

Tissue Tightening Technologies: Fact or Fiction

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Skin laxity is associated with chronological aging and exposure to solar radiation. The authors summarize the advantages and limitations of current laser, light-, and radiofrequency (RF)-based technologies purported to treat skin laxity by effecting heat-induced collagen contraction and subsequent remodeling during the months after treatment. Although penetration of laser or broadband light to the deep dermal layers is limited because of scattering of the light by epidermal melanin, a new device in which broadband infrared light is minimally scattered may overcome these limitations. RF energy offers a treatment alternative that has not only been proven to promote collagen contraction and remodeling but also is not scattered by epidermal constituents. Recently launched devices that use combinations of optical and RF energy achieve clinical benefits at lower and therefore safer levels of energy, with only mild pain and few adverse effects. A combined infrared-RF device takes maximum advantage of both optical and RF technologies to achieve the desired clinical effect. The electrooptical synergy systems have proven to be safe, effective, reliable, and user-friendly. Other more advanced powerful technologies may also be effective in this setting. (*Aesthetic Surg J* 2008;28:180–188.)

Tissue tightening refers to the correction of skin laxity. Suitable patients for nonsurgical skin tightening are those who do not want surgery or are poor candidates for rhytidectomy.¹ In addition, some patients who have undergone a face lift procedure have found that postoperative nonsurgical skin tightening enhances their results.

MECHANISM OF COLLAGEN SHRINKAGE

Collagen is a polymer that exists as a triple helix with chains held together by hydrogen bonds. These molecules are aggregated and organized as fibrils with tensile properties attributable to intermolecular cross-links.² When collagen is denatured by heat, the intramolecular hydrogen bonds rupture and the triple helices “unwind to produce a gel of random-coil molecules.”³ Tissue tension in human skin increases because, although the fibers become shorter,^{4,5} the heat-stable cross-links between molecules are maintained, thus increasing the rubber-elastic properties of the collagen polymer.⁴ The heat-modified tissues then undergo remodeling associated with fibroplasia and new collagen deposition.^{2,3}

When denaturation is complete, further increases in temperature result in additional fiber shortening, probably because of peptide bond hydrolysis.^{4,5} The mechanism of collagen shrinkage has been described in detail.³

The temperature at which collagen shrinkage occurs is often quoted as 65° C.^{2,3} However, collagen denaturation is described by the Arrhenius equation given by $k = Ae^{-E_a/RT}$, in which k is the rate constant, A represents the frequency of collisions between reacting molecules, E_a is the energy of activation, R is the gas constant, and T is the absolute temperature.⁶ According to this equation, shrinkage of collagen depends on time, as well as temperature, and collagen contraction occurs at a variety of time-temperature combinations rather than at a specific temperature.⁴ That said, it has been suggested that for millisecond exposures, collagen shrinkage will occur only at temperatures exceeding 85° C, whereas for exposures of several seconds, shrinkage will occur at 60° to 65° C.⁴

TECHNOLOGIES

Treatment options for nonsurgical skin tightening are based on heat-induced damage to tissue by light, radiofrequency, or both types of energy. Recent nonsurgical approaches to skin tightening have been reviewed.⁷

Laser and Light-Based Devices

The design of laser and light devices is based on the principle of selective photothermolysis, which states that the laser wavelength must be more strongly absorbed by the target tissue than surrounding tissues, the amount of energy (fluence) must exceed the therapeutic threshold of the target, and energy must be delivered within the thermal relaxation time of the target tissue.^{8,9} The therapeutic threshold is the minimum amount of energy to

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Table. Investigations of the Titan Device for skin tightening

