Picosecond Laser
Tattoos and Skin Rejuvenation

Raminder Saluja, MD[a], Richard D. Gentile, MD, MBA[b,c,*]

KEYWORDS

• Picosecond • LIOB • Photomechanical effect • FOCUS lens • Skin revitalization • Picotoning

KEY POINTS

- Picosecond laser technology uses ultra-short pulses in the trillionths of a second (10–12) creating photomechanical and photoacoustic effects on the skin.
- FOCUS lens is a diffractive lens array that creates high-powered microbeams per pulse and leads to the creation of light-induced optical breakdown (LIOB).
- The resultant skin effects from the creation of the LIOB are minimization of pigmentation and improvement of elastin and collagen.

INTRODUCTION

Laser science is one of the most innovative fields in modern medicine. Discernible progression has occurred from early theoretic work by Townes in 1953 to present day laser science.[1,2] The application of laser science in the medical arena has expanded into a multitude of specialties including dermatology, plastic surgery, ophthalmology, urology, cardiology, orthopedics, etc.

The cornerstone of laser science begins with selective photothermolysis, described by Anderson and Parish.[3] When the targeted chromophore is irradiated by a preferentially absorbed wavelength at an energy setting capable of target destruction, delivered at pulse durations less then thermal relaxation times of the target, then the adjacent tissue is spared thus confining destruction to the target alone.[3] Application of this principle greatly minimizes nonselective thermal damage and enhances the precision of laser irradiation in achieving intended outcomes.

PICOSECOND PULSE

A picosecond is defined as a pulse in the trillionths of a second (10^{-12}), whereas nanoseconds are pulsed in the billionths of a second (10^{-9}). Although both nanosecond and picosecond pulses can generate high target temperatures above steam formation, picosecond lasers have a faster rate of power delivery generating higher target pressure in the irradiated tissue with less thermal diffusion.

The initial cutaneous study evaluating the hypothesis that picosecond lasers were more effective than nanosecond pulses in clearing tattoos was conducted on 16 patients by Ross and colleagues[4] in 1998. Each tattoo was divided into 3 sections treated with an Nd:YAG picopulsed laser, nanosecond domain laser, or a control. All sections were evaluated with electron microscopy and assessed by blinded investigators. Most of the sections treated with the picopulsed laser (12/16 patients) displayed greater clearance of ink at lower energies and a greater depth of penetration when parameters were held constant.

In 1999 Herd[5] performed a comparative split study with a picopulsed laser and nanosecond laser on 6 albino guinea pigs and concluded that the picosecond laser was more effective than nanosecond laser in clearing tattoo pigment. Computer simulations have confirmed that high target

[a] Saluja Cosmetic and Laser Center, Private Practice, 9615 Northcross Center Court, Suite B, Huntersville, NC 28078, USA; [b] Facial Plastic Surgery, Gentile Facial Plastic Surgery and Aesthetic Laser Center, 821 Kentwood Suite C, Youngstown, OH 44512, USA; [c] Cleveland Clinic Akron General Hospital, Akron, OH, USA
* Corresponding author. Facial Plastic Surgery, Gentile Facial Plastic Surgery and Aesthetic Laser Center, 821 Kentwood Suite C, Youngstown, OH 44512.
E-mail address: dr-gentile@msn.com

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pressures generated with picosecond pulses lead to high peak tensile stress that fragment ink particles via a photomechanical impact, not previously seen with nanosecond pulses.[6] Particle fragmentation created by picosecond pulses was described at ASLMS 2013[7] as linearly dependent on laser fluence and quadratically dependent on pulse duration. With a short pulse duration, a higher photomechanical impact is imparted on ink particles, exceeding the tissue's threshold, leading to greater efficacy in particle fragmentation.[8]

PicoSure

In 2012, PicoSure brand laser system (Hologic-Cynosure, Westford, MA, USA) emerged as the first commercially available picosecond laser receiving Food and Drug Administration (FDA) clearance for cutaneous use (**Fig. 1**). The solid state, alexandrite laser, is equipped with a zoom optic allowing for titratable changes in spot size and fluence through a rotational movement on the handpiece and can deliver up to 200mj/pulse. In addition, there are 3 separate handpieces (6 mm, 8 mm, and 10 mm), equipped with either a flat or a diffractive lens array for the treatment of benign pigmentation, acne scarring, striae, and rhytides. Additional wavelengths (532 nm, 1064 nm) have been added to the PicoSure workstation to further expand capabilities in treating red, yellow, and orange ink.

Fig. 1. PicoSure laser with zoom optic. (*Courtesy of* Cynosure, Westford, MA; with permission.)

TATTOO

Tattooing has been performed since prehistoric times and the word "tattoo" is derived from the Polynesian word "tatau" brought to Europe by Captain Cook after visiting Tahiti.[9] Tattoos are categorized as cosmetic, traumatic, decorative, or medical and involve the application of ink percutaneously placed into the papillary dermis. A portion of the ink may descend into the reticular dermis and blur the tattoo or may partially fragment via the immune system and clear intrinsically. In the past, a multitude of destructive techniques were used for tattoo removal, including mechanical abrasive techniques, surgical excision, and ablative techniques, each creating its own subset of adverse events.

Nanosecond laser technology, using principles of selective photothermolysis[3] heralded a new era of targeting and removing ink; however, multiple treatments were needed and dyspigmentation, textural irregularity, and stagnant, residual ink known as a "recalcitrant tattoo" would still occur. As ink particle size diminishes, a higher impact is needed for additional fragmentation. To achieve this, higher fluence parameters were selected to create additional fragmentation while often times crossing the threshold of cutaneous safety.

Sub-nanosecond pulses deliver both photothermal and photomechanical stress to shatter the target before any substantial thermal dispersion can occur to the tissue, thus aiding the safety profile while improving efficacy. An initial study done by Brauer and colleagues[10] evaluated blue and green tattoos, traditionally difficult colors to clear, with a 750 to 900 picosecond laser prototype and found 75% clearance in 11/12 tattoos with 1 to 2 treatments. A second study performed by Saedi and colleagues[11] confirmed the efficiency of the laser with 75% reduction of ink in 2 to 4 treatments. In the clinic, the authors have seen reduction of green ink even with minimal treatments (**Fig. 2**).

