Original Article

A study of Erythematous Facial Dermatoses in Thai Dermatologic Patients in a University Hospital

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Background: Erythematous facial dermatoses is a common dermatological condition caused by a variety of skin disorders and underlying systemic diseases. Little is known about this disorder in Asian skin types.

Objective: To examine clinical presentation, investigation, final diagnoses, treatments and comorbidities in Thai patients with erythematous facial dermatoses condition.

Materials and Methods: A prospective study of 100 patients with red face attended the Dermatology outpatient clinic in a University Hospital.

Results: There were 100 patients with erythematous facial dermatoses. The mean age was 36.8±12.6 years; 83% were female. The mean symptom duration was 2.5±3.3 years. Precipitating factors were exposure to ultraviolet light and heat. The most common complaint was itching. The most frequent causes of erythematous facial dermatoses were demodicosis (42%), allergic contact dermatitis (30%), seborrheic dermatitis (26%) and rosacea (12%). Demodicosis and allergic contact dermatitis were significantly associated ($p = 0.002$).

Conclusion: Erythematous facial dermatoses can have several causes in the same patient. We recommend the *Demodex* density test and patch testing are undertaken to allow the correct diagnosis to be made and treatment given.

Keywords: Erythematous facial dermatoses; Asian skin types; Demodicosis; Allergic contact dermatitis; Seborrheic dermatitis; Rosacea

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Red face or facial erythema is defined as erythematous eruptions predominantly located on the face, resulting from an increase in cutaneous blood flow precipitated by a variety of disorders[1,2]. Flushing is typically a transient response to everyday events such as strong emotion, exercise or exposure to heat, but erythematous facial dermatoses (EFD) may be a consequence of a variety of disorders, including inflammation, and if symptoms were prolonged they could become distressing[3]. The etiology of EFD includes skin disorders and underlying systemic diseases such as atopic dermatitis, seborrheic dermatitis, contact dermatitis, rosacea, psoriasis, contact urticaria, actinic erythema, photodermatitis, corticosteroid misuse, perioral dermatitis, demodicosis, tinea faciei, dermatomyositis, cutaneous lupus erythematosus, post-neoplasia flushing, cutaneous lymphoma, ulerythema ophryogenes, psychosomatic flushing and carcinoid[4]. Making the correct diagnoses and identifying the causative factor can be problematic, because these disorders may co-exist in one patient. Clinicians should consider a wide range of differential diagnoses when investigating patients with EFD.

EFD is common worldwide, and has social consequences such as embarrassment, anxiety and depression that may also require treatment[5,6]. There was no published background information on EFD in Asians especially Thai patients. We undertook a prospective study of EFD in Thai patients to establish its clinical manifestations, precipitating factors and underlying diagnoses since the information in Thai patients have been scarce. The aim of the present study was to establish the clinical manifestations, precipitating factors and underlying diagnoses of EFD clinical character in the Thai population.

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Materials and Methods

Conduct of the present cohort study was approved by the Siriraj Institutional Review Board, Siriraj Hospital, Mahidol University, Bangkok, Thailand (*Si*539/2012). The authors' practice setting is contact dermatitis clinic in the medical school and tertiary referral centre. Study population was calculated based on Zhao YE, et al[7] findings that 43% of facial dermatosis caused from demodicosis and adding up with 20% dropped out rate. One hundred Thai patients with facial rash(es) aged ≥ 18 years were recruited prospectively from October 2012 to March 2014. Each subject gave written informed consent to participate. Patients with established diagnoses of acne or with inflammatory skin lesions more widespread than the face, and those who were pregnant or breastfeeding, were excluded. Patient history, including occupation, hobby, exposure to any specific substance, history of cosmetics used and allergy, atopic history, prior corticosteroid used were recorded, and skin examinations were performed. Patients were treated according to the most likely diagnosis, and returned for follow-up evaluation at the outpatient clinic after 1 month.

Investigations

Laboratory investigations such as antinuclear antibody, potassium hydroxide preparation or skin biopsy were carried out if indicated.

Demodex density was determined by using a standardized skin surface biopsy technique with cyanoacrylic adhesion which has been acceptable as the gold standard technique for evaluation the density of Demodex mites[8]. A diagnosis of demodicosis was made if there were > 5 mites/ cm^2 in the active lesions[8,9]. Specimens were collected from multiple sites on the face, including the cheeks, nose, chin and forehead.

