

ARTIFICIAL LICHENIFICATION PRODUCED BY A SCRATCHING MACHINE*

CAPT. RAYMOND W. GOLDBLUM, MC AND LT. COL. WILLIAM N. PIPER, MC

Lichenification is a term employed to describe cutaneous changes produced by trauma, most commonly scratching and rubbing. To most dermatologists, lichenification means a mosaic thickening of the skin in patches. In primary lichenification, the changes are produced in structurally normal skin. In secondary lichenification, the changes are produced in skin with a pre-existing disease such as eczema. Ormsby (1) stated, "That scratching alone is not responsible for lichenification is evident by the numerous examples of both local and general pruritus in which scratching is liberally practiced without the production of lichenification." There is, therefore, some other factor or cutaneous susceptibility which induces the thickening and other changes when traumatized.

Brocq (2) maintained the view that the condition occurs in neurotic persons and that excessive indulgence in condiments, tea, coffee, alcohol and tobacco is a contributing factor in the causation of the eruption. Ehrmann (3) believed that the condition was directly related to functional disturbances of the gastrointestinal tract and that malfunction, especially of the pancreas, played an important role in its causation. Spiethoff (4) made analyses of gastric juice in a number of patients and found marked deviations from the normal in the hydrochloric acid content, but he did not attribute the eruption itself to disorders of gastric function.

Ehrmann (3) in 1923 and Wise (5) in 1925 emphasized the role played by anaphylaxis in the causation of the eruption and the fact that a certain proportion of the patients also had some other atopy.

These experiments were performed on the premise that all patients will lichenify if enough pressure is applied over a long period of time.

METHODS

Selected patients were instructed as to the purpose of this experiment so that we could obtain maximum co-operation. The patients were scratched with a "scratching machine" (6) for one hour daily on the left side of the back, 1 to 2 inches below the inferior costal margin. The area was marked with 1 per cent aqueous gentian violet so that the same area would be scratched daily. The weight used on the scratching arm was the maximum weight that the patient could tolerate without producing uncomfortable burning or excoriations of the skin. The machine was watched constantly so that the scratching arm would not leave the chosen area, since patients will move when lying in this position for a period of one hour. The patients were scratched one hour daily until there were visible signs of lichenification. Biopsies were obtained of normal and scratched skin and the sections were stained with hemotoxylin and eosin.

* From the Department of Dermatology and Syphilology, Army Medical Service Graduate School and the Walter Reed Army Medical Center, Washington, D. C.

Received for publication August 27, 1953.

