Hindawi
Dermatologic Therapy
Volume 2023, Article ID 8651702, 8 pages
https://doi.org/10.1155/2023/8651702

Research Article

A Retrospective Analysis of the Efficacy and Safety of Q-Switched and Picosecond Lasers for Treating Becker's Nevus

Xing Liu,[1] Gaorong Jia,[1] Xiangdong Gong,[2] Hui Ding,[1] Qiuju Wu,[1] Lifang Guo,[1] Rong Zeng,[1] Mengli Zhang,[1] Hedan Yang,[1] Fumin Fang,[1] Huiying Zheng,[1] Yin Yang,[1] Yiping Ge,[1] and Tong Lin[3]

[1]*Department of Cosmetic Laser Surgery, Institute of Dermatology, Chinese Academy of Medical Sciences & Peking Union Medical College, Nanjing, China*
[2]*Division of Sexually Transmitted Disease Epidemiology, Institute of Dermatology, Chinese Academy of Medical Sciences and Peking Union Medical College, Nanjing, China*
[3]*Jiangsu Key Laboratory of Molecular Biology for Skin Diseases and STIs, Institute of Dermatology, Chinese Academy of Medical Sciences & Peking Union Medical College, Nanjing, China*

Correspondence should be addressed to Yin Yang; yushiyy@163.com, Yiping Ge; gypfeng@hotmail.com, and Tong Lin; ddlin@hotmail.com

Received 7 October 2022; Revised 29 November 2022; Accepted 6 March 2023; Published 28 March 2023

Academic Editor: Imran Majid

Background. Becker's nevus (BN) severely affects a patient's appearance and can lead to depression, especially when it involves the face or neck. Currently, there is no effective treatment. Laser therapy has become popular, but its efficacy has not been confirmed. We evaluated the efficacy and safety of lasers in treating BN. *Methods*. This retrospective study involved 49 patients exposed to different laser treatments who completed at least one treatment session and follow-up. *Results*. The patients treated with the 755-nm alexandrite picosecond laser and Q-switched 694-nm ruby laser gained relatively good results: 3.07 ± 1.09 and 2.87 ± 1.14 on the five-point scale and 3.47 ± 0.73 and 3.40 ± 0.85 on the GAIS, respectively. However, the results of the 755-nm alexandrite picosecond laser with a diffractive focus lens array and the fractionated 1064-nm neodymium-doped: yttrium aluminum garnet picosecond laser were poor. Furthermore, there were marked differences between the number of treatment sessions and treatment effects, both for the five-point grading score for pigment clearance ($F = 15.246$, $p < 0.001$) and GAIS ($F = 15.469$, $p < 0.001$). Concerning different lasers and efficacy, there were no marked differences between the five-point grading scale and the GAIS ($p > 0.05$). *Conclusions*. Although the efficacy of various lasers for BN is not satisfactory and there are no marked differences between picosecond and Q-switched lasers, they can help in selecting an appropriate laser for slight-to -moderate pigment removal. The 755-nm alexandrite picosecond laser is a new option, whereas nonablative fractional picosecond lasers for BN are not recommended. Increasing the number of treatment sessions can improve the curative effect slightly.

1. Introduction

Becker's nevus (BN), also known as Becker's melanosis, Becker's pigmentary hamartoma, and pigmented hairy epidermal nevus, typically presents as unilateral hyperpigmented patches with or without hypertrichosis [1]. BN is common worldwide, with a prevalence of 0.52%–2%, usually affecting young males [2]. Pigmented patches on exposed areas cause cosmetic concerns, thus warranting medical intervention. Several therapeutic options, including cryotherapy, dermabrasion, surgical excision, oral antiandrogens, and topical glycolic acid, have been proposed [3–5]. Laser therapy for BN has recently become increasingly popular. Although multiple types of lasers and light-based devices, including Q-switched lasers, nonablative and ablative lasers, and intense pulsed light (IPL), are in use [6, 7], their outcomes vary considerably and seem inconsistent and unsatisfactory. Over the past decade, newer picosecond lasers have been introduced to treat various pigmentary disorders, with generally good results. However, its effects on BN remain unclear. In the present study, we retrospectively analyzed the clinical information of all BN patients who received laser therapy in our department to evaluate the efficacy and safety of Q-switched and picosecond lasers for BN.

