

The Effect of Chemical Peeling on the Dermal Connective Tissue in Facial Wrinkles of Patients with Leprosy

Hyang Joon Park, M.D., Sung Yul Ahn, M.D.* Jong Pill Kim, M.D**.

Department of Dermatology, School of Medicine, Dankook University, Cheonan, AnY Aesthetic Plastic Surgery & Dermatology Clinic, Seoul, Korean Hansen Welfare Association, Euiwang**, Korea*

Background : Redundant and wrinkled face is a common finding in patients with long-standing leprosy, which is responsible for the appearance of premature aging. Chemical peeling plays a role in dermal regeneration in the treatment of wrinkles. However, the effect of chemical peeling has rarely been studied in patients with leprosy.

Objective : To investigate the effect of chemical peeling on dermal connective tissue components and clinical improvement of facial wrinkles in patients with leprosy.

Methods : Five patients with clinically and bacteriologically inactive lepromatous leprosy were treated with 70% glycolic acid plus 35% trichloroacetic acid (GA-TCA). Histologic and clinical changes were evaluated at 0 and 90 days postpeel.

Results : Histologically, collagen fibers and ground substance increased significantly but elastic fibers did not change at 90 days postpeel. Clinically, fine wrinkles improved considerably, whereas most deep wrinkles remained unchanged at day 90.

Conclusion : This study demonstrates that chemical peeling with GA-TCA, or medium-depth peeling, causes an increase in collagen and ground substance but not in elastic fibers. These changes result in limited clinical improvement in the facial wrinkles of leprosy patients. Therefore, medium-depth chemical peeling may be insufficient to improve the premature aging appearance in patients with leprosy. (Ann Dermatol 14(3) 153~157, 2002).

Key Words : Collagen, Elastic fiber, Ground substance, Medium-depth chemical peeling, Wrinkle

Heavy infiltration of the facial skin with lepromatous granulomas stretches the skin and destroys the fiber system of the skin. Later, when the granulomas decrease with treatment of the disease, the stretched facial skin does not shrink back and the redundant skin is accommodated by folding and wrinkling giving a premature senile appearance to the face¹. This premature senility of the face, or sagging face, causes distress to the patients and they have intense aspirations toward correction of

the problem. There are a lot of corrective methods for this problem, one of which is chemical peeling. The mechanism of action in chemical peeling is destruction of the epidermis and dermis with subsequent reepithelization from epidermal appendages and new dermal connective tissue formation. The result is an overall rejuvenation and improvement in surface topography²⁻⁴.

This study was undertaken to investigate the effect of medium-depth chemical peeling on facial wrinkles in leprosy patients through histologic change of the dermal connective tissue with clinical evaluation.

MATERIALS AND METHODS

Patients

Five patients with lepromatous leprosy(4 fe-

Received February 25, 2002.

Accepted for publication June 17, 2002.

Reprint request to : Hyang Joon Park, M.D., Department of Dermatology, School of Medicine, Dankook University, 16-5, Anseodong, Cheonan, Chungcheong Nam Do, 330-715, Korea
Tel. (041)550-3967, Fax. (041)562-6542

Fig. 1. (A) Dermal depth at day 0. (B) Increased dermal depth and more deeper staining at day 90 in the same patient (Masson's trichrome, $\times 40$).

Fig. 2. Ground substance at day 0 (A) and at day 90 (B) showing deeper staining than (A) in (B) (Alcian blue, $\times 40$).

Table 1. Measurement of dermal thickness (mean \pm SD, μm)

Patient No	at day 0	at day 90
1	500 \pm 28	900 \pm 0
2	800 \pm 0	1050 \pm 71
3	550 \pm 71	1200 \pm 0
4	450 \pm 71	950 \pm 71
5	650 \pm 71	1050 \pm 71
average	590 \pm 139	1030 \pm 116
NC*	1500 \pm 108	

* normal control

Table 2. Evaluation of the amount of ground substance*

Patient No	at day 0	at day 90
1	\pm /+	++
2	\pm /+	++
3	+	++/+++
4	\pm /+	+ / ++
5	\pm /+	++

* evaluated by strength of stainability

\pm : scanty, +: low, ++: moderate, +++: high

Fig. 3. Elastic fibers in the papillary dermis at day 0 (A) and at day 90 (B) showing no apparent ne elastogenesis (Verhoeff's elastic stain, $\times 200$).

