

Original Article

Application of Q-switch Alexandrite laser combined with fractional CO₂ laser in treating disseminated superficial actinic porokeratosis: report of two cases

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Abstract: As a subtype of porokeratosis, disseminated superficial actinic porokeratosis (DSAP) is an inherited autosomal dominant cutaneous dermal disorder of keratinization. Patients diagnosed with DSAP are characterized by multiple superficial lesions with a slightly elevated and sharply delineated ridge. Multiple therapies have been employed to treat DSAP. However, the clinical efficacy is relatively low. In this study, combined therapy of Q-switch Alexandrite laser and fractional CO₂ laser was tentatively applied for the clinical treatment of DSAP. In this case report, two patients were pathologically diagnosed with DSAP by punch biopsy. They subsequently received Q-switch Alexandrite laser combined with fractional CO₂ laser with the energy of 100-150 mJ at a pulse frequency of 2 Hz. The spot size was measured as 1.3 mm with a scan matrix of 2-7 and a density of 3. All patients were followed up for 3 to 8 months. Favorable cosmetic appearance was achieved. No recurrent DSAP was reported during follow-up.

Keywords: Disseminated superficial actinic porokeratosis, Q-switched Alexandrite laser, fractional CO₂ laser, porokeratosis

Introduction

Typical disseminated superficial actinic porokeratosis (DSAP) is a subtype of porokeratosis, primarily observed diffusely in sun-exposed body areas, especially the face and extremities. The underlying etiology of porokeratosis is considered to be associated with the clonal proliferation of a typical keratinocyte which forms the cornoid lamella [1]. Therefore, DSAP is characterized by hyperkeratotic papules, patches or plaques surrounded by a thread-like elevated border. The multiple, superficial lesions by DSAP severely affect the patient's appearance and may make them upset. Additionally, these lesions have transformation potential into invasive squamous cell carcinoma. No standardized treatment has yet been established for DSAP. Although many methods were reported to treat DSAP, no ideal treatments are available now. Recently, Q-switched ruby laser (QSRL) [2, 3] and CO₂ fractional Laser has been used to treat DSAP, respectively, showing effective results in terms of both appearance and histopathological changes [4, 5]. In the present stu-

dy, we combined the two methods at the same time on patients with DSAP on face and achieved successful results after just applying one session of treatment and no clinical recurrence occurred.

Case report

Case 1

Baseline data: A 41-year-old lady presented with a 6-year history of lesions on her face. These lesions were slowly increasing in size. In summer days, she noticed they became brightly red on exposure to sunlight, and sometimes itchy. The patient found the appearance embarrassing and had tried topical retinoid (Retin A) cream for 3 months without any effects. Her two younger sisters had the same condition. A clinical examination showed that she had multiple, brown, annular lesions with raised hyperkeratotic ridges on the face (**Figure 1**).

Histological examination: No other region was involved. The appearance was typical manifestation of DSAP. A punch biopsy taken from a



Figure 1. Initial lesions of disseminated superficial actinic porokeratosis on the face of case 1 (A), after 1 month of Q-switch Alexandrite laser combined with Fractional CO₂ Laser and IPL therapy (B), 8 months after the systemic therapy (C).

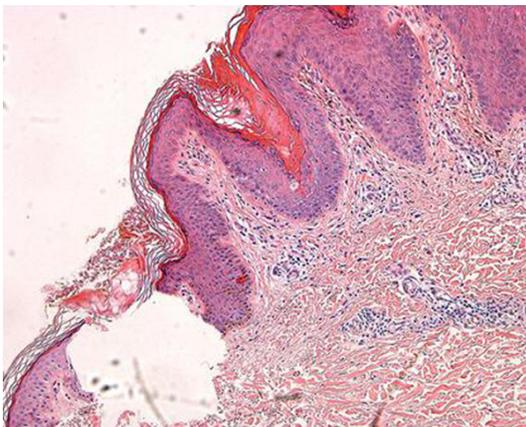


Figure 2. Histopathological findings of the case 1. The cornoid lamella, irregularly arranged keratinocytes in the spinous layer beneath and superficial perivascular lymphocytic infiltration in the dermis were seen (hematoxylin-eosin, original magnification $\times 100$).

representative lesion showed hyperkeratosis, hypergranulosis, epidermal atrophy and inflammation. And at a follow-up visit 8 months later, the residual pigmentation faded mostly. The patients were extremely satisfied with the results (disappearance of the lesions, skin smoothness and no clinical recurrence) (**Figure 2**).

Case 2

Baseline data: A 38-year-old lady presented with an 8-year history of lesions on her face which

were gradually spreading down to her neck and forearms. These lesions were slowly increasing in size and numbers. She was previously healthy and reported no history of previous medications, immunosuppression or X-ray treatment and none of her family members had the same disorder. She denied extensive sun exposure or exacerbation of the lesions by sun exposure during summer days. On examination, there were more than 100 small circular lesions on her face, neck and forearms, each lesion with a thread-like raised hyperkeratotic border. The appearance was typical manifestation of DSAP.