2. Materials and Methods

2.1. Patients. This was a retrospective study involving patients with Becker's nevus who received laser treatment at the Department of Cosmetic Laser Surgery, Institute of Dermatology, Chinese Academy of Medical Sciences, and Peking Union Medical College from March 2009 to March 2021. The inclusion criteria were as follows: (i) diagnosed Becker's nevus; (ii) a follow-up of at least one treatment session; and (iii) complete demographic information, such as sex, age, lesion location, age of onset, and treatment records. The exclusion criteria were as follows: (i) previous laser treatment; (ii) being prone to scar or keloid development after injury; and (iii) being sensitive to solar irradiation and/or suffering from a connective tissue disease. All patients signed an informed consent form before treatment.

2.2. Laser Treatments. Six lasers with seven different modalities were used to treat the pigmentation of BN. Detailed information is listed in Table 1. A topical antibiotic ointment was applied to the treatment zone for one week. Sunscreens (SPF > 30, PA+++) and 3% arbutin cream were used after crusting. Other ultraviolet light protection measures, such as wearing hats, wearing proper clothing, and seeking shade, were also advised. Treatment intervals were predominantly 3–6 months, with only a few patients having longer intervals of 1-2 years.

2.3. Evaluation of Efficacy and Safety. Three independent dermatologists used digital photographs obtained before treatment and at each follow-up to evaluate efficacy. Evaluation of the curative effect included a five-point grading scale and a global aesthetic improvement scale (GAIS). Based on the percentage of pigment clearance, the five-point grading scale was rated as follows: complete (95%–100%; score, 5), excellent (75%–94%; score, 4), good (50%–74%; score, 3), fair (25%–49%; score, 2), and poor (0%–24%; score, 1). Regarding the degree of aesthetic improvement, the GAIS grading system scored as follows: worse (score, 1), no improvement (score, 2), slight improvement (score, 3), moderate improvement (score, 4), and marked improvement (score, 5). Adverse effects were analyzed using treatment records.

2.4. Statistical Analysis. The data were analyzed using IBM SPSS (version 23.0; IBM Corp., Armonk, NY, USA). Quantitative data are presented as means ± standard deviations, while qualitative data are presented as percentages. Repeated measures of variance analysis (ANOVA) were used to analyze the influencing factors. Statistical significance was set at $p < 0.05$.

3. Results

A total of 49 patients (35 men and 14 women) met the inclusion criteria. Treatment and onset ages were 21.14 ± 6.24 years (range, 1–36 years) and 10.12 ± 5.58 years (0–19 years), respectively. The mean disease duration was 11.02 ± 6.04 years (1–26 years). The patient demographics and clinical features are presented in Table 2. Approximately, 44.9% (22/49) of the patients began to present with pigmented patches at the age of 10–14 years old, which occurred unilaterally in 95.9% (47/49) of patients and involved the face and/or neck in 77.6% (38/49) of patients. The 2 BN patients with bilateral lesions were both involved in the chest. In addition, hypertrichosis, colocalized with the pigmented lesions, was observed in 44.9% (22/49) of patients.

The average treatment session was 3.02 ± 2.21 (1–10), while the follow-up period was 7.84 ± 8.04 months (1–34). The post-treatment efficacy of each session was evaluated by three dermatologists using a five-point grading scale and GAIS. Based on laser type and uneven case distribution, we divided the patients into six different groups: Q-switched 532-nm neodymium-doped: yttrium aluminum garnet (Nd: YAG) laser (Q532), Q-switched 694-nm ruby laser (Q694), Q-switched 755-nm alexandrite laser (Q755), 755-nm alexandrite picosecond laser (Zoom handpiece, Pico755), nonablative fractional picosecond laser (pico fractional), and others. The five patients in the picosecond laser group included two treated with a 755-nm alexandrite picosecond laser with diffractive focus lens array (DLA) (Microlens Array, Focus handpiece), two treated with a fractionated 1064-nm Nd: YAG picosecond laser (Holographic Fractional, Resolve handpiece), and one treated with a combination of a 755-nm alexandrite picosecond laser with DLA and a fractionated 1064-nm Nd: YAG picosecond laser. The other group consisted of one patient treated with a Q-switched 1064-nm Nd: YAG laser, one treated with a 532-nm Nd: YAG picosecond laser, and two treated with a combination of Q-switched and picosecond lasers. The efficacy results are presented in Table 3, which shows that the mean pigment clearance score ranged from 2 to 4. Patients treated with 755-nm alexandrite picosecond laser (Figure 1) and Q-switched 694-nm ruby laser (Figure 2) gained relatively good results both at pigment removal and GAIS, being 3.07 ± 1.09 and 2.87 ± 1.14 on the five-point scale, and 3.47 ± 0.73 and 3.40 ± 0.85 on the GAIS, respectively. Notably, nonablative fractional picosecond lasers (Figure 3) were the least effective for BN.

