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RESEARCH ARTICLE

THE TREATMENT OF ERYTHEMA AB IGNE USING DR. HOON HUR'S GOLDEN PARAMETER THERAPY WITH A HIGH FLUENCE 1064nm Q-SWITCHED Nd: YAG LASER

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ABSTRACT

Erythema ab igne (EAI) is a skin condition caused by long-term exposure to heat without thermal burn. Prolonged thermal radiation exposure to the skin can lead to the development of reticulate erythema, hyperpigmentation, scaling and telangiectasia in the affected area. Generally, the outcome of treating EAI with some topical agents including tretinoin cream and imiquimod cream was not satisfactory. Unfortunately, there is no standard laser therapy for EAI yet. Therefore, in order to investigate the efficacy and safety of Dr. Hoon Hur's Golden Parameter Therapy (GPT) using a high fluence 1064nm Q-switched Nd: YAG laser (QSNL) for treating EAI, this study was performed. Eleven Korean patients with EAI were treated with a 1064nm QSNL at a one-week interval for 20 treatment sessions of Dr. Hoon Hur's GPT. The parameters were a spot size of 7 mm, a fluence of 2.4 J/cm2 and a pulse rate of 10Hz with a slow single pass by a sliding-stacking technique over the EAI. At the week of the final treatment, all of the 11 patient with EAI were achieved the complete clearance of reticulate hyper pigmented lesions without any side effects such as purpurae, crusts, PIH, mottled hypopigmentation and scarring. No recurrences were observed in any of the patients after a follow- up of 6-10 months. We suggest that Dr. Hoon Hur's GPT using a high fluence 1064nm QSNL is a safe and effective method without side effects and recurrences for treating EAI.

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INTRODUCTION

Erythema Ab Igne (EAI) is a skin reaction caused by chronic exposure to infrared radiation in the form of heat. It was once a common condition seen in the people who stood or sat closely to open fires or electric space heaters (Elsner, 2014; Hirohata, 2016). If not properly treated, EAI can become chronic and even malignant (Rudolph, 2000). Unfortunately, there is no standard laser therapy for EAIyet. Therefore, in order to investigate the efficacy and safety of Dr. Hoon Hur's Golden Parameter Therapy (GPT) using a high fluence 1064nm Q-switched Nd: YAG laser (QSNL) for treating EAI without any side effects and recurrences, this study was performed.

MATERIALS AND METHODS

This study was performed on eleven Korean patients (age range: 21-61 years old, mean age: 36.5 years old) who were clinically diagnosed with EAI (Fig.1,3,5). No significant medical or familial history was found in the patients.

Written informed consents were obtained from all of the 11 patients before proceeding into treatment. But topical anesthetics was not used before the laser treatment. And all of the 11 patients were received 20 treatment sessions of Dr. Hoon Hur's GPT using a high fluence 1064nm QSNL(Spectra Laser, Lutronic, South Korea) at a one-week interval with a spot size of 7mm, a fluence of 2.4J/cm^2 and a pulse rate of 10Hz using a slowly one pass by a sliding-stacking technique over the EAI. After the laser treatment, the lesion of EAI was cooled with ice packs but the patients did not use a broad-spectrum sunscreen and any topical agents such as tretinoin cream and steroid cream. Standardized digital photography using a Canon Camera G11 (Japan) was used for the evaluation by comparing photos taken on the day of the treatment and those taken 4 weeks after the final treatment session. The physician's clinical assesment of the degree of improvement of the patients (mean score of two investigators who did not attend the treatment) was also carried out 4 weeks after the last treatment session and reported as percentage resolution as follows: poor (0-25% clearance), fair (26-50% clearance), good (51-75% clearance), excellent (76-95% clearance) and complete (96-100% clearance) by analyzing the clinical photographs of patients. The patients were asked to report any side effects, pain or discomfort during the treatment.

