

Influence of peeling procedure in allergic contact dermatitis

JUNG EUN KIM, HYUN JEONG PARK, BAIK KEE CHO AND JUN YOUNG LEE

Department of Dermatology, St Mary's Hospital, College of Medicine,
Catholic University of Korea, Seoul, Korea

Background: The prevalence of allergic contact dermatitis in patients who have previously undergone peeling has been rarely studied.

Objectives: We compared the frequency of positive patch test (PT) reactions in a patient group with a history of peeling, to that of a control group with no history of peeling.

Patients/Methods: The Korean standard series and cosmetic series were performed on a total of 262 patients. 62 patients had previously undergone peeling and 200 patients did not.

Results: The frequency of positive PT reactions on Korean standard series was significantly higher in the peeling group compared with that of the control group ($P < 0.05$, chi-square test). However, the most commonly identified allergens were mostly cosmetic-unrelated allergens. The frequency of positive PT reactions on cosmetic series in the peeling group was higher than that of the control group, but lacked statistical significance. The frequency (%) of positive PT reactions on cosmetic series in the high-frequency peel group was higher than that of the low-frequency group, but lacked statistical significance.

Conclusion: It appears peeling may not generally affect the development of contact sensitization. Further work is required focusing on the large-scale prospective studies by performing a PT before and after peeling.

Key words: allergic contact dermatitis; patch test; peeling. © Blackwell Munksgaard, 2008.

Accepted for publication 20 August 2007

Chemical peeling, microdermabrasion and laser resurfacing have become popular methods of facial rejuvenation. Although we are fully aware of the persistent erythema, hyperpigmentation, and scarring that results after skin resurfacing, little attention has been paid to allergic contact dermatitis (ACD) after such procedures (1–3). Skin resurfacing results in a defect in the epidermal barrier, and in such situations, potential contact sensitizers such as fragrances, preservatives, or antibiotics have a greater opportunity to interact with the cutaneous immune system (4). Various pre- and post-peel managements increase the exposure to potential irritants or allergens, as do cleansers, sunscreens, emollients, and topical drugs (5, 6). Some reports in literature have documented a 4.8–65% rate of contact dermatitis (CD)

after carbon dioxide laser resurfacing (2, 4, 7–14). However, in most cases, a proper patch test (PT) was not performed, and even in those with a PT, the clinicians failed to show an allergen (2, 4, 7–14).

To our knowledge, this is the first comparative study designed to identify the prevalence of positive PT reactions after peeling. The patients were divided into 4 groups based on their individual peeling and CD history. PT was performed in all 4 groups to compare the frequency (%) of a positive PT reaction in each group. Correlation between the number of peelings (≥ 6 or < 6) and the frequency (%) of positive PT reactions and the relationship between the number of peelings and the total number of reactive allergens were measured.

Patients, Materials, and Methods

Study population

262 patients were recruited from those who visited our outpatient clinic between January 2001 and February 2003, and between June 2004 and February 2006, and were divided into 4 groups according to their peeling and CD history. 62 patients previously underwent a peeling procedure and 200 patients did not. Among the 62 patients with a peeling history, 37 had experienced CD. A history of CD was also noted in 172 patients from the 200 patients without a peeling history. The study was fully approved by the ethical committee of the Catholic University of Korea and an informed consent form was handed in by all patients. Previous peeling methods mainly consisted of superficial chemical peeling, laser resurfacing, and microdermabrasion, but a number of patients were unable to recall specific details, such as the type of laser or the percentage of glycolic acid that was used (Table 1). There were 5 males and 57 females in the peeling group and 16 males and 184 females in the control group. Their average age was 32.0 ± 8.9 years and 39.1 ± 14.3 years (mean $\pm$ SD), respectively.

Patch testing

PT was performed with the allergens from the Korean standard series, a variant of the European standard series, and the cosmetic series (Chemotechnique Diagnostics, Tygelsjö, Malmö, Sweden). Allergens were applied to the upper back for 2 days, using Finn Chambers (Epitest, Hyryla, Finland). Results were recorded according to the International Contact Dermatitis Research Group recommendations.

Statistical analysis

Statistical difference in the rate (%) of positive PT reaction between the 4 groups was calculated using the chi-square test. The SAS system for Windows V 8.01 was adopted to analyse the data. A *P* value of <0.05 was considered significant.

