Reversal of Laser-Induced Hypopigmentation with a Narrow-Band UV-B Light Source in a Patient with Skin Type VI

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Nevus of Ota (nevus fuscoceruleus ophthalmomaxillaris) is a benign dermal melanocytic hematoma clinically appearing as a bluish-brown discoloration in the ophthalmic and/or maxillary branches of the trigeminal nerve. The condition first described by Ota and Tanino occurs predominantly in Asians with estimated frequency of 0.014% to 0.034%, but can be found in other ethnicities.[1] Historical therapies for nevus of Ota include surgery, dermabrasion, electrodesiccation, skin grafting, and cryotherapy and are all associated with a significant risk of dyschromia and scarring.[2–5]

The introduction of the theory of selective photothermolysis and subsequent development of Q-switched lasers revolutionized the treatment of nevus of Ota. Q-switched ruby laser (QSRL) penetrating up to 1.5 to 2 mm (reticular dermis) allowed for selective destruction of target melanocytes without concurrent damage to surrounding structures.[6,7]

The rate of complications after Q-switched laser treatment is significantly lower than other historical methods used for nevus of Ota therapy. The most frequently encountered adverse reactions are hypopigmentation and hyperpigmentation. These are likely to be encountered more frequently in darker skin types. While it has long been considered that hypopigmentation is the most difficult-to-treat adverse effect of laser therapy in darker skin types, we report here our success in reversing hypopigmentation after clearance of a nevus of Ota with a QSRL in an African American Skin Type VI male with a narrow-band ultraviolet B (NB UV-B) source.

Case

A 36-year-old African American male, Fitzpatrick Skin Type VI, with no significant medical history, presented for treatment of a 10 × 16-cm Tanino Stage III (V1 and V2 distribution) nevus of Ota (Figure 1). The patient was treated with a QSRL, at a fluence of 3 to 5 J, spot size 6.5 mm with no greater than 10% overlap between pulses. After 20 treatment sessions, of which several were partial treatments of the same area of the nevus of Ota over a period of 6 years, the lesion was completely cleared. In total the area of the nevus of Ota had 4 to 5 complete treatment sessions over this period. Hypopigmented macules were noted within the treated area beginning at the 12th treatment session and worsened upon completion of therapy (Figure 2A). No other adverse reactions were noted.

Seventeen months after hypopigmentation was first noted, a NB UV-B light source was started at 180 mJ and increased gradually to 600 mJ (ReLume, Lumenis Inc., Santa Clara, CA). Repigmentation was first noted after 13 NB UV-B treatment sessions and progressively improved with each treatment (Figure 2B). The patient had four additional treatment sessions to completely repigment the area of

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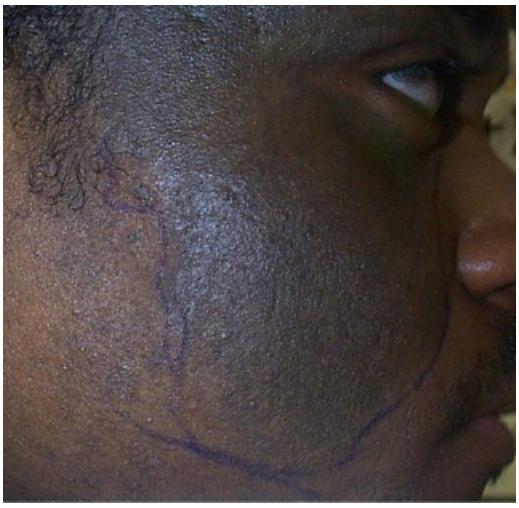

Figure 1. Nevus of Ota in a patient with Skin Type VI before treatment.

pigmentary loss in the area of the previous nevus of Ota (Figure 2C). No anesthesia was required because all treatments were painless, and no wounding, scarring, or hypopigmentation was noted. The area has remained normally pigmented after more than 1 year of follow-up.

