Asian skin rejuvenation with PicoFractional™ laser

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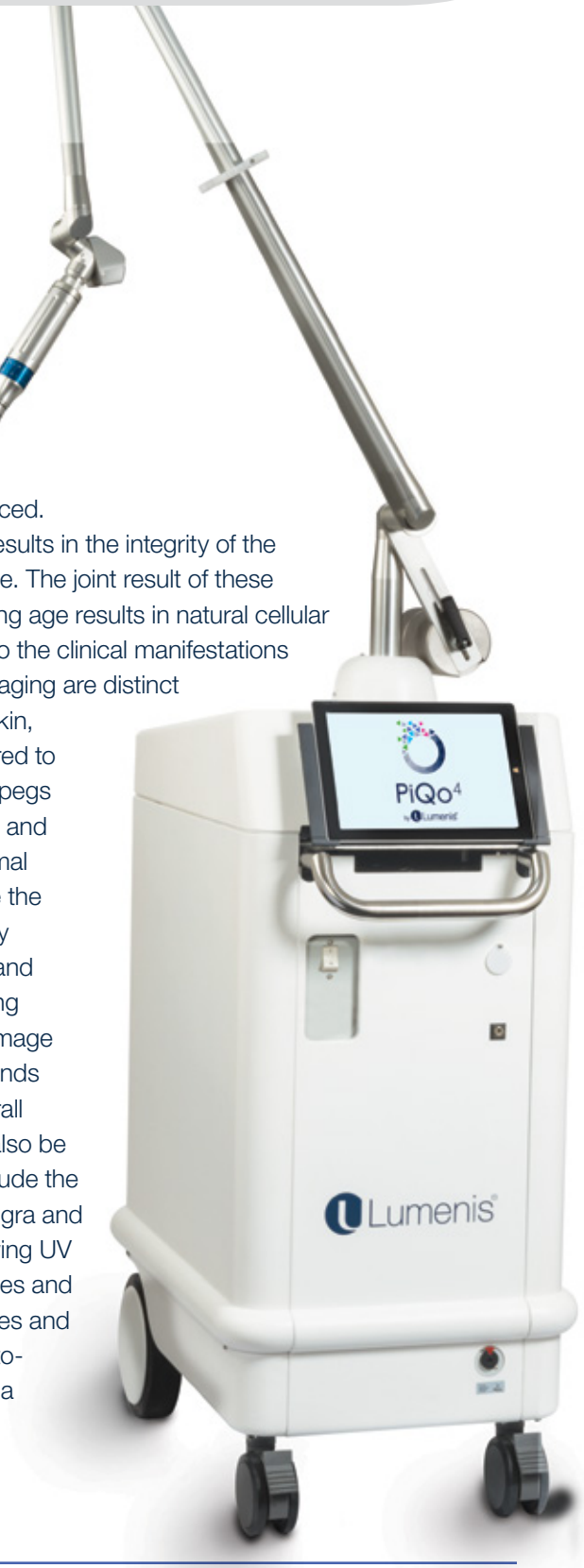
Photoaging of the Skin

Skin aging is a culmination of genetic and environmental factors and is largely influenced by the cumulative damage from exposure to ultraviolet (UV) radiation. The structural integrity of the skin is formed primarily by collagen. UV radiation exposure can induce tremendous insult to the skin through various mechanisms. One understood mechanism involves the generation of reactive oxygen species (ROS). Excessive ROS are harmful to the skin because they can cause oxidative damage to cells thus contributing to collagen breakdown. With chronological aging, exacerbated by photoaging, collagen synthesis is reduced. Increased collagen breakdown coupled with decreased neo-collagenesis results in the integrity of the dermis being compromised and the reparative response becoming defective. The joint result of these combined mechanisms is visible skin damage evident as wrinkles. Advancing age results in natural cellular attrition and senescence that must also be acknowledged as contributors to the clinical manifestations of skin aging. The specific histological changes in the skin caused by photoaging are distinct from those that occur due to chronological aging. In chronologically-aged skin, collagen fiber bundles are loose, short, thin and disorganized when compared to sun protected young skin. The epidermis is thinner, and the number of rete pegs is reduced. In contrast, photodamaged skin is marked by elevated elastosis and collagen fragmentation beneath the dermal-epidermal junction. The epidermal thickness can be irregular, as can the morphology of epidermal cells. Unlike the hypocellular nature of chronologically-aged skin, photoaged skin can display an increased number of inflammatory cells such as mast cells, eosinophils and mononuclear cells. Furthermore, melanogenesis is also upregulated following UV insult and may act as a photoprotective mechanism against UV skin damage via neutralization of free radicals. The exact nature of UV skin damage depends on skin type; type III and IV skin display leathery skin, lentigines and an overall “bronzed” appearance. A yellow cobblestone appearance of the skin may also be present resulting from the elastosis in photoaging. Other manifestations include the development of benign cutaneous growths such as dermatosis papulosa nigra and seborrheic keratoses. Additionally, changes in the dermal vasculature following UV radiation may also lead to dilatations which clinically appear as telangiectasies and if traumatized, bruising. Researchers have reported both pigmentary changes and wrinkling to be major features of photoaging in Asians, however, moderate-to-severe wrinkling becomes apparent only at about 50 years of age, which is a decade later than in age-matched Caucasian counterparts.[1,2]