Twenty patients underwent at least three treatment sessions. There were marked differences between the number of treatment sessions and the effect, both on the five-point grading score for pigment clearance ($F = 15.246$, $p < 0.001$) and on the GAIS for global aesthetic improvement ($F = 15.469$, $p < 0.001$) (Figure 4). Regarding different lasers and efficacy, there were no marked differences in the five-point grading score and the GAIS ($p > 0.05$).

Table 1: Detailed information of different types of lasers.

Types of lasers	Parameters	Endpoint
Q-switched 532-nm Nd: YAG (Medlite C6, HOYA ConBio, Fremont, California, USA)	3 mm, 1.4–2.2 J/cm^2	Moderate whitening
Q-switched 694-nm ruby (SINON, Wavelight, Erlangen, Germany)	6 mm, 2.0–3.2 J/cm^2	Moderate whitening
Q-switched 755-nm alexandrite (Accolade, Cynosure, Boston, Massachusetts, USA)	3 mm, 6.0–8.0 J/cm^2	Moderate whitening
Q-switched 1064-nm Nd: YAG (Medlite C6, HOYA ConBio, Fremont, California, USA)	6 mm, 3.5 J/cm^2	Moderate erythema with mild whitening
Picosecond 755-nm alexandrite (Zoom handpiece, Picosure; Cynosure, Westford, MA)	2.4–3 mm, 2.83–4.42 J/cm^2	Moderate whitening
Picosecond 755-nm alexandrite (Focus handpiece, Picosure; Cynosure, Westford, MA)	6 mm, 0.71 J/cm^2, 3–5 passes	Moderate erythema
Picosecond 1064-nm Nd: YAG (Resolve handpiece, PicoWay; Candela, Wayland, MA)	6×6 mm, 2.1–2.9 mJ/μbeam, 4 passes	Moderate erythema with pin-point petechiae

Table 2: Patient demographics and clinical features.

Variables ($n = 49$)	n	(%)
Age (years)		
1–19	15	30.6
20–24	22	44.9
25-	12	24.5
Age of onset (years)		
0–4	11	22.4
5–9	6	12.2
10–14	22	44.9
15–19	10	20.4
Gender		
Male	35	71.4
Female	14	28.6
Distribution		
Unilateral	47	95.9
Bilateral	2	4.1
Location		
Face, neck	38	77.6
Trunk	5	10.2
Extremities	5	10.2
Neck and trunk	1	2
Hairy		
Yes	22	44.9
No	27	55.1

Table 3: Treatment efficacy.

Lasers	n	5-point scale#	GAIS*
Q532	13	2.43 ± 0.68	3.05 ± 0.73
Q694	16	2.87 ± 1.14	3.40 ± 0.85
Q755	6	1.83 ± 1.13	2.28 ± 1.18
Pico755	5	3.07 ± 1.09	3.47 ± 0.73
Pico fractional	5	1.60 ± 0.83	2.47 ± 0.65
Others	4	2.58 ± 1.83	2.92 ± 1.67
Total	49	2.50 ± 1.12	3.04 ± 0.96

GAIS: global aesthetic improvement scale. 5-point scale#: complete (95%–100%, score 5), excellent (75%–94%, score 4), good (50%–74%, score 3), fair (25%–49%, score 2), and poor (0%–24%, score 1). GAIS*: 1 = worse, 2 = no improvement, 3 = slight improvement, 4 = moderate improvement, and 5 = marked improvement.

