Original Article

The Study of Efficacy of Excimer Light 308 Nanometers for Chronic Hand Dermatitis

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Background: Chronic hand dermatitis is one of the most common dermatological disease worldwide resulting from high incidence, prevalence, and recurrent rate. Nowadays, there are various kinds of treatments in chronic hand dermatitis. The previous studies only consisted of prospective non-randomized pilot study and retrospective cohort study of 308 nanometers excimer devices in chronic hand dermatitis.

Objective: To study the efficacy and side effect of the excimer light 308 nanometer in chronic hand dermatitis.

Materials and Methods: The researchers conducted a prospective non-randomized clinical trial to study the efficacy of 308 nanometers excimer light to treat chronic hand dermatitis. Thirty-five patients were enrolled in the eight weeks protocol. The efficacy of device was assessed by the HECSI, the PGA score, the erythema index by Mexameter MX16, and the NRS for pruritus level. In addition, the adverse effect of changing melanin index was assessed by the Mexameter MX16. The researchers also assessed the DLQI and the patient's satisfaction score.

Results: The results revealed that the mean of the HECSI, PGA, NRS, and erythema index were statistically significantly decreased after complete treatment ($p<0.001$). The result of subgroup analysis of percent of complete remission rates were 88.89 in mild group, 83.33 in moderate group, and 42.86 in severe group, which was statistically significant ($p=0.029$). In addition, the complete remission rates of pruritus were 88.89 in the mild group, 94.44 in the moderate group, and 57.14 in the severe group, and there was no statistically significant difference between the groups ($p=0.21$). On the other hand, the mean of melanin index demonstrated no statistically significant change in palmar and dorsal side of both hands ($p=0.79$, 0.57, 0.78, and 0.07, respectively). Furthermore, the DLQI was also statistically significantly improved ($p<0.001$), and the patients were very satisfied to the treatment. The adverse effects, which included burning sensation, skin dryness, and progressive itchiness, were observed (5.88, 5.88, and 8.82%, respectively) and spontaneously resolved within 24 hours without clinical skin change.

Conclusion: The excimer light 308 nanometers is the alternative treatment of chronic hand dermatitis by reducing the severity score statistically significantly without hyperpigmentation after treatment. Mild adverse effects such as itchiness, dry skin, and burning sensation without major adverse event were observed.

Keywords: Excimer light, Chronic hand dermatitis

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Chronic hand dermatitis is one of the most common dermatological diseases worldwide. The disease is characterized by chronic skin inflammation of hands that lasts longer than three months or recurs more than twice a year[1] with debilitating symptoms including erythema, scaling, fissuring, hyperkeratosis, edema, blistering, pruritus, and pain[2]. The incidence of the disease is 5.5:1,000 and with a one-year prevalence at approximately 10%[3] and increasing to 30% among high-risk populations, such as healthcare workers, hairdressers, and housekeepers[4].

The classification of chronic hand dermatitis can be defined by the morphology and etiology of the disease. The morphological classifications of chronic hand dermatitis included vesicular hand dermatitis as pompholyx or dyshidrosis, hyperkeratotic hand dermatitis, chronic fingertip dermatitis (pulpitis sicca), and nummular hand dermatitis. On the other hand, the classifications for the etiology included irritant contact dermatitis, allergic contact dermatitis, atopic hand dermatitis, protein contact dermatitis (contact urticaria), and hybrid hand dermatitis[2]. Since there are a wide range of symptoms and causes of disease, the standard classification of the chronic hand dermatitis is not clearly defined.

Because the hands are regularly exposed to the environment, almost all the time, the treatment of chronic hand dermatitis should start from the

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identification and elimination of the triggering factors. Clinicians should explore the possible causes for individual patient and let the patient know that avoidance is the key for effective treatment. Moreover, moisturizer should be frequently used by all patients.

High potency topical corticosteroids are used as a major treatment for hand dermatitis. They are very effective in short-term use, but long-term applications might cause skin atrophy, striae, telangiectasia, and systemic adverse effects[5]. Topical calcineurin inhibitors are an alternative treatment for atopic dermatitis patients aiming to reduce the side effects of the prolonged use of topical corticosteroids, but symptoms such as burning, stinging, and flushing after alcohol ingestion can be observed[6]. The systemic therapies are used in chronic, resistant, and severe hand dermatitis, including oral corticosteroid, methotrexate, cyclosporine, mycofenolate mofetil, and alitretinoin. Except for alitretinoin, no other systemic drugs have been approved for the treatment of hand dermatitis. However, alitretinoin is inadequate for pregnant women because of the teratogenic effects[7].