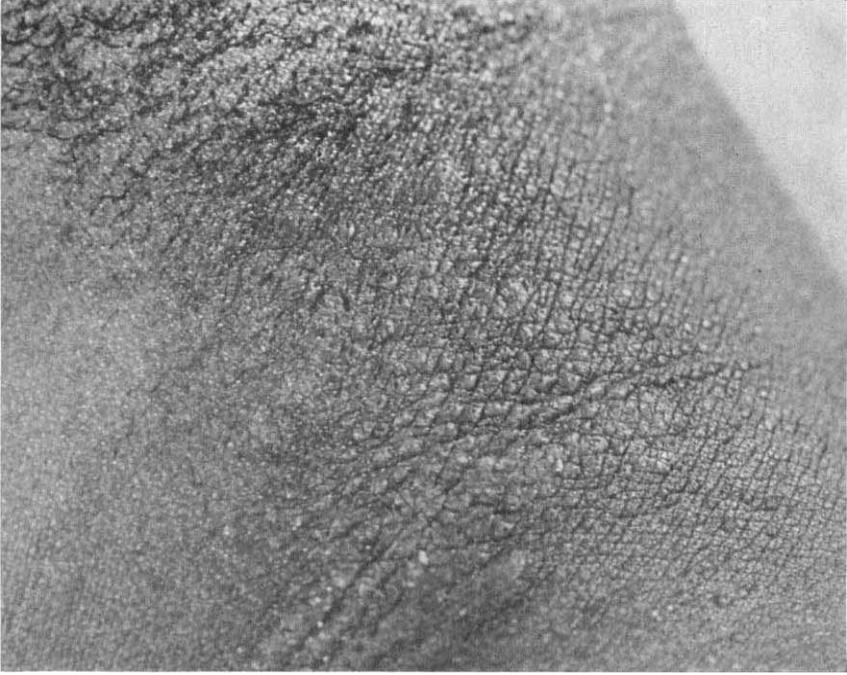


FIG. 1. Area of lichen simplex chronicus on neck



FIG. 2. Area of lichenification produced by scratching machine on back of same patient.

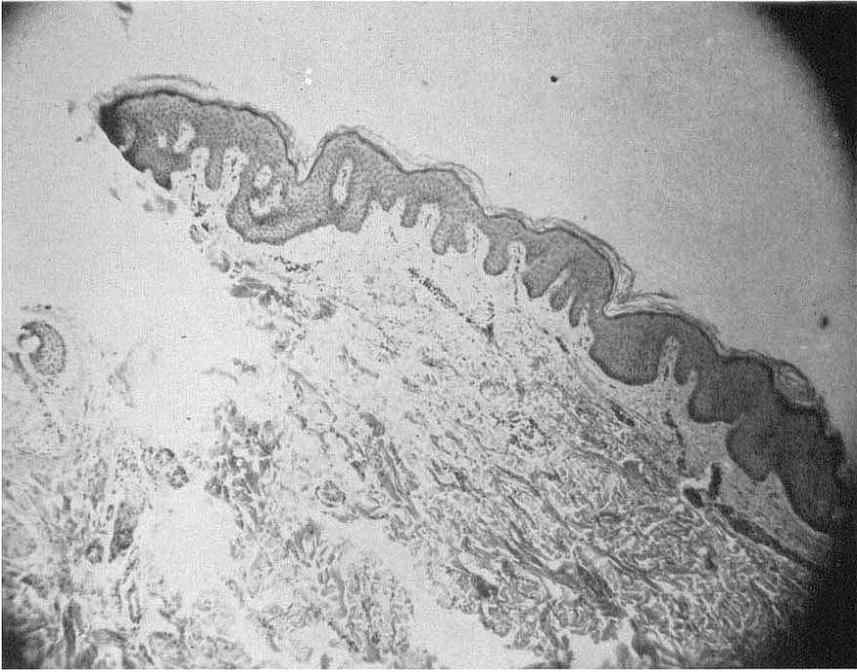


FIG. 3. Photomicrograph of scratched area showing lichenification

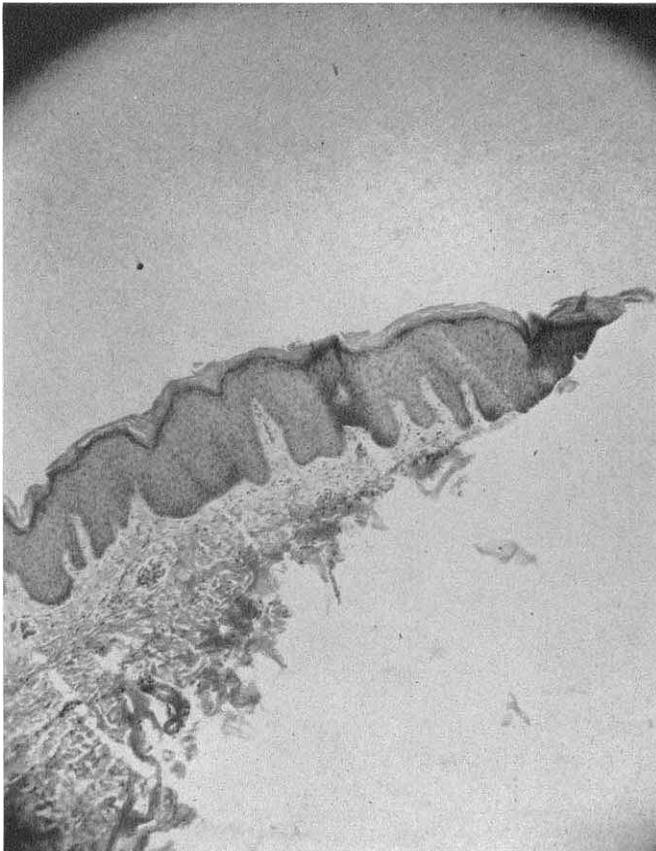


FIG. 4. Photomicrograph of normal area. Note small area of lichenification on right produced by scratching.