The addition of the frequency-doubled Nd:YAG of 532 nm wavelength, which received FDA clearance in 2015, increased capabilities to treat red, orange, and yellow dye. In vitro studies have

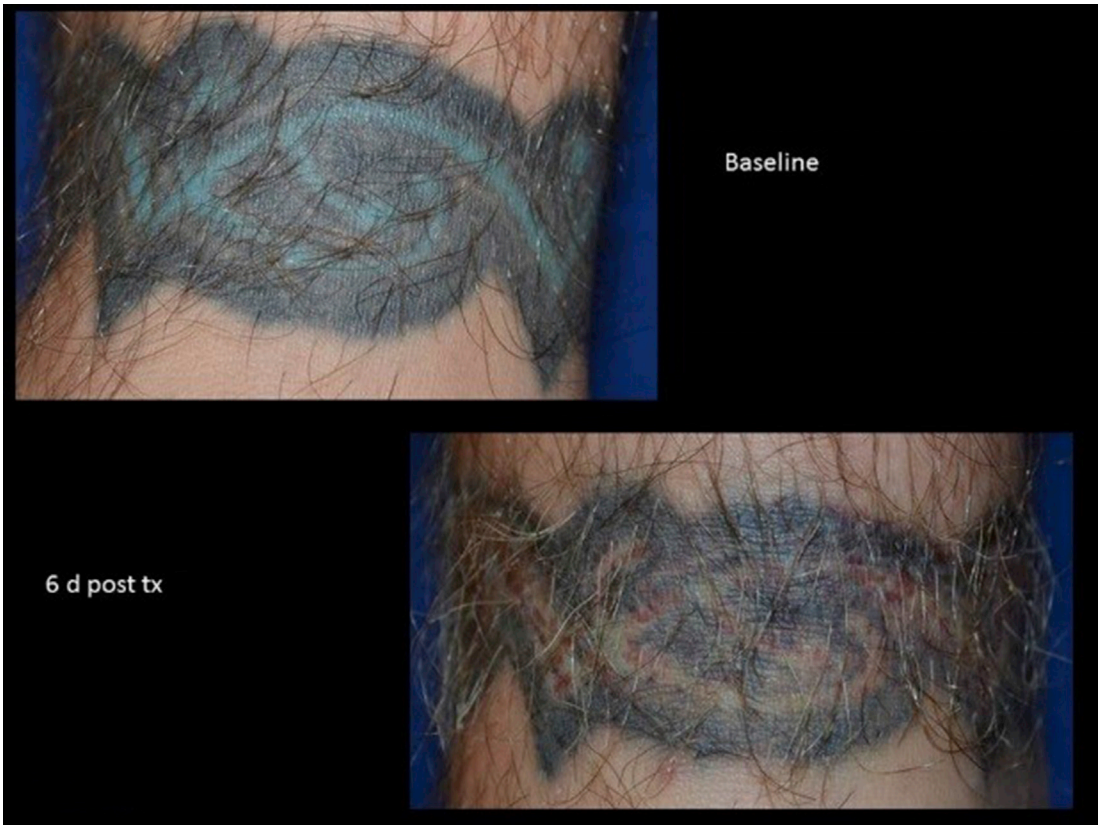

Fig. 2. Six days after 1 treatment with PicoSure. (*Courtesy of* Cynosure, Westford, MA.)

demonstrated the peak absorption wavelengths of yellow tattoo ink measures at 440 nm and 470 to 485 nm, which are nonexistent with our current lasers.[12,13] Favorable outcomes with PicoSure 532 nm on yellow ink were published, and the investigators concluded that yellow dye may be more susceptible to the photomechanical impact imparted on the ink.[14] In 2016, the 1064 nm wavelength was added to the platform.

Sub-nanosecond pulses exert a combination of effects starting with photothermal expansion that creates high tensile stress on the target. This subsequently causes photomechanical fragmentation leading to a photoacoustic "pop" that reverberates in the tissue as a shock wave.[15] With respect to ultra-short pulses, the peak tensile strength or the ability to disrupt the target is achieved with much lower fluences than comparative nanosecond technology.

Tattoo pigments have particle sizes ranging from 40 to 300 nm, which correspond to thermal relaxation times in the picosecond range (estimated 12–1060 picoseconds).[16]

Fig. 3 shows a distal appendage tattoo (finger) that was previously treated with nanosecond lasers until clearance plateau. The tattoo was then treated with PicoSure and the residual ink cleared.

LASER TATTOO CONSULT

During consultation, the authors follow the Kirby Desai[17] checklist. They begin by documenting the Fitzpatrick skin type of the patient. Although practitioners have treated darker Fitzpatrick skin types, the authors recommend test spotting Fitz IV and higher if using 755 nm and typically revert to 1064 nm for patients with Fitz V and VI skin type.

The authors indicate if the tattoo is professionally placed or is an amateur tattoo, as the latter typically has less ink density and ink placement may be more superficial, lending itself to quicker clearance.

The age of the tattoo is documented, as fading can intrinsically occur over time. The authors evaluate for scarring in the area, as this may lead to laser light scatter and an immune blockade that may minimize clearance, although they have noted clearance of tattoo ink and even improvement of baseline scarring when treated with PicoSure

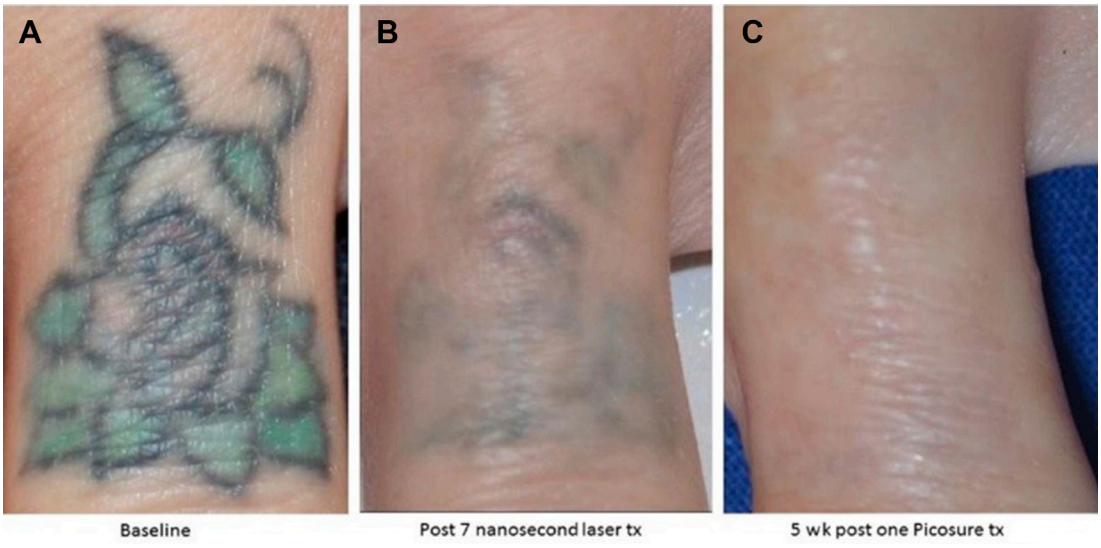

Fig. 3. Recalcitrant finger tattoo. After 1 PicoSure treatment. (*A*) Baseline. (*B*) After 7 nanosecond lasers. (*C*) Five weeks after 1 PicoSure laser. (*Courtesy of* Cynosure, Westford, MA.)

(**Fig. 4**). They also document if the patient is a smoker, or has poor health, which may slow clearance.