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Management of Photoaging

Management of photoaging, apart from prevention of exposure to the sun, involves such therapeutic approaches as topical retinoids, 5-Fluorouracil creams, and various cosmeceuticals.[1]

Laser skin resurfacing has become a valuable tool in the arsenal of the clinician, for assisting the patient achieve his/her aesthetic goals. The most highly-effective technique is full ablative resurfacing; however, it is associated with prolonged recovery periods and increased risk of complications including possibility of infection, dyspigmentation, and scarring. In the Asian patient, these risks are further magnified, rendering fully ablative treatments even less desirable for routine clinical use.[3] Fractional resurfacing has a better safety profile and is the mainstay in facial resurfacing today.

Laser Treatments in Asian Patients

Dark skin types have a few characteristics that are specifically relevant to laser aesthetic procedures: increased epidermal melanin, larger melanosomes that are more singly dispersed and widely distributed within epidermal keratinocytes, labile melanocyte responses and reactive fibroblasts. Most importantly, dark skin types react to injury or inflammation with changes in pigment production. Thus, laser procedures are associated with a greater risk for post-procedure hyper- or hypopigmentation in individuals with skin types IV–VI. It therefore is highly important to select treatment modality and settings as well as to use pre- and post-treatment precautions with the aim of minimizing epidermal and dermal injuries.[4]

As darker skin types have relatively large quantities of melanin in the basal layer of the epidermis, there is a higher risk for nonspecific thermal injury and untoward effects, including permanent dyspigmentation, textural changes, focal atrophy, and scarring The development of non-ablative and fractional lasers has broadened the scope of safe and effective treatment options for patients with darkly pigmented skin, however, this patient population requires precautions to mitigate the risk of pigmentary abnormalities. In a recent review of the literature, post-inflammatory hyperpigmentation (PIH) was observed in up to 92% of ablative fractional laser-treated patients. Published studies in East Asian subjects (SPT III and IV) report favorable efficacy in the treatment of acne scarring, surgical scars and photoaging, with a considerable risk for PIH.[6–8]

Picosecond Laser for Skin Rejuvenation

Fractionated laser can vary in pulse duration. Picosecond laser pulses use very high laser intensities that are provided through focused beams in short pulses. Focusing these beams on the surface of the skin for ultra-short periods of time causes breakdown beneath the skin surface, leading to formation of voids or vacuoles. The laser-induced injury promotes wound healing processes in the dermis, either by direct stimulation or injury from the laser energy, or through an indirect mechanism such as cytokine signaling. The injury induces neo-collagenesis and remodeling. The major advantage is the preservation of an intact epidermis with minimal disruption of the dermal-epidermal junction, which translates to shorter and milder adverse effects. In the Asian population, non-ablative fractional laser may be considered a first line treatment for wrinkle reduction. The favorable side effect profile and low risk of dyspigmentation make it the preferred option for the majority of Asian patients seeking photorejuvenation as well. The major advantage of non-ablative fractional laser is the favorable risk profile and short downtime. Erythema and edema are usually seen and resolve within 2–7 days.[3]

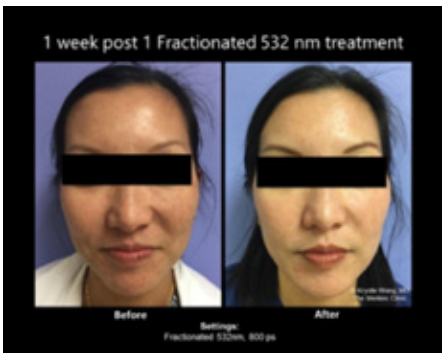
The PiQo4 is a non-ablative laser that provides wavelengths of 1064 nm (recommended for all skin types) and 532 nm (recommended when treating epidermal lesions in lighter skin types, I-III). Sub-surface optical breakdown has been noted with both the 532nm and the 1064nm hand pieces. The PiQo4 provides pulse duration as short as 600 picoseconds and 800 picoseconds. The fractional handpiece allows for multiple passes, with minimal overlap.