RESULTS

Case I. This 27-year-old Negro male had a five-year history of recurrent localized neurodermatitis on the nape of the neck (Fig. 1), the inner aspects of the thighs and the scrotum. There was no history of atopy in the patient or his family. The patient was scratched with the scratching machine for 30 days (1 hour per day—140,000 scratches—79 grams of weight). The patient did not experience any itching sensation during or after the period of scratching. The skin became hyperpigmented after six days of scratching. After 11 days, visible lichenification (Fig. 2) of the scratched area was noted. After 30 days, a biopsy of normal (Fig. 3) and abnormal skin (Fig. 4) was obtained and the histopathology of the scratched area revealed hyperkeratosis, acanthosis, clubbing of the rete pegs and a small amount of perivascular lymphocytic infiltrate.

Case II. This 38-year-old Negro male had a five-month history of infectious eczematoid dermatitis with a sensitization phenomenon. The patient was well controlled with antibiotics administered locally and systemically. The patient was scratched for 95 days over a normal appearing portion of skin (1 hour per day—400,000 scratches—75 grams of weight). The patient had a slight burning sensation during the scratching, but had no pruritus. He became hyperpigmented on the scratched area after three hours of scratching (1 hour per day). After 95 days of scratching, the patient had no visible signs of lichenification. On palpation the skin did not feel indurated or infiltrated. A biopsy was

