

Treatment of Freckles (Ephelides) Concurrent with Hori's Nevus (ABNOM) Using a Combination Treatment of Q-Switched Nd:YAG 1064nm Laser with 660nm (RuVY) Laser

Foo Lee Lyn¹, Oon Wei Chin¹, Natalie Kwong Zhu Wen^{2*}, Tay Su Yee³, Wong Hui Hung⁴



¹UR Klinik Bukit Mertajam, Bukit Mertajam, Pulau Pinang

²UR Klinik Cheras Leisure Mall, Wilayah Persekutuan Kuala Lumpur

³UR Klinik Puchong, Wilayah Persekutuan Kuala Lumpur

⁴UR Klinik Greenlane, Greenlane, Pulau Pinang

Abstract

Ephelides and Acquired Bilateral Nevus of Ota-like Macules (ABNOM) are common skin pigmentations in Asian and Caucasians that have become a cosmetic concern nowadays. We hereby present the case of a 34-year-old Chinese lady with Fitzpatrick type III skin who presented with hyperpigmentation over bilateral cheeks and the nose for 20 years. We have diagnosed her to have ephelides concurrent with acquired bilateral nevus of Ota-like macules (ABNOM) based on her clinical presentation. She was treated with Q-Switched Nd: YAG laser with a converted wavelength of 660nm (RuVY Touch) targeting ephelides and a wavelength of 1064nm targeting ABNOM. Her hyperpigmentations responded well to the Q-Switched Nd: YAG laser and were completely clear after 10 sessions of laser therapy.

In conclusion, our findings show that combining Q-switched Nd:YAG laser treatment with RuVY 660 nm laser treatment is effective in treating patients with freckles (ephelides) concurrent with Hori's nevus (ABNOM).

Keywords: Freckles (Ephelides), Hori's Nevus, ABNOM, Q-Switched Nd: YAG laser

Address of corresponding author:

*UR Klinik Cheras Leisure Mall,
Taman Bukit Segar, 56100
Wilayah Persekutuan Kuala
Lumpur, Malaysia.
Email: natalwen93@gmail.com*

Received: January 2, 2023

*Revision received: February
14, 2023*

Accepted after revision:

February 16, 2023

www.japa-edu.org

Freckles, also known as ephelides, are caused by an increase in melanin, a dark pigment found in the epidermis layer of the skin. Ephelides are small macules that range from 1-2 millimetres or bigger and can be red, light brown, or dark brown in colour. These spots are more likely to appear on sun-exposed skin, such as the cheeks, nose, forehead, and arms. It faded during the winter and became more pigmented during the summer [1]. Ephelides can manifest as early as 2–3 years after sun exposure, increase during adolescence, and often partially disappear with age. It is also more prevalent in individuals with fair skin and red or blond hair [2]. Ephelides are caused by genetic predisposition and induced by UV radiation from sunlight. It is photosensitive and can be induced or, more likely, made visible in those who already have it [1]. Various treatment modalities have been used to treat ephelides. Previously, dermabrasion, electrodesiccation, and chemical peeling were used to treat ephelides. However, this treatment can result in unfavourable side effects, such as scarring.

Over the last decade, ephelides have been reported to clear significantly with QS Nd:YAG 532nm lasers due to the high melanin absorption rates at this wavelength [3]. However, 532nm is also highly absorbed by hemoglobin. As a result, it may increase the risk of superficial vascular injury, which causes erythema and post-inflammatory hyper-pigmentation. As technology advanced, RuVY Touch (Ruby-like Versatile YAG) 660nm became a safety-proven new pigment removal treatment performed by converting 532nm QS Nd:YAG laser energy to 660nm laser energy [4]. RuVY Touch 660 nm is a safer wavelength than 532nm for treatment of epidermal pigmented lesions due to its lower absorption by melanin and oxy- and deoxy-hemoglobin. The lower absorption characteristics of 660 nm in oxy- and deoxy-hemoglobin allow vessels to remain intact even after laser treatment, therefore significantly reducing the possibility of having post-inflammatory hyperpigmentation. Besides, it can be as effective as a 532nm

wavelength in removing ephelides (Lutronic corporation 2019).