Ten patients (20.41%) experienced transient adverse effects; among them, five patients (10.20%) exhibited hyperpigmentation, four (8.17%) exhibited hypopigmentation, and one (2.04%) had persistent erythema lasting two years. Scarring or textural changes were not observed.

4. Discussion

Typically, BN presents as well-defined, irregularly shaped brown patches with follicular papules and/or hypertrichosis on the surface [8]. The colocalization of multiple papules and hypertrichosis on brown plaques is a pathognomonic feature [1, 9]. Often, BN begins in late childhood and adolescence [2, 10]. In the present study, the average age of onset was 10.12 ± 5.58 years (range, 0–19 years), and 65.3% of patients began during the second decade of their lives. Previous studies have reported the appearance of BN lesions on the upper trunk and limbs [1, 2, 10], lower limbs [1], and face [2]. We found that the face and/or neck were affected in 77.6% of patients, and patients with BN on exposed sites have an urgent demand for treatment. In this study, the analysis of BN lesion distribution is concluded from patients accepting laser treatments, which has a discrepancy with other reported data. However, this also suggests that BN lesions on exposed areas are not rare; therefore, prompt intervention is required for these patients. A higher prevalence of BN in males was found, consistent with a previous study [1]. The lesions mostly presented as unilateral patches, with 4.1% (2/49) exhibiting bilateral lesions, also consistent with previous findings [11]. Lesional hypertrichosis does not occur simultaneously with pigmented patches and is not found in all patients with BN. Hypertrichosis was observed on the surface of pigmented lesions in 44.9% (22/49) of the patients involved in this study, which was higher than the 17% reported in previous studies [2].

Histologically, BN exhibits rete ridge elongation, fusion, and basal hyperpigmentation, usually without an increase in the number of melanocytes. In addition, hyperproliferation of dermal nerve fibers and arrector pili muscles is observed [10]. Therefore, when patients present with only brown patches without obvious hypertrichosis and papules, a histopathological examination is necessary to differentiate between a melanocytic nevus, café-au-lait macules, congenital smooth muscle hamartoma, and postinflammatory hyperpigmentation [9, 10]. The etiology and pathogenesis of BN have not yet been determined conclusively. However, androgen sensitivity is thought to be involved in BN pathogenesis because of male preponderance, peripubertal onset, hypertrichosis within patches, and increased expression of androgen receptors [2, 10, 12–15]. In addition, verification of postzygotic mutations in the *ACTB* gene indicates that BN may be genetically linked [16].

Although the optimal device and treatment parameters have yet to be elucidated, various lasers with different wavelengths have been used to treat hyperpigmentation. Q-switched lasers, nonablative lasers, ablative lasers, and intense pulsed light have been investigated. Q-switched lasers exert rapid pulses of energy with a short pulse duration that is less than the thermal relaxation time of melanin, exhibiting a stronger ability to crush melanin particles. Q-switched lasers with different wavelengths have been reported. One study [17] showed that one treatment session with a Q-switched 532-nm Nd: YAG laser caused a 43% reduction in pigmentation. However, another study [18] showed that six of eight participants had no significant pigmentation removal (0–25%) and two had moderate improvement (26–50%) with an average of 1.8 treatment sessions of Q-switched 532-nm Nd: YAG laser. Some other studies used a Q-switched 694-nm ruby laser to improve BN pigmentation. One study [17] reported a 63% reduction in pigment after only one treatment. Another study [19] also showed that pigmentation improved with a single treatment, but recurrence was observed four weeks later. In contrast, a retrospective analysis [20] involving 59 BN cases treated with Q-switched 755-nm alexandrite laser reported minimal improvements; 63.4% of patients showed no marked change in pigmentation clearance after one treatment session of Q-switched 755-nm alexandrite laser, suggesting that the

Figure 1: A 22-year-old male with BN (the area marked with a red line in (a)) received one treatment with a 755-nm alexandrite picosecond laser and achieved 95–100% pigment removal (2.6 mm, 3.77 J/cm^2). The hypopigmented patch with the scar in (a) was left after cryotherapy at another hospital a year ago.

