Efficacy and Safety of 730-nm Picosecond Laser for the Treatment of Acquired Bilateral Nevus of Ota-like Macules

Rui Han, MM,* Yifang Sun, MM,* and Mingshan Su, MBBS*

BACKGROUND The effectiveness and safety of 730-nm picosecond laser for treating acquired bilateral nevus of Ota-like macules remain uncertain.

OBJECTIVE This study aims to evaluate the potential benefits and risks of using the 730-nm picosecond laser for ABNOM removal.

METHODS This is a retrospective review of patients who were presented to the clinic between January 2020 and January 2024 for the treatment of ABNOM with 730-nm picosecond laser alone. The efficacy of the laser was assessed based on the Quartile Improvement Scale, using high-resolution photographs evaluated by blinded dermatologists.

RESULTS A total of 72 Chinese participants with Fitzpatrick skin types III to IV were included in the study. The overall effective rate of the treatment was 75%, achieved after an average of 2.42 ± 0.75 sessions. A subgroup analysis of 41 patients who completed 3 treatment sessions showed statistically significant differences in outcomes across the sessions. The mean improvement scores for sessions 1, 2, and 3 were 1.63 ± 1.04, 2.66 ± 1.22, and 3.29 ± 1.17, respectively ($p < .01$). No cases of hypopigmentation were observed. The incidence of postinflammatory hyperpigmentation was 5.56%.

CONCLUSION The 730-nm picosecond laser is a safe and effective treatment for ABNOM in Chinese patients.

Acquired bilateral nevus of Ota-like macules (ABNOM), also known as Hori nevus, was first described by Hori and colleagues[1] in 1984. This condition is characterized by blue-brown macules that appear bilaterally on the face and typically develop later in life (in the second decade). Histopathological examinations reveal pigment-bearing cells scattered in the upper and middle layers of the dermis. ABNOM can impose significant cosmetic and psychosocial burdens on the affected individuals.

Over the past 2 decades, Q-switched lasers (ruby, alexandrite, and Nd:YAG) with nanosecond pulse durations have been used to treat ABNOM based on the principles of selective photothermolysis. While these lasers are generally effective, they often require multiple treatment sessions. In addition, patients may experience several complications during and after treatment. Common side effects include pain, erythema, edema, blistering, postinflammatory hypopigmentation, and postinflammatory hyperpigmentation (PIH).[2]

Picosecond lasers, characterized by their pulse durations in the subnanosecond range, are distinct from traditional nanosecond lasers. These advanced technologies offer the advantage of enhanced photomechanical effects when targeting pigmented chromophores. The photomechanical effects promote the mechanical breakdown of pigment into smaller fragments, facilitating easier clearance. In addition, the shorter pulse durations, which are significantly less than the thermal relaxation time of melanosomes, help minimize thermal damage to surrounding tissues and reduce potential side effects.[3–5] In a prospective, split-face, randomized study, researchers compared the efficacy of a 1064-nm picosecond Nd:YAG laser with a 750-picosecond pulse duration to that of a 1064-nm Q-switched Nd:YAG laser with a 2-nanosecond pulse duration for the treatment of ABNOM. The findings of the study demonstrated that the picosecond laser was more effective in clearing dermal pigmented lesions than the Q-switched laser.[6] Similarly, another prospective, split-face, self-controlled study evaluated the efficacy and safety of picosecond alexandrite lasers (PSAL, with a pulse duration of 750 ps) compared with Q-switched alexandrite lasers (QSAL, with a pulse duration of 70 ns) in treating ABNOM. The results indicated that PSAL therapy produced significantly better clinical outcomes and a lower incidence of PIH.[4] Collectively, the aforementioned studies support the

*From the *All authors are affiliated with the Dermatology, Su Medical Cosmetic Clinic, Beijing, China*

The authors have indicated no significant interest with commercial supporters.