On the other hand, Hori et al. (1984)⁵ first described the acquired bilateral nevus of Ota-like macules (ABNOM), also known as Hori's nevus in 1984, and it is classified as a circumscribed dermal melanosis. It presents clinically as multiple symmetrical speckled macules with a brown, slate-grey, or blue-black hue in colour. The number of spots on each malar region varies, and some guttate macules progress to form confluent, large macules over time. It is prevalent in women of Asian descent and only rarely in men [6] and known to develop after the age of 15 (mean age: 36) in approximately 94% of cases [7] Hori's nevus is located bilaterally on the face in the trigeminal nerve distribution, more commonly in the malar areas and less commonly at the forehead, temples, upper eyelids, and nose. There is no pigmentation on the ocular or mucosal membranes, which differentiates it from the Nevus of Ota, a unilateral Mongolian spot-like macular blue-black or grey-brown patchy pigmentation [7]. The pathogenesis of this condition is unknown. However, several theories have been proposed. This includes dropping-off of epidermal melanocytes, migration from follicular bulb melanocytes, and reactivation of pre-existing misplaced latent dermal melanocytes from faulty migration during embryological development, which is triggered by dermal inflammation, UV radiation, or aging-related degeneration of the epidermis and dermis melanocytes [5].

Lee et al. (2004)⁷ reported that in the management of Hori's nevus, topical depigmentation therapy and chemical peels do not achieve significant lightening in the treatment of dermal pigmentation. Other methods for instant dermabrasion produce excellent results, but they are invasive and may result in scarring. The development of lasers revolutionised the treatment of dermal pigmentation with their theory of selective photothermolysis. Q-switched lasers such as QS Ruby, QS alexandrite, and QS

Nd:YAG lasers have been shown to be effective in treating ABNOM.

This case report will be focusing on the treatment of ephelides and Hori's nevus by using Q-switched Nd: YAG lasers of different wavelengths and their treatment outcome.

Case Presentation

A 34-year-old Chinese lady, Fitzpatrick type III with no known medical illness presented to our clinic with hyperpigmentation over bilateral cheeks and nose for 20 years. She is married with 2 kids, with the age of 6 years old and 3 years old. Her menstrual cycle is regular and she is not on hormonal contraceptive pills. She works as an engineer in an indoor office. She is actively involved in outdoor activities during leisure time and she goes for evening jog at least twice a week. Her hyperpigmentation got worse after a few picnic sessions with her family at the beach over the weekends. She has a positive family history of having similar hyperpigmentation, which affects her elder sister and her mother. She has not sought any treatment for her hyperpigmentation prior to this. Her skincare regime comprises mild cleanser, toner, serum, moisturiser and sheet mask. She does not apply sunblock due to finding it being tacky on her skin. She was concerned about her hyperpigmentation as it continued to worsen which led to her uneven skin-tone appearance. She had low self-esteem and tried to use concealers in an attempt to cover up her hyperpigmentation, however she found it challenging to completely cover the pigments. On physical examination, there were multiple brown, flat, circular spots, covering bilateral cheeks and nose. She also had a few slate-grey coloured, round, grain-like spots confined to her cheekbone amidst the hyperpigmentation mentioned earlier. She has a mixed-pattern type of hyperpigmentation and was diagnosed with ephelides (freckles) and Hori's Nevus (also known as ABNOM - acquired bilateral nevus of Ota-like macules). She also had some moles on her face for which she was keen to remove as well.

Management and Outcome

The patient had undergone laser treatment of the entire face by a single doctor after obtaining written informed consent. A total of 10 sessions of laser treatment were conducted with treatment intervals of 1 to 3 months. As the patient was presented with a mixture of two different types of hyperpigmentation - abnom and freckles, a combination treatment using Q-switched Nd:YAG laser with a wavelength of 1064nm and Q-Switched Nd:YAG laser with a wavelength of 660nm (RuVY Touch (Ruby-like Versatile YAG)) was used.

For the treatment of freckles (ephelides), Q-switched Nd:YAG laser with a wavelength of 660nm (RuVY Touch (Ruby-like Versatile YAG)) was used. The pulse rate was set at 1Hz, with a spot size of 3mm and fluence ranging from 0.75J/cm² to 1.1J/cm² (as shown in Table 1).