Reference (no.)	No. of Patients	Treatment areas (no.)	No. of treatments/ Treatment interval (no.)	Results (no.)	Adverse events (no.)
Ruiz-Esparza 2006 ¹⁷	25	Eye brow only (3) lower face only (1) cheek and neck (21)	1 session (20) 2 sessions (4) 3 sessions (1)	Excellent (13) Moderate (3) Minimal (6) No change (3)	Pain during treatment at higher fluences, edema*
Taub et al. ²¹	42	Face, lower face, neck areas	2 sessions/2.5 to 7 weeks (41) 3 sessions/ 4 weeks (1)	None (4) Mild (15) Moderate (14) Marked (8) Outstanding (1)	Mild transient discomfort during treatment, edema and erythema after treatment
Chua et al. ²²	21	Face and neck	3 sessions/ 4 weeks	43% good improvement, 38% moderate improvement, 19% mild improvement at 6 months	Minimal to no pain, occasional superficial blistering
Goldberg et al. ²³	12	Lower neck and face	2 sessions/ 1 month	Obvious clinical improvement in 11 of 12 subjects; dramatic changes for patients whose laxity draped separately from deeper soft tissue	Mild transient erythema

*First 5 patients treated with topical anesthetic.

achieve the therapeutic goal, and the thermal relaxation time is the time for the target structure to lose 50% of the delivered energy.⁹

Ablative treatments of facial skin with CO₂ or Er:YAG laser devices have been shown to cause collagen contraction and remodeling associated with tightening skin and reducing wrinkles. Although the efficacies of these modalities are striking, erythema, pigmentary changes, infection, dermatitis, scarring, and long recovery times are common.¹⁰ The risk of adverse effects depends on the experience of the treating physician and have been reduced somewhat by improved laser design.¹¹

Nonablative laser and broadband light devices have been developed to reduce both recovery time and the risk of adverse effects associated with ablative treatments. Beams of these devices inflict thermal damage to the lower layers of the dermis and stimulate collagen production but do not injure the epidermis.^{12,13} Wavelengths ranging from 532 to 1540 nm and intense pulsed light (IPL) have been used with varying levels of success.¹²

Although collagen remodeling has been histologically proven to occur after laser or light-based treatments,^{12,14} correlation of remodeling with clinical improvement has been variable.^{12,15} Full-face treatments with either IPL or a combination of 532-nm and 1064-nm laser devices appear to stimulate overall collagen remodeling and provide higher patient satisfaction.¹² Stimulation of new collagen production by laser treatments has been attributed to the release of inflammatory mediators from vascular epithelial cells.¹⁶ When stimulated by treatment with a combination of 532-nm and 1064-nm laser

devices, collagen remodeling continues for 6 to 12 months and increases with the number and intensity of treatments, as well as elapsed time.¹² Nonablative laser treatments are suitable for patients desiring short recovery times and minimal adverse effects and willing to accept mild improvement at considerable expense.¹⁵

The Titan system (Cutera, Inc., Brisbane CA) uses broad-spectrum (1100–1800 nm) infrared (IR) light in multisecond cycles to heat water in the dermis. With this band, bulk heating of the dermis is maximized at 1 to 3 mm, and absorption by melanin and hemoglobin is low. Heating also occurs at 5 mm.¹⁷ The epidermis is protected by a cooling head.¹⁸ Collagen fibril denaturation after 4 passes has been shown by electron microscopy.¹⁹ Multiple passes at low energy levels are associated with bulk dermal heating and collagen contraction.²⁰ Patient discomfort is minimal, and anesthesia is not required.¹⁸ Studies evaluating the efficacy and safety of the Titan device are summarized in the Table.

Overall the effectiveness of the Titan system for skin laxity is apparent for all skin types and ages. Low fluences may be used, thus negating the need for anesthetics. One to 2 sessions 1 month apart seems to be effective for most patients. Although an immediate tightening effect is achieved, the full effect often does not appear for 6 months or longer, which makes management of patient expectations crucial.

Radiofrequency Devices

An alternative to nonablative light-based systems are devices that use radiofrequency (RF) energy to heat, lift,

and tighten dermal tissue.^{13,24} RF energy is actually alternating current that flows from the tip of an electrode to tissue with which it is in contact. In direct current, the flow of electrons is in one direction, whereas in alternating current the direction of flow cycles back and forth at a certain frequency. In medicine, the frequency of the alternating current in RF devices is typically 0.3 to 10 MHz.²⁵

In biological tissue, the thermal effects of RF devices depend on the electrical characteristics of the tissue. In RF devices, alternating current flows from an electrode to tissue with which it is in contact. When the current enters tissue, ions in the tissue try to follow the high-frequency changes in the direction of the current. The resulting ionic agitation constitutes opposition to the flow of alternating current (impedance) and results in the production of heat in the tissue.^{26,27} The amount of heat produced depends on the impedance, the square of the intensity of current, and length of time the skin is exposed to RF energy.²⁷