Figure 2: A 21-year-old male with BN received two treatment sessions with a Q-switched 694-nm ruby laser and achieved 95–100% pigment removal (6 mm, 2.5 J/cm^2).

overall efficacy may be associated with the number of treatment sessions. Q-switched1064-nm Nd: YAG lasers have also been used to treat pigmented BN lesions. Trelles et al. [21] treated 11 BN patients with three sessions at two-month intervals, with one, five, and three patients showing marked (51%–99%), moderate (26%–50%), and mild (1%–25%) clearance, respectively. No clearance was observed in the other two patients. However, pigmentation progressively recurred 6, 9, 12, 15, 18, and 24 months after the final treatment. Another study [22] reported less than 25%

Figure 3: A 27-year-old female with BN received five treatment sessions with a fractionated 1064-nm Nd: YAG picosecond laser; no pigment removal (0–24%) was observed (6 × 6 mm, 2.7–2.9 mJ/μbeam, 4 passes).

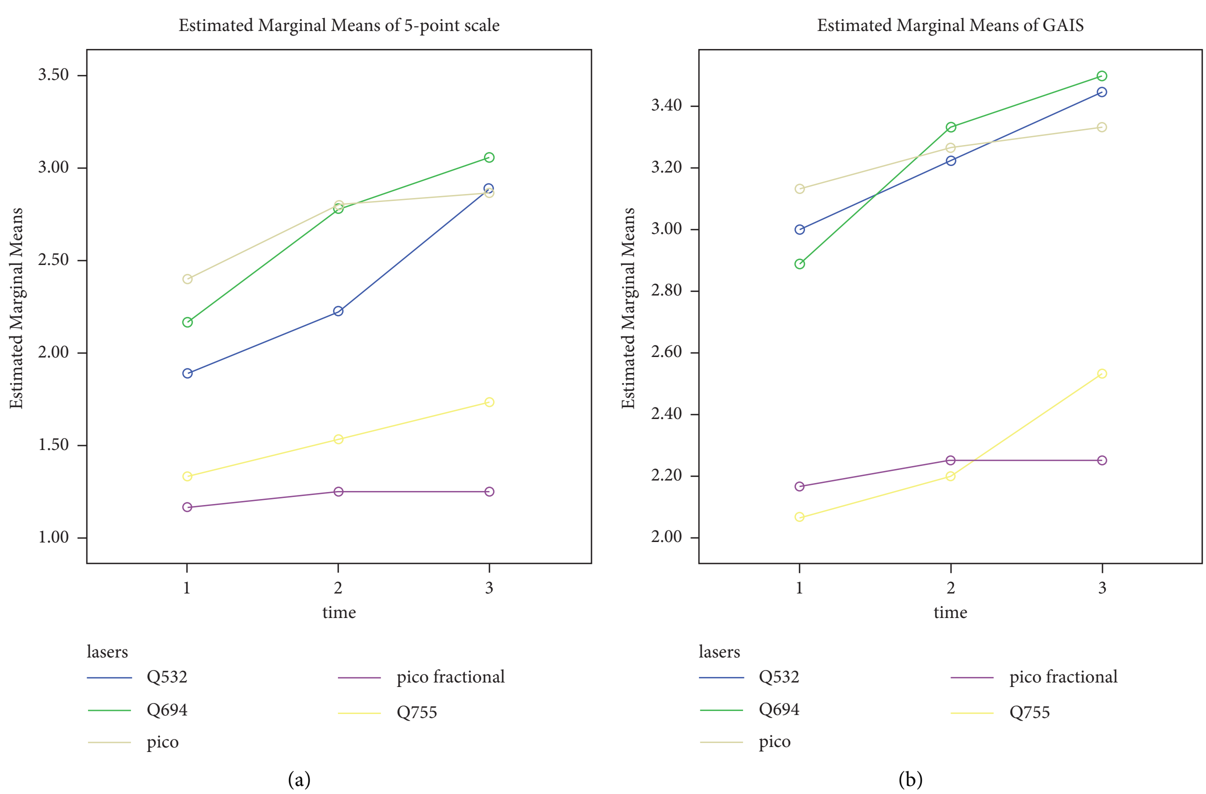

Figure 4: A repeated measures of variance analysis showed a significant difference between the number of treatment sessions and the treatment effect. (a) The treatment effect on the five-point scale; (b) the treatment effect on the GAIS.