Address correspondence and reprint requests to: Mingshan Su, MBBS, Dermatology, 1 St Shanyuan, Haidian District, Beijing 100000, China, or e-mail: sumingshan@vip.163.com

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.dermatologicsurgery.org).

Dermatol Surg 2025;51:485–489
http://dx.doi.org/10.1097/DSS.0000000000004545

notion that shorter pulse durations are associated with improved efficacy and reduced PIH.

Recently, a novel 730-nm picosecond titanium sapphire laser, featuring a pulse duration of 246 picoseconds, has become commercially available.[7] This laser modality holds potential for treating ABNOM due to its superior melanin absorption compared with the 755-nm picosecond laser, as well as its appropriate penetration depth and shorter pulse duration. Loh[8] reported that the 730-nm picosecond laser is both effective and safe for treating nevus of Ota, which shares histological similarities with ABNOM. Despite these findings, there is a scarcity of studies addressing the efficacy and safety of the 730-nm picosecond laser specifically for ABNOM treatment. This study aims to present the initial application of the 730-nm picosecond laser in treating ABNOM.

Materials and Methords

Study Design

This study conducted a retrospective analysis of patients who received 730-nm laser treatment for ABNOM at the clinic from January 2020 to January 2024. The research adhered to the principles outlined in the 1975 Declaration of Helsinki. Informed consent was obtained from all participants before treatment. Exclusion criteria included a recent history (within the past 3 months) of using topical or oral medications such as hydroquinone (HQ), azelaic acid, tranexamic acid, tretinoin, triple combined cream (hydroquinone, tretinoin, and corticosteroid), or undergoing laser/intense pulsed light (IPL) treatment. Patients who received combination therapies with other energy devices (including other lasers or IPL) for ABNOM were also excluded. Furthermore, pregnant or lactating patients, as well as those lacking baseline or follow-up digital photography for evaluation, were not included in the analysis.

Laser Treatment

This study used a 730-nm picosecond laser, which is a separate handpiece connected to a Nd:YAG laser device (Picoway; Candela Medical, Marlborough, MA). This laser features a pulse duration of 246 picoseconds and offers spot sizes of 2 mm, 3 mm, and 4 mm. Before each session, a topical anesthetic agent containing 5% lidocaine was applied to the treatment area and left for 30 to 50 minutes. Standardized digital photography (Thinkview; BOSE Electronic Co., Wuhan, China) was taken at baseline, before each treatment session and at each subsequent visit. Following the procedure, medical cooling masks were applied to facilitate recovery. Finally, patients were advised to protect themselves from ultraviolet radiation by using sunscreens with a sun protection factor (SPF) greater than 30 and a PA rating above +++ after each treatment.

Assessment of Responses and Complications

This study collected various data points, including initial treatment age, skin type classified by the Fitzpatrick scale, number of treatment sessions, the interval between treatment sessions, follow-up information, lesion location, and the presence of melasma overlapping with ABNOM lesions. High-resolution digital photographs of the subjects were captured at baseline, before each treatment session, and during follow-up visits. Two blinded dermatologists independently evaluated these photographs using the Quartile Improvement Scale: no improvement (0%, score 0), minor improvement (1%–25%, score 1), moderate improvement (26%–50%, score 2), marked improvement (51%–75%, score 3), or very significant improvement (76%–100%, score 4)[9] (see Table 1, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Quartile Improvement Scale). The agreement between the 2 dermatologists was assessed using the Cohen weighted kappa procedure. Adverse events were extracted from patient records. These events included pain, erythema, edema, blistering, crusting, purpura, petechia, itching, scarring, and postinflammatory hyperpigmentation or hypopigmentation. The information was primarily gathered through routine telephone follow-ups conducted through WeChat the day after treatment, as well as 1 week and 1 month posttreatment. In addition, scarring and postinflammatory changes were evaluated through photographic analysis. The overall effective rate was calculated as the proportion of subjects classified as having marked improvement (51%–75%) or very significant improvement (76%–100%) among all participants.