RF devices designed to remodel cutaneous tissue have been reviewed¹³ and will be summarized here. Unlike laser and light energy, RF current is not scattered by tissue or absorbed by epidermal melanin. Patients of all skin types can therefore be treated, and considerable heat can be generated in the dermal layers to stimulate collagen contraction and neocollagenesis.¹³ RF devices are also considerably less expensive than laser devices.²⁶

In dermatology, RF devices are either monopolar (unipolar), bipolar, or both. In monopolar systems, current flows from an active electrode in contact with the treated area to a large grounding electrode positioned on the skin far from the active electrode.^{13,25} The current flows from the electrode contact point, through the entire body (the path of least resistance), and to the grounding pad. Most of the heat is produced in the tissue just beneath the electrode, and little heat is generated at the grounding pad^{13,26} because the energy diminishes with distance from the active electrode. Monopolar RF energy is the first nonsurgical procedure developed for tightening facial skin.²⁸

The advantage of monopolar RF devices is that the current penetrates to the deeper layers of skin (eg, 5 mm depth for a 10-mm electrode).^{25,27} Unfortunately the high levels of energy and the deep penetration also cause pain during treatment, necessitating the use of anesthesia.²⁷ The ThermoCool TC (Thermage, Inc., Hayward, CA) is a nonablative monopolar RF device.

Bipolar RF devices use 2 electrodes positioned at fixed distances from each other. Both electrodes are in contact with the area to be treated. In these devices, alternating current enters the skin from the active electrode and passes only through the tissue between the 2 electrodes. Because the current does not pass through the entire body, grounding pads are not needed.¹³ In these devices, the penetration depth of the electrical current is approximately half the distance between the electrodes.²⁵ The advantage of bipolar systems is that the distribution of current inside the tissue can be controlled. The Aurora

(Syneron Medical Ltd., Yokneam, Israel) is a combined bipolar RF and optical energy device.

Monopolar radiofrequency. The efficacy and safety of the ThermoCool device for skin tightening have been evaluated in a variety of studies.^{1,6,10, 29-34} A histologic study suggests that collagen fibrils contract immediately after treatment, and neocollagenesis is induced as part of a wound-healing response.³⁵ In this device, a 6-MHz monopolar current signal is produced in a disposable capacitive membrane tip that treats a 1.0- to 1.5-cm² area to depths of 3 to 6 mm. A cryogen gas spray device cools the skin surface before, during, and after the delivery of RF current. The balance between the superficial cooling and the deep tissue heating creates a reverse thermal gradient in which the dermis receives the most intense heat without affecting the skin surface.¹³

The initial protocol for treating patients with the ThermoCool device was a single pass at the highest energy patients could tolerate. With this technique, patient feedback was negative, and clinical results were not optimal.³⁶ In a study comparing a new technique of multiple passes at lower energies with the traditional single-pass high energy technique, Kist et al³⁷ showed that the multiple pass-lower fluence technique resulted in fewer side effects, less pain during treatment, and more consistent clinical improvement. Bogle et al³⁸ reported similar findings by use of a similar technique to tighten the skin of the lower face. The use of a 3-cm² tip and a generous amount of coupling fluid has also been reported.³⁸ A new 0.25-cm² treatment tip has been evaluated for the treatment of human eyelids.^{39,40}

A retrospective study of more than 600 patients treated with the ThermoCool showed that the most frequent adverse effects are temporary erythema and edema.⁴¹ Reliance on patient feedback to adjust treatment settings, with a treatment grid used to prevent overlaps and delaying for an appropriate time between passes has been recommended to minimize adverse effects.⁴²

Combined bipolar radiofrequency and optical energy. A technology that combines RF and optical energies, called electrooptical synergy (ELOS), is designed to overcome the limitations of light-based systems alone.^{13,25} The ELOS technology is used in the Aurora DS, Polaris WR (Syneron Medical Ltd.), and the Galaxy (Syneron Medical Ltd.).