Phototherapy is widely used as alternative treatment of chronic hand dermatitis for patients who have not responded to topical corticosteroids. In most studies, photochemotherapy as psoralen, plus ultraviolet A was superior to the ultraviolet B therapy[8]. However, the major adverse effect in long-term use is associated with non-melanoma skin cancer[2].

The xenon chloride excimer devices, which are used firstly in psoriasis, vitiligo, and atopic dermatitis showed the benefits in chronic hand dermatitis in some small trials[9,10]. The excimer devices emit a 308 wavelength, closing to a narrow-band ultraviolet B (NB-UVB). These devices were suitable in difficult area to treat on the patients' hands and feet because of the movable hand piece apparatus[10]. These advantages brought the researchers to investigate the efficacy and side effect of a 308-nanometers excimer light in chronic hand dermatitis.

Materials and Methods

Patients

The sample size was calculated according to the study of Shroff et al[10], which the primary outcome was improvement of the physician global assessment (PGA) score and the mean difference was 1.8 point with a standard deviation (SD) of 3.6 points, Therefore, the sample size required was 35. After the approval of the present study protocol by the Ethical Committee Review Board of Srinakharinwirot University, Bangkok, Thailand (EC number: SWUEC-305/60E), 35 patients enrolled in a prospective and non-randomized trial. All the patients were informed and signed consents before starting the study protocol. All the patients were diagnosed with chronic hand dermatitis defined by duration of the disease for more than three months or relapsing more than twice a year. The exclusion criteria were defined as skin infections, a history of skin cancer, photosensitivity disease, pregnant, and lactating woman. One of the patients dropped out in the first week of the study due to unable to follow-up, so the number of patients were thirty-four and included six males and twenty-eight females, with an age range of twenty-one to sixty years, and a mean age of forty-one years. The patients were required to discontinue all topical therapy for at least eight weeks and cease all systemic therapies for at least twelve weeks.

Figure 1. TheraBeam (Ushio).

Device

The 308-nanometers xenon chloride monochromatic excimer light device (TheraBeam; Ushio, Osaka, Japan) (Figure 1) was used in the present study. The system produced an average twenty mW/cm² irradiation intensity with average 1 MED (307 mJ/cm²) irradiation time for fifteen seconds, and 100×80

Table 1. Hand eczema severity index (HECSI)

	Fingertips	Fingers	Palms	Dorsal of hands	Wrists
Symptoms (0-3 scores)					
Erythema					
Induration					
Vesiculation					
Fissuring					
Scaling					
Edema					
Total symptoms score (0-18 scores)					
Affected area (0-4 scores)					
Total HECSI score (0-360 scores) (Total symptom scores x Affected area)					

Table 2. Physician global assessment score (PGA)

Score	PGA severity	Features	Intensity (at least one)	Area (%)
0	Clear	Erythema, scaling, hyperkeratosis	Absent	No detectable
		Vesicles, edema, fissure, pruritus/pain	Absent	
1	Almost clear	Erythema, scaling, hyperkeratosis	Mild	Less than 10
		Vesicles, edema, fissure, pruritus/pain	Absent	
2	Mild	Erythema, scaling, hyperkeratosis	Mild	Less than 10
		Vesicles, edema, fissure, pruritus/pain	Mild	
3	Moderate	Erythema, scaling, hyperkeratosis	Mild/moderate	10 to 30
		Vesicles, edema, fissure, pruritus/pain	Moderate	
4	Severe	Erythema, scaling, hyperkeratosis	Moderate/severe	More than 30
		Vesicles, edema, fissure, pruritus/pain	Severe	

mm of irradiation area. Each treatment usually lasted one to two minutes, depending on the intensity of each session.

