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Role of Fractional Erbium Yag Laser 2940nm in Treatment of Eye Wrinkles

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Abstract

Background: The erbium yttrium aluminum garnet (Er: YAG) laser (Sciton, Palo Alto, CA) has been used as an alternative to the CO2 laser. Er:YAG laser-induced improvement in rhytids was comparable to that achieved with CO2 laser resurfacing, and that healing time, redness, swelling, and the incidence of late hypopigmentation were reduced but with reduced thermally induced collagen tightening after Er:YAG treatment compared to CO2 treatment. Since the 2940 nm absorption efficiency is so high, nearly all the 2940 nm energy is consumed during ablation, so minimal energy is left for a necrotic effect on the underlying tissue. The result is a larger zone of irreversible thermal necrosis (50-100 microns) underneath the ablated area.Fractional Er: YAG laser resurfacing showed significant effects on the epidermis and dermal collagen with a considerable improvement of skin texture and fine rhytids.
Keywords: Fractional Erbium Yag Laser, Eye Wrinkles

Fractional erbium yag laser 2940nm in periorbital wrinkles:

The eyes situate in the orbital sockets in the upper face region. The skin that is directly superior to
All types of ablative resurfacing essentially rely on some action that causes tissue damage. Regardless of the peeling modality, treatments that cause deeper damage to the skin produces the most powerful rejuvenation. These deeper treatments, however, lead to longer recoveries and increased risks such as pigmentation and scarring. The history of the development of resurfacing techniques is a progression towards maximizing results, while minimizing risks and recovery times **(1)**

Erbium-doped yttrium aluminum garnet (Er:YAG) lasers were developed in the 1990s as an alternative to the existing CO2 lasers, addressing the main issue of excessive thermal damage to the skin responsible for pigmentation changes. This was accomplished through the substitution of an Er:YAG crystal medium, instead of gaseous CO2, to yield a smaller wavelength of light. Er:YAG lasers produce energy with a wavelength of 2940 nm, which is

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very near the 3000 nm peak absorption of water. Because this wavelength has 10 times the water absorption of CO2 lasers and a very short extinction, Er:YAG lasers deliver more efficient tissue ablation with minimal thermal damage, shorter recovery times, and lower incidence of side effects. Less heat spreads out into adjacent dermal layers, which leads to a lower incidence of dyschromia and scarring, but at the expense of less tissue tightening than achieved with CO2**(1)**

Laser skin resurfacing with ablative lasers, such as the 10 600 nm CO2 laser, the 2940 nm Er:YAG laser and the 2790 nm Er:YSGG laser, has been used for facial rejuvenation for the last 20 years**(2).**

Recently, fractional photothermolysis (FP)has been introduced as a way to overcome the limitations of traditional ablative resurfacing6, and ablative FP using a 2,940-nm Er: YAG laser has become commercially available. This modality is as effective as traditional ablative approaches, but recovery time is considerably shortened and traditional post resurfacing sequelae are absent7. Lee et al.8 reported that a fractional 2,940-nm short-pulsed Er: YAG laser is an effective and minimally invasive treatment modality for photodamagedskin **(3)**

Fractional lasers ablate only columns of the treated area, leaving intervening areas of unharmed skin that help in rapid re-epithelization, reducing the chances of adverse effects. Fractional laser skin resurfacing has been shown to have a much lower complication rate than full-spot ablative laser skin resurfacing in large retrospective studies.1 More than 3 0% of patients suffer from hyperpigmentation after full-spot ablative laser treatments compared with <1% after fractional treatment.1 However, the aggressiveness of the full spot treatment depends on the wavelength and fluence 6 used **(4).**

The Er:YAG laser produces less residual thermal injury and hence less total depth of tissue necrosis than CO2 laser7 resulting in faster re-epithelialization,3,5 less erythema both in degree and duration,3-5 and lower risk of side effects.3 On the other hand, more aggressive treatments give comparable results in fewer treatment sessions. Four sessions of fractional Er:YAG had comparable effects on dermal collagen to a single session of full-spot Er:YAG laser.8 Higher laser fluence results in deeper ablation. For Er:YAG wavelength approximately 4 μm are ablated per each J/cm2.9 At least 15 J/cm2 are required to completely ablate the epidermis.9 Deeper resurfacing produces more dramaticeffects at the cost of longer downtime and higher risk of side effects **(5).**

Fractional Erbium: YAG (Er: YAG) laser creates microscopic thermal injury zones in the skin, thereby inducing the collagen production. The target chromophore is water. Thus, structures rich in water such as collagen, vessels, and epidermal keratinocytes are selectively injured: a concept known as selective photothermolysis. This injury stimulates the epidermal turnover and collagen production **(6)**

Er: YAG lasers are flash lamp pumped crystal lasers that emit light at a wavelength of 2940 nm, which closely approximates the absorption peak of water (3000 nm). It allows for superficial skin ablation and less underlying thermal damage compared with the CO2 laser.