For the treatment of Hori's nevus (ABNOM - acquired bilateral nevus of Ota-like macules), Q-switched Nd:YAG laser with a wavelength of 1064nm was used. The pulse rate was set at 5Hz, with a spot size of 4mm and fluence ranging from 4.6J/cm² to 6.0J/cm² (as shown in Table 1), with pulse stacking technique of 5 to 10 seconds. The melanocytic nevi (moles) were removed using electrocauterization in one treatment session.

Photos of the patient were taken immediately before and immediately after each treatment session. The evaluation was performed by standardized digital photography using the camera of an iPhone at a specific photo corner of the room, with the same lighting. The patient was asked to report any pain or discomfort during the procedure.

The treatment outcome was satisfactory with a Global Aesthetic Improvement Scale (GAIS) of 1 -very much improved (as shown in Figure 2 to Figure 6). The patient was very satisfied with the result. There were no significant side effects such as post-inflammatory hyperpigmentation (PIH) or

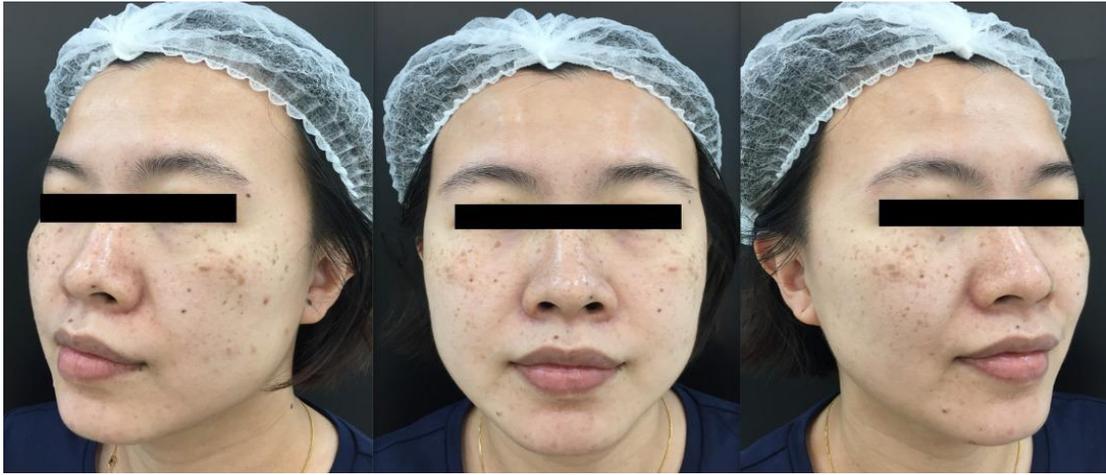


Figure 1: Left face (45 degree), front and right face (45 degree) view photos of the patient during her first presentation. Note that there were multiple freckles over bilateral cheeks and nose as well as Hori's nevus over her bilateral cheekbone prominence.



Figure 2: Front view photos of the patient. Left: 1st presentation. Middle: After 5 treatment sessions. Right: Final 10th treatment session.



Figure 3: Left face (45-degree angle) photos of the patient. Left: 1st presentation. Middle: After 5 treatment sessions. Right: Final 10th treatment session.



Figure 4: Left face (90-degree angle) photos of the patient. Left: 1st presentation. Middle: After 5 treatment sessions. Right: Final 10th treatment session.

