CASE REPORT

Indonesia Journal of Biomedical Science (*IJBS*) 2021, Volume 15, Number 2: 101-105
P-ISSN.2085-4773, E-ISSN.2302-2906

Published by
Indonesia Journal of Biomedical Science

A case of Nevus of Ota treated with laser picosecond Alexandrite 755 nm: A case-report

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Received: 2021-05-30
Accepted: 2021-07-10
Published: 2021-08-01

ABSTRACT

Background: Nevus of Ota is a well-defined dermal melanocytosis characterized by bilateral multiple small, bluish-brown macules in the area innervated by the first and second branches of the trigeminal nerve. Currently, the therapeutic modalities for this condition are still limited and complete resolution is difficult to achieve.

Case Description: A 23-year-old woman complained a brown spot on the right cheek since the patient was born. It looked like the skin but slightly darker than its surroundings. Four years ago the patient had received 6 sessions of QS: Nd-YAG laser therapy, but the spot is still clearly visible. Dermatological status of the orbital, infraorbital, zygomatic, and right buccal regions showed multiple hyperpigmented patches, gray-brown, well-defined, geographically in shape with size 0.2 x 0.3cm – 5 x 7cm. The lesion was unilateral and distributed within the innervation area of the second and third trigeminal nerve. Miravex® skin analysis showed that the average level of melanin was 0.464 with a melanin variation of 45%. Therefore, patient was diagnosed with Nevus of Ota. The proposed treatment was picosecond alexandrite 755nm laser, with a frequency of 2.5 Hz, pulse duration 550-750 ps, spot size 4 mm, and fluence 1.59 J/cm^2. A marked improvement was observed after the treatment and after 21 days, a good grade of improvement was reported.

Conclusion: Nevus of Ota can effectively treated with 755nm picosecond alexandrite laser therapy and results in a good grade of improvement.

Keywords: nevus of Ota, laser picosecond alexandrite 755 nm, melanocytosis

Cite this Article: Winaya, K.W., Setiadji, I.M. 2021. A case of Nevus of Ota treated with laser picosecond Alexandrite 755 nm: A case-report. *IJBS* 15(2): 101-105. DOI: 10.15562/ijbs.v15i2.326

INTRODUCTION

Skin pigmentation disorders, especially those that occur in the facial area, often affect patient's emotion and psychology. An example of pigmentation disorder that is often found on the face is nevus of Ota (nevus fuscoceruleus ophthalmomaxillaris). Nevus of Ota is a well-defined dermal melanocytosis characterized by bilateral, multiple and small, bluish-brown macules in the area innervated by the first and second branches of the trigeminal nerve. The therapeutic modalities of this condition are still very limited, with complete resolution are rarely achieved. Advances in the laser therapy are important momentums in improving medical treatments which also extend to dermatological disorders. They often associated with better efficacy with minimal side effects and downtime.[1]

Nevus of Ota was first described by Ota in 1939.[1] Early hyperpigmentation may appear lighter in colour with a continuous process of hyperpigmentation. Nevus of Ota is characterized by blueish-black or grey dermal melanocytic pigmentation and usually occurs in the areas innervated by the first and second branches of trigeminal nerve.[1] In rare cases, it may involve the ocular and oral mucosal surfaces.[2,3]

Nevus of Ota is most common in Asian descent, with an estimated prevalence of 0.6% in the Asian population.[1] Studies had shown that it also prevalent in other ethnic groups including African, African-American, and East Indian, but rarely in white people. Its prevalence in women tend to be five times higher than in men.[4] Based on the registry of the Wing Amertha Clinic of Dermatocosmetic, there were 6 new patients with nevus of Ota from a total of 1537 visits (prevalence 0.39%). Approximately 50% of cases are present since birth, while the others appeared in puberty and adulthood.[1] It can be triggered by infection, trauma, exposure to ultraviolet light, and hormonal influences. Nevus of Ota is persistent and usually does not regress spontaneously.