The Aurora DS system delivers pulses of IPL (400–980, 580–980, and 680–980 nm) and bipolar RF energies simultaneously, but the RF pulse has a longer duration than the IPL pulse to allow the IPL component to preheat the dermal target. Preheating increases the temperature of the target over that of the surrounding tissue, thus reducing its impedance and preferentially attracting the RF current.^{13,25,43} (The higher the temperature of a target, the lower its impedance, and the greater its attraction to an electrical current.⁴³) In an evaluation of the Aurora system for skin rejuvenation,⁴⁴ 58% of patients were satisfied with improvement in skin laxity after 1 to 2 treatments. In a later study of 108 patients, Sadick et al⁴⁵ achieved 62.9% overall improvement in

skin laxity, 75.3% overall skin improvement, and an 8.3% minor complication rate.

The Polaris WR system combines 900-nm diode laser and bipolar RF energies. The diode laser component treats superficial rhytids, blood vessels, and pigmentation, whereas the RF stimulates collagen production at deeper levels.¹³ In their study of 20 patients treated 3 times at 3-week intervals, Doshi and Alster⁴⁶ showed modest improvement in wrinkles 6 months after the final treatment and progressive improvement in skin laxity during this follow-up period in most patients. Adverse effects were minimal, and 80% of patients experienced mild discomfort during treatment. In a multicenter trial,⁴⁷ more than half of 23 patients treated similarly achieved greater than 50% improvement in wrinkle appearance, and all patients experienced improvement in skin texture and smoothness.

In 2006, Alexiades-Armenakas⁴⁸ treated 28 patients 1 to 5 times, first with the Polaris and then the Aurora or Galaxy system in each session. With a comprehensive grading scale for various categories of photoaging, she achieved 22% overall improvement in skin laxity.

Combined unipolar and bipolar radiofrequency. The Accent (Alma Lasers, Inc., Ft. Lauderdale, FL) RF system includes both a unipolar handpiece for volumetric heating of the subcutaneous adipose tissue and a bipolar handpiece for nonvolumetric heating of the dermis. During treatment the skin is slowly heated to the patient's pain threshold (40° to 44° C) and kept within that temperature range for approximately 2 minutes before the physician moves to the next treatment area to repeat the process. The use of this device for the treatment of cellulite and the subcutaneous tissue of the buttocks and thighs has been evaluated.⁴⁹

A case study of a patient treated for skin laxity, texture, firmness, and volume reduction with the Accent device and a monopolar RF device (ThermaCool) has been reported.⁵⁰ A 60-year-old woman (skin type III) underwent a series of 6 Accent treatments (at 2-week intervals) to tighten the skin of her left upper arm. The unipolar handpiece was used to a maximum skin temperature of 42.5° C. The right upper arm had been treated in a single session with the ThermaCool device according to the device's original protocol and using a 3-cm² treatment tip. Although the patient was pleased with the results for both upper arms, she believed that the skin in her Accent-treated area was tighter and firmer. An additional 3 treatments with the Accent device were given to the upper left arm with the combination of both unipolar and bipolar RF handpieces. The upper right arm received 2 similar treatments. The result was further tightening without adverse effects. Although multiple treatments with the Accent device were required to achieve the desired result, treatment times were relatively short, and a new disposable tip is not required for each treatment.

Vacuum-assisted radiofrequency. The safety and efficacy of an investigational prototype of a vacuum-assist-

ed bipolar RF device (Lumenis, Inc., Santa Clara, CA) has been evaluated for the treatment of wrinkles and elastosis.^{51,52} The device uses functional aspiration-controlled electrothermal stimulation technology in which skin, with the aid of a vacuum system, is folded to a predetermined depth between the bipolar RF electrodes during treatment. The rationale for this approach is that by restricting the volume of treated tissue to that positioned between the 2 electrodes, physicians can treat both superficial and deep layers with less energy than would be required from the unfolded skin surface. In other words, the vacuum system reduces the distance between the source of RF energy and the dermis, theoretically reducing pain and increasing safety during treatment.

