Q-switched 532 nm Nd:YAG laser-assisted depigmentation in vitiligo: a long term follow-up

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ABSTRACT:

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Background : Vitiligo is an acquired depigmenting disorder. Therapy option include repigmentation of affected skin or depigmentation of unaffected skin. One of the preferred option for widespread and recalcitrant cases is depigmentation therapy with Q-switched pigment laser.

Objectives : To evaluate the efficacy and long term safety of Q-switched 532 nm Nd:YAG laser for treatment of extensive and recalcitrant vitiligo.

Materials and Methods: Six vitiligo patients with extensive disease and resistance to conventional treatment were enrolled in this study. Treatment with Q-switched 532 nm Nd:YAG laser was performed in all subjects on the exposed and unaffected normal skin. One laser treatment session per area was given with 2-3 month treatment intervals.

Results: All patients were on consistent follow-up for 2 to 10 years. The majority were treated with only one laser treatment, with the exception of some areas on the face. One patient who had Koebner phenomenon achieved the best result. No skin malignancy was found in treated skin.

Conclusion: Q-switched Nd:YAG 532 nm laser-assisted depigmentation is an effective and safe to eliminate remnants of normal pigmented skin in generalized vitiligo.

Key words: Hyperpigmentation, Nd:YAG, Pigmentary disorder, Skin cancer, Vitiligo

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บทคัดย่อ :

สมศักดิ์ ตันรัตนากรการศึกษาผลระยะยาวของเลเซอร์ Q-SWITCHED Nd:YAG 532 นาโนเมตรในการทำลายสีผิวปกติในผู้ป่วยโรคด่างขาว วารสารโรคผิวหนัง 2561; 34: 143-150.

สาขาวิชาโรคผิวหนัง ภาควิชาอายุรศาสตร์ คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล

โรคด่างขาวเป็นโรคที่เกิดจากเซลล์เม็ดสีถูกทำลายซึ่งพบได้บ่อย การรักษามีทั้งการฟื้นคืนสีผิวของรอยโรคและในรายที่เป็นมากและไม่ตอบสนองต่อการรักษาอื่นๆแล้ว การกำจัดเซลล์เม็ดสีของผิวหนังปกติที่เหลือน้อยเพื่อให้สีผิวผู้ป่วยดูสม่ำเสมอกันในบริเวณนอกร่มผ้าโดยการใช้เลเซอร์สีผิว

วัตถุประสงค์: เพื่อศึกษาผลการรักษาและผลข้างเคียงหลังการรักษาในระยะยาวของการใช้เลเซอร์ Q-switched Nd:YAG 532 นาโนเมตรในการกำจัดเซลล์เม็ดสีในบริเวณสีผิวปกติในผู้ป่วยด่างขาวที่ไม่ตอบสนองต่อการรักษาปกติ

วิธีการการศึกษา: ผู้ป่วยโรคด่างขาว 6 ราย ซึ่งมีรอยโรคบริเวณกว้างและไม่ตอบสนองต่อการรักษาอื่นๆแล้ว ได้รับการรักษาด้วยเลเซอร์ Q-switched Nd:YAG 532 นาโนเมตร บริเวณผิวหนังปกติที่เหลืออยู่ หนึ่งครั้งต่อพื้นที่ทุกๆ 2-3 เดือน

ผลการศึกษา: มีการติดตามผู้ป่วยทุกรายเป็นระยะเวลา 2 ถึง 10 ปี ส่วนใหญ่จะทำการรักษาด้วยเลเซอร์สี-ผิว Nd:YAG 532 nm เพียง 1 ครั้ง ยกเว้นบริเวณใบหน้าที่จะกลับเป็นซ้ำได้บ่อย แต่ในรายที่มีปรากฏการณ์ Kobner ได้ผลการรักษาที่ดีมาก ไม่พบการกลับเป็นซ้ำเลย ไม่มีรายใดที่ตรวจพบมะเร็งผิวหนัง

สรุปผล: การใช้เลเซอร์ Q-switched Nd:YAG 532 นาโนเมตรเพื่อกำจัดเซลล์เม็ดสีที่หลงเหลืออยู่ เป็นการรักษาที่ปลอดภัย ได้ผลดี