The advent of Q-switched (QS) lasers with pulse durations as short as 10 nanoseconds (ns) allows precise targeting of melanosomes by reducing damage to surrounding tissues.[5] The Picosecond (ps) laser, which has a pulse duration of 1000 times shorter than ns, was first shown to be effective in tattoo removal by

Ross and colleagues in 1990.[6] A version of alexandrite (PicoSure; Cynosure, Westford, MA, USA) was commercially available and was FDA approved in 2012 for tattoo treatment. However, it also effective in removing nevus of Ota as reported by Chestnut et al. in which significant improvements were observed in 3 nevus of Ota patients that recalcitrant to Q-switched ns in 2 treatments.[7]

In this case report, we report a case of nevus of Ota which was treated with a 755-nm alexandrite picosecond laser. This case is reported to gain insight regarding the application of 755-nm alexandrite picosecond laser in treating this persistent condition.

CASE REPORT

A 23 year-old Balinese woman came with the chief complaint of a brownish spot on the right cheek. It appeared since the patient was born and it looks like the skin but slightly darker than its surroundings. The patches are said to be flat compared the surrounding skin, not prominent, without itching or pain. There were no complaints of similar spots on the eyes, oral cavity, or nasal cavity.

The patient had seen a dermatologist about 10 years ago and received topical medication which was used for a month but with no improvement. Four years ago the patient had received 6 sessions of QS: Nd-YAG laser therapy but the spots are not reduced in number or improved and still clearly visible.

Dermatological status in the orbital, infraorbital, zygomatic, right buccal regions showed multiple hyperpigmented patches, gray-brown in color, well-defined, geographically defined, 0.2 x 0.3cm – 5 x 7cm in size, unilaterally distributed within the innervation area of the 2nd and 3rd branches trigeminal nerves. A dermoscopy was performed and multiple unstructured brown areas were seen. A biopsy was not performed because of the patient's refusal. Further examination was performed using Miravex skin analysis which revealed that the average level of melanin was 0.464 with a variation of melanin at 45%.