Patch testing (PT) was undertaken in patients suspected of having contact dermatitis, generally using the cosmetic allergen series (C-1000; Chemotechnique Diagnostics AB), with additional testing for suspicious allergens and patients' cosmetic products guided by the history and physical findings. The PT allergens (Chemotechnique Diagnostics AB, Vellinge, Sweden) were presented in aluminum Finn Chambers® (SmartPractice, Phoenix, Arizona, USA) and tested and interpreted according to a standardized method as previously described[10].

Treatments

The treatment modalities were according to their diagnosis such as topical corticosteroids (TCS) or topical tacrolimus/pimecrolimus for ACD or seborrheic dermatitis and anti-*Demodex* treatments; oral ivermectin, metronidazole, or benzoyl peroxide for demodicosis.

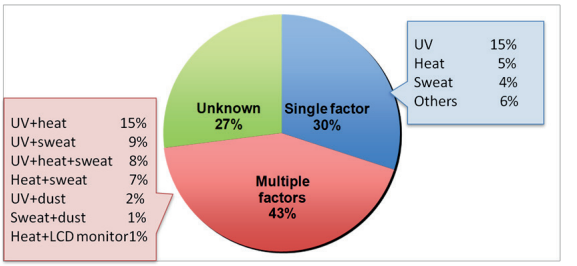
Statistical analysis

Descriptive statistics were used to present demographic data and test results. Mean values were presented with the standard deviation. The Pearson Chi-squared test was performed to analyze the association between potentially contributing factors and EFD characteristics. All statistical analyses were performed using PASW statistics 18.0 (SPSS Inc., Chicago, USA). A p-value < 0.05 was considered to be statistically significant.

Results

There were 100 patients. The mean age of the patients was 36.8 years (± 12.6 years) and the mean duration of EFD was 2.5±3.3 years. The majority (83.0%) were female. Forty-four (44.0%) were employed as office workers. Most had no personal or family history of atopic diathesis, and only one-fifth reported sensitivity to cosmetics, (Table 1). Most patients in our cohort (71.0%) had previously used TCS, and just over one-third (34.0%) presented with recognized side effects of TCS, such as skin atrophy, telangiectasia or TCS-induced acneiform eruption.

The most common precipitating factor was exposure to ultraviolet (UV) light (reported by 50.0% of patients), followed by heat (36.0%) and sweating (29.0%, Figure 1). The clinical features of EFD in our patients were shown in Table 2. The most common complaint was of itching (either alone, or in combination with burning in 79.0%), the second most common complaint was of burning (35.0%), but 12.0% were asymptomatic. Skin type was almost equally distributed between oily and normal to dry. The most



* Others; including cosmetics, skin care, cleanser, medication used, and shaving

Figure 1. Precipitating factors for erythematous facial dermatoses.

Table 1. Demographic and clinical characteristics of the study cohort

Characteristic	n (%)
Sex	
Male	17 (17.0)
Female	83 (83.0)
Mean age±SD (years)	36.8±12.4
Personal history of atopy	
Present	25 (25.0)
Absent	75 (75.0)
Family history of atopy	
Present	23 (23.0)
Absent	77 (77.0)
Previous cosmetic allergy	
Present	20 (20.0)
Absent	80 (80.0)
Cosmetic use	
Present	92 (92.0)
Absent	8 (8.0)
Occupation	
Retired	9 (9.0)
Business	9 (9.0)
Office worker	44 (44.0)
Student	13 (13.0)
Agriculture	1 (1.0)
Healthcare professional	13 (13.0)
Household duties	7 (7.0)
Others	4 (4.0)

Abbreviation: SD, standard deviation.

Table 2. Characteristics of erythematous facial dermatoses

Characteristic	n (%)
Duration of symptoms	
Mean ± SD (years)	2.5±3.3
Presenting symptoms	
Itching only	53 (53.0)
Burning only	9 (9.0)
Itching and burning	26 (26.0)
No symptom	12 (12.0)
Facial skin type	
Normal to dry	44 (44.0)
Combination to oily	56 (56.0)
Location of red lesions	
Single site, cheek	37 (37.0)
Multiple sites	63 (63.0)
Lesion morphology	
Eczematous lesions	72 (72.0)
Acneiform lesions	28 (28.0)
Presence of *Demodex* mites/cm^2	42 (42.0)
Patch test positive (Total n= 51)	35 (68.6)

Abbreviation: SD, standard deviation.