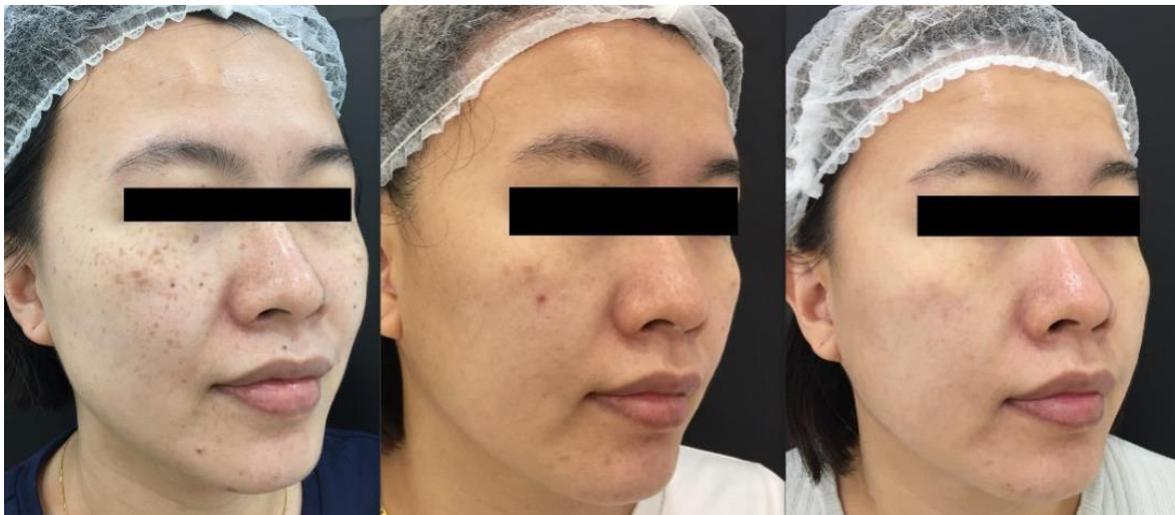


Figure 5: Right face (45-degree angle) photos of the patient. Left: 1st presentation. Middle: After 5 treatment sessions. Right: Final 10th treatment session.



Figure 6: Right face (90-degree angle) photos of the patient. Left: 1st presentation. Middle: After 5 treatment sessions. Right: Final 10th treatment session.

Table 1: Parameters used in the laser treatment of patient's Hori's nevus using Q-switched Nd:YAG laser 1064nm and freckles using Q-switched Nd:YAG laser 660nm (RuVYTouch)

Session	Date	Mode	Spot Size (mm)	Fluence (J/cm ²)	Pulse Rate (Hz)
1	24/4/2021	Q-switched Nd:YAG 1064nm	4	4.6	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.85	1
2	3/7/2021	Q-switched Nd:YAG 1064nm	4	5.0	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.90	1
3	7/9/2021	Q-switched Nd:YAG 1064nm	4	5.6	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.90	1
4	8/10/2021	Q-switched Nd:YAG 1064nm	4	5.6	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.85	1
5	2/11/2021	Q-switched Nd:YAG 1064nm	4	5.6	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.80	1
6	9/12/2021	Q-switched Nd:YAG 1064nm	4	5.8	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.75	1
7	20/1/2022	Q-switched Nd:YAG 1064nm	4	6.0	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	1.0	1
8	30/3/2022	Q-switched Nd:YAG 1064nm	4	6.0	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.85	1
9	14/5/2022	Q-switched Nd:YAG 1064nm	4	4.6	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	0.75	1
10	26/8/2022	Q-switched Nd:YAG 1064nm	4	5.8	5
		Q-switched Nd:YAG 660nm (RuVY Touch)	3	1.1	1

scar observed after the treatment, except for mild pricking sensation during the procedure which was tolerable without the requirement of any local anaesthesia.

Discussion

Pigmentary disorders appearing on the face, even if they are benign, frequently cause cosmetic and psychological problems to many people, especially women. Q-switched (QS) lasers are widely used to effectively treat a variety of cutaneous pigmentation lesions. In this study, we intend to study the treatment of freckles (ephelides) concurrent with Hori's Nevus (ABNOM) using a combination treatment of Q-Switched Nd:YAG 1064nm laser with Q-Switched Nd:YAG 660nm (RuVY) laser.

Treatment of freckles and lentigines with the Q-switched Nd:YAG (QSNY) is usually applied with the frequency-doubled 532nm visible green beam, but overtreatment can cause separation or even damage at the dermoepidermal junction leading to post-inflammatory hyperpigmentation (PIH) formation. The 660nm beam is highly absorbed in melanin to ensure subcellular selective photothermolysis. On the other hand, the 660nm energy is significantly less well absorbed in blood, removing that element as a competing chromophore and making it a safer treatment, helping to minimise inflammation in the epidermis [8].

For the treatment of freckles (ephelides) in this patient, Q-switched Nd:YAG laser with a wavelength of 660nm [RuVY Touch (Ruby-like Versatile YAG)] was used. Using a handpiece equipped with solid dye, 532nm QS Nd:YAG laser energy can be converted to 660nm laser energy for use in ruby-like versatile YAG(RuVY) laser treatment. Compared with the 532 nm wavelength which was the previous wavelength of choice, the 660nm beam offers significantly lower oxy- and deoxyhemoglobin absorption, and therefore less damage to

superficial blood vessels with reduced side effects due to inflammation or aggressive reactions and reduced possibility of PIH. The absorption of melanin is still high, but with slightly lower absorption compared with the 532nm beam, the safety level for treatment of discrete epidermal lesions is increased (Lutronic corporation 2019).