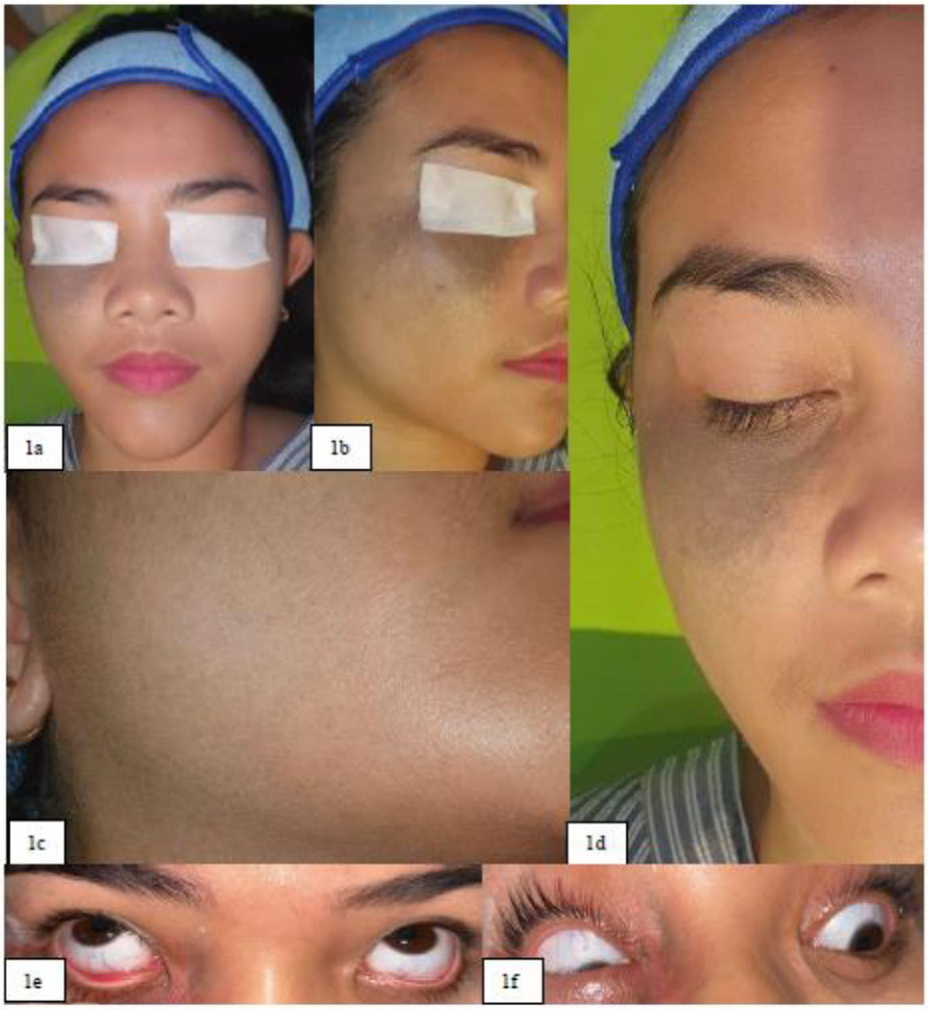

Figure 1a-d. Unilateral gray-brown hyperpigmented patch in orbital region and region innervated by 2nd and 3rd branches of the trigeminal nerve.
1e-f. No lesions were found on the eyelids.

According to the history and physical examination, the patient's working diagnosis was nevus of Ota. The treatment was planned using 755nm alexandrite picosecond laser with a frequency of 2.5 Hz, pulse duration at 550-750 ps, spot size 4 mm, and fluence 1.59 J/cm^2. Patients were given 0.5% tretinoin cream once daily at night for priming purpose for at least 2 weeks and stopped 3 days before the laser procedure.

The device used were a 755nm alexandrite picosecond laser (PicoSure®; CynoSure, Inc, Westford, MA, USA) and handpiece, laser tip, operator-specific protective eyewear for 755nm, patient protective eyewear, masks, gloves, NaCl solution, 0.1% gentamicin antibiotic cream and sterile gauze.

The patient was given gentamicin 0.1% cream and moisturizer which was applied twice a day to the laser-treated lesion area for home treatment. Patient was advised to clean their face carefully, using a gentle cleanser without soap, or simply clean with 0.9% NaCl only. Patient was advised not to peel or rub the skin, avoid direct sun exposure by using physical protection such as hats and masks, and apply sunscreen 30 minutes before exposure to the sun. A night cream containing 5% hydroquinone + 0.025% tretinoin + 0.1% dexamethasone could be used once a day at night after the post-laser wounds had been recovered.

After 7 days, improvement of the lesions was moderate (25-49%). The therapy was continued after 21 days. Dermatological status of the orbital, infraorbital, zygomatic, right buccal regions showed macules - multiple hypopigmented and hyperpigmented patches, gray-brown, well-defined, geographic shape, 0.2 x 0.3cm – 5 x 7cm in diameter, unilateral distribution of lesions

according to the area of innervation of the 2nd and 3rd branches of the trigeminal nerve. Improvement of the lesion was obtained in good grade (50-74%).

DISCUSSION

Hyperpigmentation of the skin occurs due to the accumulation of melanin in the epidermis, dermis, or both.[8,9] One of the most common dermal hyperpigmentation disorders is nevus of Ota or also known as nevus fuscoceruleus ophthalmomaxillaris. Nevus of Ota lesions are most commonly seen in Asians, especially in women with a visible onset at birth, although they can also be seen in early childhood or puberty.[1] This disorder has several precipitants, including infection, trauma, exposure to ultraviolet light and hormonal influence.

The aetiologies and pathogenesis of Nevus of Ota are largely unknown. Although unconfirmed, the nevus of Ota and other melanocytic cutaneous disorders, such as the nevus of Ito, blue nevus, and Mongolian spot show melanocytes that have not migrated completely from the neural crest to the epidermis during the embryonic stage.[10] The different prevalence among different populations suggests a genetic predisposition might be play an important role, although familial cases of nevus of Ota are very rare. The two peaks in age of onset in infancy and at the beginning of puberty suggest that hormones are one of important factors in the development of this condition. Schwann cell precursors have been shown to be a source of melanocytes in the skin.[11]

Physical examination of the nevus of Ota showed a well-defined dermal melanocytosis clinically characterized by multiple small bluish-brown to grey macules that are most commonly seen in areas innervated by the first and second branches of the trigeminal nerve.[1] Peking Union Medical College Hospital (PUMCH) classified the nevus of Ota into five classifications based on the extent and distribution of pigmentation according to the branches of the trigeminal nerve; Type I if the pigmented macula involves one branch of the trigeminal nerve, Type II if the pigmented macula involves two branches of the trigeminal nerve, Type III if the pigmented macula involves three branches of the trigeminal nerve, Type IV if the macula involves at least one bilateral trigeminal innervation, Type V if there are complications.[12] The incidence of scleral pigmentation in this case is about 60%. Other sites that can be affected are the conjunctiva and tympanic membrane.[1] This disorder initially appears as discrete brown macules, which over time confluent and become bluish or grey in color.[13] The pigmentation does not disappear over time and does not respond to depigmenting agents.[14]

