitanguy) abdominoplasty methods. In particular, the seroma rates (which are a prevalent problem in abdominoplasty) have been reported to be much improved with these techniques.

In my opinion, the shapes and results that can be achieved with these newer techniques are far superior to older-style methods.

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