คำสำคัญ: รอยคล้ำ, Nd:YAG, โรคสีผิวผิดปกติ, มะเร็งผิวหนัง, ด่างขาว

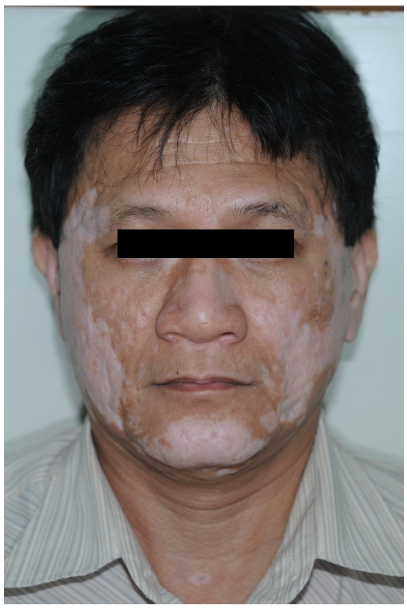
Introduction

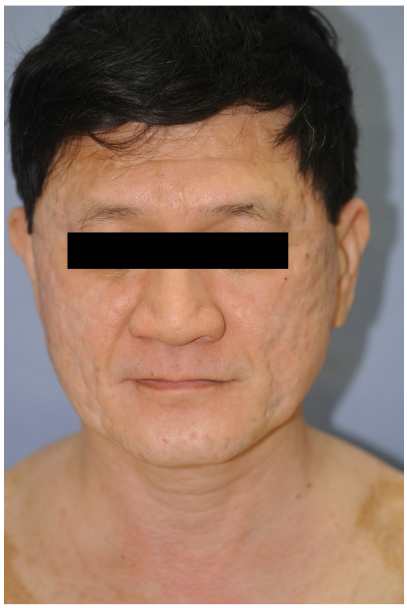
Vitiligo is an acquired depigmenting disorder causing white macules and patches which can change a patient's appearance and have a negative impact on quality of life.[1, 2] Treatment of vitiligo can be divided into two main groups, one concerned with repigmentation of affected skin and the other aimed at depigmentation of unaffected skin for evening out skin tone. Depigmentation is an attractive alternative for achieving uniform skin tone in patients with widespread vitiligo resistant to repigmenting therapies.[3] The first line treatment options include topical treatment with monobenzyl ether of hydroquinone (MBEH)[4-5] which is not available in our country, phenol peels[6], cryotherapy[7], and lasers.[8,9,10]

Q-switched Ruby laser[8], Q-switched Alexandrite laser[10] and Q-switched Nd:YAG laser[9] are used for depigmentation in vitiligo. The Q-switched lasers have been reported to achieve faster depigmentation compared to chemical agents[11]. Moreover, it offered less scar formation when compared to cryotherapy[12]. However there

are few study about laser-assisted depigmentation showing the result and safety for long term follow especially in Asian skin.

The main purpose of this study is to evaluate the efficacy of laser-assisted depigmentation and long-term side effects in recalcitrant vitiligo patients.



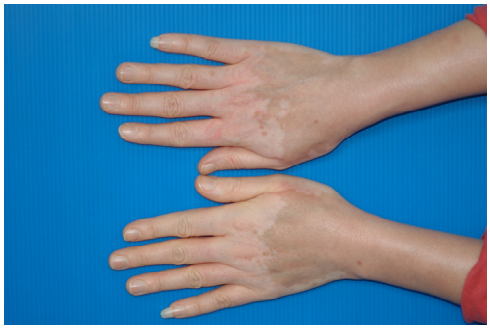


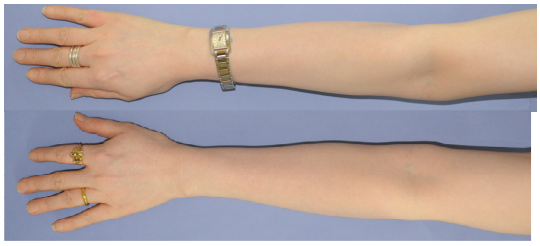
Case 1
After 3 ½ year
1 laser treatment

Case 1
Positive Koebner
After 3 ½ year
1 laser treatment

Case 1
With tattoo
After 3 ½ year
1 laser treatment

Case 2
After 6 year





Case 2
After 6 year

Materials and Methods

A retrospective study was conducted for generalized vitiligo treated with Q-switched Nd:YAG 532 nm laser for depigmentation between 1999 and 2016 at a university-base. Eligible patients were identified by screening medical charts and baseline digital photography. They were asked to re-visit the clinic for post-treatment photographs which compared with baseline photograph to assess the degree of depigmentation achieved. Questionnaire on these visits covered demographic data, history of vitiligo, treated area, laser parameter, number of sessions to achieve complete depigmentation, total number of sessions, repigmented area,

period of follow up and side effects were collected and analyzed.

Results

In total, six patients with generalized and resistance to conventional treatment for vitiligo received Q-switched Nd:YAG 532 nm laser therapy for depigmentation and were included for the analysis. The results are summarized in Table 1. There were five female and one male. The mean age at first visit was 46.5 years (range 42-52). There were three patients each in the Fitzpatrick skin phototype III and IV. The mean duration of disease was 10.66 years (range 7-14). The most common treated area was the face. The average of body surface involvement (BSA) was treated was 13.08% (range 5-28.5%). There was greater than 90% of normal skin achieved complete depigmentation in one session of laser treatment.

The patient who had Koebner (isomorphic) phenomenon (case 1) achieved the best result. Only single laser treatment was required to achieve complete depigmentation. The recurrent of repigmentation was not observed in 3 ½ years follow-up period.

In the term of drawbacks, five patients developed repigmentation on the face 1-27 months after first laser treatment. The median duration of follow-up was 5.25 years (range 3.5-10). The side effects of laser treatment were minimal. There were erythema and blisters that resolve spontaneously in 3-5 days. No serious side effects and malignancy were reported through the follow-up period.