It is important to indicate if the tattoo is covering another smaller tattoo, and if so, document the colors of the hidden tattoo.

The location of the tattoo is important, as head and neck locations have an abundance of regional lymph nodes and vascular supply facilitating clearance while areas such as the distal appendages pose the greatest challenge for clearance.

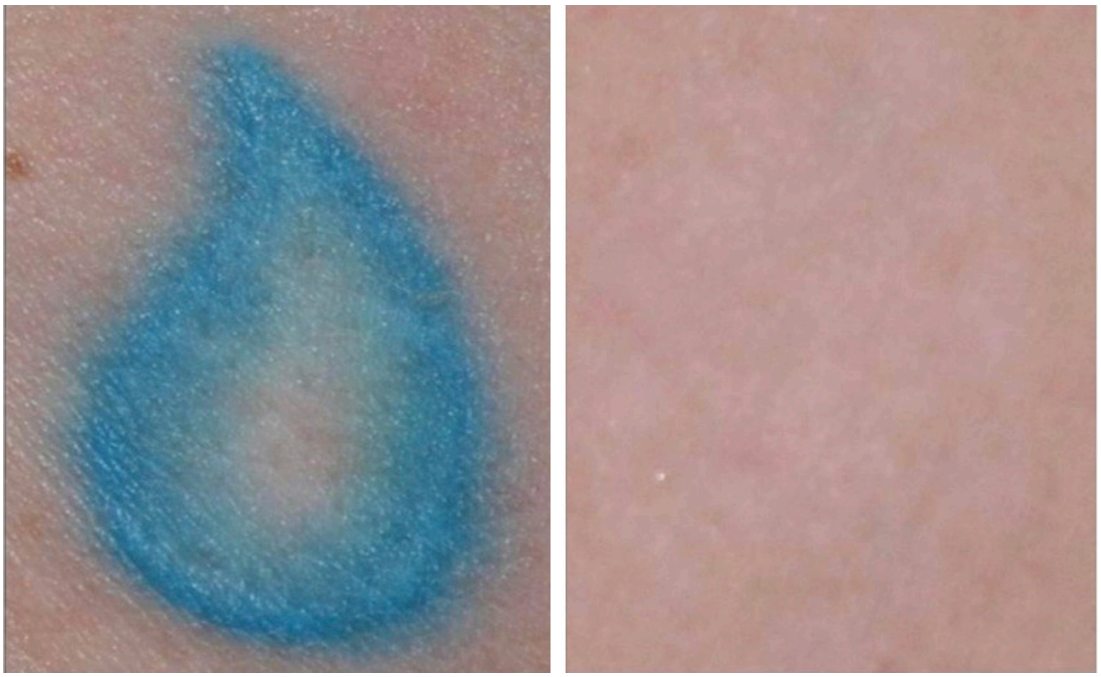

Fig. 4. (*Left*) Iridescent blue tattoo on neck with baseline fibrotic ridge of scarring inferiorly. (*Right*) After 9 PicoSure laser Tx with clearance of ink and improvement of baseline scarring. (*Courtesy of* Cynosure, Westford, MA.)

The process can be painful. Topical numbing can be used for smaller tattoos as the risk of lidocaine toxicity should be respected. Subcutaneous lidocaine injection is not recommended secondary to increased risk of scarring and laser light scatter. Cold air or ice may also minimize discomfort.

Immediately after treatment a low-powered, low pulse duration fractional CO_2 laser may be used to create fractional zones, as an egress pathway for fluid helps hasten healing.

Ointment-based emollients are recommended for 4 days posttreatment, and patients are recommended to keep the area out of stagnant water (hot tubs, pools, soaking in bath tub). The treatments are separated by 10 to 12 weeks. Strict sun protection is followed pre- and posttreatment to avoid pigmentary issues.

FOCUS LENS ARRAY

The FOCUS lens is a hexagonal lens array etched with a diffractive grating on the refracting surface (**Fig. 5**). This specially designed lens minimizes aberrations to improve the optical performance. The lens is equipped with a 25 mm spacer and delivers 70% of the total emitted energy to the underlying skin through high-intensity microbeams.[18] The remaining 30% of energy is emitted at the lower fluence associated with each of the tips (6 mm = 0.71 j/cm^2, 8 mm = 0.4 j/cm^2, and 10 mm = 0.25 J/cm^2). As the spot size increases, the number of microbeams increase, which minimizes the energy output per microbeam.

The pitch between the centers of each microbeam is 500 microns. Per pulse, up to 10% of the underlying tissue is exposed to the higher-energy microbeams allowing multiple passes to be delivered while protecting the skin from a full-field, higher fluence setting. Although the 6 mm FOCUS lens is used routinely in Fitzpatrick skin types I to III, a larger spot size of 8 mm or 10 mm, with associated lower fluences, may be used for Fitz IV and V.

LIGHT-INDUCED OPTICAL BREAKDOWN

A light-induced optical breakdown (LIOB) is the unique histologic finding that occurs with the diffractive lens array in the epithelial layer. Photothermo-mechanical disruption is the initiator of the LIOB.[19] Melanosomes and melanin granules absorb the picosecond photons, which are pulsed in shorter durations, then the thermal relaxation time of the granules. Melanin granules become "superheated" and behave as a nucleation site for microbubble formation. These spatially separated microbubbles coalesce, increase in size, and finally collapse, dissipating their energy through shock wave emission.[20]

Tanghetti describes this phenomenon histologically as an intraepidermal injury surrounded by unaltered appearing cells with an intact overlying stratum corneum. The high-energy microbeams are readily absorbed by melanin leading to ionization (ejection of a free electron). The free electrons continue to increase in an avalanche style process, blocking the microbeam from propagating any further than the epithelial melanin. The laser beam terminates and creates an intraepidermal, spherical vacuole or LIOB at the termination location (**Fig. 6**), visualized within minutes of laser irradiation.[18,20] At 24 hours, the vacuole is filled with rehydrated cellular debris staining positively for melanin (**Fig. 7**). The vacuole contracts over the next days to weeks. Microscopic epidermal necrotic debris (MENDS) can also be visualized,

Fig. 5. Diffractive lens array (FOCUS lens). (*Courtesy of* Cynosure, Westford, MA; with permission.)

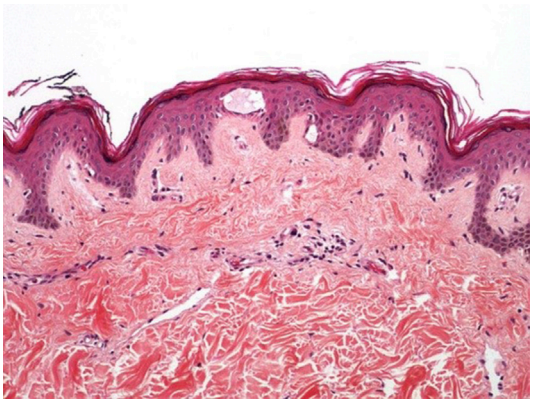

Fig. 6. Ten minutes posttreatment showing focal injuries in epidermis (LIOB). (*Courtesy of* E. Tanghetti, MD; with permission.)