pigment reduction after one session of a Q-switched 1064-nm Nd: YAG laser. One study [23] comparing BN patients treated with Q-switched 532-nm Nd: YAG, Q-switched 694-nm ruby, Q-switched alexandrite, and Q-switched 1064-nm Nd: YAG revealed that the efficacy was not optimal, with only 11.5% of the patients exhibiting some degree of improvement. In our analysis, patients treated with either Q-switched 532-nm Nd: YAG or Q-switched 694-nm ruby lasers achieved fair to good pigment removal and slight to moderate aesthetic improvement. In general, the effect of Q-switched lasers on BN pigmentation was acceptable. When it comes to adverse effects, in our study, pigmentation occurred in 10.20% of patients; hypopigmentation occurred in 8.17% of patients, while one patient (2.04%) exhibited persistent erythema lasting two years. Scarring or textural changes were not observed.

Picosecond lasers are equally or more effective than Q-switched lasers for treating various pigmented diseases, including a nevus of Ota [24], an acquired bilateral nevus of Ota-like macules [25], lentigines [26], and melasma [26]. However, its efficacy in treating BN is unknown. In our analysis, the overall outcome of picosecond laser treatment might be slightly more effective than that of Q-switched lasers on both the five-point scale and the GAIS, but no statistically significant differences were found between the different lasers. It is difficult to conclude whether the efficacy of picosecond lasers for BN is better than that of Q-switched lasers because of the small sample size used in this study. Despite this, our results suggest that the 755-nm alexandrite picosecond laser may be a new treatment option, whereas nonablative fractional picosecond lasers are not recommended for BN. A prospective study adopting a split-lesion design with a larger sample size is warranted to compare the different lasers' efficacy in treating BN.

In addition, in this study, for both Q-switched and picosecond lasers, after several sessions, most patients achieved at least fair to good pigmentation removal and slight to moderate aesthetic improvements on average. Notably, the number of treatment sessions influenced therapeutic efficacy, and more sessions generally led to better pigmentation clearance. This outcome validates the continued use of lasers for more treatment sessions for patients with BN, even though patients may have shown no improvement after the first session.

In recent years, other types of lasers have been applied to the treatment of BN, such as IPL [27], 1550-nm erbium-doped fiber laser [28], and erbium: yttrium aluminum garnet (Er: YAG) [21, 29], and they appear to be effective. However, the benefits of ablative 10600-nm fractional lasers for BN remain unknown and require more trials and data [30, 31]. In our retrospective analysis, there is currently a lack of data on treating BN with IPL and an Er: YAG laser, but these also suggest that IPL or an Er: YAG laser can serve as an option, and we need more details to evaluate its efficacy accurately.

In conclusion, although the efficacy of various lasers for BN is not satisfactory and there are no marked differences between picosecond lasers and Q-switched lasers, these studies can inform the selection of an appropriate laser for slight-to-moderate pigment removal. Lasers, either Q-switched or picosecond, can be used for pigment removal. The 755-nm alexandrite picosecond laser can be a new treatment option, whereas nonablative fractional picosecond lasers are not recommended for BN treatment. Increasing the number of treatment sessions improves the curative effects slightly.

Data Availability

The data supporting the findings of this study are available from the corresponding authors upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This study was funded by the CAMS Innovation Fund for Medical Sciences (grant no. CIFMS-2021-I2M-1-001) and the National Natural Science Foundation of China (grant no. 82103705).

References

[1] A. Patrizi, M. Medri, B. Raone, F. Bianchi, S. Aprile, and I. Neri, "Clinical characteristics of Becker's nevus in children: report of 118 cases from Italy," *Pediatric Dermatology*, vol. 29, no. 5, pp. 571–574, 2012 Sep-Oct.

[2] A. Rasi, H. Berenji Ardestani, and S. M. Tabaie, "Hypertrichosis is not so prevalent in becker's nevus: analysis of 47 cases," *International Scholarly Research Notices*, vol. 2014, no. 1, Article ID 953747, 4 pages, 2014 Apr 30.