Table 1. Previous peeling methods in the peeling group

Peeling methods	Number of patients
Chemical peel	41
Dermabrasion	5
Laser	3
Chemical peel + dermabrasion	6
Chemical peel + laser	6
Dermabrasion + laser	1
Total	62

Results

PT results of Korean standard series

In the peeling group of 62 patients, 45 (72.6%) patients showed one or more positive patch reactions with the Korean standard series, whereas 115 (57.5%) out of 200 controls had a positive patch reaction. The peeling group showed twofold odds of a positive PT reaction compared with the control group [$P < 0.05$, chi-square test, odds ratio (95% confidence interval) = 1.957 (1.048–3.653)] (Table 2).

The frequency (%) of a positive PT reaction among patients with a history of CD ($n = 209$), with or without a peeling history was 70.3% (26/37) and 59.9% (103/172), respectively. The frequency (%) of a positive PT reaction in patients without a history of CD ($n = 53$), with or without a peeling history was 76.0% (19/25) and 42.9% (12/28), respectively. On the whole, there was no significant difference in the frequency of a positive PT reaction between the 4 groups ($P > 0.05$, chi-square test) (Table 2).

Among the patients with or without a history of peeling, nickel sulfate accounted for 32.3% (20/62) and 28.0% (56/200) of the reactions, respectively. Nickel was followed by potassium dichromate, cobalt chloride, thimerosal, and mercury ammonium chloride in the group with a history of peeling and CD (Table 3). The ranking of causative allergens was similar in the group lacking a peeling history to that of the group with a history of peeling.

PT results of cosmetic series

PT on the cosmetic series was performed in the patient group with a peeling history ($n = 41$) and without a peeling history ($n = 105$). In the peeling group, 15 patients (36.6%) showed 1 or more positive patch reactions with the cosmetic series, whereas 28 (26.7%) out of 105 controls had a positive patch reaction. The peeling group

Table 2. Comparative frequency of patch test (PT) reactions within the Korean standard series

	Positive % (number of positive cases/total)	
	Peeling history (+)	Peeling history (–)
Contact dermatitis (+)	70.3 (26/37)	59.9 (103/172)
Contact dermatitis (–)	76.0 (19/25)	42.9 (12/28)
Total	72.6* (45/62)	54.7* (52/95)

$P < 0.05$, chi-square test, odds ratio (95% confidence interval) = 1.957 (1.048–3.653).

*The odds ratio is 1.957, showing that the frequency of PT is more likely positive in the peeling group than control group.

Table 3. The ranking of the most common allergens among the Korean standard series in each group

Peeling history (+)		Peeling history (–)	
Contact dermatitis (+)	Contact dermatitis (–)	Contact dermatitis (+)	Contact dermatitis (–)
1 Nickel sulfate	Nickel sulfate	Nickel sulfate	Nickel sulfate
2 Potassium dichromate	Potassium dichromate	Mercury ammonium chloride	Cobalt chloride
3 Cobalt chloride	Thiuram mix	Thimerosal	Thimerosal
4 Thimerosal	Thimerosal	4-phenylenediamine	Mercury ammonium chloride
5 Mercury ammonium chloride	Mercury ammonium chloride	Potassium dichromate	Thiuram mix

showed a higher positive PT reaction ratio compared with the control group, but this lacked statistical significance ($P > 0.05$, chi-square test) (Table 4).

Frequency (%) of a positive PT reaction among patients with a history of CD ($n = 119$), with or without a peeling history was 38.5% (10/26) and 26.9% (25/93), respectively. Frequency (%) of a positive PT reaction in patients without a history of CD ($n = 27$), with or without a peeling history was 33.3% (5/15) and 25.0% (3/12), respectively. On the whole, there was no significant difference in the frequency of a positive PT reaction between the 4 groups ($P > 0.05$, chi-square test) (Table 4).

Among the cosmetic series allergens, octyl gallate showed the highest positive PT rate in patients with or without a history of peeling. In the peeling group, 4 (9.8%) out of 41 patients showed a positive patch reaction with octyl gallate, whereas 7 (6.7%) out of 105 controls had a positive patch reaction. The peeling group showed a slightly higher frequency of positive PT reactions compared with the control group on octyl gallate, but this also lacked statistical significance ($P > 0.05$, chi-square test) (Table 5).

Relationship between the frequency of peeling and the frequency (%) of positive PT reactions

The number of previous peeling episodes varied from 1 to as many as 144 (9.11 ± 19.12 , mean $\pm$ SD). The patient who had undergone 144 peeling episodes had received superficial chemical peeling

once a week for 3 years. Patients were divided into a high-frequency group (≥ 6) and a low-frequency group (< 6), regardless of the type of peeling that was performed. The frequency (%) of a positive PT reaction among patients with a history of CD was similar in the high-frequency group (71.4%) compared with the low-frequency group (69.6%) with the Korean standard series, and definitely higher in the high-frequency group (50.0% versus 27.8%) with the cosmetic series (Table 6).