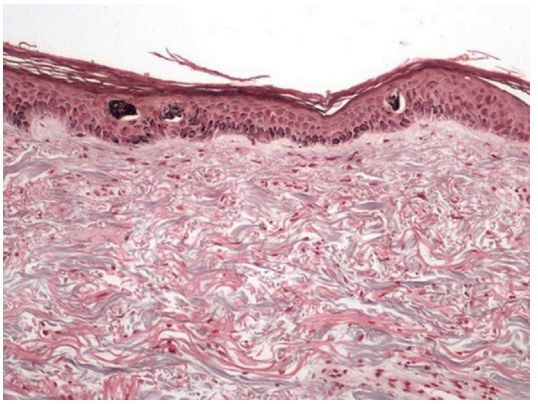

Fig. 7. Twenty-four hours after showing focal injuries with vacuole filled with cellular debris. (*Courtesy of* E. Tanghetti, MD; with permission.)

which exfoliates between 3 and 5 weeks posttreatment. The combination of debris-filled vacuoles and MENDS help to shunt and clear unwanted pigmentation.

Dermal inflammation is visualized after 24 hours (**Fig. 8**) and is thought to be caused by microbubble formation and photoacoustic interactions sending pressure waves into the dermis. McDaniel has shown how direct exposure to fibroblasts with an alexandrite wavelength causes changes in cell signaling and cytokine release from alterations in cellular membranes. Upregulation of heat shock proteins was noted leading to increased collagen and elastin with downregulation of elastinase.[21] McDaniel continued exploring his hypothesis by showing histologic evidence of new collagen and elastin in the dermis 3 and 6 months after FOCUS lens treatment.

Dermal remodeling via FOCUS lens represents a new method in rebuilding dermal architecture not solely reliant on thermal mechanisms. Although thermal methods are involved, they are occurring more at the granular level of the chromophore (melanin), which initiates the subsequent photomechanical and photoacoustic processes. The melanin index of the skin should be taken into consideration when selecting laser parameters.

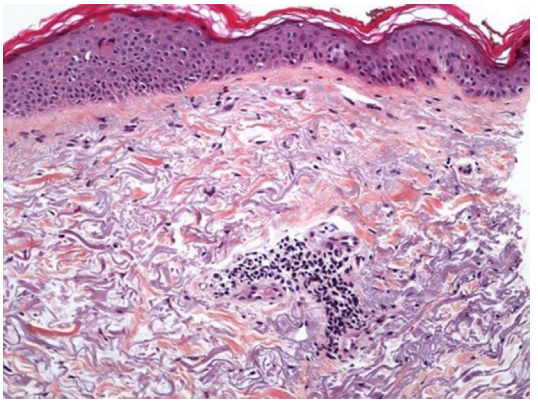

Fig. 8. Healing response in dermis, after 24 hours leading to new collagen and elastin. (*Courtesy of* E. Tanghetti, MD; with permission.)

ACNE SCARRING—FDA CLEARED JULY 2014

Brauer and colleagues[22] did a study evaluating the FOCUS lens in 20 acne scarred patients with Fitzpatrick skin types II to V. Six treatments were performed every 4 to 8 weeks. A 3-dimensional scar analysis revealed a mean 24.3% improvement, maintained at 1 (24.0%) and 3 (27.2%) months after treatment. Histologic analysis revealed elongation and increased density of elastic fibers, with an increase in dermal collagen and mucin. In addition, reduction in residual postinflammatory hyperpigmentation was visualized. This remains the treatment of choice when treating acne scarring in adolescent patients with associated PIH (**Fig. 9**).

PROCEDURE FOR ACNE SCARRING

After the face is thoroughly cleansed, topical numbing can be applied (optional). Treatment begins with one quadrant at a time and multiple passes are placed until confluent erythema is achieved. Posttreatment patients will feel heat effects for 1 to 3 hours. Higher melanin index patients will experience erythema quicker with lower total pulses. Lower fluences are used with Fitzpatrick skin types IV through VI. Perioral edema will be noted for 1 to 4 hours posttreatment, and some patients may experience a papillary type of response that may be secondary to a histamine release or vascular interaction in lower melanin index patients. The LIOB created in patients with melanin index of 12 or lower may contain a combination of melanin and red blood cells.[23] If this occurs, antihistamine taken 1 hour before subsequent treatments may help. Three to six treatments are recommended every 4 to 6 weeks.

Recommended pulse counts with the diffractive lens array for treating acne scarring, full-face acne is between 3000 to 6000 pulses. A small pilot study evaluated standard pulse recommendation compared with higher than recommended pulses in a split face design. The study concluded that additional pulses greater than the standard protocol did not yield statistically significant

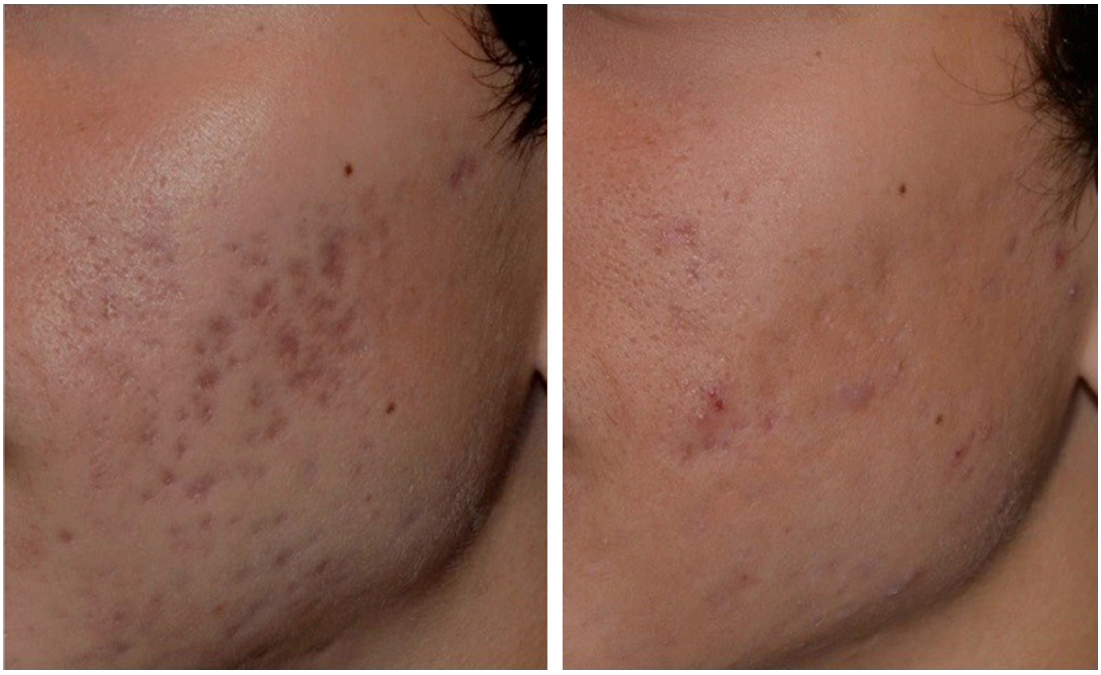

Fig. 9. After 2 PicoSure 6 mm FOCUS lens with improvement in PIH and texture. PIH, postinflammatory hyperpigmentation. (*Courtesy of* Cynosure, Westford, MA.)