[3] H. Hafezi, H. Galehdari, M. Rezaie, and R. Moeini, "Successful treatment of Becker's nevus with dermabrasion by sandpaper: a case report," *Clinical Case Reports*, vol. 9, no. 9, Article ID e04725, 2021 Aug 30.

[4] S. Hernandez-Quiceno, E. Uribe-Bojanini, J. J. Ramírez-Jiménez et al., "Becker's nevus syndrome in a pediatric female patient," *Case Reports in Pediatrics*, vol. 2016, Article ID 3856518, 2016.

[5] Y. Zhong, Y. Chen, L. Huang et al., "Lightening Becker nevus with topical glycolic acid," *Journal of the American Academy of Dermatology*, vol. 80, no. 1, p. e3, 2018.

[6] Y. J. Choi, S. Yim, G. Huh, G. Y. Lee, and W. S. Kim, "The beneficial effect on pigmentation using laser epilation as an initial treatment approach for becker's nevus in asian Skin," *Journal of Cosmetic and Laser Therapy*, vol. 23, no. 3-4, pp. 87–91, 2021 May 19.

[7] Y. Zhong, B. Yang, L. Huang, P. M. Elias, and M. Q. Man, "Lasers for Becker's nevus," *Lasers in Medical Science*, vol. 34, no. 6, pp. 1071–1079, 2019.

[8] P. Patel, K. Malik, and A. Khachemoune, "Sebaceus and becker's nevus: overview of their presentation, pathogenesis, associations, and treatment," *American Journal of Clinical Dermatology*, vol. 16, no. 3, pp. 197–204, 2015 Jun.

[9] A. Alfadley, B. Hainau, A. Al Robaee, and N. Banka, "Becker's melanosis: a report of 12 cases with atypical presentation," *International Journal of Dermatology*, vol. 44, no. 1, pp. 20–24, 2005 Jan.

[10] P. Sheng, Y. L. Cheng, C. C. Cai et al., "Clinicopathological features and immunohistochemical alterations of keratinocyte proliferation, melanocyte density, smooth muscle hyperplasia

and nerve fiber distribution in becker's nevus," *Annals of Dermatology*, vol. 28, no. 6, pp. 697–703, 2016.

[11] A. G. Rao, "Bilateral symmetrical congenital giant becker's nevus: a rare presentation," *Indian Journal of Dermatology*, vol. 60, no. 5, p. 522, 2015 Sep-Oct.

[12] J. R. Person and C. Longcope, "Becker's nevus: an androgen-mediated hyperplasia with increased androgen receptors," *Journal of the American Academy of Dermatology*, vol. 10, no. 2, pp. 235–238, 1984 Feb.

[13] P. Nirdé, O. Dereure, C. Belon, S. Lumbroso, J. J. Guilhou, and C. Sultan, "The association of Becker nevus with hypersensitivity to androgens," *Archives of Dermatology*, vol. 135, no. 2, pp. 212–a-214, 1999 Feb.

[14] Y. J. Kim, J. H. Han, H. Y. Kang, E. S. Lee, and Y. C. Kim, "Androgen receptor overexpression in Becker nevus: histopathologic and immunohistochemical analysis," *Journal of Cutaneous Pathology*, vol. 35, no. 12, pp. 1121–1126, 2008 Dec.

[15] H. Grande Sarpa, R. Harris, C. D. Hansen, K. P. Callis Duffin, S. R. Florell, and M. L. Hadley, "Androgen receptor expression patterns in Becker's nevi: an immunohistochemical study," *Journal of the American Academy of Dermatology*, vol. 59, no. 5, pp. 834–838, 2008 Nov.

[16] E. D. Cai, B. K. Sun, A. Chiang et al., "Postzygotic mutations in beta-actin are associated with becker's nevus and becker's nevus syndrome," *Journal of Investigative Dermatology*, vol. 137, no. 8, pp. 1795–1798, 2017 Aug.

[17] Y. Tse, V. J. Levine, S. A. McClain, and R. Ashinoff, "The removal of cutaneous pigmented lesions with the Q-switched ruby laser and the Q-switched neodymium: yttrium-aluminum-garnet laser. A comparative study," *Journal of Dermatologic Surgery & Oncology*, vol. 20, no. 12, pp. 795–800, 1994 Dec.