Study protocol

The outcomes of the present study used two validated score systems, the hand eczema severity index (HECSI) (Table 1) and the PGA score (Table 2). The HECSI scores were calculated for each patient as the sum of their symptoms and the severity of each area, ranging from 0 to 360 with 0 as clear and 360 as very severe disease. The PGA scores ranged from 0 to 4 with 0 as clear and 4 as very severe disease. Moreover, the Mexameter MX16 was used to evaluate the erythema index of the dermatitis affected areas for an objective measurement of disease severity. The numerical rating scale (NRS) was also used for pruritus to measure the severity of the itchiness of each session, ranging from 0 to 10 with 0 as no itchiness and 10 as very severe itchiness. For adverse effect measurement, the Mexameter MX16 was used to evaluate the melanin index for skin for observing hyperpigmentation changes after the completion of the treatment.

The initial dose was determined by Fitzpatrick skin type[10]. In the present study, all the patients had Fitzpatrick skin type IV to VI. The initial dose was 300 mJ/cm² at the palmar site and 150 mJ/cm² on the dorsal side of the hands. The subsequent doses were determined by the clinical response of each session. Without erythema, the dose was increased 10% from the previous session. When mild erythema was observed, the same doses was continued. On the other hand, if severe erythema was identified, the dose was decreased by 10% from the last treatment. If severe adverse effects developed, such as blistering, the treatment was stopped until the lesion was clear. The patients were treated twice a week with an average of 8.7 sessions, ranging from three to twelve sessions.

Statistical analysis

All the continuous data, including HECSI, PGA,

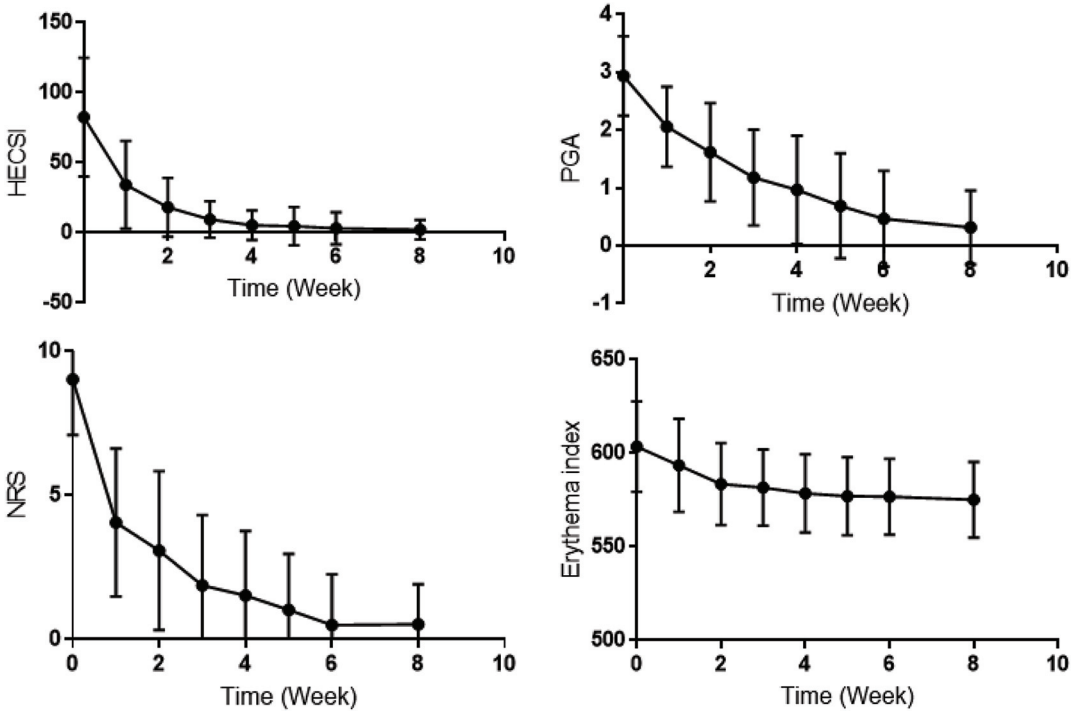

Figure 2. Remission rates of HECSI (p<0.001), PGA (p=0.017), NRS (p<0.001) and erythema index(p<0.001) after treatment with 308-nm xenon chloride monochromatic excimer light.