Table 3. Causes of erythematous facial dermatoses

Diagnosis	n (%)
Demodicosis	42 (42.0)
Allergic contact dermatitis	30 (30.0)
Seborrheic dermatitis	26 (26.0)
Rosacea	12 (12.0)
Acneiform/folliculitis	5 (5.0)
Irritant contact dermatitis	1 (1.0)
Perioral dermatitis	1 (1.0)
Eosinophilic folliculitis	1 (1.0)
Tinea faciei	1 (1.0)
Pseudolymphoma	1 (1.0)
Inconclusive	7 (7.0)

common morphology was erythematous scaly papules or patches similar to subacute dermatitis (70.0%).

The variety of clinical presentations of EFD resulted in a variety of diagnoses. The majority of patients (72.0%) had a single diagnosis and the remainder (28.0%) had co-existing skin diseases. The patients with single cause of EFD consisted of 26% demodicosis, 21% allergic contact dermatitis (ACD), 11% seborrheic dermatitis, and 6% rosacea. However, there were some patients who had concomitant dermatological condition which could explain their EFD conditions (Table 3). Demodicosis was diagnosed in 42.0% (26.0% were solely demodicosis, and 16.0% were coexisting with demodicosis). The clinical characteristics of those diagnosed with demodicosis were shown in Table 4: almost all (92.9%) presented with itching as the most distressing symptom (p = 0.005 compared with patients not diagnosed with demodicosis). The number of mites identified did not correlate with the prior use of TCS. Those with demodicosis were significantly more likely to have co-existing allergic contact dermatitis (ACD, p = 0.002).

Patch testing was performed in 51 patients and was positive in 35 cases (68.6%); 20 cases were judged

to be clinically relevant (57.1%). The most common allergens identified with high clinical relevance were preservatives, especially parabens, isothiazolinones then fragrances (Table 5). Cosmetic products that patients brought for testing were found to be positive in 29.4% of cases, with high clinical relevance in 73.3% of these. The most common causative cosmetic product categories were skin care including facial moisturizer, sunscreen (60%) and cleanser (27%). Allergic contact dermatitis was considered to be the sole cause of EFD in 21% of cases, and to co-exist with demodicosis in 5% of cases, with seborrheic dermatitis in another 5% of cases and with rosacea a further 5% of cases.

The diagnosis made significantly determined the duration of treatment ($p = 0.02$). Most of the patients (63%) had partially improvement, 12% showed no improvement and 25% completely improvement during 1-month follow-up period. The disorders most likely to respond to treatment within 1 month were irritant contact dermatitis, tinea faciei and eosinophilic folliculitis. The four most common cause of EFD, namely demodicosis, ACD, seborrheic dermatitis and rosacea, generally took more than 1 month of treatment to resolve.

Discussion

We found that the most common causes of EFD were demodicosis, followed by ACD, seborrheic dermatitis and rosacea. Red face condition is thought to be underdiagnosed in Asian people[11] possibly because it is difficult to identify redness in the Asian skin type (III - IV). However, skin whitening is becoming more popular in Asians, and the increased use of topical and systemic whitening agents may have made the disorder more noticeable. To the best of the authors' knowledge, this is the first study of EFD in the Asian skin type.

In our cohort, EFD was a chronic condition most commonly found in working-age women who apply cosmetics extensively. Most of our patients (more than 90%) were not aware that their cosmetics might have provoked their conditions because of long period of used, and therefore had not discontinued them. Persistent use of cosmetics or changes in cosmetic use may be responsible for the long duration of EFD symptoms. Three-quarters of our patients with EFD had used TCS, and one-third exhibited side effects of TCS use. Oral and topical corticosteroids are available over the counter in Thailand without prescription, which leading to overuse and misuse of these medications. We also found that EFD was provoked by UV exposure, heat or sweating, which are common

Table 4. Clinical characteristics of the 42 patients with erythematous facial dermatoses diagnosed with demodicosis