Clinical treatment: Same procedure was performed on the two patients. Before the treatment, topical anesthetic containing 2.5% prilocaine and 2.5% lidocaine (Compound Lidocaine Cream, ZiGuang Pharmaceutical Co., Ltd, Beijing, China) was applied via occlusion for 1 hour, and then was removed with dry gauzes just before the procedure. At first, with active mode of the fractional CO₂ Laser (Ultrapulse Encore CO₂ laser, Lumenis, Santa Clara, CA, USA), we ablated the raised hyperkeratotic ridges of the lesions sufficiently until the dermal tissue appeared. Each lesion needed about one to four passes, with the energy of 100-150 mJ (spot size, 1.3 mm; spot shape, 1; Size of Scan matrix, 2-7; density, 3). After the first step, we could see there was a fine circular pigmentation in the center of each lesion. Then each lesion was irradiated with Q-switch Alexandrite



Figure 3. Photos illustrating the cosmetic outcomes of case 2.

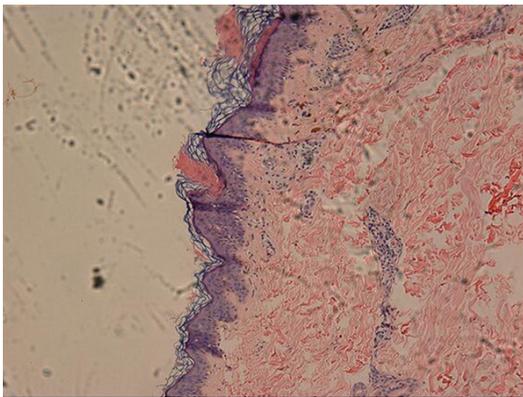


Figure 4. Histopathological findings of the patient of case 2 (hematoxylin-eosin, original magnification $\times 100$).

laser (QSAL, Cynosure Company, Westford, USA) at 755 nm, with pulse frequency 2 Hz. Other parameters for treatment were as follows: pulse width: short, spot size: 3 mm, energy density: 7.8~8.2 J/cm², resulting in the whitening phenomenon which represents a good indicator of effectiveness after the irradiation. The patient may have mild burning sensation during the treatment. After the treatment, Basic Fibroblast Growth Factor (b-FGF) cream and Mupirocin antibiotic cream were applied on the wound surface twice a day for about 3 days. And the wound could heal within 10 days. In order to relieve the pigmentation, we instructed the patients to have a session of intensive pulse light with Lumenis One (Lumenis, Santa Clara, CA, USA). The parameters were as follows: filter 590 nm, double pulse, pulse width

3.5 ms, pulse delay 30-35 ms, energy density 17-18 J/cm². Follow-up examination 3 months later showed that the lesions disappeared with slight residual pigmentation left. A punch biopsy taken from a representative lesion of the preauricula showed the typical histopathological changes of DSAP (Figures 3 and 4).

Discussion

DSAP is a chronic disorder of keratinization distributed over sun-exposed sites which may affect life quality of patients. Many therapeutic measures have been described for DSAP treatment, such as 5-fluorouracil [6], vitamin D3 analogs [7], systemic retinoid therapy [8] and cryotherapy [9]. Additionally, some laser therapies including CO₂ laser, 585-nm pulsed dye laser, have been performed to remove the lesions. However, most of these treatments have failed to achieve ideal effects.

Observed through dermoscopy, the lesion shows a “white track” structure at the periphery with a brownish pigmentation in the inner side and “double white track” in some parts of the lesion. The “white track” structure at the margin corresponds to the cornoid lamella and is a characteristic of porokeratosis [10]. Q-switched Alexandrite laser is typically used for treating pigmented skin diseases. Q-switched ruby laser has been reported to treat DSAP and achieved effective results. However, multiple sessions of treatment and longer duration were required. The treatment of DSAP with traditional CO₂ laser vaporization has demonstrated a poor response of hyperpigmented scarring [11-15]. But the current Ultrapulse Encore CO₂ laser can create hundreds of microscopic treatment zones at controlled depths while sparing the surrounding tissue. This technique makes wound heal faster owing to small injury regions and short migratory paths for keratinocytes, which makes scarless healing possible. Through CO₂ laser vaporization, we can remove the “white track” structure at the margin. Moreover, we want to find out whether QSAL and current CO₂ laser are able to complement each other. In

our study, we observed that Ultrapulse Encore CO₂ laser could effectively remove the cornoid lamella of DASP following CO₂ laser ablation, and the depth of the ablation can be precisely controlled. After the dermal ablation, a brownish pigmentation in the inner side was exposed clearly, which was advantageous to the sequential pigmentation removal with QSAL.

The results were remarkable and revealed that the lesions of both patients faded, the skin became smooth and scarless, and no recurrence occurred. Probably, the improvement of skin texture owes much to the stimulatory effects of Ultrapulse Encore CO₂ laser and the IPL which can resurface on dermal collagen remodeling and epidermal regeneration. However, compared with other methods, there may be more pain and longer pigmentation time. Additionally, the lack of histologic confirmation of resolution of the skin lesions is the limitation of our report. It would be useful to prove histologically changes of the lesions after our treatment in future reports because this resolution would reduce the risk of carcinomatous change in these patients.

Conclusion

In our investigation, besides these two cases, QSAL combined with Ultrapulse Encore CO₂ laser showed successful results and good cosmetic outcome with a high patient satisfaction level in similar cases (data not shown). Despite of the above-mentioned limitations, it can be said that it is an ideal treatment option with shorter duration of recovery time and increased application safety for DSAP. However, more cases and controlled studies with long-term follow-ups are required to evaluate its clinical efficacy.

Disclosure of conflict of interest

None.

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