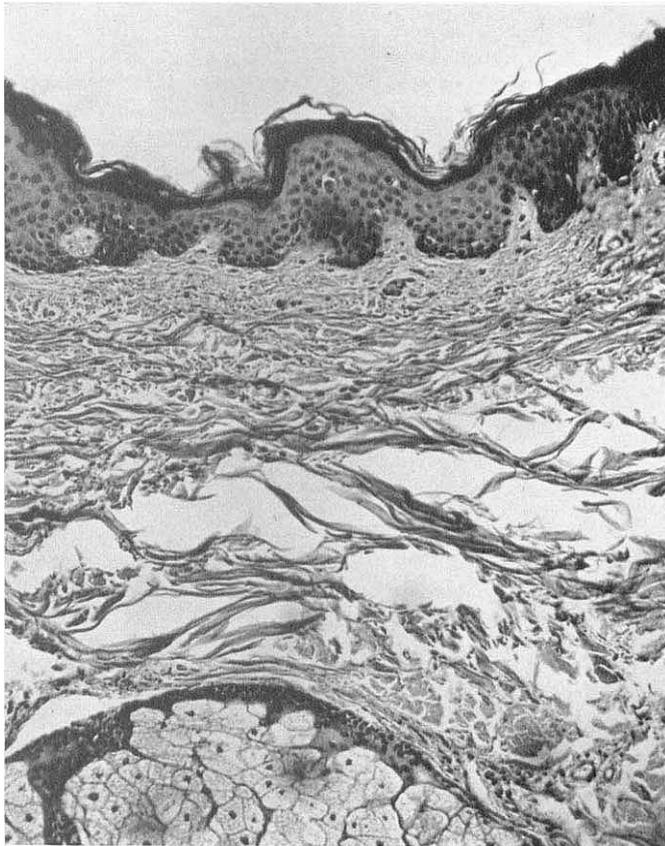


FIG. 5. Photomicrograph of normal skin

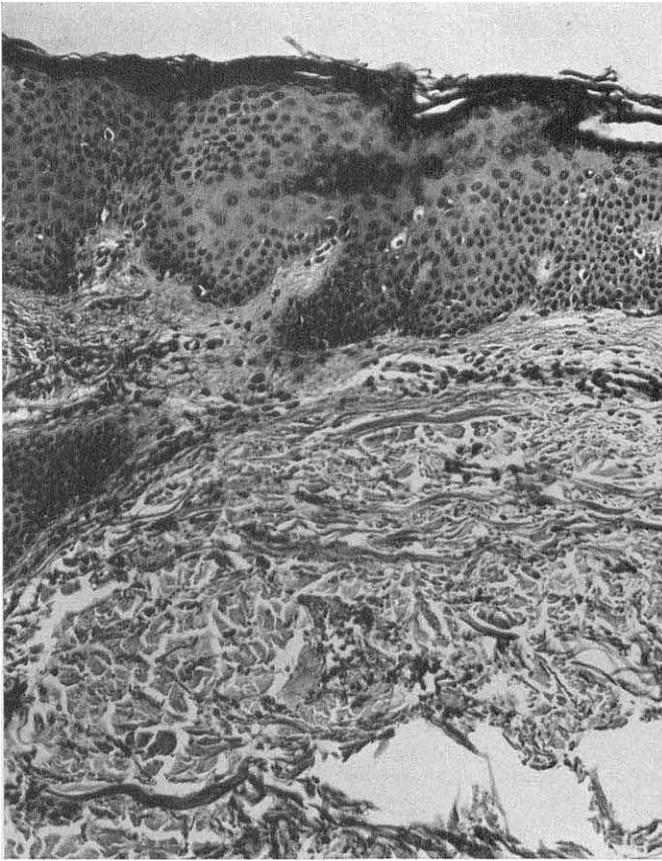


FIG. 6. Photomicrograph of scratched area showing lichenification. Note minimal perivascular infiltrate.

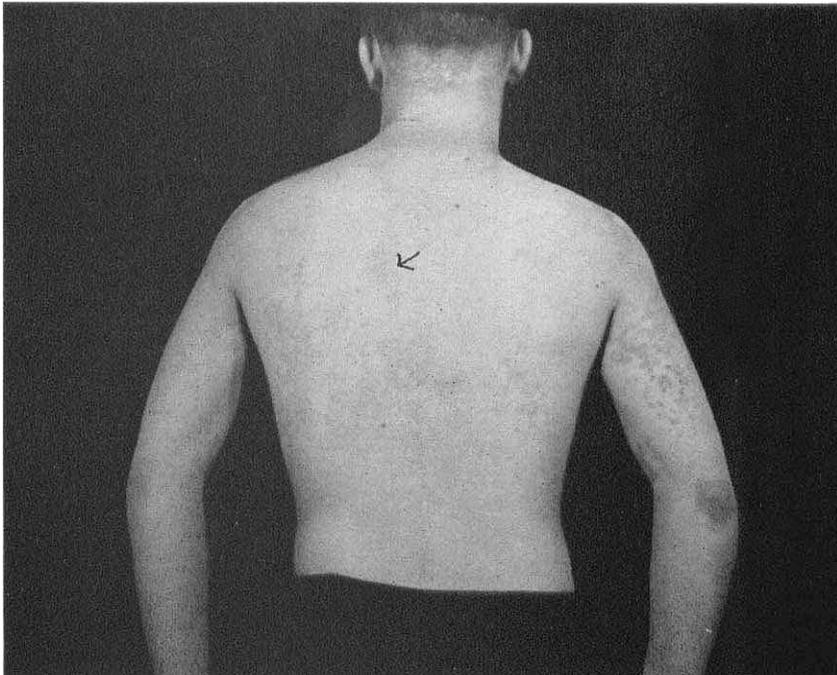


FIG. 7. Patient with pityriasis rubra pilaris before treatment with vitamin A. Arrow points to scratched area.