In this study, 46 patients received 8 facial treatments at 1- to 2-week intervals. Pain levels were low, patients were satisfied with the treatment, facial wrinkling and elastosis scores improved significantly 6 months after the final treatment, and adverse effects were limited primarily to temporary erythema, burns, and blisters. The authors are currently using 3-dimensional imaging tools, measuring skin elasticity, and conducting histologic studies to further investigate the cutaneous effects of this device. Preliminary results of an ongoing investigation⁵³ of this device for nonfacial skin tightening are promising as well.

The device evaluated by Gold et al⁵³ was further evaluated as the Aluma by Montesi et al.²⁷ Thirty patients received 6 to 8 treatments at 2-week intervals. Biopsy samples were taken from 15 of these patients before the first treatment and 3 months after the final treatment. Among the treated imperfections (periorbital wrinkles, glabellar wrinkles, slack cheeks, striae distensae, and acne scars), the most improvement (clinical, histologic, and immunohistochemical) occurred in the abdominal striae distensae. In most cases, side effects were limited to transient rashes and ecchymosis. Improvements appeared to continue for at least several months after the final treatment.

Combinations With Other Technologies

Combination infrared and bipolar radiofrequency. A device that combines 700- to 2000-nm infrared (IR) and bipolar RF energies (ReFirme ST Applicator, Syneron Medical Ltd.) has been evaluated for the treatment of facial laxity in Asian patients.⁵⁴ In this prospective study, 19 patients (skin types III to V) with skin laxity and periorbital rhytids were given 3 full-face nonablative treatments at 3-week intervals with the combined IR-RF device. Clinical end points were skin tightening and edema and anesthesia was not used. Standardized photographs were obtained with the Canfield Visia CR system (Canfield Scientific, Inc., Fairfield, NJ) before treatment and serially for 3 months after the final treatment.

All subjects completed the study. At 3 months, the authors observed mild improvement in skin laxity in the mid and lower face. Statistically significant improvement was found (by blinded assessors) in the cheek, jawl, and

nasolabial folds. Patients reported high overall satisfaction, with 89.5% achieving moderate to significant improvement in skin laxity of the cheek, jowl, periorbital area, and upper neck. Subjective improvement in skin laxity was noticed in all patients after the initial treatment session. Most patients experienced mild pain, and only 3 patients reported moderate pain. Temporary erythema occurred after all treatments, and 3 patients had edema that disappeared within 24 hours. Superficial crusting was the primary side effect.

The results of this study suggest that the combined IR and RF energy device achieves clinical improvement in skin laxity and rhytids at 10 J/cm² optical fluence, which is lower than the 32- to 40-J/cm² fluences used by Doshi and Alster⁴⁶ and the 30- to 50-J/cm² fluences used by Sadick and Trelles⁴⁷ with the Polaris WR system. Yu et al⁵⁴ speculate that the IR energy, because it is absorbed by water and possibly collagen, has a more direct dermal heating effect than the 900-nm diode energy, which is absorbed by hemoglobin, thus heating the dermis only indirectly.

In a 2-center study of subjects with skin types I to III, 31 subjects received 2 to 5 treatments with the combined IR-RF device at 3- to 4-week intervals without anesthesia. Blinded evaluators compared pretreatment and posttreatment photographs to assess wrinkle clearance rates, and patients graded satisfaction with the treatment. The overall median clearance rate for wrinkles was 50%, and the median patient satisfaction rate was 7 on a 10-point scale in which 1 to 2 is not satisfied and 9 to 10 is exceptionally satisfied. Adverse effects were limited to mild temporary erythema and edema.⁵⁵ Clinical examples of patients treated with the Refirme are shown in Figures 1 to 4.

Combination fractional infrared and radiofrequency. The Matrix IR Fractional Treatment Applicator (Syneron

Medical Ltd.) that combines fractional 915-nm diode laser energy with RF has become available for wrinkle reduction. Designed for deep dermal heating, the new ELOS device creates microthermal thermal bands while leaving surrounding tissues undamaged to promote rapid healing and minimize downtime. Improvement in wrinkles is noticeable after 2 to 3 sessions.⁵⁵ In the author's experience, the ELOS systems have proven to be safe, effective, reliable, and user friendly.