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Fig.1. Diffuse reddish to brown reticulate hyperpigmented patches without atrophic scars on the anterior aspect of left lower leg (before treatment)

Fig. 2. A complete clearance of EAI (after treatment with Dr. Hoon Hur's GPT)

Fig. 3. Diffuse reddish to brown reticulate hyperpigmented patches without atrophic scars on the posterior aspect of the both lower legs (before treatment:9/12/2016)

RESULTS

Eleven Korean patients with EAI were enrolled in this study (Table 1). All of the 11 patients with EAI were achieved complete clearance of the reticulate hyperpigmented lesions (Table 2).

Table 1. The demographic data of 11 patients with EAI and the characteristics of EAI

Age	
Age range	21-61 years old
Mean age	36.5 years old
Gender	
Male	1/11(9.1%)
Female	10/11(90.9%)
Family history	(-)
Location	
Thighs	2/11(18.2%)
Lower legs	9/11(81.8%)
Characteristics of lesion	
Reticulate hyperpigmentation	11/11(100%)
Skin atrophy	2/11(18.2%)

Table 2. The result of treatment with Dr. Hoon Hur's GPT

Treatment response	Number of patients
Poor (0-25% clearance)	0
Fair (26-50% clearance)	0
Good (51-75% clearance)	0
Excellent (76-95% clearance)	0
Complete (96-100% clearance)	11/11(100%)

Fig. 4. A complete clearance of EAI (after treatment with Dr. Hoon Hur's GPT:8/17/2017)

Fig. 5. Diffuse reddish to brown reticulate hyperpigmented patches without atrophic scars on the anterior aspect of the both lower legs (before treatment:9/12/2016)

And there were no significant side effects including purpurae, crusts, PIH, mottled hypo pigmentation and scarring except mild pain during the laser treatment (Fig. 2, 4 & 6). No recurrences have been detected after a follow-up of 6-10months (Fig.7).

Fig. 6. A complete clearance of EAI (after treatment with Dr. Hoon Hur's GPT:8/17/2017)

Fig. 7. There is no recurrence at 10 months' follow-up(6/7/2018)

DISCUSSION

Erythema abi gne (EAI) also known as "toasted skin syndrome" and "fire stains" is characterized as localized areas of reticulate erythema, hyperpigmentation and telangiectasia due to chronic and repeated exposure to infrared radiation (Elsner, 2014; Hirohata, 2016).

Patients with EAI have a history of repeated exposures to heat at a lower level than that which causes a thermal burn. It was often seen on the inner thighs and lower legs (Elsner, 2014; Hirohata, 2016). The pathogenesis of EAI remains idiopathic. It has been proposed that thermal radiation exposure can induce epidermal damage and injury superficial blood vessels that subsequently leads to vascular dilation. Subsequently the deposition of melanin and hemosiderin, and the degeneration of the elastic fibers can occur in a reticular distribution. The vasodilation of vessels presents morphologically as the initially observed erythema. The extravasation of red blood cells, and the deposition of melanin and hemosiderin that clinically appear as hyper pigmentation (Rudolph, 2000; Mitsuhashi, 2005). The diagnosis is made clinically and supported by a medical history. On rare occasions, histology may be necessary. The histopathological findings show hyperkeratosis, parakeratosis and epidermal atrophy. The dermis discloses abundant melanophages and occasional the degeneration of elastic fibers similar to actinic elastosis. There is also the deposition of melanin and hemosiderin, and formation of telangiectasis. Also a perivascular infiltration of polymorphonuclear cells is present in the dermis. EAI is usually a chronic disease. The most significant long term risk is the malignant transformation of EAI into cutaneous squamous cell carcinomas or Merkel cell carcinomas (Rudolph, 2000; Mitsuhashi, 2005). At present, there is no effective laser therapies available (Michel, 1997; Polder, 2011). Generally, the 532 nm wavelength of the QSNL, the 694 nm wavelength of the ruby laser, the 515-755 nm wavelength of intense pulsed lights and the 755 nm wavelength of the alexandrite are absorbed by melanin much more than the 1064 nm wavelength of QSNL (Hur, 2016 and 2017).