This patient had grey-brown patches on the right cheek with a unilateral distribution without any pigmentation abnormalities on the conjunctival, oral, or nasal mucosa. According to the PUMCH classification, this patient is classified as Type II, more specifically Type IIb (pigmented macula involving the skin of the zygomatic area, temporal region, cheek, innervation area (maxillary nerve and mandibular nerve; V2 + V3) second and third branches of the trigeminal nerve). The patch has occurred for approximately 23 years which supports the diagnosis of an acquired pigmentation disorder, one of which is the nevus of Ota.

The most common differential diagnosis for a nevus of Ota is acquired bilateral nevus of Ota-like macules (ABNOM). The difference between the two lies in the onset of occurrence, unilateral or bilateral, the presence or absence of mucous membrane involvement and the histopathological appearance of melanocytes.[15] Nevus Ota often occurs congenitally and at a young age, unilateral in areas innervated by the trigeminal nerve, the ophthalmic and maxillary branches, may involving the mucosa, and histological examination often shows dermal melanocytes scattered throughout the dermis layer.[3,7] Acquired bilateral nevus of Ota-like macules, on the other hand, occurs in middle age, bilaterally symmetrical, and with no mucosal involvement. Dermal melanocytes are often found scattered in the upper and lower dermis.[15]

Based on the history and clinical features, the patient was diagnosed with nevus of Ota. Histopathological examination was not performed because the patient's refusal. Although, histopathological examination is not absolutely necessary in this case because the overall differential diagnosis is a benign hyperpigmented lesion.

There are several therapeutic modalities for the treatment of nevus of Ota. Neither treatment with topical depigmenting agents nor chemical peels are deemed effective because of the scattered melanocytes in the dermis.[16] Although cryotherapy and surgery have been used in the past, they should be avoided because of significant scar tissue formation. Laser surgery is the treatment of choice with Q-switched (QS) lasers including the ruby, alexandrite and neodymium: yttrium-aluminium-garnet (Nd:YAG) lasers that are considered as the most effective treatment in this condition. Picosecond lasers have also been reported to be effective in treating this condition.[1]

The underlying theory of picosecond lasers for the pigmented lesions is the theory of thermal relaxation time (TRT) and stress relaxation time (SRT), both of which are related to reactions caused by lasers on the skin, namely photo thermolytic reactions and photomechanical reactions (photoacoustic). The picosecond lasers currently in use are 755 nm (alexandrite), QS Nd: YAG (1064 nm), and Potassium Titanyl Phosphate (532 nm). The choice of laser to be used is made according to the depth of the lesion and the patient's skin type.[17] Longer wavelengths are intended for deeper pigments and pigments in dark-skinned patients, while shorter wavelengths are used for light-skinned patients with superficial lesions.[18] Peak absorption by melanin lies in the ultraviolet (400 nm) range and decreases with increasing wavelength.[19] The 755nm Alexandrite laser is absorbed by melanin, and less absorbed by oxyhaemoglobins, thereby, limiting the unwanted thermal damages to the epidermis and blood vessels. It has the deepest penetration as well as high efficacy for dermal lesions.

Laser parameters are determined by the type of lesion and skin type of the patient. Darker skin types have a higher risk of experiencing post-operative pigmentation disorders, so it is necessary to choose the right fluence, spot size, repetition rate or frequency and interval

of therapy. For small, discrete lesions, 2-3 Hz is chosen to provide better control.[20] The therapeutic interval should also be considered as shorter interval increases the risk of hypopigmentation, while longer interval reduces the success rate due to re-production of melanin.[20] The recommended parameters are the lowest fluence that gives a visible response (fluence is determined by spot size; 1-4 J/cm^2), spot size according to the lesion being treated (between 1.5 – 4 mm), frequency variation (1-5 Hz) with therapy interval of 4-6 weeks or determined according to individual response to therapy. The end-point of the 755nm alexandrite picosecond laser is an immediate whitening reaction accompanied by a popping sound at each laser shot which indicates the explosion of the melanin-containing cells.[21] The absence of the end-point indicates a lack of fluence.