The LuxIR and LuxDeepIR Fractional Infrared Handpieces (Palomar Medical Technologies, Inc., Burlington, MA) are designed to deliver IR radiation 1.5 to 3 mm into the dermis and 1.0 to 4.0 mm into the dermis and fat layer, respectively, without damaging the epidermis and upper dermis. The LuxDeep IR Handpiece offers a longer pulse duration and more powerful cooling. The resulting soft-tissue coagulation can lead to collagen remodeling and tighter skin, according to the manufacturer. Each beam of the array of small beams creates a "lattice of hyperthermic islets" surrounded by undamaged tissue, a pattern considered to expedite healing and collagen remodeling. Skin is cooled before, during, and after each pulse to minimize patient discomfort.⁵⁶

The Affirm (Cynosure, Inc., Westford, MA) is a 1440-nm Nd:YAG laser device with combined apex pulse (CAP) technology for the treatment of photodamaged skin. The CAP technology produces a pattern of coagulated tissue columns surrounded by unaffected tissue. The coagulated columns are created by high-fluence "apexes," whereas the surrounding uncoagulated columns are produced by lower background fluences. The entire treated area is heated, but the coagulated columns are heated more than the uncoagulated tissue.⁵⁷

In solar elastosis, bundles of loosely packed collagen⁵⁸ are present in the dermis at depths of 100 to 400 μ m.^{59,60}



Figure 1. **A**, Pretreatment view. **B**, Posttreatment view 1 month after treatment with a device combining IR and bipolar RF energies.



Figure 2. Split screen view demonstrates patient before and immediately after 1 treatment combining IR and bipolar RF energies.

CAP energy can penetrate up to 400 μm , where most sun damage occurs.⁴ Healing after treatment with the Affirm is rapid, and collagen remodeling is stimulated in the uncoagulated tissue, as well as in the coagulated columns, a benefit supported by histologic studies.^{57,61}

FRACTIONAL ABLATIVE DEVICES

The new Lux2940 (Palomar Medical Technologies, Inc.) is a microfractional Er:YAG laser device designed to ablatively reduce wrinkles, improve skin texture, and reduce hyperpigmentation with 3 to 4 days downtime, much less than traditional ablative laser devices.⁶² Histologic analyses show that the microcolumns close within 12

hours, thus minimizing the risk of complications. Clinical trial results show that efficacy appears to be comparable to that of an ablative CO₂ laser device, and patients may not require preoperative or postoperative pain medication. A major advantage is that clinical benefits appear after a single treatment. Preliminary results of 12-month clinical trials have been presented.⁶³

The ActiveFX Fractional CO₂ laser device with UltraPulse Encore (Lumenis, Inc.) provides noticeable clinical benefit after a single treatment, with less downtime than traditional CO₂ laser devices.⁶⁴ The novel device ablates a fraction of the surface, which permits bridges of undamaged tissue to promote rapid reepithelialization. Clinical trials have shown the efficacy of the ActiveFX in the treatment of dyschromia, rhytids, and skin laxity, and that treatment parameters can be adjusted to minimize erythema and edema.

FRACTIONAL INFRARED DEVICES

A fractional IR device (LuxIR Fractional Infrared Handpiece, Palomar Medical Technologies, Inc.) uses 850- to 1350-nm pulses to cause soft tissue coagulation and collagen remodeling in deep (1.5–3 mm) dermal layers. The IR light is delivered in an array of small regularly spaced beams that produce hyperthermic islets surrounded by undamaged tissue.⁶⁵ A similar device (LuxDeepIR Fractional Infrared Handpiece, Palomar Medical Technologies, Inc.) delivers IR light to 4 mm while cooling the epidermis.⁶⁶

New IR Devices

A new broadband (800–1400 nm) light source (SkinTyte, Sciton, Inc., Palo Alto, CA) selectively coagulates soft tissue and targets dermal collagen while cooling the epidermis before, during, and after treatment. The device