Discussion

Depigmentation is the preferred treatment of extensive vitiligo by means of removing normal residual pigmentation. This modality can be an effective way to improve cosmetic results in patients who are unresponsive to conventional regimentation therapies.

Candidates for depigmentation therapy should be carefully screened and patient education is essential. Expert consensus recommends that patient selection is important in depigmentation treatment. In general, depigmentation is undertaken only when the patient has more than 50% pigment loss in their skin, or when the depigmentation is extensive in the cosmetically sensitive areas of the hands and face. Depigmentation is not recommended for children.[1] Slow action and irritant reaction are limitations of topical depigmenting treatment in vitiligo.[4] On the other hand, the laser generates rapid response and has low side effects.

The Q-switched laser used for depigmentation therapy, is capable of selectively destroying melanocytes[13] and can potentially be a Koebner phenomenon inducer. Patients with active vitiligo show better results after laser treatment than patients with stable vitiligo.[8] Patients with Koebner phenomenon are more

likely to have active vitiligo.[14] Q-switched Ruby laser (694 nm) has been used for depigmentation in patients after tanning, where melanocytes have been activated. Activated melanocytes can be more easily targeted by lasers to make a permanent depigmenting effect.[15] The Q-switched Alexandrite (755 nm) has shown to be effective in treating recalcitrant pigmentation for depigmentation therapy in vitiligo patients.[10] Q-switched Nd:YAG laser uses two wavelength of 532 nm and 1064 nm to cause both photothermolysis and photoacoustic to destroy melanosomes and even melanocytes. Epidermal pigment is a target of the 532-nm wavelength while dermal pigment is a target of 1064 nm wavelength.

In one study of 15 patients efficacy of Q-switched Nd:YAG 532 nm laser to destroy epidermal pigment and to encourage koebnerization of vitiliginous lesions for depigmentation therapy was evident for universal vitiligo. They used one or two sessions of the laser in combination with a topical depigmenting agent MBEH for a few day prior to laser treatment to achieve total and near total depigmentation. Ninety percent or greater depigmentation, defined as excellent response was achieved in 13 of 15 patients, whereas 2 patients showed a poor response, with less than 50% depigmentation. The number of sessions required to treat each site ranged between one and three. No significant adverse events were reported. However, the follow up period were only 3 months which was too short to show stability of the treatment.[9]

This study presented case series to illustrate the efficacy and safety of Q-switched Nd:YAG 532 nm laser in the treatment of depigmentation in generalized vitiligo on the cosmetically sensitive area's of the hands, face and legs. I used only one session of laser treatment without topical depigmenting agent to achieve total depigmentation without significant side effect. Our patients tolerated laser treatment well. Most areas of depigmentation have maintained long-lasting results with excellent cosmetic outcome's after this therapy. The depigmentation laser is particularly effective in patients with a positive Koebner status and can produce rapid depigmentation. This isomorphic response is suspected to be a factor of good result.

Initially, repigmentation occurred at the perifollicular area's. Repigmentation was observed more on the face as a result of higher number of hair follicles. Five patients developed small area of repigmentation on the face 1-27 months after first laser treatment. The areas successfully retreated.

The side effects of laser treatment were minimal. There were transient erythema and blisters that resolve spontaneously in 3-5 days.

In this series, no skin malignancy was found in the treated and non-treated vitiligo site during the long-term follow-up. To date, there is no evidence on the extent of vitiligo as an influential risk factor for melanoma and non-melanoma skin cancers development.[18]

Conclusion

Q-switched Nd:YAG 532 nm laser-assisted depigmentation is an effective and safe modality to eliminate remnants of normal pigmented skin in generalized vitiligo. Koebner phenomenon is a factor of good result.

Table 1 Patient characteristics and results

Patient	Sex	Age (years)	Skin type	Duration of vitiligo in year (Before Treatment)	Koebner phenomenon	Treated area	BSA*	Laser parameter (Qs-Nd:YAG 532nm)	Area/Number of sessions to achieve complete depigmentation	Repigmeted area	Follow up in year
1	M	52	IV	13	Yes	Neck, arms, forearms, hand	15	4-7 mm, 1.5-2.5 J/cm^2	Whole area -1	None	3 ½
2	F	45	III	14	No	Face, neck, arms, forearm, legs, upper back and chest	28.5	4-7 mm, 1.5-2.5 J/cm^2	Other area -1 Face -4	Forehead	6
3	F	49	IV	10	No	Periorbital, neck, forearm, arm	7	4-7 mm, 1.5-2.5 J/cm^2	Forearm -1 Face -3	Cheek, periorbital	10
4	F	44	IV	10	No	Face, forearm	5	4-7 mm, 1.5-2.5 J/cm^2	Forearm -1 Face -2	both lower eyelids	4
5	F	42	III	7	No	Face, forearm	8	5-6 mm, 1.5-2.5 J/cm^2	Forearm -1 Face -3	Cheek, periorbital	4 ½
6	F	47	III	10	No	Face, forearm	15	4-7 mm, 1.5-2.5 J/cm^2	Forearm -1 Face -2	Cheek	3 ½

*BSA (Body Surface Area involvement)

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