This patient was treated with a picosecond alexandrite laser 755nm with a fluence at 1.59 J/cm^2, frequency of 5 Hz, pulse duration at 750 ps, and spot size 4 mm. Immediate bleaching and popping sounds were observed which indicated sufficient fluence. The largest spot size was chosen according to the PicoSure manual, which is 4 mm to get the lowest fluence for initial therapy. The frequency used is medium (2.5 Hz) due to the extensivity of the nevus of Ota. This patient has Fitzpatrick skin types III-IV which are at higher risk for post-inflammatory pigmentation disorders which tried to be minimized through the selection of appropriate parameters.

Prior to therapy, it is necessary to prime the lesions using topical tretinoin, alpha hydroxy acid or beta hydroxy acid to prepare the skin for at least 2 weeks and discontinue 3 days before the laser procedure.[21] The purpose of this treatment is to thinning the stratum corneum as much as possible in order to reduce the refraction of the laser light. The patient was priming with 0.05% tretinoin for 2 weeks before therapy and stopped 3 days before laser treatment. Furthermore, laser treatment can be performed according to the parameters that have been determined with the hand piece positioned perpendicular to the lesion.[21] Immediately after the laser procedure, the lesion can be compressed with ice packs or cold compresses and followed by topical antibiotics and good wound care.[21] Patients are advised to clean the face carefully, use a gentle cleanser, do not exfoliate or rub the skin, avoid sun exposure, apply sunscreen regularly, and use a night cream containing whitening after the laser wound heals.[21]

The most common complication of laser use is changes in pigmentation.[17,20] Hypopigmentation can occur as a result of damage to normal melanin by the laser, whereas hyperpigmentation is caused by the direct inflammatory effect of the high levels of energy produced.[17,20] Both of these complications are more common in darker skin types within 2-3 weeks post-therapy with a peak in a month post-therapy. The complications usually disappear in 3-4 months, although it can also be permanent.[19] As previously described, this complication can be minimized by using longer wavelengths, lower fluence, larger spot size, appropriate treatment interval, avoidance of sunlight and sunscreen application.[17,21] Topical corticosteroids and whitening agents can also be added in post-laser treatment to reduce the risk of hyperpigmentation.[20] However, all of those measures cannot totally avoid the complications, so a proper informed consent is needed at every stage of laser work to maintain patient satisfactions.[22]

Evaluation of therapeutic results can be conducted using serial photography scoring methods with 95-100% clearance is considered as complete, 75-94% considered perfect, 50-74% considered good, 25-49% rated moderate, 10-24% assessed low and <9% is considered poor.[23] Treatment is considered effective when there is at least 50% clearance of the lesion.[14] Evaluation with serial photography is subjective, so an objective parameter was developed to assess pigment reduction or fading response, namely by estimation of the dermal melanin fraction or Melanin index which can be measured with a device called Mexameter® or DermaSpectrometer®.[24] Miravex® is a skin analyzer that can measure melanin levels and variations. It can also be used to evaluate the results of therapy for melasma, vitiligo and nevus.

This patient returned after a month and an improvement of 50-70% was observed after one therapy session with no complications such as hypo- or hyperpigmentation. Complications of pigmentation changes can still occur up to a month after therapy so the patient needs to be monitored continuously. The evaluation of therapeutic results was carried out objectively using Miravex® and a decrease in melanin levels and melanin variation (0.464, 49% vs 0.357, 36.3%) was observed. Repeated therapy was planned to be done after 2 months. The prognosis in this case is *dubius ad bonam*.

CONCLUSION

A case of nevus of Ota has been reported with no improvement after 6 treatments with QS Nd:YAG in a 23-year-old Balinese woman. The condition was improved with 755nm picosecond alexandrite laser therapy in one session. The nevus of Ota lesion is a dermal melanocytosis that needs to be distinguished from other similar pigmentation disorders. Currently, picosecond alexandrite laser is the latest therapy in pigmentation disorders of the skin. Knowledge of the mechanism of action of the laser, the parameters used, patient selection, post-laser care, and proper patient education will guarantee good results with minimal risk and complications.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

ETHIC APPROVAL

A written consent had been obtained from the patient regarding the use of the clinical data. The ICJME disclosure form has been submitted with this article.

FUNDING

This study was self-funded with no involvement of any third-party funding.

AUTHOR CONTRIBUTIONS

All authors contributed equally in the writing of this article

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