Statistical Analysis

Statistical analysis for this study was conducted using IBM SPSS Statistics for Windows (version 27.0; IBM Corp., Armonk, NY). Descriptive statistics summarized continuous variables as mean ± SD and categorical variables as percentages. In addition, the minimum and maximum values for continuous variables were reported. To assess the significance of differences before and after each treatment session, a Wilcoxon signed rank sum test for paired samples was conducted. Furthermore, multiple logistic regression was used to examine the influence of factors such as treatment age and skin color types on the degree of treatment improvement. All statistical tests were two-sided, with a confidence level set at 95% ($\alpha = 0.05$).

Results

Demographics

A total of 72 patients were included in the study, and all of them were women. Overall, 96% were classified as Fitzpatrick skin type III, while the remaining patients were of skin type IV. Eleven patients (15.3%) exhibited melasma in areas overlapping with the locations of ABNOM. The patients were categorized into 6 groups based on the site of ABNOM involvement. The majority, 46 patients (63.8%), had lesions limited to the zygomatic area. Involvement of the forehead and temporal areas was observed in 6 (8.3%) and 5 patients (6.9%), respectively. In addition, 4 patients (5.6%) had lesions affecting both the zygomatic and temporal areas, while 8 patients (11.1%) had involvement in the zygomatic,

temporal, and forehead regions. Lastly, 3 patients (4.2%) presented with lesions in both the zygomatic and forehead areas (see Table 2, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Demographics).

The treatment parameters for ABNOM consisted of a spot size of 2 mm or 3 mm, a frequency of 3 Hz, and a fluence of 2.75 to 4 J/cm^2 for a 2-mm spot size and 1.6 to 1.8 J/cm^2 for a 3-mm spot size (see Table 3, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Laser Parameters). The therapeutic endpoints varied from immediate whitening to erythema without frosting. Single-pass treatment without pulse overlap was administered. Overall, 72 patients participated in treatment session 1. Of these, 61 underwent treatment session 2, while 11 opted out. Among the 61 patients, 20 chose to discontinue further treatment sessions, resulting in a total of 41 patients receiving 3 treatment sessions (see **Figure 1**, **Supplemental Digital Content 1**, http://links.lww.com/DSS/B578, Treatment Flowchart). Participants received an average of 2.42 ± 0.75 treatments (range: 1–3), with an initial treatment age of 38.5 ± 7.0 years (range: 27–63). The mean treatment interval was 192 ± 145 days (range: 29–940), and the average follow-up duration was 180 ± 258 days (range: 34–1,456) (see Table 4, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Treatment Parameters). During the COVID-19 pandemic, individual patients experienced extended treatment intervals and follow-up periods as a result of limited in-person visits, to reduce the risk of SARS-CoV-2 infection and implement epidemic prevention and control measures.

Efficacy Analysis

The 2 dermatologists showed strong agreement in assessing the photographs (weighted kappa, k = 0.795, 95% CI 0.734–0.855, $p < .0001$), indicating high reliability in the investigator's assessment of treatment outcomes.

Table 1 summarized the treatment response for the patients that received 1 to 3 treatment sessions (Table 1). Of the 72 patients who initially received 1 treatment, 27.8% (20/72) experienced more than a 50% improvement. Subsequently, 61 of these patients underwent a second treatment, with 62.3% (38/61) achieving more than a 50% improvement. After this, 41 patients received a third treatment, and 80.5% (33/41) of them experienced more than a 50% improvement. The proportions achieving marked and very significant improvement were 16.7% (12/72) and 58.3% (42/72), respectively, which means the overall effective rate was 75% (54/72) after a mean of 2.42 ± 0.75 treatments. Please refer to Figure 1 for representative photographs of lesions before and after treatment. No evidence of recurrence was seen during the follow-up period.