Patient was treated with 10 sessions of Q-switched Nd:YAG laser with RuVY treatment. The 660nm RuVY touch can deliver intense energy onto the same spot size compared with 532nm and can precisely treat only the lesion. Unnecessary heat damage to the surrounding areas is therefore contained as the undesired laser energy is not delivered. Accordingly, skin reaction is comparatively milder after RuVY Touch treatment, which is an advantage to the clinician, enabling him or her to treat epidermal pigmented lesions with a low potential for pigmentation after inflammation. The milder skin reaction also means faster healing and less unsightly erythema and crusting, which is an advantage for the patient (Lutronic corporation 2019).

ABNOM is an acquired disease, usually appearing during the fourth or fifth decades of life and is usually bilateral [9]. The diagnosis of ABNOM was made by clinical appearances, according to the description by Hori et al. and skin biopsies were not performed. The colour of ABNOM was categorised into one of four groups, namely brown, slate-grey, brown-blue and blue [10].

Although dermabrasion has been successful in the treatment of ABNOM [11], this procedure is highly invasive and is associated with many complications, including scarring, infection and post-inflammatory hyperpigmentation. Therefore, QS lasers are the main treatment modalities for ABNOM as well as for nevus of Ota [9].

For this patient's Hori's nevus, Q-switched Nd:YAG laser with a wavelength of

1064 nm was used. The laser fluence used was 4.6J/cm² to 6.0J/cm², at a repetition rate of 5Hz, spot size of 4mm and pulse stacking technique of 5 to 10 seconds. Treatment sessions are performed at 1-3 months intervals. This short interval was chosen to improve the rate of clearing and prevent epithelial repigmentation. Epidermal melanin and melanocytes are competing chromophores for dermal pigment laser therapy and increase the risk of post-inflammatory hyperpigmentation. By performing treatment sessions at short intervals, more photons can target the dermal chromophores through the hypopigmented epithelium while avoiding scattering of the beam [12]. In addition, heat has little effect on the hypopigmented epidermis, thereby preventing post-laser hyperpigmentation (PLH) [7].

Histologically, in ABNOM, dermal melanocytes are scattered throughout the upper and middle portions of the dermis, whereas in nevus of Ota, melanocytes are diffused throughout the entire dermis [5]. In addition, ABNOM is characterised by prominent epidermal hypermelanosis together with dermal melanophages. Variations in colour (brown, grey, blue) are due to the proportion of pigmented cells in the epidermis and dermis [13]. Although the pathogenesis of ABNOM is unclear, it may be due to 'epidermal melanocyte migration' [5]. This mechanism is consistent with the fact that the colour of the macules varies with the maturity of the ABNOM. Initially these macules are usually brown and discrete, becoming bluish-grey and diffuse over time. The early-stage brown lesions are thought to be due to the presence of melanocytes at the basal layer of the epidermis; their subsequent migration into the dermis leads to a darker bluish-grey colour [14].

In agreement with the epidermal migration hypothesis, early-stage brown lesions have more epidermal melanosis, and post-laser hyperpigmentation (PLH) is more likely to

occur in epidermis that contains abundant melanin. Moreover, melanocytes in ABNOM contain immature melanosomes, which are at stage II melanisation [15]. In cases of early-stage brown ABNOM, there are more melanocytes with immature melanosomes, and laser treatment may fail to destroy these amelanotic melanocytes; this may activate immature melanocytes, leading to PLH [16]. Thus, care should be taken when treating patients with early-stage disease [9].

In conclusion, our findings show that combining Q-switched Nd:YAG 1064nm laser treatment with Q-Switched Nd:YAG 660nm (RuVY) laser treatment is effective in treating patients with freckles (ephelides) concurrent with Hori's nevus (ABNOM).

Acknowledgement

First and foremost, we would like to acknowledge with thanks to Prof. Dr. Wan Azman Bin Wan Sulaiman, Assoc. Prof. Dr Ungku Mohd Shahrin bin Ungku Mohd Zaman, Dr Shah Jumaat Bin Mohd Yusoff and everyone who have directly and indirectly guided us in medical aesthetic training.