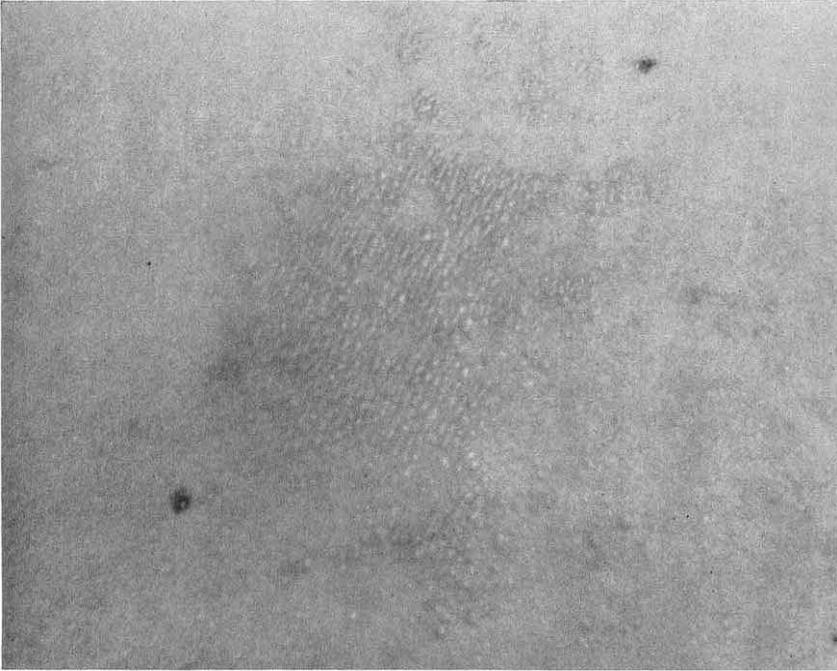


FIG. 8. Diffuse papules produced by scratching clear area of skin on patient with pityriasis rubra pilaris.