Finding A: An ordinal logistic regression analysis was performed on data from 72 patients who had undergone 1 to 3 treatment sessions to explore the link between the improvement scores and several factors: initial treatment age, presence of melasma overlapping with ABNOM lesions, skin type, lesion location, and the number of treatment sessions received. The outcomes suggested that none of these variables exhibited a statistically significant impact on the improvement scores of ABNOM (see Table 5, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Variables Associated with ABNOM Improvement).

Finding B: A subgroup analysis was conducted on 41 patients who underwent 3 treatment sessions. Among these patients, the proportion of individuals experiencing marked improvement (51%–75%) or very significant improvement (76%–100%) increased progressively with each treatment session. Specifically, 17.1% (7/41) of patients reported marked or very significant improvement after the first treatment, 56.1% (23/41) after the second treatment, and 80.5% (33/41) after the third treatment. This trend indicated that the effective rate increased as the number of treatment sessions increased. Paired samples Wilcoxon signed rank sum test revealed statistically significant differences among the outcomes of the 3 treatment sessions, with mean improvement scores of 1.63 ± 1.04, 2.66 ± 1.22, and 3.29 ± 1.17, respectively ($p < .01$) (Figure 2). This result confirmed that a greater number of treatment sessions was associated with enhanced efficacy for the 41 patients.

Safety Analysis

During the treatment, all patients reported experiencing mild pain despite the use of topical numbing. After the procedure, mild to moderate erythema and edema were commonly observed, with these symptoms typically resolving within 5 days. It is noteworthy that there were no cases of scarring, blistering, or hypopigmentation. However, PIH emerged as the most notable adverse event, affecting 6 out of 174 treatments and 4 out of 72 patients. All cases of PIH resolved spontaneously within a maximum of 14 months (see Table 6, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Overview of Information for Patients with PIH).

TABLE 1. Treatment Response for the Patients Those Received 1 to 3 Treatment Sessions

Number of Treatment Sessions	*n*	PIH, *n* (%)	Treatment Outcomes, *n* (%)				
			0%	1%–25%	26%–50%	51%–75%	≥76%
1	72	3 (4.17)	0 (0)	31 (43.06)	21 (29.17)	12 (16.67)	8 (11.11)
2	61	2 (3.28)	0 (0)	7 (11.48)	16 (26.23)	13 (21.31)	25 (40.98)
3	41	1 (2.44)	0 (0)	3 (7.32)	5 (12.20)	7 (17.07)	26 (63.41)

PIH, postinflammatory hyperpigmentation.