We would also like to express our gratitude to UR Klinik for giving us the opportunity in conducting and writing this report.

References

1. Praetorius C, Sturm RA, Steingrimsdottir E. Sun-induced freckling: ephelides and solar lentigines. *Pigment Cell & Melanoma Research*. 2014 May;27(3):339-50.
2. Plensdorf S, Martinez J. Common pigmentation disorders. *American family physician*. 2009 Jan 15;79(2):109-16.
3. Rashid T, Hussain I, Haider M, Haroon TS. Laser therapy of freckles and lentigines with quasi-continuous, frequency-doubled, Nd:YAG (532 nm) laser in Fitzpatrick skin type IV: a 24-month follow-up. *Journal of Cosmetic and Laser Therapy*. 2002 Jan

- 1;4(3):81-5.
4. Goo BL, Kang JS, Cho SB. Therapeutic Efficacy and Safety of Wavelength-Converted 660-nm Q-Switched Ruby-Like Versatile YAG Treatment on Various Skin Pigmentation Disorders. *Medical Lasers*. 2014 Dec 30;3(2):48-54.
 5. Hori Y, Kawashima M, Oohara K, Kukita A. Acquired, bilateral nevus of Ota-like macules. *Journal of the American Academy of Dermatology*. 1984 Jan 1;10(6):961-4.
 6. Park JH, Lee MH. Acquired, bilateral nevus of Ota-like macules (ABNOM) associated with Ota's nevus: Case report. *Journal of Korean Medical Science*. 2004 Aug 1;19(4):616-8.
 7. Lee B, Kim YC, Kang WH, Lee ES. Comparison of characteristics of acquired bilateral nevus of Ota-like macules and nevus of Ota according to therapeutic outcome. *Journal of Korean Medical Science*. 2004 Aug 1;19(4):554-9.
 8. SPECTRAXT: A multiple platform Nd:YAG device. *PRIME*. September 2014.
 9. Lee WJ, Han SS, Chang SE, Lee MW, Choi JH, Moon KC, Koh JK. Q-Switched Nd: YAG laser therapy of acquired bilateral nevus of Ota-like macules. *Annals of Dermatology*. 2009 Aug 1;21(3):255-60.
 10. Cho SB, Park SJ, Kim MJ, Bu TS. Treatment of acquired bilateral nevus of Ota-like macules (Hori's nevus) using 1064-nm Q-switched Nd: YAG laser with low fluence.
 11. Kunachak S, Kunachak S, Sirikulchayanonta V, Leelaudomniti P. Dermabrasion is an effective treatment for acquired bilateral nevus of Ota-like macules. *Dermatologic surgery*. 1996 Jun;22(6):559-62.
 12. Manuskiatti W, Fitzpatrick RE, Goldman MP. Treatment of facial skin using combinations of CO₂, Q-switched alexandrite, flashlamp-pumped pulsed dye, and Er: YAG lasers in the same treatment session. *Dermatologic surgery*. 2000 Feb;26(2):114-20.
 13. Ee HL, Wong HC, Goh CL, Ang P. Characteristics of Hori naevus: a prospective analysis. *British Journal of Dermatology*. 2006 Jan 1;154(1):50-3.
 14. Leong Ee H, Leok Goh C, Khoo, Chan EY, Ang P. Treatment of acquired bilateral nevus of ota-like macules (Hori's nevus) with a combination of the 532 nm Q-Switched Nd: YAG laser followed by the 1,064 nm Q-switched Nd: YAG is more effective: prospective study. *Dermatologic surgery*. 2006 Jan;32(1):34-40.
 15. Hori Y, Takayama O. Circumscribed dermal melanoses: classification and histologic features. *Dermatologic clinics*. 1988 Apr 1;6(2):315-26.
 16. Lam AY, Wong DS, Lam LK, Ho WS, Chan HH. A retrospective study on the efficacy and complications of Q-switched alexandrite laser in the treatment of acquired bilateral nevus of Ota-like macules. *Dermatologic surgery*. 2001 Nov;27(11):937-42.
 17. RuVYTouch. Lutronic Spectra XT Physician Clinical Guide, 2-1.