improvement but also did not cause an increase in side effects other than transient increases in erythema and mild edema.[24]

SKIN REVITALIZATION—FDA CLEARED SEPTEMBER 2014

Because of the increased luminosity associated with the reduction of fine lines and wrinkles, the term "skin revitalization" was coined for this treatment. Weiss and colleagues completed a prospective, blinded study evaluating the efficacy and safety of the treatment of perioral and ocular wrinkles using the 6-mm diffractive lens with the 755 nm wavelength on 40 subjects with Fitzpatrick skin types I to IV. Subjects received 4 treatments monthly with an average of 5000 pulses delivered over 4 passes to the treatment site. In addition, 6 patients had biopsies performed at the treatment site for histologic evaluation.

A statistically significant reduction of rhytids was observed and histologic analysis confirmed an increased density and depth to the new dermal architecture visualized at 6 months. Most of the patients had edema and erythema resolving within hours. The reduction in benign pigmentation, added to the textural improvement constituted the "revitalization" properties seen in the skin posttreatment.[25]

PICOTONING

Laser toning had traditionally been performed with a Q-switched neodymium-doped yttrium aluminum garnet laser and had gained popularity for facial rejuvenation in the Asian population.[26,27] Multiple treatments were required for visual results. Even at subselective photothermolytic settings, issues such as leucoderma, postinflammatory hyperpigmentation, and generalized rebound pigmentation could occur.

Conceptually, using a picosecond laser, with less thermal effects, could provide an alternative to higher Fitzpatrick skin patients with benign pigmentation, by targeting melanin at lower fluences, thereby minimizing secondary pigmentary alterations. Picotoning summarizes the cutaneous changes induced by FOCUS lens by targeting unwanted pigmentation while improving the texture and tone to the skin through new collagen and elastin production.

The clinical results of the FOCUS lens can be attributed not only to the design of the diffractive lens array, delivering high-energy microbeams, but also to the optical of absorption of melanin to 755 nm wavelength delivered at sub-nanosecond pulses. The inherent absorption of the alexandrite wavelength by melanin is greater than that of hemoglobin allowing for the production of LIOB without hemorrhage as seen with 1064 nm and 532 nm.[27]

To validate the safety and efficacy of "picotoning" on darker skin types, Tanghetti and Shin evaluated 20 Asian patients with Fitzpatrick skin types IV and V receiving 3 to 5 treatments every 2 to 4 weeks with an 8 mm (0.40 j/cm^2) FOCUS lens. Patients received between 5000 and 6000 pulses delivered over 3 to 4 passes. Posttreatment results indicated a 90% to 95% reduction in pigmentation, 70% to 75% improvement in texture, and 50% to 60% improvement in pore size.[28]

The authors, in their clinic, recommend using the 8- or 10-mm flat or FOCUS lens in darker skin type individuals, with long duration intervals between treatments (4–6 weeks) to allow for healing and visualization of any issues with pigmentation. Pulse counts between 3000 and 5000 are often used, and areas are treated per quadrant until mild, confluent erythema is noted.

OFF-FACE APPLICATIONS

Laser toning, before PicoSure, has primarily been for facial photodamage. The exact mechanism of laser toning is not thoroughly known; however, it has been proposed that melanin granules are fragmented and dispersed into the cytoplasm without cellular destruction by repetitive laser energy with a sub-photothermolytic fluence delivery.[29]

Although minimization of pigmentation does occur, the longer pulse durations were not substantive to induce thermal or acoustic dermal remodeling to affect textural irregularities of the face. Off-the-body applications are challenging as less dermal adnexal structures are present for healing and dyspigmentation, and textural irregularity can result.

Picotoning lends itself to off-body applications with the use of FOCUS lens. Several initial studies were performed on the décolletage[30,31] and the dorsum of the hands[31] with documented improvements in rhytid reduction and pigmentation (**Figs. 10** and **11**). Although topical numbing is helpful in the décolletage area, it is not necessary for the dorsum of the hands.

Other off-face applications include treatment of hemosiderin staining in patients postsclerotherapy. One to two treatments with the 6-mm FOCUS lens are recommended to minimize the pigmentary alteration (**Fig. 12**).

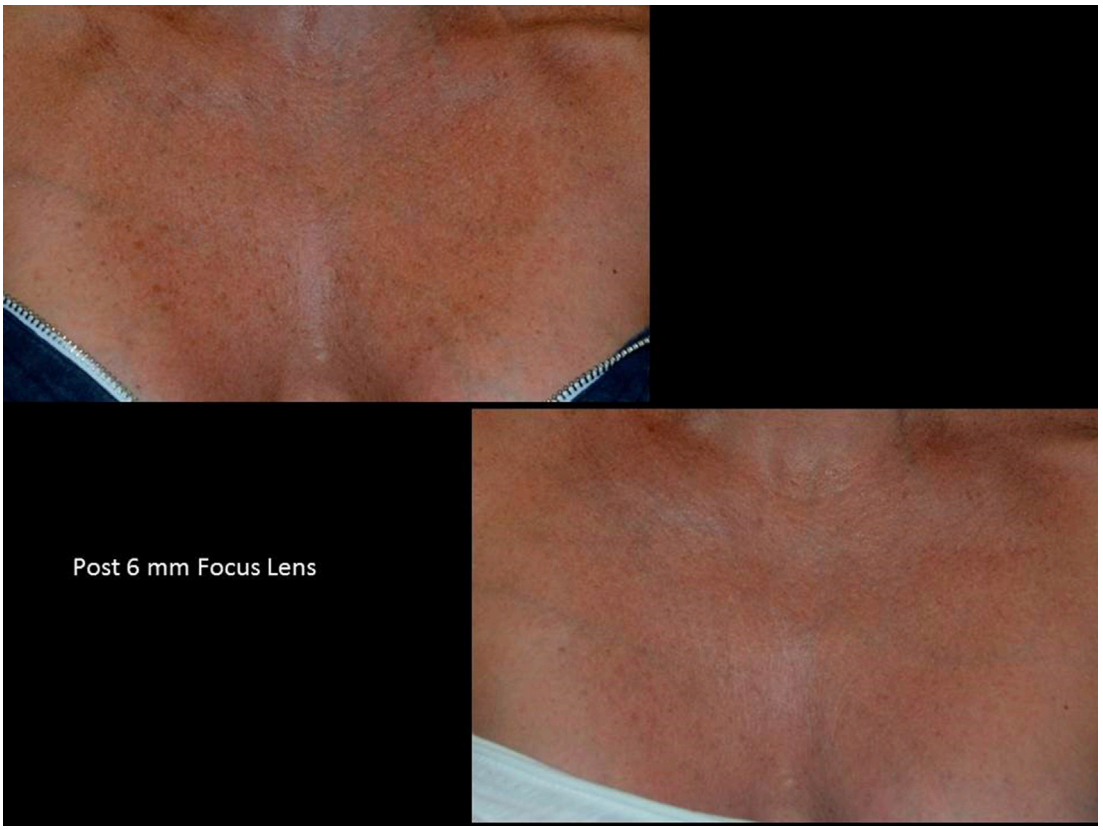

Fig. 10. After 4 PicoSure FOCUS lens Tx to decolletage. (*Courtesy of* Cynosure, Westford, MA.)