This higher absorbance to melanin produces laser energy that destroys epidermal melanocytes and simultaneously damages surrounding keratinocytes in the lesions (Hur, 2016 and 2017). When the damaged keratinocytes secrete interleukin-1(IL-1), which stimulates keratinocytes to secrete some keratinocytic injury-induced cytokines such as endothelin-1, α-melanocyte stimulating hormone (MSH), adrenocorticotropic hormone (ACTH) and prostaglandin (PGE2, PGF2α). These melanogenic cytokines activate melanocytes, thereby increasing melanin synthesis in melanosomes. For this reason, PIH occurs and EAI becomes worse (Hattori, 2004 and Okazaki 2003 and 2005). Therefore, the authors devised a new treatment using a Dr. Hoon Hur's GPT with a high fluence 1064nm QSNL (Spectra Laser, Lutronic, South Korea) at a one-week interval with a spot size of 7 mm, a fluence of 2.4 J/cm^2, a pulse of 10 Hz and a sliding stacking technique that slowly irradiated the laser to the lesion site of EAI to minimize side effects such as purpurae, crusts, PIH, mottled hypo pigmentation and scarring caused by the traditional laser therapy. In previous papers, the authors also reported that Dr. Hoon Hur's GPT using a high 1064 nm QSNL is effectively treated without side effects such as PIH, mottled hypopigmentation or scarring in various skin lesions such as café au lait spot, partial unilateral lentiginosis, Becker's nevus, Ota's nevus, Hori's nevus, congenital melanocytic nevus and Riehl's melanosis (Hur, 2016, 2017 and 2018).We believe that the wavelength of 1064nm used in Dr. Hoon Hur's GP T is less absorbed by the epidermal melanin. This mechanism is able to induce the gradual elimination of hemosiderin and melanin deposition in the dermis and promotes the new formation of collagen fibers and elastic fibers by stimulating

the fibroblasts while minimizing the epidermal damage (Hur, 2016 and 2017). Especially, Dr. Hoon Hur's GPT can stimulate the platelets, macrophages and fibroblasts with less thermal injury in the dermis (Hur, 2018). This mechanism for dermal response without thermal damage is able to stimulate the platelets which secrete platelet –derived growth factor (PDGF), epidermal growth factor (EGF), transforming growth factor- beta1 (TGF-beta1), TGF-beta2 and TGF-beta3 to activate the macrophages. The activated macrophages secrete TGF-beta3 and basic fibroblast growth factor (bFGF) which stimulate the fibroblasts (Shah, 1995 and Hur, 2017 and 2018). Subsequently the activated fibroblasts produce the extracellular matrix such as natural hyaluronic acid, collagen, elastin and fibronectin which stimulates a healing response.

Also the melanin, hemosiderin and the end products of the degenerated elastic fibers are removed by either the transepidermal elimination or dermal melanophages via the lymphatic system. In short, the end point of Dr. Hoon Hur's GPT with a high fluence 1064 nm QSNL is not to cause petechiae or purpurae, but to induce erythema only. Dr. Hoon Hur's GPT transmits enough energy without destroying normal background tissue, and eliminates the deposition of melanin and hemosiderin in the dermis but does not cause crusts and purpurae, and prevents PIH and scarring because it is less absorbed by epidermal melanin (Hur, 2016 and 2017). However, in order to completely remove EAI without recurrences, this treatment must be treated 20 consecutive times for 5 months. In this study, we treated all 11 patients with EAI (Fig.1,3,5) using Dr. Hoon Hur's GPT with a high fluence 1064 nm QSNL. The complete removals of the reticulate pigmented lesions were achieved without PIH and scarring in all 11patients with EAI (Fig.2,4,6). There is no recurrence after 6-10 months of follow-up (Fig.7).All patients treated with Dr. Hoon Hur's GPT using a high fluence 1064 nm QSNL were satisfied with the results.

Conclusion

In this study, EAI were treated by Dr. Hoon Hur's GPT using a high fluence 1064 nm QSNL and were completely eliminated without side effects and recurrences. We suggest that Dr. Hoon Hur's GPT using a high fluence 1064 nm Q-switched Nd: YAG laser is a new, safe and good treatment option to expect complete clearance of EAI.

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