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Skin Tightening Technologies

Comparing and Contrasting Available Technologies

By Michael H. Gold, MD



Skin tightening technologies have become some of the most popular aesthetic cosmetic procedures being performed in the laser world today. Nearly every laser company has a skin tightening device available for laser surgeons worldwide. This discussion will attempt to compare and contrast the various devices available for use in skin tightening and review the medical literature associated with this technology.

SKIN TIGHTENING DEFINED

In order to understand the specifics for this article, we must further define what is truly meant by skin tightening and separate devices used to accomplish it from other lasers, light sources, and energy sources used to improve the appearance of the skin.

This discussion will not focus on either cellulite and its management nor laser-assisted lipolysis — both of which will be evaluated in a future article. Here, skin tightening devices will be defined as those that are truly associated with tightening lax skin, whether through radiofrequency (RF) means or light source methods.

TYPES OF DEVICES DISCUSSED

A variety of devices fit into the category of skin tightening and these are listed in **Table I**. The remainder of this discussion will deal only with devices currently available in the United States market. Other RF and light sources being utilized for skin tightening in other parts of the world may be available in the U.S. market at some point in the near future.

HOW THE DEVICES WORK

All of the skin tightening devices currently on the market work via a similar mechanism of action. These medical devices deliver heat into the deep dermis (up to 2 mm to 4 mm into the dermis) to create both mechanical and biochemical effects, which lead to an initial contraction of the collagen fibers followed by a well-documented wound healing response with dermal remodeling and ultimate neocollagenesis. The devices achieve this through the delivery of RF energy or light energy. In order to achieve successful deep dermal heating and ultimate skin tightening, these medical devices have also been designed to provide sufficient epidermal cooling and perform this cooling prior to, during and after the therapy. The laser/RF companies that are producing these devices are spending considerable time and effort to assure adequate cooling of the skin for this therapy to be safe.

ISSUES/POTENTIAL DRAWBACKS

We also need to discuss patient and physician expectations from these treatments before discussing each individual device.

Pain Control. With some of the original clinical protocols being brought to clinicians for these therapies, pain control — even with proper epidermal cooling — was the biggest drawback of the treatments. Some patients required intravenous (IV) sedation or frank anesthesia in order for the procedures to be tolerated. Working with some very outstanding clinicians and researchers, most companies have worked on improving their

TABLE 1 SKIN TIGHTENING DEVICES

Device Type	Company (Device)
Monopolar RF	Thermage (ThermaCool)
Bipolar RF with diode	Syneron (Polaris, ReFirme)
IPL at 1100-1800nm range	Palomar (StarLUX IR)
	Cutera (Titan)
	Sciton (BBL SkinTyte)
Bipolar RF with Vacuum	Lumenis (Aluma)
Unipolar and Bipolar	Alma Lasers (Accent, Accent XL)

clinical protocols so that the majority of procedures can be performed without anesthesia by using lower fluences and multiple passes to the treated area.

Reproducibility of Results. The second major drawback to these procedures has been reproducibility of results. While presentations and clinical photographs from our device companies always show wonderful results, in reality, we are still unsure who will respond to these therapies.

Patient Selection and Expectations. Patient selection and patient expectations are keys to success. Patients with skin laxity without a great deal of muscular attachment are the ones who usually yield the most promising results. However, those with a great deal of fat associated with their skin laxity probably would be best advised to have laser-assisted lipolysis performed, followed by liposuction.

We need to inform our patients that we are still uncertain as to how many treatments are ideal for the majority of these medical devices and how long the results will be maintained. We do realize, through experience, that many patients have an immediate effect, and that the results will continue to evolve over the course of about 6 months following the procedures. We also know from our own experiences that many patients have results that have lasted for several years, but long-term clinical studies need to be performed to document this longevity.

RF ENERGY SOURCES

Thermage ThermaCool

The first device that received FDA clearance for tissue tightening is the Thermage ThermaCool (Reliant, Hayward, CA). It is a monopolar RF device that has been the most studied and published of any of the tissue tightening devices on the market. More than 40 clinical manuscripts have been published on this device and many investigations have looked at the efficacy and safety of this device over the past 5 years.

In its simplest form, this device utilizes monopolar RF energy with a proper grounding paddle placed on the patient to deliver heat deep into the dermal tissues, a process known as volumetric deep dermal heating. It has also been shown to cause deep heating of the fibrous septae within the adipose layers of the skin. The machine uses a cryogen-type cooling device to help with epidermal cooling. Available are a variety of "tips," which can be used on different body parts including the face, eyelids and body. These tips are disposable and recommended for single patient use.

In the original clinical trials¹⁻⁷ and from early clinical experience, clinicians used high energies (up to 144 joules) delivered with one or two passes to achieve the clinical results. The treatments given, however, were quite painful to many of the patients and either IV sedation or general anesthesia was needed for many of these patients. Also, with the

increasing fluences being utilized, some adverse effects, such as fat necrosis and atrophic scarring were noted.