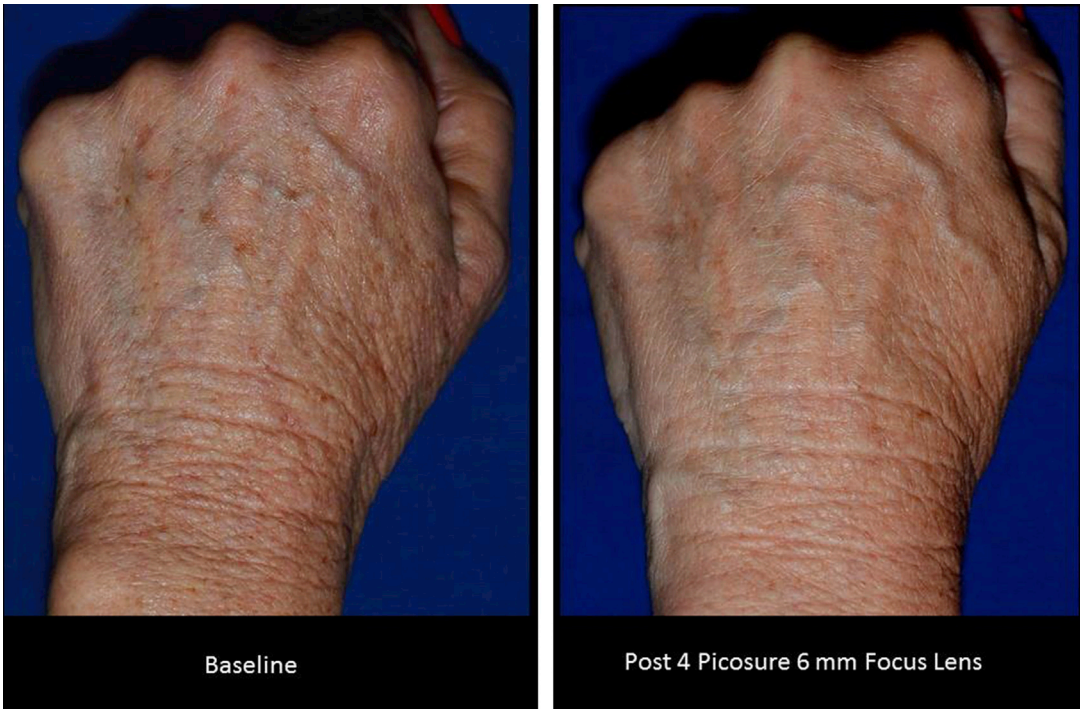

Fig. 11. After 4 PicoSure FOCUS lens Tx to dorsum of hand with improvement of texture and pigmentation. (*Courtesy of* Cynosure, Westford, MA.)

MELASMA

Melasma is one of the most challenging cutaneous issues to treat. Before any treatment, it is recommended for the skin to be "primed" with topical retinoic acid, a bleaching agent, and a photoprotector such as topical vitamin C/E/Ferulic serum. Patients should practice strict sun protection with a tinted (iron oxide), physical blocking sunscreen (zinc and titanium), as visible light as well as ultraviolet radiation can worsen melasma. Mandatory evaluation posttreatment is required, as a percentage of patients with melasma can worsen with laser irradiation.

With multiple modalities of lasers available, the authors opt for a low-level treatment starting either with an 8 or 10 mm flat lens in Fitz IV and higher and 6-mm FOCUS in Fitzpatrick skin types 3 and lower. The authors typically treat with a 5 Hz repetition rate (or lower) and deliver between 1500 and 3500 pulses until the melasma darkens. Treatments are performed every 6 weeks to evaluate for any postinflammatory hyperpigmentation. With this conservative method, improvement can be visualized in most of the patients in whom laser may be an option (**Figs. 13** and **14**). If any darkening occurs after 2 treatments, laser treatment is aborted and continued with topicals. Prelaser discussions regarding periodic maintenance is important to communicate.

MULTIPLE-WAVELENGTH PICO LASERS

Discovery Pico Plus

Discovery Pico Plus™ (**Fig. 15**) (Quanta System S.p.A, Milan, Italy), an FDA-approved second-generation picosecond laser, uses Quanta's patented Pico-Boost technology to generate the highest peak power among available picosecond lasers such as PicoSure, Picoway, Lutronic PicoPlus, Enlighten, etc. Multiple-wavelength Pico lasers haveblossomed since 2014, with most adopting the 1064/532 frequency-doubled platform including the Picoway, Pico Plus, Enlighten, and PiQ04, some of which use handpiece configurations to obtain multi-wavelength capabilities (**Fig. 16**). Discovery Pico Plus has 1.8 GW peak power, which is many times higher than regular nanosecond Q-switched lasers such as the Fotona StarWalker MaQX (which has a 5-ns pulse duration and is not a picosecond laser) that have peak powers ranging from 0.2 to 0.5 GW. Higher peak power laser pulses can break up pigments more thoroughly and at a deeper depth in the

