White Paper

Blending Wavelengths for Hair Removal Results in Less Pain in Darker Skin Types

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Since 1995 laser hair removal has become a popular treatment option for the reduction of unwanted hair. The use of the 755nm Alexandrite and 1064nm Nd:YAG wavelengths have been proven in numerous published clinical studies to be the gold standard for the reduction of unwanted hair.[1-4] The 755nm wavelength is more highly absorbed by melanin and is the treatment of choice for lighter skin types. Lloyd and Mirkov reported in their study that the average patient had a 78% clearance of hair, noted at one year after five treatments at three week intervals, with no evidence of scarring or pigment changes. Patients ranged in age from 16 to 46 years old with Fitzpatrick skin types I-III.[1]

When treating skin types I-VI, Alster and Tanzi reported, at six months after a series of three long pulsed Nd:YAG laser treatments, a mean hair reduction of 41% to 46% on the face and 48% to 53% on the body, depending on the skin phototype.[2] In another study completed by Alster and colleagues, they reported substantial hair loss, observed at one year, with a 70-90% reduction with darker skin, types IV through VI. Auxiliary hair was substantially more responsive to laser irradiation than hair located on the legs and face.[3] Also Sarradet et al. reported positive results in using the 1064nm Nd:YAG wavelength for facial telangiectasia.[4]

Even though the Nd:YAG is ideal for treating darker skin types, it has been reported that treatment with this wavelength is painful. The objective of this study was to compare the Nd:YAG wavelength with the blended Alexandrite and Nd:YAG wavelengths of the Elite MPX™ laser system.

Mechanism of Action

The rapid growth in the use of lasers for cosmetic procedures is attributed to the ability to apply light energy to a targeted chromophore. In the case of hair removal, follicular melanin serves as the intended chromophore for laser epilation. Absorption of light energy by the melanin results in destruction of the hair follicle.

Melanin is contained in the skin as well as in the hair follicle. For effective treatment, the appropriate balance must be struck between minimizing the delivery of energy to the skin and providing enough energy to the hair melanin to destroy the follicle. Delivery of too much energy to the skin can destroy or injure the epidermis, resulting in hyper- or hypopigmentation. The 1064nm is less absorbed in melanin than the 755nm and is therefore considered safer for high concentrations of melanin within the skin. However, due to its deeper depth of penetration, the 1064nm has been reported as a more painful treatment than that of the 755nm.

In a presentation at the American Society for Laser Medicine and Surgery conference in 2008, Ross et al. concluded that the combination of the 1064nm and 755nm wavelengths is less painful than the 1064nm alone. In their study, patients were treated in the axilla region or the legs. Two treatments were administered four weeks apart and with follow-ups at two months post treatment for hair counts. They found that the blended treatments are more tolerable overall, treat finer hair, and offer a higher degree of safety for the epidermis.[5]

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Materials and Methods

A total of 35 different locations (Figure 1) were treated on seven patients with Fitzpatrick skin types II-VI (Figure 2) and ranging in age from 25 to 45 years old. Wavelengths were randomly selected and the patient was not informed as to the specific wavelength or combination of wavelengths used to treat the area. Exclusion criteria included recent tanning, hair bleaching, or waxing within the past two months.

The laser used in this study was the Elite MPX, which incorporates the Alexandrite and Nd:YAG lasers in one system. The laser wavelengths can be emitted individually or sequentially. Both wavelengths can also be combined in sequence with single pulses using MultiPlex™ dual-wavelength-sequencing technology. To enhance patient comfort, air-cooling is integrated into the system. The Elite MPX design allows customized treatments to be developed for unwanted hair, pigmented and vascular lesions, veins, and aging/photodamaged skin in all skin types. The MultiPlex settings are versatile, allowing the clinician to titrate or fine tune the blend of wavelengths depending on the sequence and energy settings of the two wavelengths.

The Nd:YAG was compared to the MultiPlex blend of Alexandrite/Nd:YAG or Nd:YAG/Alexandrite in a 50/50% ratio or 75/25% ratio as listed below.

1. **100% YAG**
2. **Combination 75% YAG, 25% Alex**
3. **Combination 50% YAG, 50% Alex**
4. **Combination 25% YAG, 75% Alex**

The Nd:YAG fluence was determined by the physician based on skin type. Equivalent energy was selected for the blends based on mathematical models.