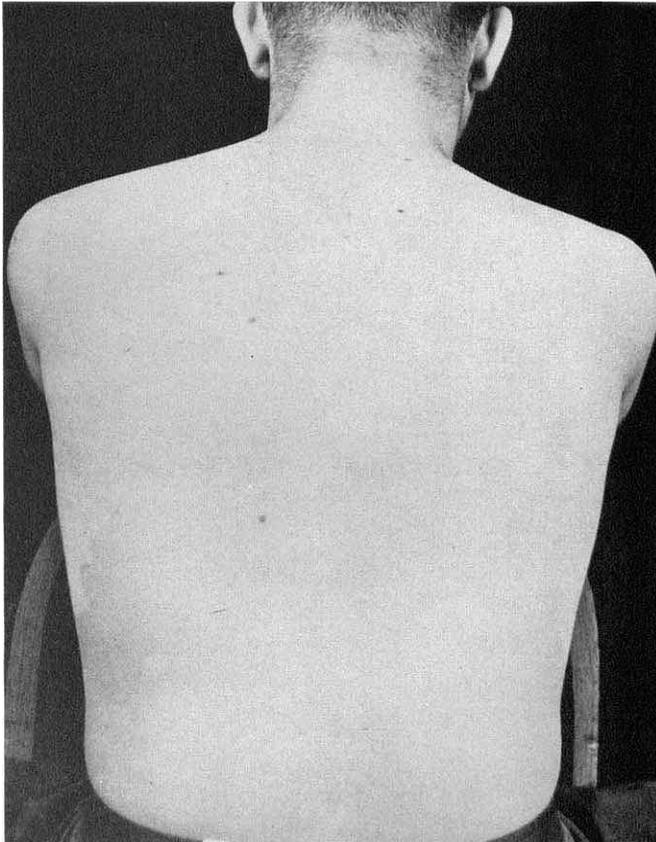


FIG. 9. Patient with pityriasis rubra pilaris after treatment with vitamin A

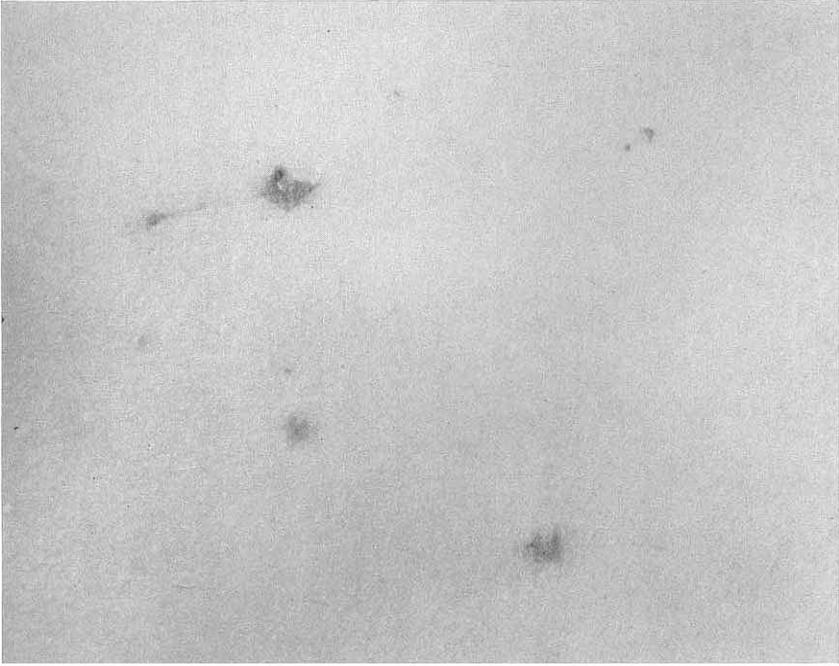


FIG. 10. Scratched area after 10 days of vitamin A administration. Erythematous and scaling papules could not be produced in spite of vigorous scratching which was able to excoriate skin.

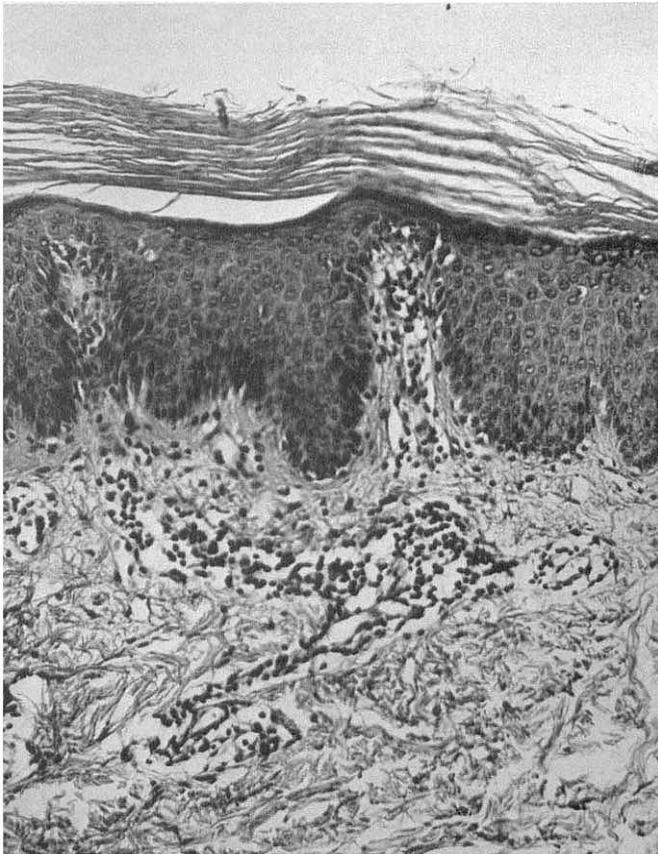


FIG. 11. Photomicrograph of involved skin from patient with pityriasis rubra pilaris.



FIG. 12. Photomicrograph of section of skin from scratched and normal areas. Note lichenification on left which stops abruptly in normal part of section.



FIG. 13. Scratched area of skin. Note excoriation produced by scratching machine. Skin does not appear lichenified, but biopsy revealed considerable acanthosis.