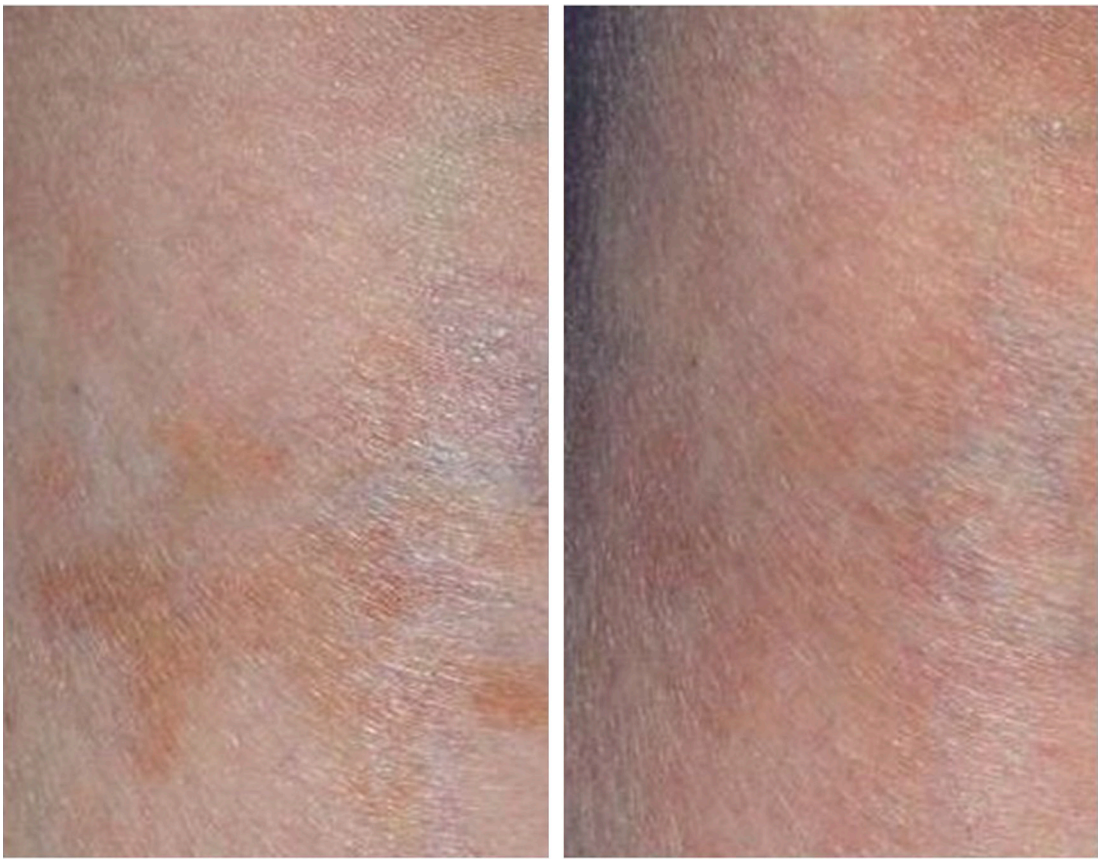

Fig. 12. After 1 treatment with 6-mm FOCUS lens for hemosiderin staining. (*Courtesy of* Cynosure, Westford, MA.)

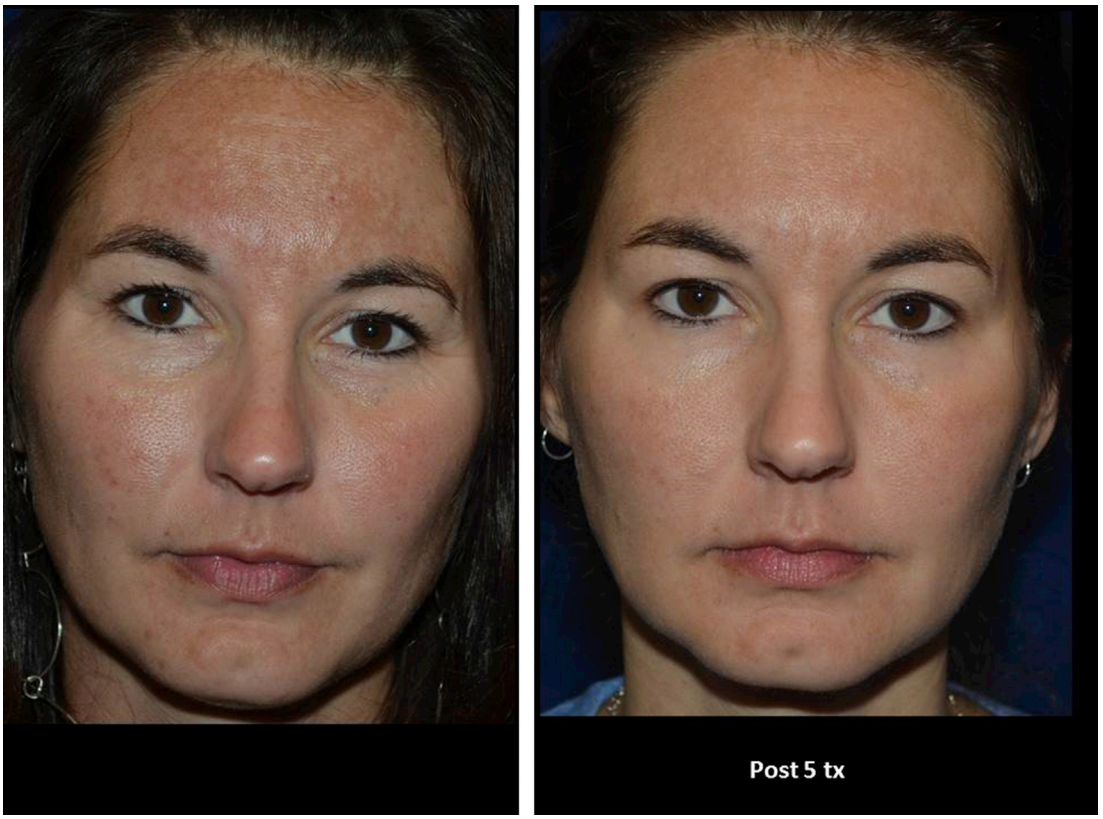

Fig. 13. After 5 FOCUS lens, 6 mm Tx for melasma. (*Courtesy of* Cynosure, Westford, MA.)

Fig. 14. After 5 PicoSure FOCUS lens Tx with 6 mm for melasma. (*Courtesy of* Cynosure, Westford, MA.)

Fig. 15. Quanta discovery Pico Plus. (*Courtesy of* Quanta System, Samarate, Italy; with permission.)

skin, making it more effective for stubborn pigmentation.

Triple-Wavelength with Full-Powered Ruby Wavelength

Green (frequency-doubled Nd:YAG—532 nm), red (ruby—694 nm), and infrared (Nd:YAG—1064 nm) laser light can be emitted. Quanta Discovery Pico Plus houses a full-powered ruby laser. Other q-switched picosecond or nanosecond lasers use dye convertor handpieces requiring a 2-step wavelength conversion with high conversion losses, leading to inadequate power and hence slower and less effective treatments. For example, a full-powered nanosecond NdYAG laser with 1600 mJ energy per pulse would only be able to produce a 220 mJ pulse after conversion, compared with the 1200 mJ of the Quanta Discovery Pico Plus. A third wavelength with adequate power is essential for treating notoriously difficult to eradicate green, sky blue, and blue tattoos effectively. The higher melanin absorption of the ruby wavelength also makes it more effective for clearing pigmentation without producing complications