NRS, the erythema index, the melanin index, the Dermatology Life Quality Index (DLQI), and patient's satisfaction score were reported as mean and SD. The test of probability (p-value) was conducted using repeated ANOVA for HECSI, PGA, NRS, and the erythema index. In addition, a paired t-test was used in the melanin index and the DLQI. The outcome was considered statistically significant if the p-value was less than 0.05. All statistical analyses were produced by IBM SPSS Statistics, version 22.0 (IBM Corp., Armonk, NY, USA).

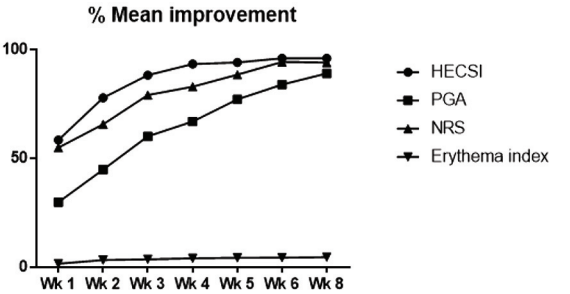

Figure 3. Percent mean improvement rates of HECSI, PGA, NRS, and erythema index after 308-nm xenon chloride monochromatic excimer light (p<0.001).

Results

In all thirty-four patients, significant clinical improvement was observed. The average of the HECSI score before and after treatment was 82.5 and 2.32, respectively (Figure 2), and the percent mean improvement was 97.2% (Figure 3). A statistically significant improvement was seen following treatment (p<0.001). The mean of the PGA score before and after treatment was 2.94 and 0.32 (Figure 2), a mean improvement of 89.1 with a statistically significant improved PGA score for every session (p<0.001) (Figure 3). The mean NRS for pruritus also did well, resulting from 9.03 to 0.53 after treatment (p<0.001) (Figure 2). The mean of the erythema index by Mexameter MX16 responded well in the same way from 603.56 to 575.15 (Figure 2), with a mean statistically significant improvement of 4.7% (p<0.001) (Figure 3). On the contrary, the mean difference of the melanin index by Mexameter MX16 in both the palmar and dorsal side of their hands had no statistically significant changes (p=0.79, 0.57, 0.78, 0.07). Only a mild burning sensation, skin dryness, and itchiness after one day of treatment were observed in 5.88%, 5.88%, and 8.82%, respectively, without clinical skin changes.