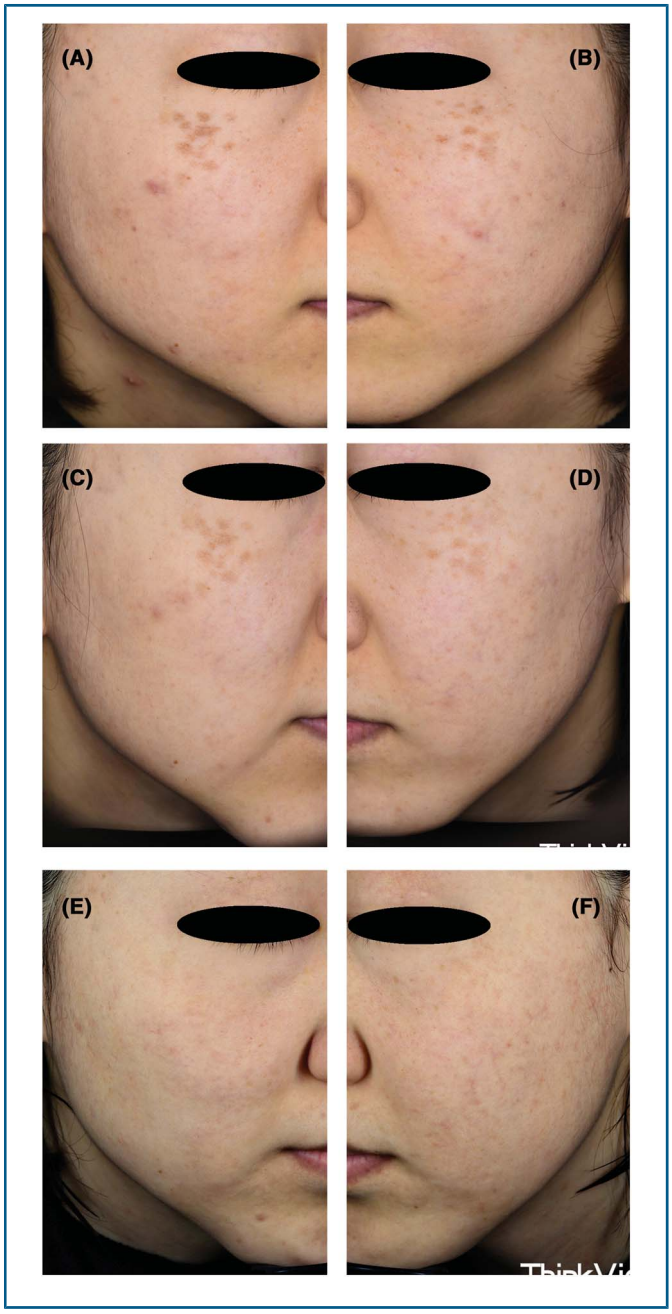

Figure 1. (A) 33-year-old woman with ABNOM underwent treatment with a 730-nm picosecond laser. (A and B) baseline; (C, D) after 15 weeks of first treatment, a 26% to 50% improvement was observed; (E, F) following a second treatment, evaluations at 32 weeks indicated a 76% to 100% improvement.

Discussion

The prevalence of ABNOM is 3.18% in China, and most of the patients are women.[10] The disorder adversely affects the mental health and socialization of patients. Q-switched nanosecond lasers are widely used therapeutic modalities in ABNOM, which act by the principle of selective photothermolysis.[2] The disadvantages of nanosecond laser treatments are that they require several treatment sessions (roughly 5–15) to achieve good improvement[11–13] and the incidence of PIH ranges from 12.5% to 75%.[11,14,15]

The evolution of laser technology has led to increased interest in picosecond lasers within the field of aesthetic medicine. These devices theoretically produce a stronger photomechanical effect. This enhanced effect can result in improved clearance of dermal pigmentation disorders. In addition, picosecond lasers offer a reduced risk of complications. Yu's study demonstrated that compared with 755-nm nanosecond laser, 755-nm picosecond laser therapy afforded significantly better clinical outcomes (average scores of the quartile improvement scale were 3.73 ± 0.521 and 2.4 ± 0.894 for picosecond laser and nanosecond laser, respectively) and lower incidence rate of PIH (27.77% vs 54.44%).[4] Some retrospective studies all showed that 755-nm picosecond laser were effective and safe for ABNOM treatment.[16–18]

Compared with the 755 nm picosecond lasers, the novel 730-nm picosecond laser modality demonstrates potential for treating ABNOM due to its enhanced melanin absorption, optimal penetration depth, and shorter pulse duration. However, the late introduction of the 730-nm picosecond laser to the market has led to a scarcity of studies examining its application for ABNOM treatment. To the authors' knowledge, this study is the first to retrospectively analyze the effectiveness and safety of the 730-nm picosecond laser in a cohort of over 50 patients with ABNOM.

In this study, the overall effective rate was 75% (54 out of 72) after an average of 2.42 ± 0.75 treatments. The effective rates for treatment sessions 1, 2, and 3 were 27.8% (20 out of 72), 62.3% (38 out of 61), and 80.5% (33 out of 41), respectively. Among the 11 patients who received only 1 treatment session, 63.64% (7 out of 11) achieved more than a 50% improvement. By contrast, only 17.07% (7 out of 41) of patients who underwent 3 treatment sessions attained similar results after their initial treatment. In addition, among the 20 patients who finally received 2 treatment sessions, 75% (15 out of 20) experienced more than a 50% improvement after the second session. This was compared with 56.10% (23 out of 41) of the patients who received totally 3 treatment sessions after the second session (see Table 7, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Treatment Response for Patients who Received Only Once or Twice Treatment Sessions). It was observed that patients who displayed significant improvement after the first or second treatment tended to discontinue treatment thereafter. This decision may have been influenced by considerations such as the escalating cost of additional treatments or the logistical challenges of arranging multiple trips. Conversely, patients who did not achieve satisfactory results from the initial treatments tend to choose further treatment sessions.