Characteristic, n = 42	n (%)
Sex	
Male	10 (23.8)
Female	32 (76.2)
Mean age±SD (years)	37.7±12.4
Duration of facial erythema	
Mean±SD (years)	3±4
Presenting symptoms	
Itching	38 (90.5)*
Burning	14 (33.3)
Previous use of topical corticosteroid	24 (58.5)
Type of facial skin	
Normal to dry	20 (47.6)
Combination to oily	22 (52.4)
Location of mite	
Single site	17 (40.5)
Multiple sites	25 (59.5)
Lesion morphology	
Eczematous lesion	27 (64.3)
Acneiform lesion	15 (35.7)
Co-existing dermatosis	
Allergic contact dermatitis	5 (12.2)*
Seborrheic dermatitis	9 (22.0)
Rosacea	2 (4.9)
Number of mites found (per cm^2)	
5–10	24 (57.1)
11–20	14 (33.3)
>20	4 (9.6)
Location of mites	
Cheek(s)	41 (48.8)
Chin	15 (17.9)
Forehead	14 (16.7)
Nose	8 (9.5)
Eyebrow	4 (4.8)
Nasolabial fold	2 (2.4)
1-month treatment outcome	
No improvement	5 (11.9)
Partial improvement	24 (57.1)
Complete recovery	13 (31.0)

*, $p < 0.05$ compared with patients not diagnosed with demodicosis
1-month treatment outcome included no improvement, partial improvement and complete recovery, so they should be continue and no line between partial improvement and complete recovery.

Table 5. Patch testing results

Allergens	Tested concentration (%)	Positive reaction (%) (Total n = 51)	Clinical relevance (%)
Preservatives/ antioxidants			
Parabens	16.0 pet	3 (5.9)	3 (100)
Methylchloroisothiazolinone/ Methylisothiazolinone	0.02 aq	3 (5.9)	3 (100)
Benzalkonium chloride	0.01 aq	7 (13.7)	4 (57.1)
Formaldehyde	1.0 aq	2 (3.9)	1 (50.0)
Methyldibromo glutaronitrile	0.5 aq	1 (2.0)	0 (0.0)
Thimerosal	0.1 aq	7 (13.7)	0 (0.0)
Dodecyl gallate	0.25 pet	3 (5.9)	0 (0.0)
Mercury ammonium chloride	1.0 aq	1 (2.0)	0 (0.0)
Fragrances			
Fragrance mix I	8.0 pet	3 (5.9)	3 (100)
Fragrance mix II	14.0 pet	3 (5.9)	3 (100)
Myroxylon pereirae	25.0 aq	1 (2.0)	0 (0.0)
Isoeugenol	2.0 pet	1 (2.0)	0 (0.0)
Vehicles, emulsifiers			
Cocamidopropyl betaine	1.0 aq	2 (3.9)	1 (50.0)
Propylene glycol	5.0 aq	2 (3.9)	0 (0.0)
Colophonium	20.0 aq	2 (3.9)	0 (0.0)
Lanolin alcohol	30.0 pet	1 (2.0)	0 (0.0)
Others			
Nickel sulfate	5.0 pet	16 (31.4)	0 (0.0)
Gold sodium thiosulfate	2.0 pet	4 (7.8)	0 (0.0)
Cobalt chloride	1.0 pet	1 (2.0)	0 (0.0)
Potassium dichromate	0.5 pet	1 (2.0)	0 (0.0)
Carba mix	3.0 pet	1 (2.0)	0 (0.0)
Patients' products		15 (29.4)	11 (73.3)
Skin care		12 (23.5)	8 (66.7)
Cleanser		3 (5.9)	3 (100)

Abbreviations: pet, petrolatum; aq, aqueous.

in a tropical country.

The *Demodex* mite is responsible for the various dermatological presentations: rosacea-like demodicosis; seborrheic dermatitis-like eruption; perioral dermatitis-like lesions; and papulopustular or acneiform lesions[12]. A cross-sectional study by Phutthanuphapant *et al* revealed that the mean density of *Demodex* mite in facial dermatosis patients were 1.46 ± 3.78, which was significant higher than control (0.55±1.70). However, high number of *Demodex* was also found in healthy individual[13]. Demodicosis predominantly diagnosed in late 30's female having chronic intermittent course longer than a year which was supported by previous report from Taiwan[14]. Factors predisposing to demodicosis are primary or secondary immunosuppression[15]; however, the prior

use of TCS would not be expected to cause sufficient immunosuppression and leads to demodicosis. The ability for Thais to purchase corticosteroids over-the-counter may explain the association between ACD and demodicosis. The extent to which *Demodex* mites contribute to human inflammatory skin disease is controversial[16]; *Demodex* density tends to be higher when the local immune response is suppressed[14, 15]. The diagnoses of demodicosis may be obscured by other diagnoses, such as rosacea, seborrheic dermatitis, contact dermatitis, atopic dermatitis, steroid-induced dermatitis or primary irritation dermatitis[7,9,17].