[18] D. H. Suh, K. H. Han, and J. H. Chung, "The use of Q-switched Nd:YAG laser in the treatment of superficial pigmented lesions in Koreans," *Journal of Dermatological Treatment*, vol. 12, no. 2, pp. 91–96, 2001 Jun.

[19] D. Kopera, U. Hohenleutner, and M. Landthaler, "Quality-switched ruby laser treatment of solar lentigines and Becker's nevus: a histopathological and immunohistochemical study," *Dermatology*, vol. 194, no. 4, pp. 338–343, 1997.

[20] Y. Zhong, L. Huang, Y. Chen, T. Yan, B. Yang, and M. Q. Man, "755-nmQ-switched alexandrite laser does not markedly benefit Becker's nevus: a retrospective analysis of 59 cases," *Lasers in Medical Science*, vol. 36, no. 3, pp. 699–702, 2021 Apr.

[21] M. A. Trelles, I. Allones, G. A. Moreno-Arias, and M. Vélez, "Becker's naevus: a comparative study between erbium: YAG and Q-switched neodymium:YAG; clinical and histopathological findings," *British Journal of Dermatology*, vol. 152, no. 2, pp. 308–313, 2005 Feb.

[22] M. A. Trelles, I. Allones, M. Vélez, and G. A. Moreno-Arias, "Becker's nevus: erbium:YAG versus Q-switched neodimium: YAG?" *Lasers in Surgery and Medicine*, vol. 34, no. 4, pp. 295–297, 2004.

[23] A. Alkhalifah, F. Fransen, F. Le Duff, J. P. Lacour, A. Wolkerstorfer, and T. Passeron, "Laser treatment of epidermal nevi: a multicenter retrospective study with long-termfollow-up," *Journal of the American Academy of Dermatology*, vol. 83, no. 6, pp. 1606–1615, 2020 Dec.

[24] Y. Ge, Y. Yang, L. Guo et al., "Comparison of a picosecond alexandrite laser versus a Q-switched alexandrite laser for the treatment of nevus of Ota: a randomized, split-lesion, controlled trial," *Journal of the American Academy of Dermatology*, vol. 83, no. 2, pp. 397–403, 2020 Aug.

[25] C. Ungaksornpairote, W. Manuskiatti, N. Junsuwan, and R. Wanitphakdeedecha, "A prospective, split-face, randomized study comparing picosecond to Q-switched Nd: YAG laser for treatment of epidermal and dermal pigmented lesions in asians," *Dermatologic Surgery*, vol. 46, no. 12, pp. 1671–1675, 2020 Dec.

[26] M. C. Lee, Y. F. Lin, S. Hu et al., "A split-face study: comparison of picosecond alexandrite laser and Q-switched Nd: YAG laser in the treatment of melasma in Asians," *Lasers in Medical Science*, vol. 33, no. 8, pp. 1733–1738, Nov 2018.

[27] D. Piccolo, D. Di Marcantonio, G. Crisman et al., "Unconventional use of intense pulsed light," *BioMed Research International*, vol. 201410 pages, Article ID 618206, 2014.

[28] A. S. Glaich, L. H. Goldberg, T. Dai, J. H. Kunishige, and P. M. Friedman, "Fractional resurfacing: a new therapeutic modality for Becker's nevus," *Archives of Dermatology*, vol. 143, no. 12, pp. 1488–1490, 2007 Dec.

[29] F. Al-Saif, E. Al-Mekhadab, and H. Al-Saif, "Efficacy and safety of short-pulse erbium: yttrium aluminum garnet laser treatment of Becker's nevus in Saudi patients: a pilot study," *International Journal of Health Sciences*, vol. 11, no. 3, pp. 14–17, 2017 Jul-Sep.

[30] A. A. Meesters, B. S. Wind, M. W. Kroon et al., "Ablative fractional laser therapy as treatment for Becker nevus: a randomized controlled pilot study," *Journal of the American Academy of Dermatology*, vol. 65, no. 6, pp. 1173–1179, 2011 Dec.

[31] B. S. Wind, A. A. Meesters, M. W. Kroon et al., "Formation of fibrosis after nonablative and ablative fractional laser therapy," *Dermatologic Surgery*, vol. 38, no. 3, pp. 437–442, 2012 Mar.