The average cumulative doses of palmar and

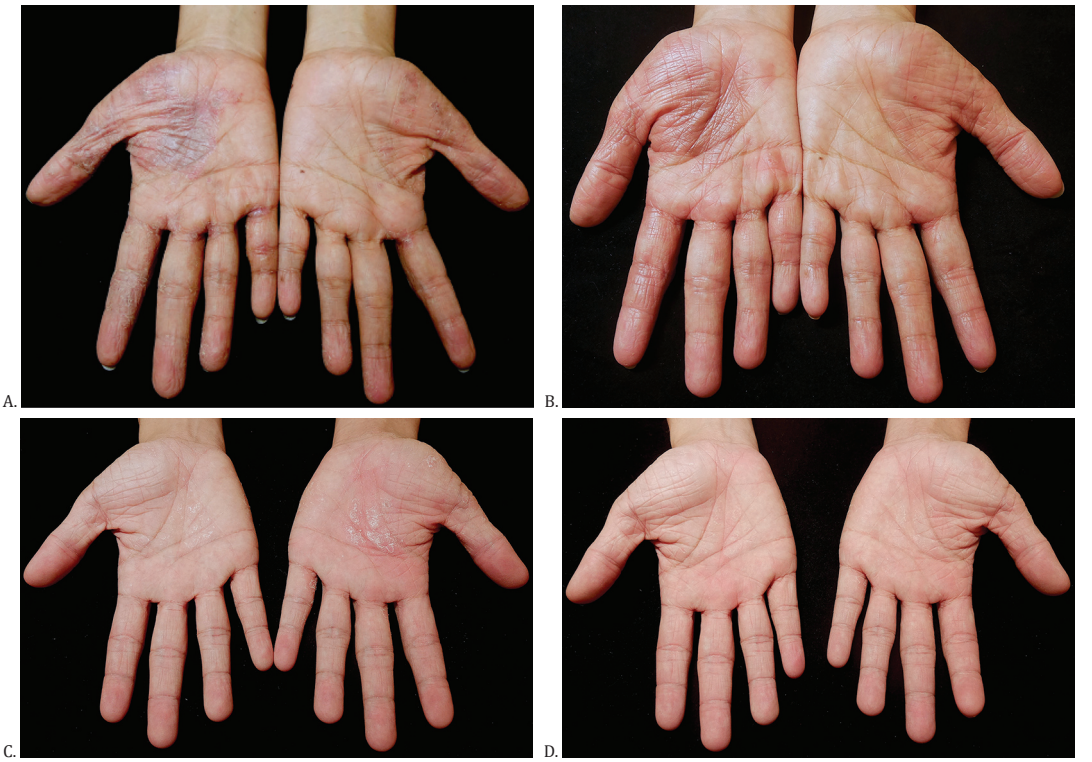

Figure 4. Chronic hand dermatitis before (A, C) and after (B, D) 308-nm xenon chloride monochromatic excimer light treatments with satisfaction with improvements.

dorsal sites were 4445.13 mJ/cm² and 2394.76 mJ/cm². The clearance of the disease, defined by clear lesions and symptoms with no new disease activity development after complete protocol, was achieved in 19 to 34 patients (55.88%). In addition, the disease activity was also recorded after two weeks of completed treatment to observe recurrences. There was no statistically significant change of HECSI, PGA, NRS, and erythema index immediately and two weeks after treatment.

Discussion

The present study revealed that the 308-nanometers xenon chloride excimer light was very effective and safe to treat chronic hand dermatitis (Figure 4). From the previous studies, in 2003, Aubin et al[9] used monochromatic xenon chloride 308 nanometers excimer light (Excilite®; DEKA) to treat chronic localized dermatoses in a prospective non-randomized pilot study. The study included eight patients with chronic atopic dermatitis and ten patients with chronic nonatopic dermatitis, with the mean number of MED per treatment of 13 and 8.4. The mean number for treatment was 7.3 and 12.5, and the percent mean improvement was 54% and 46%, respectively. In addition, in 2016, Shroff et al[10] conducted a retrospective cohort study in 30 patients of chronic hand and foot eczema treated with 308-nanometers excimer laser improvement. The HECSI, PGA, NRS, and erythema index were 97.2, 89.1, 94.1 and 4.7) ($p<0.001$). As the result, the clinical scores (HECSI, PGA, and NRS) improved more than the erythema index score. These results were analyzed and revealed that some of the lesions did not present as erythema in terms of clinical symptoms but showed other symptoms such as hyperkeratosis, scaling, and itchiness. Moreover, in the present study, hyperpigmentation of the skin was observed as a result of phototherapy with the melanin index before and after treatment, and there was no statistically significant change of the melanin index of both hands after treatment. However, there were only mild burning sensations, itchiness, and dryness of the treatment area without clinical skin changes. Hence, this 308-nanometers monochromatic xenon chloride excimer light appeared to be effective and safe to treat chronic hand dermatitis.

Conclusion

Excimer light 308 nanometers is the alternative

treatment of the chronic hand dermatitis by reducing severity score statistically significantly without hyperpigmentation after treatment. Mild adverse effects such as itchiness, dry skin, and burning sensation were observed. The researchers concluded that the Excimer light can reduce the symptoms of chronic hand dermatitis without major adverse effect.

What is already known on this topic?

Chronic hand dermatitis is a common disease, causing disability and chronic recurrence. The first line therapy is high potent topical corticosteroid but can lead to undesirable side effects. Phototherapy and Excimer laser are the alternative treatment of chronic hand dermatitis, but the device is expensive and not widely available in all clinic.

What this study adds?

The Excimer light 308 nanometers is an effective modality to treat chronic hand dermatitis without major adverse effect. These devices were suitable with difficult area to treat on the patients' hands and feet because of movable hand piece apparatus and widely available in many dermatological centers in Thailand.

Further study

The next study should research the cost-effectiveness of the Excimer light 308 nm and carry out a randomized controlled trial between the Excimer light 308 nm and the conventional treatment.

Conflicts of interest

The authors declare no conflict of interest.

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