The next most common cause of EFD in the authors' cohort was ACD. The most frequent clinically relevant PT was the patients' own cosmetic products, followed by preservatives and fragrances. The authors found fragrance mixes I and II very useful for detecting allergens by PT. We have previously described a high incidence of cosmetic allergy among Thais[18], and have identified preservatives and fragrances as the most common cosmetic allergens. In the present cohort, ACD was judged to be responsible for one-third of cases of EFD and was significantly associated with demodicosis (12.2%). It is likely that ACD arose first, and patients are predisposed to demodicosis as a result of easy acquiring over-the-counter TCS. The local immunosuppressive effect of TCS could lead to overgrowth of the *Demodex* mites. Nickel was the most common positive patch test allergen in the present study and certainly had past clinical relevance. Nickel could be the cause of ectopic contact dermatitis, however, we could not confirm the relationship with recent EFD of the patients.

The present study also found that seborrheic dermatitis and rosacea were often diagnosed in patients with EFD. Seborrheic dermatitis is a chronic and superficial inflammatory dermatosis of the skin, which reportedly affects between 1% and 3% of the US population[19]. Rosacea, presenting with erythema, telangiectasia, papules and pustules, typically affect Caucasian people with fair skin types[20]. Ultraviolet light plays a role in the onset of rosacea by increasing production of vascular endothelial growth factor, which has been implicated in the development of visible blood vessels[21]. The present finding that UV light had a substantial role in aggravating facial erythema concurs with investigators from Japan[22]. The majority of the patients with EFD had used TCS before attending the clinic. We found two cases of TCS-induced EFD in the present study. The adverse effects of corticosteroids include rosacea, pruritus, severe burning and severe erythema[23]. These findings suggest that TCS may also be an important etiologic factor in EFD.

A limitation of the present study was the selection bias. We recruited EFD cases from dermatologic patients at the University Hospital. Furthermore, we excluded the patients with lesions widespread other than the face and pregnant women. These factors made the results might not reflect the causes of EFD in general Thais population. Another limitation was the relatively short 1-month follow-up period, which made it difficult to establish course of the disease. Future study with longer follow-up duration should be done.

Conclusion

Erythematous facial dermatoses is a common dermatologic problem. Diagnosis and treatment is challenging. The authors found the most common causes of red face in Thais dermatologic patients in a University Hospital were demodicosis, allergic contact dermatitis, seborrheic dermatitis and rosacea, which may co-exist. To obtain the correct diagnosis and identify the optimum management strategy, the standardized skin surface biopsy technique or the potassium hydroxide preparation should be used to identify *Demodex* mites, and PT should be performed in selected cases, especially in cases of recurrent or persistent EFD or prolonged use of TCS. We encourage dermatologists treating Asian patients with EFD to be mindful of the alternative diagnoses to rosacea, and be aware that EFD could have more than one cause.

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What is already known on this topic?

Erythematous facial dermatoses is a common dermatological condition caused by various skin disorders and underlying systemic diseases such as atopic dermatitis, seborrheic dermatitis, contact dermatitis, rosacea, psoriasis, photodermatitis, corticosteroid misuse, perioral dermatitis, demodicosis, tinea faciei, dermatomyositis, cutaneous lupus erythematosus.

What is this study adds?

The most common causes of red face in Thais

dermatologic patients in a University Hospital were demodicosis, allergic contact dermatitis, seborrheic dermatitis and rosacea. More than one diseases were identified in nearly one-third of the patients. The standardized skin surface biopsy technique or the potassium hydroxide preparation should be used to identify *Demodex* mites, and patch testing should be performed in selected erythematous facial dermatoses patients, especially in cases of recurrent or persistent facial erythema or prolonged use of topical corticosteroids. Preservatives and fragrance were the most common cosmetic-related allergens, while the most frequent causative cosmetic product categories were skin care and cleanser.

Potential conflicts of interest

The authors declare no conflict of interest.

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