Discussion

The clinical efficacy of QSRL in the treatment of nevus of Ota is well documented.[6–8] The advantages of the QSRL compared to other lasers include high clearance rates combined with low incidence of scarring and pigmentary changes in adult as well as pediatric populations.[9]

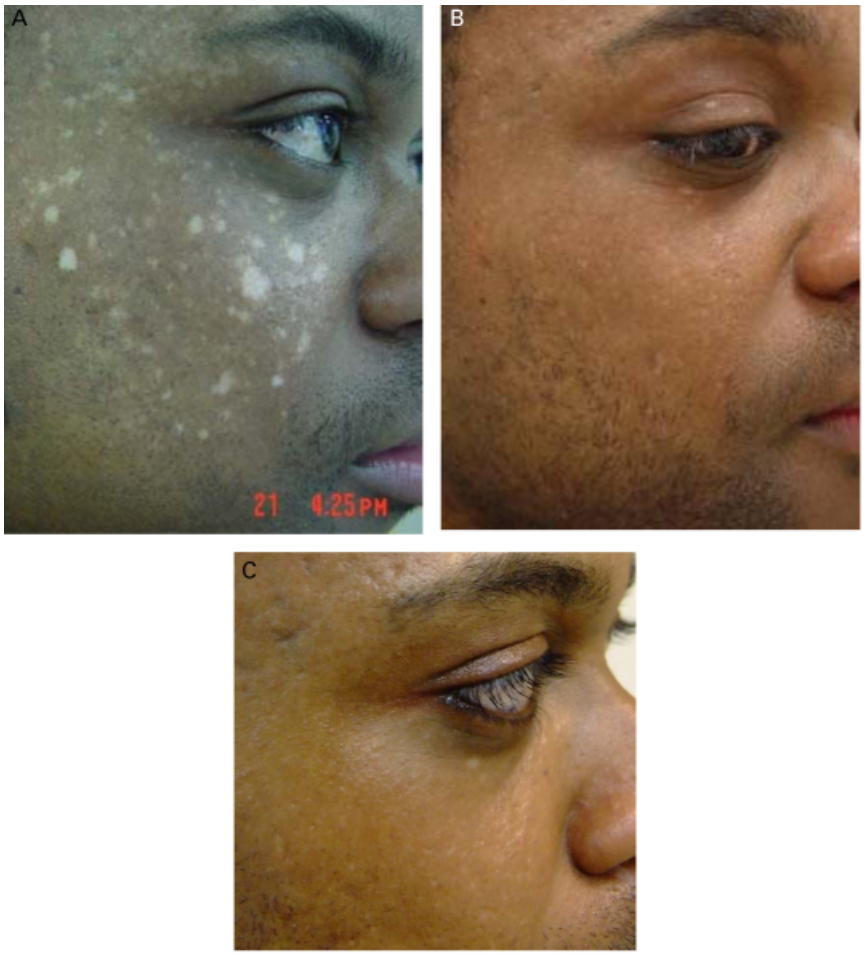

Figure 2. (A) Hypopigmented macules in area of QSRL treatment before NB UV-B therapy. (B) Improvement in hypopigmentation after 15 treatments with NB UV-B (3 months after that in A). (C) Complete repigmentation of laser-induced hypopigmentation (1 month after final NB UV-B treatment and 2 years 7 months after that in B).

Clinical data on laser therapy of nevus of Ota discussed in the literature were gathered primarily in Asian populations.[7,10] Limited data exist to correlate skin type and genetic background with QSRL efficacy and side effects profile.[6] Laser therapy in patients with darker skin types (Fitzpatrick Skin Types III–VI) carries higher inherent risks of unwanted side effects. Fluence, number of treatment sessions, and spot size are variables that should be appropriately selected to provide the desired effect safely, with a low incidence of side effects. Generally, in the treatment of pigmented skin lesions, the lowest fluence should be used to induce the desired clinical end point.

