Nevus of Ota Successfully Treated by Fractional Photothermolysis Using a Fractionated 1440-nm Nd:YAG Laser

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The Cutting Edge: Challenges in Medical and Surgical Therapeutics

REPORT OF A CASE

A 46-year-old man of Japanese descent presented with a pigmented patch under his right eye that had been present since birth. He had no history of ocular disease, hearing loss, or use of medications that produce pigmentation. Throughout his early life, the lesion had been significantly larger, and 25 years before he presented to our clinic, it had been partially excised, resulting in a smaller patch with some white central scarring that was visible in the center (Figure 1). Physical examination revealed a blue-gray, hyperpigmented, poorly defined patch on the right infraorbital cheek area. There was no pigmentary disturbance of either eye or the oral mucosa. Other than long-standing, bilateral tear-trough deformity–related hyperpigmentation, the patient had no other pigmented macules or patches on his head or neck.

THERAPEUTIC CHALLENGE

Our patient’s nevus of Ota was resistant to standard Q-switched (QS) laser treatment, and some central fibrosis was present from the previous excision. Therefore, our challenge was to preserve his natural Fitzpatrick type III skin tone and to avoid postinflammatory hyperpigmentation, while removing his nevus of Ota.

SOLUTION

The initial treatments were administered with a dual-pulsed QS Nd:YAG 1064-nm laser (Spectra VMII; Lutronic Corp, Inchon, South Korea) with a 4-mm spot size at 4 J/cm². After 3 treatments, the patient had not seen any improvement, so the decision was made to use fractional photothermolysis (FP) because its side effect profile in Asian skin is favorable and because previous studies have demonstrated its efficacy in treating dermal pigmentary deposition disorders. A fractionated 1440-nm Nd:YAG laser (Affirm; Cynosure Inc, Westford, Massachusetts) with a penetration depth of 300 µm was used first at a fluence of 3.5 J/cm² and then at a fluence of at 4.0 J/cm². For each treatment, only 1 pass was made, with an overlap of approximately 20% between pulses. A 1-cm spot size was used. Local anesthesia was achieved by 15 minutes of pretreatment with 5% lidocaine and then by air cooling (Zimmer Cooling Device; MedizinSystems, Irvine, California) during the procedure. The patient’s pain level was consistently scored as 3 out of 10. The end point was treatment of the entire field, which was ensured by a confluent, immediate erythema that is characteristic of FP treatments. The interval between treatments was 4 weeks.

While there was only roughly 10% improvement after the first treatment, the nevus of Ota completely resolved within 6 weeks of the second treatment (Figure 2A), and 4 months later, there was still no evidence of recurrence or postinflammatory hyperpigmentation (Figure 2B).

COMMENT

Although uncommon in white populations, oculodermal melanocytosis, or nevus of Ota, affects roughly 0.02% of the Asian population, and nearly 0.2% are of Japanese descent.1-3 The cutaneous lesion presents as a slate-blue hyperpigmented patch along the distribution of the ophthalmic or maxillary divisions of the trigeminal nerve.4 More than 90% of cases are unilateral, and the disorder is more common in females.2 Extracutaneous disease is most notable for ocular involvement, occurring in more than 60% of cases.2 The most serious complications include glaucoma and transformation to malignant melanoma; concomitant deafness has also been reported.6

Figure 1. Nevus of Ota on the right infraorbital cheek of a 46-year-old man before fractional photothermolysis.
Pathologically, nevus of Ota is a melanocytic hamartoma that resides at the level of the middle dermis; therefore, to be effective, treatment modalities should extend to this depth. Early methods of treatment included cryotherapy and microsurgery, both of which may be associated with scarring, especially in the Asian population. More destructive lasers and resurfacing procedures, including carbon dioxide and argon lasers as well as dermabrasion, have also been used. In the recent past, the use of QS lasers has resulted in significantly improved outcomes. The following tabulation lists modalities that have previously been used to treat nevus of Ota.

<table>
<thead>
<tr>
<th>Modality</th>
<th>Laser Type</th>
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<tbody>
<tr>
<td>Cryotherapy</td>
<td>RF</td>
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<tr>
<td>Surgical excision</td>
<td>QS Nd:YAG (1064 nm)</td>
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<tr>
<td>Laser</td>
<td>QS ruby (595 nm)</td>
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<td>QS alexandrite (755 nm)</td>
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<td>Carbon dioxide</td>
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<td>Argon</td>
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<td>Chemical peeling</td>
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<td>Dermabrasion</td>
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<td>Topical hydroquinone-based bleaching agents</td>
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Treating the lesion earlier in life is preferable, as the lesion is more hyperpigmented, with less bluish hue. In childhood, the lesion responds more favorably to laser treatments. Later in life, UV light and sex hormones can darken the hamartoma, making it more resistant to treatment. Demonstrated a remarkable increase in postinflammatory hyperpigmentation in adults who were treated with the QS ruby laser for the nevus of Ota. When fluences of 5 to 7 J/cm² and a 4-mm spot size were used, 4.8% of children and 23.4% of adults experienced postinflammatory hyperpigmentation. Unfortunately, our patient presented in middle adulthood; furthermore, his lesion was resistant to standard QS laser treatments. With these factors in mind, we sought to find an effective and safe laser modality that would treat this dermal melanocytosis with minimal risk of hyperpigmentation.