Case Report

Below is a description of a case of a 46 year-old woman, who requested treatment for facial skin rejuvenation. The treatment and its results are presented, along with tips and recommendations from the treating physician, Krystle Wang, MD, The Menkes Clinic.

Treatment settings:

- 532nm fractional handpiece (pulse duration default is 800 ps)
- 200 mJ, 3 passes, 10% overlap, 5Hz
- Finish 1 pass over the entire face before performing 2nd pass etc.
- The second pass should criss-cross over the first pass, resulting in a basket-weave distribution
- Metal eye shields were used on the patient during the treatment; the operator should have appropriate laser goggles covering the 532nm wavelength
- At the end of treatment, there was mild erythema
- As can be seen in the series of pictures below, 1 week after a single treatment the skin is visibly lighter and the texture has improved.



Calibration

- The fractional handpiece is calibrated using the 10 mm homogenized hand piece adaptor. Pulse duration should always be 800 ps.
- The energy displayed in small print under the fluence display should be recorded as the treatment setting. After the system is calibrated with the 10 mm homogenized hand piece adaptor, one can then switch to the fractional handpiece and attach the designated fractional metal standoff.

Pretreatment instructions:

- A topical anesthetic cream (Benzocaine 20%-Lidocaine 8%-Tetracaine 4%) was applied to the entire face 30 minutes before the laser treatment
- Immediately prior to the laser treatment, the anesthetic topical cream was removed from the face, and the face was cleaned with alcohol pads. It is important to ensure there are no residual topical cream(s) or makeup on the face prior to the treatment.

Timeline

- There is immediate mild erythema and edema (followed by darkening of the dyschromia. Darkened lesions scab and peel over the course of 7-10 days but can occur up to 14 days.

Pointers:

- The 532nm fractional handpiece is recommended for skin types I and II and up to skin type III
- Treatments are ideal for overall epidermal pigmentation especially when there are too many ephelides and lentigines to target individually
- 2-4 treatment sessions are recommended at 4-6 week intervals
- Each treatment session artistically destroys a fraction of the epidermal pigment
- For Asian patients, I am very cautious with my PiQo4 settings as Asians are extremely unpredictable with laser-induced post inflammatory hyperpigmentation
  - We did a test spot initially on this patient to ensure she did not hyperpigment from the chosen settings
  - This patient was pre-treated with hydroquinone 4% + tretinoin 0.05% alternating nights starting at least 2 weeks prior to the treatment
  - Immediately after the treatment, a class III topical steroid was applied to her face to decrease erythema/ inflammation, which I think helps decrease the risk of post-inflammatory hyperpigmentation.
  - The patient then used the class III topical steroid twice a day after the laser treatment until the redness resolved (3-5 days).
  - The patient resumed hydroquinone 4% + tretinoin 0.05% alternating nights starting 1 week post treatment
  - During the 2 weeks before treatment and the month post treatment, the patient religiously stayed out of the sun and wore physical sunscreen when outdoors.
- **Note of caution:** These same settings can cause post inflammatory hyperpigmentation in a patient with similar skin type/coloring. It's very important to do a test spot to ensure no post inflammatory hyperpigmentation results. Lower energy settings and fewer passes may be needed.
- **Note of caution:** This 532nm fractional PiQo4 treatment is not intended for treatment of melasma or dermal pigmentation.

Fractional handpiece

- Delivers approximately 120 micro-spots within a 12 mm area. Each micro-spot is approximately 200 microns in diameter.

Testimonial

The PiQo4 – with its adjustable pulse durations in the picosecond and nanosecond domain, four wavelengths, and additional fractional handpiece – has greatly expanded how I am able to treat pigment in my patients. It has broadened my ability to treat a wide variety of pigmented lesions in patients of all skin types and color tones.

References

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