At 694 nm, the most significant chromophore in the skin is melanin, while hemoglobin and water show weak to no absorption. This results in the high selectivity of QSRL in targeting melanoses, such as those of nevus of Ota. Based on the theory of selective photothermolysis, in the nanosecond time scale the QSRL can target melanin for selective heating while no harm is done to surrounding structures. Not surprisingly, overall dychromia is noted to be the most common side effects of the laser therapy. Reports of hypopigmentation and hyperpigmentation occurring after QSRL therapy for nevus of Ota are in the range of 0% to 17% and 0% to 40%, respectively.[11] Interestingly, hypopigmentation as opposed to hyperpigmentation after laser treatments may be a more significant risk as skin type darkens. Chan and colleagues[12] studied the risk of postinflammatory 532-nm alexandrite laser–induced hyperpigmentation in patients with skin types ranging from II to VI. Interestingly, they found no increased risk of hyperpigmentation for darker skin types (IV–VI) compared to Skin Type III.[12]

Studies on the use of laser for hair removal in Skin Types IV to VI point to the presence of erythema on Day 1 as the most significant predictor of the laser-induced pigmentary changes. Application of the topical betamethasone 10 minutes before and twice daily afterward was shown to minimize and promote resolution of erythema and edema.[13] Similar data are not available for QSRL.

Similarly, early work on CO_2 resurfacing in lighter skin types correlated long-term residual erythema with eventual hypopigmentation. We have not noted persistent erythema in our patient in the areas that developed hypopigmentation. It is possible that a different mechanism is at play in the development of hypopigmentation in Skin Type VI patients or that persistent erythema is difficult to discern.

Hypopigmentation often appears as small white macules that match laser spot size and shape. Most cases of post-QSRL hypopigmentation occur within weeks of treatment; however, in a small percentage of cases hypopigmentation occurred up to 4 to 11 months after treatment.[14] Hypopigmentation often may last more than 12 months and may be permanent in a number of cases. The risk of hypopigmentation appears to be directly proportional to the number of treatment sessions and fluence.[11]

Treatments of hypopigmentary disorders have shown limited efficacy and variable safety profiles. Systemic or topical PUVA (psoralen ultraviolet A), NB UV-B, NB UV-B microphototherapy, topical calcipotriene and NB UV-B or PUVA, 308-nm excimer with or without topical tacrolimus, and fractional resurfacing have all been used in the treatment of vitiligo and other pigmentary disorders with variable efficacy and, in some cases, unpredictable results. The time course of repigmentation varies with the use of different treatment modalities, as well as patient age, type and stage of disease, and affected body site, but is on average more than 6 months.[11,15–20]

In 2002 a 290- to 320-nm NB UV-B light source (ReLume repigmentation phototherapy system, Lumenis Inc.) was FDA-approved for the treatment of leukoderma including stretch marks, acne scars, postsurgical scars, and traumatic scars. Treatment was shown in vivo to stimulate melanocytes and enhance melanin synthesis. Biopsies of the striae distensae after treatment with UV-B showed

increased melanin content, hypertrophy of melanocytes, and an increase in the number of melanocytes in all patients.

In summary, we present a case of complete resolution of posttreatment hypopigmentation that had begun 17 months earlier, after only 2 months of therapy with a NB UV-B source in an African American male with Fitzpatrick Phototype VI skin. While it remains a remote possibility that the repigmentation over the period of NB UV-B treatment was spontaneous after 17 months of no improvement in hypopigmentation, the time course for complete repigmentation was much shorter than expected for spontaneous repigmentation (more than 6 months). Importantly, the area of skin has remained repigmented after more than 12 months of follow-up. This modality represents a relatively new addition to the therapeutic armamentarium that can effectively, rapidly, and completely resolve laser-induced hypopigmentation. It is highly efficacious in all skin types and is likely to be effective in the treatment of other hypopigmentary disorders as well.

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