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The findings of ablative fractional photothermolysis of rhytides that have been published so far are encouraging, but they are inconsistent in detail as far as study design and the respective efficacy of different laser modalities are concerned. Many authors believe that fractional Er: YAG laser equals fractional CO2 laser in efficacy and has a favorable side effect. profile due to improved control of the total depth of injury and decreased underlying thermal injury [5, 6]. Those who support the considerable efficacy of Er: YAG laser contend that the depth of ablation is what determines the degree of dermal remodeling, not the depth of underlying thermal injury**(7)**

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The first study to evaluate the efficacy of fractional Er:YAG laser in thetreatment of facial wrinkles was performed by Teikemeier et al in 1997. The authors showed that 2940 nm fractional Er:YAG laser was effective in the treatment of perioral, periorbital, andforehead wrinkles at a fluence of 0.1-1.7J and a spot size of 2.5-7 mm without producing any scarring or pigmentary changes.5 In 1999, McDaniel et al showed that the addition of Er:YAG laser to carbondioxide laser in the treatment of perioral wrinkles not only added to the treatment efficacy but also decreased the duration of side effects such as erythema and crusting.6 When performed alone, Er: YAG laser has less side effects compared to carbondioxide laser. scarring or pigmentary changes.5 In 1999, McDaniel et al showed that the addition of Er:YAG laser to carbondioxide laser in the treatment of perioral wrinkles not only added to

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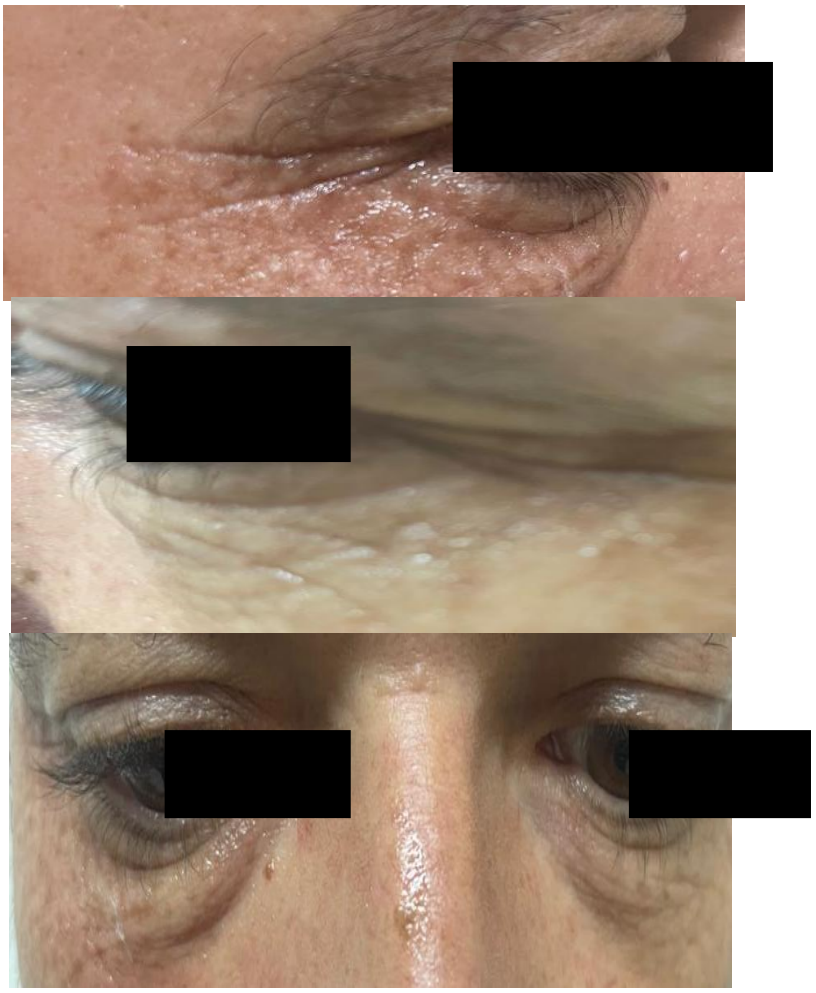

Figure 1: Eye wrinkles after use of laser

Figure 2: Eye wrinkles before use of laser

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Figure 3: Eye wrinkles before use of laser

Figure 4: Eye wrinkles after use of laser

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