Fig. 4. Clinical views of prepeel(A,C) and postpeel evaluated as good(B) and partly fair(D).

Table 3. Clinical evaluation at day 90 postpeel

Patient No	fine wrinkles	deep wrinkles
1	fair	no response
2	fair	no response
3	good	fair(partly)
4	fair	no response
5	fair	no response

males, 1 male), ranging in age from 45 to 68 years, participated in the study. All of them were considered to be inactive clinically and bacteriologically. No patient had previous treatment to the face. A written informed consent was obtained from each patient.

Treatment

All patients were treated with tretinoin cream (Agina, 0.025%) nightly for 3 weeks prior to the chemical peeling. The entire face was cleaned preoperatively with cleanser to degrease the skin. Seventy percent GA was applied for 3 minutes then neutralized with sodium bicarbonate solution. Thirty five percent TCA was then applied to the entire face using cotton-tipped applicators until a uniform white frost was achieved. This was followed by iced water soaks for 30 minutes.

Histologic and clinical evaluations

Punch biopsies (3mm) were taken from the face at 0 and 90 days postpeel. To evaluate histologic changes, the biopsied specimens were stained with H&E, Verhoeff's elastic stain, Masson's trichrome stain, and alcian blue stain. The depth of dermis and the amount of collagen, elastic fibers and ground substance were compared between pre- and post-peel specimens. We measured the thickness of the dermis from the basement membrane zone to the level of the sweat glands using a micrometer, and the measurement was done at two randomly selected sites on each section. As a control of dermal thickness, biopsy specimens were obtained from the faces of 4 women in a similar age range to the patients. Clinical improvement was assessed by two independent dermatologists using photographic analysis as to fine and deep wrinkles, and was described as grades: no response, fair, good, and excellent.

Statistical analysis

Data on dermal thickness were assessed using the paired t-test and considered statistically significant when $p < .05$.

RESULTS

In prepeel specimens, both epidermis and dermis were thin and dermal components such as collagen, elastic fibers and ground substance were scanty or absent. In the upper dermis, moderate to severe elastotic changes were also seen. At day 90, the epidermis was mildly hyperplastic and the dermis was thickened (Fig. 1, Table 1). The mean dermal thickness increased significantly from $590\mu\text{m}$ of prepeel to $1030\mu\text{m}$ of postpeel ($p < 0.05$). However, there was still a significant difference from mean

dermal thickness of controls ($1500\mu\text{m}$, $p < 0.05$). The amount of collagen stained with Masson's trichrome stain and ground substance stained with alcian blue stain increased remarkably as compared to the prepeel (Fig. 2, Table 2), but no differences were noted in elastic fibers between postpeel and prepeel (Fig. 3).

Clinically, fine facial wrinkles improved from fair to good in all patients. However, deep wrinkles and redundancy seen in the upper lip, nasolabial region and mental area remained unchanged in most patients at day 90 (Fig. 4, Table 3).

DISCUSSION

It is well known that chemical peeling induces new collagen synthesis and ne elastogenesis and stimulates the accumulation of ground substance^{3,5}. Stegman⁶ observed a normal appearing zone developed where the papillary dermis usually is found after chemical peeling in a healthy man with a sun-damaged face. He referred to it as the expanded papillary dermis or the Grenz zone. In addition, a band of thick amorphous tissue developed in the middle to upper dermis during the later stages of healing. It was referred to as a dermal scar, in which a large amount of dark brown staining fibers and glycosaminoglycan were present^{6,7}. In our study, collagen and ground substance increased but a 'Grenz zone' and a 'dermal band', in other words, ne elastogenesis was not observed in postpeel specimens. This may be due, in part, to the agent and method used in the study, namely 35% TCA without occlusion. Both Brody and Stegman noted the development and thickness of the Grenz zone and dermal scar increased with the strength of the wounding agents, specifically TCA, unoccluded full strength phenol, Baker's phenol solution, Baker's phenol under occlusion, and dermabrasion^{6,9}. In fact, the zone and the band were only faintly present in the TCA peel^{4,7}. Another possible explanation is that because most patients had suffered from lepromatous leprosy for a very long period of time, destruction of dermal tissue was too extensive to regenerate by medium-depth chemical peeling. Some studies on extracellular matrix changes in leprosy showed the presence of antibodies to collagen and elastic microfibrils in the sera of patients with leprosy^{10,11}. So, the destruction of the dermis resulted not only from the in-

flammatory process of the disease but also from antibodies to the components of the dermis. The state of elastic tissue in patients with leprosy may not be unlike in cutis laxa¹⁰. Collagen and ground substance, in contrast to elastic fibers, showed an increase at 90 days postpeel, but the amount seemed to be less in degree than that of other previous reports conducted in normal subjects^{3-5,12,13}.