Of 174 treatments, 6 PIH events were observed, affecting 4 of the 72 patients (5.56%) (see Table 6, **Supplemental Digital Content 2**, http://links.lww.com/DSS/B579, Overview of Information for Patients with PIH). This rate is significantly lower than the 27.77% reported by Yu and colleagues[4] and aligns with Hu's[17] finding of 5.56%. The duration of PIH was 223 ± 139 days, approximately 7.43 ± 4.63 months, significantly longer than the 1.32 ± 0.73 months reported by Yu.[4] The extended duration of

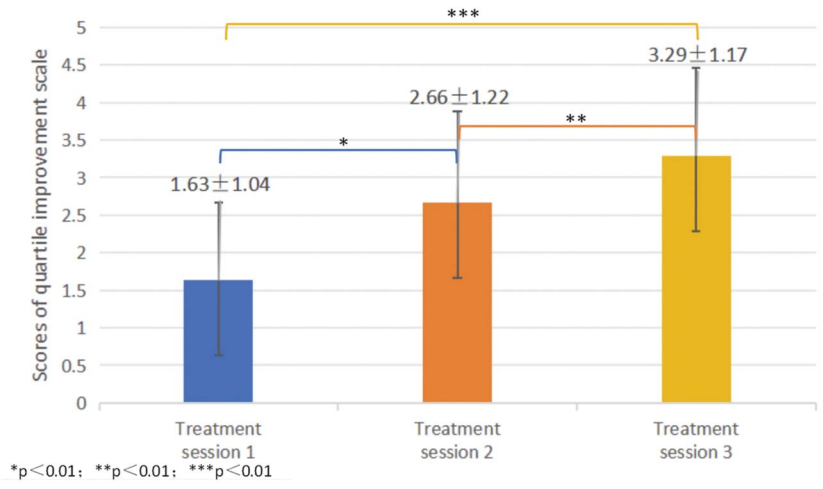

Figure 2. The scores of quartile improvement scale for 41 patients who underwent 3 treatment sessions. The mean improvement scores after the first, second, and third treatments were 1.63 ± 1.04, 2.66 ± 1.22, and 3.29 ± 1.17, respectively, with statistically significant differences among the 3 scores.

PIH observed was partly due to delays in patient follow-up and photography caused by the COVID-19 pandemic.

When interpreting the results of this study, several limitations must be acknowledged. First, the retrospective design resulted in variability in treatment sessions, intervals, and follow-up times. Second, the sample size was relatively small, which may affect the generalizability of the findings. In addition, the absence of a control group limits the ability to draw definitive conclusions about the treatment's efficacy. To enhance the credibility of evidence regarding the efficacy and safety of the 730-nm picosecond laser in treating ABNOM, further prospective randomized controlled trials with larger sample sizes are necessary. In addition, split-face, randomized, controlled studies should be conducted to compare the efficacy and complication rate of the 730-nm picosecond laser with other picosecond laser wavelengths, such as 755 nm and 1,064 nm, in the treatment of ABNOM. Despite these limitations, this study offers valuable insights for future research in laser therapy.

Conclusion

These results indicate that the 730-nm picosecond laser is both effective and safe for treating ABNOM in Chinese patients. The authors observed no instances of hypopigmentation and identified a low risk of PIH.