On the other hand, patients without a history of CD showed a small increase in the frequency (%) of positive PT reactions between the high (≥ 6) and low frequency (< 6) groups. Overall, there was no statistical significant difference between the frequency of peeling and the frequency (%) of positive PT reactions ($P > 0.05$, chi-square test) (Table 6).

Relationship between the frequency of peeling and total number of reactive allergen

The number of peeling occurrences varied from 1 to 144 (9.11 ± 19.12 , mean $\pm$ SD) and the total number of reactive allergens with the Korean standard series and the cosmetic series ranged from 0 to 7. On the whole, there was no correlation between the 2 variables according to the Spearman correlation test ($r = 0.017$).

Discussion

Recently, the exposure of various contact allergens is increasing, and because peeling affects the skin barrier, subjects with a history of peeling may have a higher chance of contact sensitization. After peeling, the stratum corneum becomes

Table 4. Comparative frequency of patch test reactivity within the cosmetic series

	Positive % (number of positive cases/total)	
	Peeling history (+)	Peeling history (–)
Contact dermatitis (+)	38.5 (10/26)	26.9 (25/93)
Contact dermatitis (–)	33.3 (5/15)	25.0 (3/12)
Total	36.6 (15/41)	26.7 (28/105)

$P > 0.05$, chi-square test, odds ratio (95% confidence interval) = 0.593 (0.271–1.297).

Table 5. The ranking of the most common allergens among the cosmetics series

	Peeling history (+) ($n = 41$)	Peeling history (–) ($n = 105$)
1	Octyl gallate (9.8%)	Octyl gallate (6.7%)
2	Abitol (4.9%)	Parabens (4.8%)
3	Quaternium-15 (4.9%)	Tert-butylhydroquinone (4.8%)

Table 6. The frequency of positive patch test reaction between high-frequency group versus low-frequency group in peeling

Frequency of peel	Positive % (number of positive cases/total)			
	Contact dermatitis (+)		Contact dermatitis (–)	
	Korean standard series	Cosmetic series	Korean standard series	Cosmetic series
1–5	69.6 (16/23)	27.8 (5/18)	75.0 (9/12)	28.6 (2/7)
≥6	71.4 (10/14)	50.0 (4/8)	76.9 (10/13)	37.5 (3/8)
Total	(25/37)	(9/26)	(19/25)	(5/15)

thinner and shows enhanced desmosomal breakdown on ultrastructural observations (15–17). Protein and messenger RNA expression of tumour necrosis factor- α (TNF- α) and interleukin-1 α in murine epidermis was significantly increased after glycolic acid application (17). TNF- α and interleukin-1 α appear to be of prime importance in contact sensitization. They facilitate Langerhans' cell migration and hyperresponsiveness in allergen-induced contact sensitization (18). These previous findings support the hypothesis that peeling may increase the risk of ACD.

In this study, PT reaction positivity on the Korean standard series was significantly higher in the patient group with a peeling history than that of the control group. Because patients who are receiving peeling therapy usually show more interest in cosmetics and accessories than patients who do not, it is likely that they are more frequently exposed to piercing and metal-containing makeup products such as eyebrow pencils, eye shadow, mascara, and nail varnish. This may explain the peeling group's higher PT reaction positivity to cosmetic-unrelated allergens (e.g. nickel, cobalt chloride, and mercury compounds).

We postulated an increase of sensitization to cosmetic allergens in the patient group after various pre- and post-peel managements. The frequency of PT reaction positivity on cosmetic series in the peeling group was twofold higher than that of the control group, but lacked statistical significance. Considering that patients who take so much care in performing peeling may be more careful in choosing mainly dermatology-prescribed cosmetics with a lower allergenic potential, this may influence the PT positivity results.

We expected that frequent peeling could affect PT results in our study. On the contrary, there was no relation between the frequency of peels and the frequency (%) of positive PT reactions or the total number of positive PT results. Although the frequency of a positive PT reaction in the high-frequency peel group was higher than that of the low-frequency peel group, these results were not statistically significant. However, before investigating the relationship between the frequency of

peelings and PT positivity, it is noteworthy to point out that the number of allergens tested was limited in that the cosmetic series does not include the allergens that might mostly be responsible for the new allergies acquired after the peeling process such as other sunscreens, topical antibiotics, and antivirals. Thus, it is possible that the high-frequency peel group may show more frequent-positive PT reactions if a wider variety of cosmetic series tests are carried out on a larger number of participants.