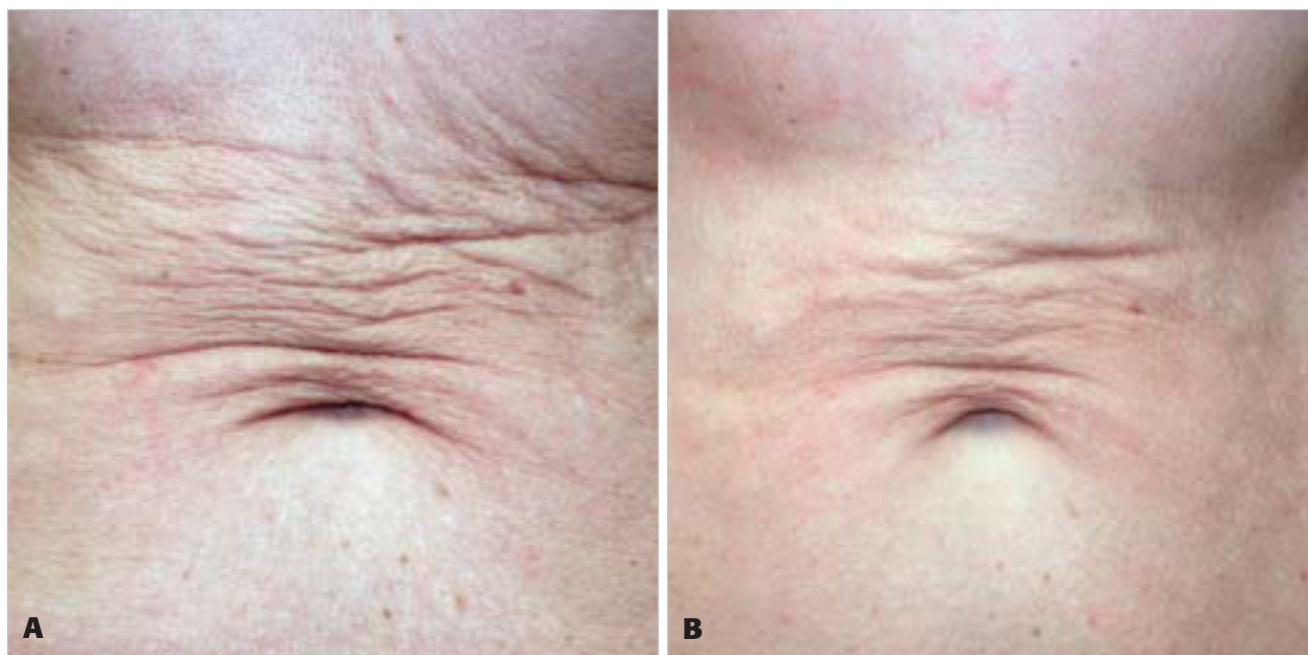


Figure 3. **A**, Pretreatment view. **B**, Posttreatment view 1 month after 1 treatment combining IR and bipolar RF energies.



Figure 4. **A,** Pretreatment view. **B,** Posttreatment view 1 month after 5 treatments combining IR and bipolar RF energies.

can be used to treat large surface areas such as the legs, arms, and abdomen.⁶⁷

The ST module of the Harmony platform (Alma Lasers, Inc.) uses near-IR (780–1000 nm) light to shrink collagen and induce collagen remodeling in the papillary and upper reticular dermis, resulting in skin tightening. The near-IR light heats subdermal connective tissue and proteins and is absorbed minimally by epidermal water, thus eliminating the need for aggressive epidermal cooling. The hand piece is stationary while held against skin during treatment.⁶⁸ Noticeable tightening requires 5 or 6 treatment sessions.⁶⁹

OTHER NEW DEVICES

Additional recently launched devices for skin tightening include the C-Sculpt (DermaMed International, Inc., Lenni, PA), which uses a 626-nm LED with cooling and massage, and the Surgitron Dual Frequency RF (Ellman International, Inc., Oceanside, NY).⁷⁰

CONCLUSION

A variety of devices to tighten skin have been either improved or launched since the first skin-tightening device became available. Laser and light-based devices, although effective, have limited efficacy because of scattering of light by epidermal constituents. A combined IR-RF device used by the author takes maximum advantage of both optical and RF technologies to achieve the desired clinical effect. Other more advanced powerful technologies may also be effective in this setting. ▀

DISCLOSURES

The author has no disclosures with respect to the contents of this article.

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