References

1. Hori Y, Kawashima M, Oohara K, Kukita A. Acquired, bilateral nevus of ota-like macules. *J Am Acad Dermatol* 1984;10:961–4.
2. Kaur H, Sarma P, Kaur S, Kaur H, et al. Therapeutic options for management of Hori's nevus: a systematic review. *Dermatol Ther* 2020;33:e13167.
3. Kung KY, Shek SY, Yeung CK, Chan HH. Evaluation of the safety and efficacy of the dual wavelength picosecond laser for the treatment of benign pigmented lesions in asians. *Lasers Surg Med* 2019;51:14–22.
4. Yu W, Zhu J, Yu W, Lyu D, et al. A split-face, single-blinded, randomized controlled comparison of alexandrite 755-nm picosecond laser versus alexandrite 755-nm nanosecond laser in the treatment of acquired bilateral nevus of ota–like macules. *J Am Acad Dermatol* 2018;79:479–86.
5. Wong THS. Picosecond laser treatment for acquired bilateral nevus of ota-like macules. *JAMA Dermatol* 2018;154:1226–8.
6. Ungaksornpairote C, Manuskiatti W, Junsuwan N, Wanitphakdeedecha R. A prospective, split-face, randomized study comparing picosecond to q-switched nd: yag laser for treatment of epidermal and dermal pigmented lesions in asians. *Dermatol Surg* 2020;46:1671–5.
7. Bernstein EF, Schomacker KT, Shang X, Alessa D, et al. The first commercial 730 nm picosecond-domain laser is safe and effective for treating multicolor tattoos. *Lasers Surg Med* 2021;53:89–94.
8. Loh TY, Wu DC. Novel application of the 730 and 785 nm picosecond titanium sapphire lasers for the treatment of nevus of ota. *Lasers Surg Med* 2021;53:1141–5.
9. Saedi N, Petrell K, Arndt K, Dover J. Evaluating facial pores and skin texture after low-energy nonablative fractional 1440-nm laser treatments. *J Am Acad Dermatol* 2013;68:113–8.
10. Zhang Q, Jiang P, Tan C, Yang G. Clinical profile and triggering factors for acquired, bilateral nevus of ota-like macules. *Cutan Ocul Toxicol* 2017;36:327–30.
11. Lam AY, Wong DS, Lam LK, Ho WS, et al. A retrospective study on the efficacy and complications of q-switched alexandrite laser in the treatment of acquired bilateral nevus of ota-like macules. *Dermatol Surg* 2001;27:937–42; discussion 41–2.
12. Suh DH, Han KH, Chung JH. Clinical use of the q-switched nd:Yag laser for the treatment of acquired bilateral nevus of ota-like macules (abnoms) in koreans. *J Dermatolog Treat* 2001;12:163–6.
13. 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. *Int J Dermatol* 2009;48:1308–12.
14. Wang CC, Chen CK. Effect of spot size and fluence on q-switched alexandrite laser treatment for pigmentation in asians: a randomized, double-blinded, split-face comparative trial. *J Dermatolog Treat* 2012;23:333–8.
15. Kunachak S, Leelaudomlipi P, Sirikulchayanonta V. Q-switched ruby laser therapy of acquired bilateral nevus of ota-like macules. *Dermatol Surg* 1999;25:938–41.
16. Ding H, Yang Y, Guo L, Lin T. Use of a picosecond alexandrite laser for treating acquired bilateral nevus of ota-like macules in Chinese patients. *Lasers Surg Med* 2020;52:935–9.
17. Hu S, Yang C-S, Chang S-L, Huang Y-L, et al. Efficacy and safety of the picosecond 755-nm alexandrite laser for treatment of dermal pigmentation in asians—a retrospective study. *Lasers Med Sci* 2020;35:1377–83.
18. Koh YP, Tan AWM, Chua SH. Treatment of laser-responsive dermal pigmentary conditions in type iii-iv asian skin with a 755-nm picosecond pulse duration laser: a retrospective review of its efficacy and safety. *Dermatol Surg* 2020;46:e82–e87.