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### Title

Further Investigation of Pigmentary Changes After Alexandrite Laser Hair Removal in Conjunction With Cryogen Spray Cooling

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### Further Investigation of Pigmentary Changes After Alexandrite Laser Hair Removal in Conjunction With Cryogen Spray Cooling

To the Editor:

We reviewed "Pigmentary Changes After Alexandrite Laser Hair Removal" by Drs. Weisberg and Greenbaum with great interest and believe this article to be important in helping to optimize the safety and efficacy of laser-assisted hair removal in conjunction with cryogen spray cooling (CSC).<sup>1</sup>

Over the last year, several similar cases of skin dyspigmentation after laser-assisted hair removal in combination with CSC have come to our attention. Clinicians have hypothesized that the damage was secondary to cryo-injury.<sup>2</sup> To determine the validity of this hypothesis, we performed a series of experiments using the RAFT tissue model of human skin in which specimens were exposed to cryogen spurt durations of 10 to 500 ms.<sup>3</sup> We demonstrated that cryogen spurts of up to 80 ms do not result in major epidermal injury and thus are not likely to cause skin dyspigmentation. Moreover, extensive clinical use of CSC with exposure of human skin to cryogen spurt durations of 100 ms or more has not resulted in cryo-injury.<sup>4-6</sup>

Drs. Weisberg and Greenbaum speculate that "super cooling" of the distance gauge may be the cause of skin dyspigmentation. We consider this an unlikely explanation of injury because distance gauges are generally made from Teflon, which has very low thermal conductivity. To demonstrate that a cooled distance gauge is an unlikely cause of injury, we purged the cryogen for 1 minute without firing the laser, resulting in considerable frost build up on the gauge, which was then placed firmly against a volunteer's skin for 10 seconds. No discomfort was noted, and no erythema or discoloration occurred immediately or at follow-up over several weeks.

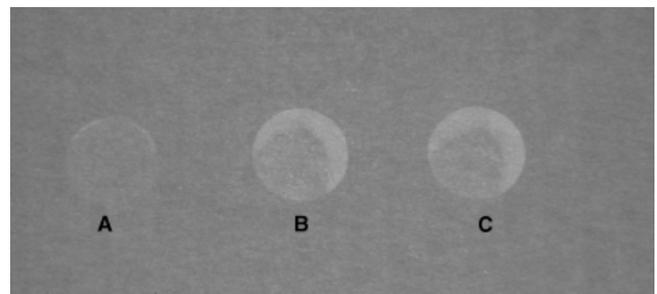
We believe the skin dyspigmentation occasionally observed after laser-assisted hair removal in combination with CSC is not cryo-injury, but rather laser-induced thermal injury. Currently available laser devices incorporate epidermal cooling to improve the margin of safety by increasing the threshold for epidermal damage, which allows the use of higher fluences, permits treatment of darker skin types, and decreases patient discomfort. However, to be effective and safe, the cooling medium must completely cover the skin surface before laser irradiation. When epidermal protection is incomplete, thermal injury is likely to result, particularly during the use of higher fluences in patients with darker skin types.

In a recent publication,<sup>7</sup> we used thermal-sensitive test paper to compare cryogen coverage with laser spot diameter. In the cases presented by Drs. Weisberg and

Greenbaum, a 50-ms cryogen spurt was used to cover an 18-mm diameter spot. We determined that a 50-ms spurt, delivered by a GentleLASE (Candela, Wayland, MA) nozzle similar to that used by Drs. Weisberg and Greenbaum, created a cryogen coverage area of 18 mm. As this is the exact diameter of the laser-irradiated spot, epidermal protection is complete only when the handpiece is held perpendicular to the skin surface. If the handpiece is angled 6° or more from perpendicular normal, incomplete cryogen coverage of the laser spot occurs and a crescent-shaped burn can be observed (Figure 1). We have also noted a similar effect if the cryogen nozzle is misaligned in the handpiece, which may occur with moving of the laser from room to room or between office locations.

As a result of the previously described studies, we have three recommendations to mitigate or eliminate the type of adverse effects reported by Drs. Weisberg, Greenbaum, and others. First, when large (15 or 18 mm) spot sizes are used, selection of longer spurt durations will ensure complete cryogen coverage of the irradiated skin surface. Second, cryogen coverage can be quickly confirmed before each procedure or after changes of cooling/laser parameters by firing the beam onto a porous surface such as ordinary cardboard. If thermal injury is noted when the handpiece is held perpendicular and adequate cryogen spurt duration has been chosen, the spray nozzle may be misaligned and require adjustment. Finally, care should be taken to hold the handpiece perpendicular to the skin surface throughout the entire procedure, as indicated in the manufacturer's guidelines. This may require special attention, particularly during treatment of curved anatomic surfaces.

We would like to thank Drs. Weisberg and Greenbaum for their observations and the educational opportunity provided. Recognition of this potential



**Figure 1.** Burn patterns created on cardboard by an Alexandrite laser in conjunction with CSC (18-mm spot size; 20 J/cm<sup>2</sup>; 50-ms cooling). (A) Even coverage is noted when the handpiece is held perpendicular to the skin. A progressively more prominent crescent shaped burn pattern was noted when the handpiece was angled at 6° (B) and then 12° (C). The crescent-shaped burn occurred because with angling of the handpiece, the laser spot was not completely covered by the protective cryogen spurt.

problem and proper attention to technique will optimize the efficacy and safety of laser treatment to the benefit of clinicians and patients alike.

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