Fractional photothermolysis, or fractional resurfacing, is a rapidly evolving modality, which, at its core, relies on the production of microscopic arrays of thermal damage of controlled size and density. Because the treated zones are of such small size and because the intervening areas are spared the thermal effects of the laser, healing is quite rapid, with patients only experiencing minimal adverse effects of a transient erythema. As a result, much of the inflammatory response and associated potential adverse effects are minimized compared with other conventional ablative resurfacing methods. The microscopic pores heal rapidly, as myofibroblasts initiate dermal neocollagenesis. While FP is used primarily for rejuvenation, reports have demonstrated that it may be effective in the treatment of hyperpigmented conditions such as melasma and solar lentigines. Mechanistically, some researchers have shown that these coagulated columns of tissue contain melanin granules, while others have postulated that FP may improve the dermal component of melasma by destroying dermal macrophages that contain melanin granules. Because of its favorable side effect profile and its history of success in treating melasma, we decided to use FP to treat our patient’s nevus of Ota, which had proved recalcitrant to other laser treatments.

The device we chose to use was a 1440-nm Nd:YAG fractioned resurfacing laser with a microscopic thermal injury pattern (Affirm laser; Cynosure Inc). Its combined apex pulse array creates apexes of high-fluence regions for collagen remodeling surrounded by a collagen-stimulating, low-fluence treatment zone. The combined apex pulse array is a special lens construction consisting of approximately 1000 diffractive elements that affect a 1-cm² area per pulse. The high-fluence apexes create a pattern of coagulated columns, while the background fluence gently heats the intervening uncoagulated tissue. Histologically, the high-fluence combined apex pulse columns are limited to a depth of approximately 300 µm (Figure 3).

The practical uses of FP, as well as the number of fractionated ablative lasers, are increasing rapidly. Recent data have demonstrated not only that FP can be used to treat facial dyschromia and rhytids but also that it appears to be safe and effective for use on nonfacial skin as well. In addition to melasma and photodamage, surgical scars, poikiloderma of Civatte, and acne scars all appear to respond favorably to FP treatment, as evidenced by these early small-scale pilot studies.

Herein, we have further expanded the applications of FP to include a member of the group of disorders marked by pronounced dermal melanocytosis. The FP treatment of a nevus of Ota was successfully performed on the infraorbital cheek area of a middle-aged Japanese man whose

Figure 2. Posttreatment photographs. A, At 6 weeks after therapy, the nevus of Ota is no longer visible. B, At 4 months after therapy, there is complete clearance, with no evidence of postinflammatory hyperpigmentation.
lesion, which had previously been recalcitrant to other therapies, responded rapidly to 2 treatments with the fractionated 1440-nm laser. While a proven technical explanation for our patient’s response is not possible, the clearance of his birthmark is likely simply an ablative phenomenon whereby the superficial dermal pigment was destroyed with the coagulated tissue. Furthermore, it is likely that 2 treatments were required to achieve the response because only a portion of the target area was treated during each session. This technology has also allowed us to avoid the postinflammatory hyperpigmentation and scarring that are common when QS lasers are used to treat nevus of Ota in adults. Because the 1440-nm Nd:YAG fractioned resurfacing laser has been shown to be safe for use on Asian skin and because nevus of Ota is so common in individuals of Japanese descent, FP may become the mainstay of treatment for adult or long-standing cases involving this type of lesion. Further studies are warranted to explore the potential efficacy of FP treatment of other dermal melanocytoses.

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Author Contributions: Dr Moy had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Kouba and Moy. Acquisition of data: Kouba Fincher, and Moy. Analysis and interpretation of data: Kouba, Fincher, and Moy. Drafting of the manuscript: Kouba, Fincher, and Moy. Critical revision of the manuscript for important intellectual content: Kouba, Fincher, and Moy. Administrative, technical, and material support: Kouba, Fincher, and Moy. Study supervision: Kouba and Moy.

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REFERENCES

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Clinicians, residents, and fellows are invited to submit cases of challenges in management and therapeutics to this section. Cases should follow the established pattern. Manuscripts should be prepared double-spaced with right margins non-justified. Pages should be numbered consecutively with the title page separated from the text (see Instructions for Authors [http://archderm.ama-assn.org/misc/ifora.dtl] for information about preparation of the title page). Clinical photographs, photomicrographs, and illustrations must be sharply focused and submitted as separate JPEG files with each file numbered with the figure number. Material must be accompanied by the required copyright transfer statement (see authorship form [http://archderm.ama-assn.org/misc/autnst_crt.pdfl]. Preliminary inquiries regarding submissions for this feature may be submitted to George J. Hruza, MD (ghruza@aol.com). Manuscripts should be submitted via our online manuscript submission and review system (http://manuscripts.archdermatol.com).