Investigations soon focused on lower energies and multiple passes with the ThermaCool. Lower energies made the treatments more palatable to topical anesthesia and more accepted by patients. Heat sensations by patients has become the end target for successful therapy, and many now claim that clinical results are even better with this approach than some using the original parameters. A recent clinical review of 5,700 treatment sessions has confirmed this approach with this device.⁸ The incidence of fat necrosis has also been studied extensively and has virtually disappeared with the new treatment paradigms now in place.⁸ Appropriate patient selection and expectations are crucial because not every patient will receive that perfect result.

A newer model, the ThermaCool NXT, is now available and has made the device easier to use with new computerized treatment screens.

Syneron Polaris and ReFirme

The Polaris and ReFirme from Syneron (Irvine, CA) utilize bipolar RF associated with light systems (780-nm to 910-nm diode for the Polaris and 700-nm to 2000-nm infrared light for the ReFirme). The RF electrodes are located fairly close to each other and a grounding plate is not required. The premise is that by combining light and RF current, less RF energy is necessary and that proper collagen denaturation and resultant remodeling will occur to provide the desired effect. Most investigations with the newer ReFirme device have focused on diminution of facial fine lines and wrinkles along with some tissue tightening. The cooling apparatus is within the handpiece of the device. The major drawback noted is that the RF energy does not penetrate very deeply into the skin and that if not performed properly, tissue arcing, which can lead to scar formation, can result. Overall, the procedure is tolerated well by most patients and wrinkle reduction can be achieved.

Clinical studies with the Polaris⁹ and ReFirme¹⁰ have documented the efficacy and safety profile with these devices in

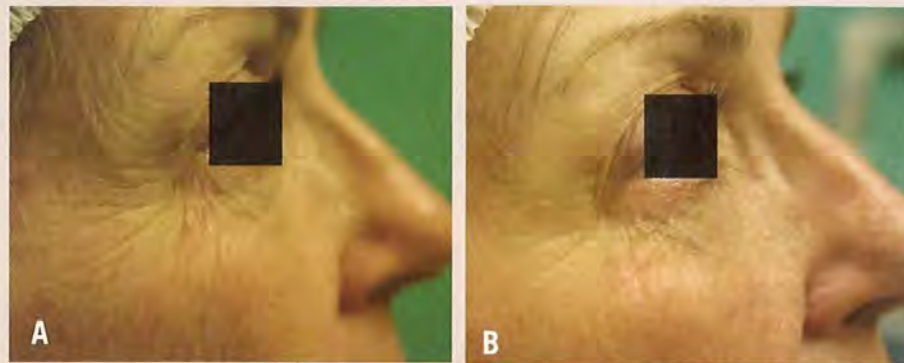


Figure 1: Clinical examples of tissue tightening with the Aluma device (Lumenis, Santa Clara, CA) before treatment (A) and after 8 treatments (B). Photos courtesy of Michael H. Gold, M.D., The Laser and Rejuvenation Center of Gold Skin Care Center, Nashville, TN.



Figure 2: Clinical example of patient treated with Aluma with new larger tip for skin tightening. Before treatment (A) and after 1 treatment with 4 passes (B). Photos courtesy of Michael H. Gold, M.D., The Laser and Rejuvenation Center of Gold Skin Care Center, Nashville, TN.

treating skin laxity and wrinkles. In addition, a recent study in Asians¹¹ showed its usefulness in treating skin laxity and wrinkles at lower optical energies than previously used – 10 J/cm² in the Asian study compared with 32 to 40 J/cm² for the Polaris and 30 to 50 J/cm² for the ReFirme in lighter skinned individuals.

Lumenis Aluma

Another bipolar RF device is known as the Aluma from Lumenis (Santa Clara, CA). It utilizes bipolar RF energy with an accompanying vacuum apparatus, which allows deep dermal energy to be specifically targeted to the deep dermis. The vacuum also seems to have an effect on the pain associated with the procedure, which is virtually non-existent and has been demonstrated in clinical trials on this device.^{12,13} Less energy for an effective treatment is needed, as the vacuum apparatus brings the dermal tissue closer to the electrodes. The clinical trials have demonstrated safety and

efficacy, and histologic changes demonstrating new collagen formation have been documented. This device has been approved for the treatment of fine lines and wrinkles, but many are finding that it is also useful for tissue tightening. The treatment tip on this device is a disposable tip, but allows for multiple treatment sessions with each tip.

A clinical example is shown in **Figure 1**. A new larger tip is currently undergoing investigations and an example of therapy with it is shown in **Figure 2**.

Alma Accent

The next RF device currently available in the United States is the Alma Lasers Accent (Buffalo Grove, IL). It utilizes both unipolar and bipolar RF to be able to deliver heat energy to different depths in the skin — bipolar for more superficial heating, and unipolar for deeper heating. It also utilizes a closed system in that there is no separate grounding plate required for

the therapy; the grounding plate is built in to the handpiece of the device.