Ideally, a PT should be carried out before and after peeling, as well as at the point when CD is suspected to demonstrate the 'exposure–effect relationship' between peels and sensitization. However, this is not usually applicable to clinical practice.

In summary, it appears that peeling may not generally affect the development of contact sensitization. However, this study has some limitations, mostly stemming from its small sample size and retrospective design. Though the induction and elicitation of ACD is affected by peeling, we could not completely exclude the possibility that several biases, including a small sample size, might influence the results.

Future studies should be designed as large-scale prospective-controlled studies, with a PT being performed before and after peeling in a larger number of participants.

References

1. Perkins S W. Complications of chemical face peeling: prevention and management. *Facial Plast Surg* 1995; 11: 39–46.
2. Tina S A, Jason R L. Prevention and treatment of side effects and complications of cutaneous laser resurfacing. *Plast Reconstr Surg* 2002; 109: 308–316.
3. Sabini P. Classifying, diagnosing, and treating the complications of resurfacing the facial skin. *Facial Plast Surg Clin North Am* 2004; 12: 357–361.
4. Nanni C A, Alster T S. Complications of carbon dioxide laser resurfacing. An evaluation of 500 patients. *Dermatol Surg* 1998; 24: 315–320.
5. Eun H C, Kwon O S, Seo K I, Youn C S, Han W S, Suh D H. Review of the patch test results in patients with the cosmetic CD. *Korean J Dermatol* 1999; 37: 1009–1016.

6. Hunter D, Frumkin A. Adverse reactions to vitamin E and aloe vera preparations after dermabrasion and chemical peel. *Cutis* 1991; 47: 193–196.
7. Fitzpatrick R E, Goldman M P, Satur N M, Tope W D. Pulsed carbon dioxide laser resurfacing of photo-aged facial skin. *Arch Dermatol* 1996; 132: 395–402.
8. Bernstein L J, Kauvar A N, Grossman M C, Geronemus R G. The short- and long-term side effects of carbon dioxide laser resurfacing. *Dermatol Surg* 1997; 23: 519–525.
9. Alster T S. Cutaneous resurfacing with CO₂ and erbium: YAG lasers: preoperative, intraoperative, and postoperative considerations. *Plast Reconstr Surg* 1999; 103: 619–632.
10. Ratner D, Tse Y, Marchell N, Goldman M P, Fitzpatrick R E, Fader D J. Cutaneous laser resurfacing. *J Am Acad Dermatol* 1999; 41: 365–389.
11. Lowe N J, Lask G, Griffin M E. Laser skin resurfacing. Pre- and posttreatment guidelines. *Dermatol Surg* 1995; 21: 1017–1019.
12. Alster T S, Nanni C A. Complications of cutaneous laser surgery. In: *Carbon Dioxide Lasers in Facial Aesthetic and Reconstructive Surgery*, Biesman B S (ed.): Baltimore, Williams and Wilkins, 1999.
13. Nanni C A. Handling complications of laser treatment. *Dermatol Ther* 2000; 13: 127.
14. Alster T S. Side effects and complications of laser surgery. In: *Manual of Cutaneous Laser Techniques*, 2nd edition, Alster T S (ed.): Philadelphia, Lippincott Williams and Wilkins, 2000.
15. Horikoshi T, Matsumoto M, Usuki A et al. Effects of glycolic acid on desquamation-regulating proteinases in human stratum corneum. *Exp Dermatol* 2005; 14: 34–40.
16. Song J Y, Kang H A, Kim M Y, Park Y M, Kim H O. Damage and recovery of skin barrier function after glycolic acid chemical peeling and crystal microdermabrasion. *Dermatol Surg* 2004; 30: 390–394.
17. Jeong S K, Ko J Y, Seo J T, Ahn S K, Lee C W, Lee S H. Stimulation of epidermal calcium gradient loss and increase in TNF-alpha and IL-1alpha expressions by glycolic acid in murine epidermis. *Exp Dermatol* 2005; 14: 571–579.
18. McFadden J P, Basketter D A. Contact allergy, irritancy and 'danger'. *Contact Dermatitis* 2000; 42: 123–127.

Address:

Jun Young Lee, MD, PhD
Department of Dermatology
College of Medicine
Catholic University of Korea
St Mary's Hospital
62 Youido-dong
Yongdeungpo-gu
Seoul 150-713
Korea
Tel: +82 2 3779 1230
Fax: +82 2 783 7604
e-mail: jylee@catholic.ac.kr