Clinically, fine facial wrinkles were improved a little more than deep, redundant wrinkles. Fine wrinkling is usually attributed to senile process or actinic injury¹⁴. Elastotic changes seen in prepeel specimens may be more severe than in senile and actinic changes: however, its correlation with leprosy has not yet been known. As our patients were in the 5th and 7th decades of life, it was not unusual to expect lepromatous facial skin manifesting both redundancy and wrinkling. The improvement of fine wrinkles in the patients may be related to an increase of collagen and ground substance as evidenced by the significant increase and deeper stained dermis in postpeel specimens. The effect on the epidermis and elastotic change was not remarkable. It is ground substance that controls the tone and turgor of the skin through its water-binding capacity, which in turn alleviates wrinkled appearance¹⁴.

In conclusion, it is unlikely that medium-depth chemical peeling with GA-TCA would be beneficial for the management of redundant and deeply wrinkled skin in patients with leprosy as it resulted from a decrease in the amount of elastic tissue rather than elastotic changes. Therefore, to correct premature senility in the face of patients with leprosy, more radical methods such as deep phenol peeling, dermabrasion or a face lift may be necessary.

ACKNOWLEDGEMENT

The present research was supported by the research fund of Dankook University in 2000.

REFERENCES

1. Hasting RC. Leprosy. 2nd ed. New York, Churchill Livingstone, 1995, pp411-447.
2. Piacquadio D, Dobry M, Hunt S, Andree C, Grove G, Hollenbach KA. Short contact 70% glycolic acid peels as a treatment for photodamaged skin. *Dermatol Surg* 22: 449-454, 1996.
3. Becker FF, Langford FRJ, Rubin MG, Speelman P. A histologic comparison of 50% and 70% glycolic acid peels using solutions with various pHs. *Dermatol Surg* 22: 463-465, 1996.
4. Tse Y, Ostad A, Lee HS, et al. A clinical and histologic evaluation of two medium-depth peels. *Dermatol Surg* 22: 781-786, 1996.
5. Newman N, Newman A, Moy LS, Babapour R, Harris AG, Moy RL. Clinical improvement of photoaged skin with 50% glycolic acid. *Dermatol Surg* 22:455-460, 1996.
6. Stegman SJ. A comparative histologic study of effects of three peeling agents and dermabrasion on normal and sundamaged skin. *Aesth Plast Surg* 6: 123-135, 1982.
7. Brody HJ. Chemical peeling. St. Louis, Mosby Year Book, 1992, pp7-22.
8. Brody HJ. Variations and comparisons in medium-depth chemical peeling. *J Dermatol Surg Oncol* 15: 953-963, 1989.
9. Brodland DG, Cullimore KC, Roenigk RK, Gibson LE. Depths of chemoexfoliation induced by various concentrations and application techniques of trichloroacetic acid in a porcine model. *J Dermatol Surg Oncol* 15: 967-971, 1989.
10. Enna CD, Moschella SL, Delgado DD, Dyer R. Redundant and wrinkled facial skin in lepromatous leprosy. A correlation of clinical and histopathological findings. *Int J Lepr* 42: 297-302, 1974.
11. Antunes SLG, Gallo ME, Almeida SMR, Mota E, Pelajo M, Lenzi HL. Dermal extracellular matrix in cutaneous leprosy lesions. *Int J Lepr* 67: 24-35, 1999.
12. Coleman III WR, Futrell JM. The glycolic and trichloroacetic acid peel. *J Dermatol Surg Oncol* 20: 76-80, 1994.
13. Brody HJ, Hailey CW. Medium-depth chemical peeling of the skin: A variation of superficial chemosurgery. *J Dermatol Surg Oncol* 12: 1268-1275, 1986.
14. Obagi ZE: Obagi Skin Health Restoration and Rejuvenation. New York, Springer-Verlag, 2000, pp1-14.