The first published clinical trial showed its effectiveness in reducing the appearance of cellulite and also demonstrated its effect on tissue tightening.¹⁴ Since then, several clinical reports confirming its safety and efficacy in treating lines, wrinkles, and skin laxity have appeared in the medical literature.^{15,16}

The Accent XL, an updated version of the device, has recently become available. A clinical example with the use of the Accent XL is shown in **Figure 3**. In addition, a new unipolar tip, known as the UniLarge, has become available, making the treatments faster than previously.

BROAD-BAND ENERGY LIGHT SOURCES

Another type of energy being used for skin tightening is broad-band infrared light, in the range of 800 nm to 1800 nm, depending on the device being utilized. Three such devices are currently available in the United States. They are the Titan by Cutera (Brisbane, CA), the StarLUX IR by Palomar (Burlington, MA) and the SkinTyte by Sciton (Palo Alto, CA). Each one will be described briefly.

Cutera Titan

The Titan device was the first of the light based systems to enter the skin tightening market. It utilizes light energy in the range of 1100 nm to 1800 nm, specifically targeting water as its chromophore to achieve collagen denaturation resulting in collagen remodeling and tissue tightening. It has a cooling apparatus in the treatment handpiece and requires upwards of 6 seconds for proper pre- and post-cooling to be achieved. Tissue tightening has been noted as a result and pain seems to have been addressed nicely after some initial concerns as to the pain associated with this light source. Two types of Titan are available, the Titan V and the faster Titan XL. (Clinical studies on the Titan could not be located.)

Palomar StarLux IR

The StarLux IR is part of the StarLux platform and it delivers fractionated energy through the handpiece of the device, which emits light in the range of 850 nm to 1350 nm to the deep dermis, again

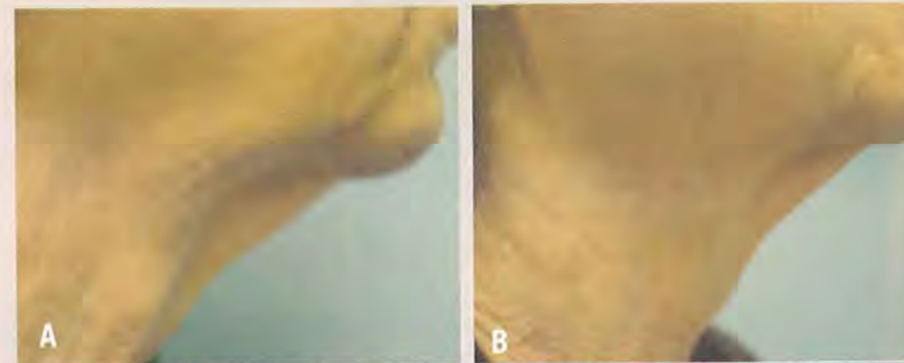


Figure 3: Clinical example of patient treated with Accent XL for skin tightening. Clinical examples of tissue tightening with the Accent device (Alma Lasers, Buffalo Grove, IL) before and after 6 treatments. Photos courtesy of Michael H. Gold, M.D., The Laser and Rejuvenation Center of Gold Skin Care Center, Nashville, TN.

targeting water as the principal chromophore. It can deliver up to 120 J/cm² through a sapphire crystal with contact cooling to prevent epidermal injury. Several treatments are required with the StarLux IR for successful collagen remodeling to be achieved, and several clinical trials have shown its effectiveness in skin tightening.^{17,18,19}

Sciton SkinTyte

The Sciton SkinTyte is a broad-band light source as part of the Sciton Profile platform. It utilizes light energy in the range of 800 nm to 1400 nm. It works through a sophisticated cooling mechanism with pre- and post-cooling needed as well as cooling during the actual treatment. Clinical studies with the SkinTyte are not available at this time.

OTHER LASER ENERGIES

There are a whole host of other laser energies and wavelengths that may be useful for tissue tightening that are not covered in this discussion. These include the 1064-nm wavelength, the 1319-nm and 1320-nm wavelengths, and perhaps some others in the infrared spectrum of light. Also, newer RF devices such as those utilizing “TriPollar” energy or three RF electrodes, are being studied. Furthermore, in the future, we may see several ultrasound devices capable of playing a major role in body contouring and perhaps, tissue tightening.

CONCLUSIONS

Skin tightening medical devices has become very popular over the past several

years. These devices have the capabilities to tighten dermal skin providing patients with clinical results that, at times, rival some cosmetic surgical procedures.

We must remember that patient selection and patient as well as physician expectations are crucial to yielding acceptable results.

Maintenance therapies may be required and future clinical research is essential, especially for those devices that have no clinical peer-reviewed papers behind them as well as to continue the safety and efficacy of these devices. We must have clinical science, not just clinical hype. ■

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DISCLOSURES: Dr. Gold is a consultant for Lumenis and Sciton, owns stock, speaks on their behalf, receives honoraria and performs research. Dr. Gold speaks on behalf of Alma Lasers, receives honoraria and performs research.