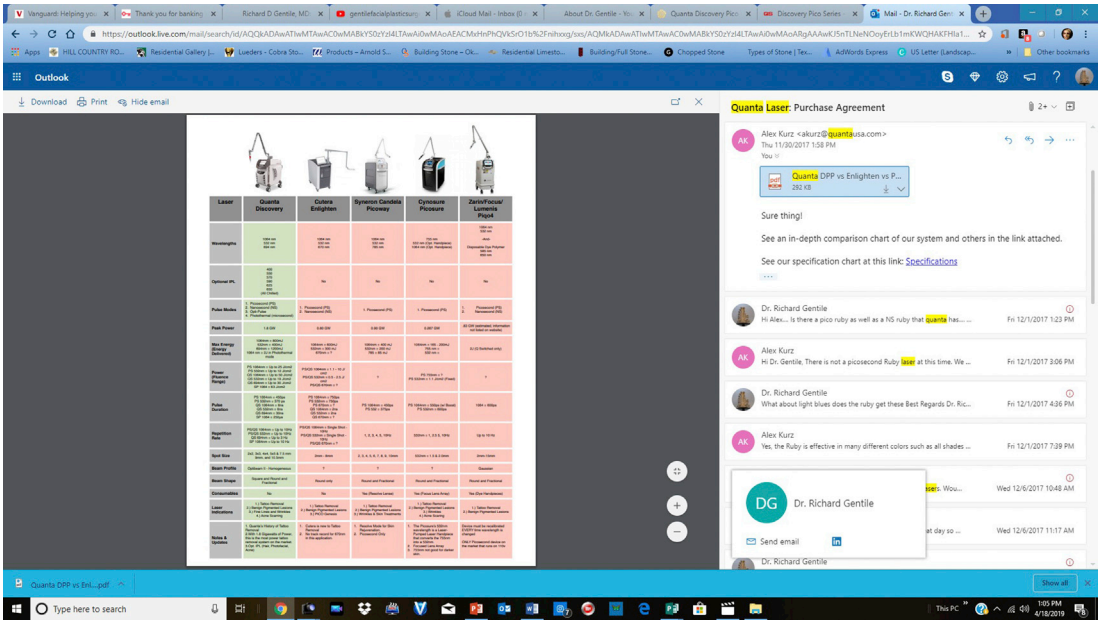

Fig. 16. Pico laser summary sheet. (*Courtesy of* Cynosure, Westford, MA; with permission.)

such as postinflammatory hyperpigmentation or blistering.

Adjustable Pulse Duration with Four Emission Modes

Unlike many other picosecond lasers that can only produce picosecond pulses, Quanta Discovery Pico Plus is able to produce picosecond, nanosecond, OptiPulse (double nanosecond) to quasi-long pulsed 300 us pulse durations. This adjustable pulse duration allows the physician to customize the desired effect of the laser, using ultrashort pulse durations for photoacoustic effects (for breaking up pigmentation, scar treatments) and longer ones for photothermal effects (to treat acne, stimulate collagen production).

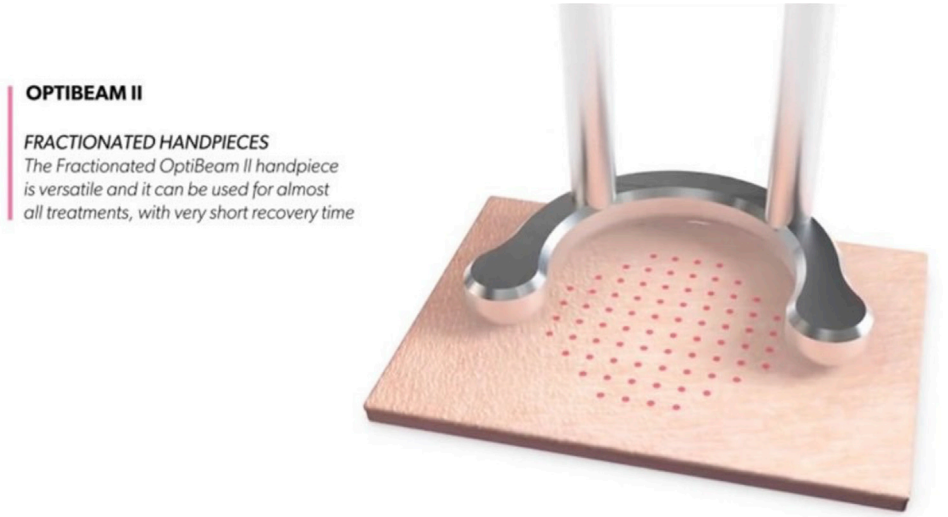

Fig. 17. Fractionated OptiBeam II handpiece. The Fractionated OptiBeam II handpiece is versatile and it can be used for almost all treatments, with very short recovery time. (*Courtesy of* Quanta System, Samarate, Italy; with permission.)

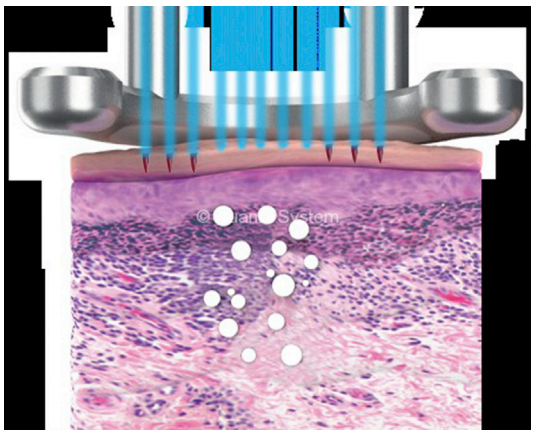

Fig. 18. Multilevel LIOB.

Fractional Microlens Array

Quanta Discovery Pico Plus laser uses a special fractional microlens array (MLA) handpiece to further concentrate the laser energy into tiny spots (**Fig. 17**). These areas of extremely high energy can generate LIOB leading to plasma formation, cavitation, and shockwave formation. This effectively breaks down scar tissue and old collagen and activates intense collagen stimulation leading to skin renewal, improvement in skin texture, scarring, and pore size.

Multilevel Picosecond Effect

Discovery PICO's fractional treatments take advantage of 2 different laser actions with the creation of LIOBs for collagen remodeling and the ablation of damaged skin through picosecond "cold" ablation. The synergy between these 2 effects is the key to the success in full treatment of wrinkles and acne scars (**Fig. 18**).

Twain Handpieces for Discovery Pico Plus

Optional Twain options are IPL or Er:YAG handpieces that can be attached to the Twain connector of the device. Twain IPL is indicated for permanent hair reduction, dermatologic vascular lesions, benign pigmented lesions, and inflammatory acne. Twain 2940 is indicated for skin resurfacing, treatment of wrinkles, epidermal nevi, actinis cheilitis, keloids, verrucae, skin tags, keratoses, scar revision (including acne scars), and with microbeam handpiece it is indicated for skin resurfacing.

SUMMARY

PicoSure and pico pulsed lasers with the zoom handpiece and flat and FOCUS lens and other versions of MLA have contributed to our ability to safely treat tattoo ink, benign pigmentation, rhytides, scarring, and striae in both lighter and darker Fitzpatrick skin type individuals.

DISCLOSURES

None.

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