A mathematical model was developed to identify the parameters for the multiplexed wavelengths of 755nm and 1064nm. The model calculated the appropriate optical absorption within the melanin that would lead to equivalent absorption in the hair follicle at 2 mm depth. At this depth, the Alexandrite effectively epilates the bulb. (The calculation also takes into account the absorption of the two wavelengths in the epidermis.)

Areas treated included: the sideburn area, leg, back of the hand and/or back of the neck. Patients were asked to rate the pain level of each treatment on a scale of 0-5. A pain score of "0" was equivalent to no pain during treatment and a pain score of "5" was equivalent to a high level of pain during treatment.

Results

All patients tolerated the treatment well. There were no major complications or adverse effects. Patients reported less pain with the blended wavelengths, as compared to the Nd:YAG alone. Areas treated with the Nd:YAG reported the most pain (4.6 out of 5).

The combination 50%/50% reported the least amount of pain (1.5 out of 5). The combination of 75% Nd:YAG and 25% Alexandrite was reported to be slightly more painful (2.2 out of 5) (Figure 3).

In all cases, treatments with the blended wavelengths were less painful than the single wavelength Nd:YAG treatments (Figure 4).

Anatomical Location	# of Subjects
Legs	14
Side Burns	9
Back of Neck	3
Back of Hand	9

Figure 1

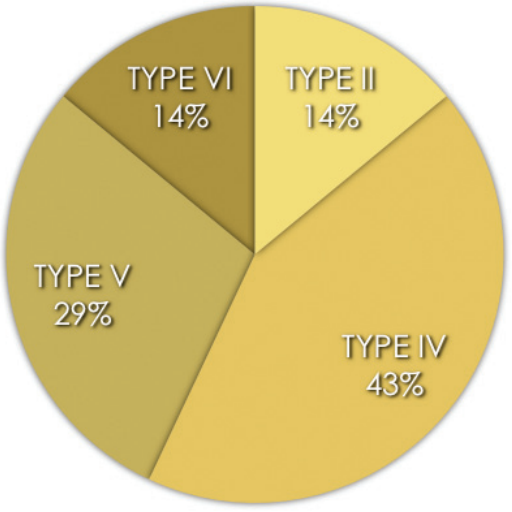

Figure 2: Fitzpatrick Skin Type Scale

Figure 3: Elite MPX Treatment Pain

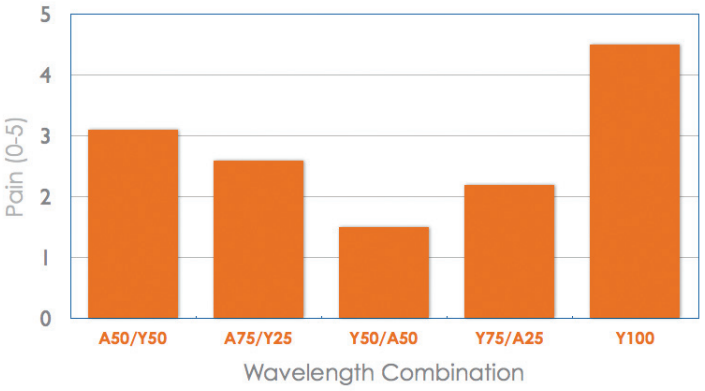

Figure 4: Elite MPX Treatment Pain

Conclusion

When treating darker skin types, treatments administered with the blended wavelengths of the Elite MPX are less painful than those with the single wavelength Nd:YAG. The addition of the 755nm Alexandrite wavelength in substitution of the 1064nm fluence requirement, demonstrated a significant reduction in pain, while continuing to deliver a safe and appropriate energy level to destroy the hair follicle. Pain scale results confirmed that when treating in the Elite MPX blended mode, when the Nd:YAG was emitted prior to the Alexandrite wavelength, the treatment was the least painful.

References

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4. Sarradet D, MD, Hussain M, MD, Goldberg D, MD, "Millisecond 1064-nm neodymium:YAG laser treatment of facial telangiectases," *Dermatologic Surgery*, 2003; 29:56-58.

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