FIG. 14. Photomicrograph of normal skin

taken from the scratched area (Fig. 6) and a normal area (Fig. 5) of skin. The biopsy revealed hyperkeratosis, acanthosis, clubbing of the rete pegs and a slight perivascular lymphocytic infiltrate, which was diagnostic of lichenification.

Case III. This 23-year-old white male had a diagnosis of pityriasis rubra pilaris (Fig. 7) of six months' duration. The patient had no treatment before the scratching was begun. He was scratched for 63 days (1 hour per day—325,000 scratches—75 grams of weight). The patient had slight burning, but no pruritus during scratching. The patient developed skin changes similar to his disease (Fig. 8), which were erythematous follicular papules. After 30 days of scratching, the patient was administered 100,000 units of aqueous vitamin A, intramuscularly. In 10 days the follicular papules on the scratched area, as well as in the involved areas subsided (Fig. 9) considerably. In spite of continuous scratching, the papular element was not prominent while the patient was administered vitamin A (Fig. 10). When the vitamin A was discontinued for one week the area that was being scratched returned to the original state. A biopsy was taken of the normal and scratched skin (Fig. 12), as well as the originally involved skin (Fig. 11).

Case IV. This 27-year-old Negro male had a four-year history of localized neurodermatitis of the extensor surfaces of the arms and legs. There was no history of atopy in the patient or his family. He was scratched for a period of 66 days (1 hour per day—280,000 scratches—75 grams of weight). The patient had neither pruritus nor burning during the scratching. The patient had visible hyperpigmentation in the area after

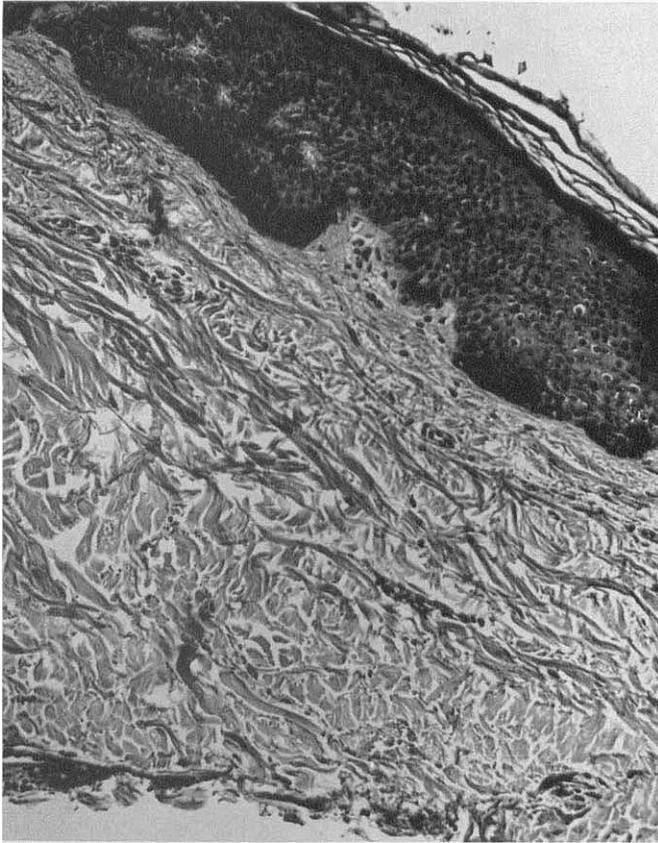


FIG. 15. Photomicrograph of scratched skin. Note hyperkeratosis, acanthosis, clubbing of rete pegs and minimal changes in the dermis.

three hours of scratching over a period of three days. After 20 days the area was indurated (Fig. 13) and there were slightly increased skin markings. A biopsy was performed on the normal (Fig. 14) and on the scratched skin (Fig. 15). The scratched area revealed hyperkeratosis, acanthosis, papillomatosis, clubbing of the rete pegs and a slight perivascular infiltrate of lymphocytes in the upper corium.

DISCUSSION AND CONCLUSIONS

Two colored patients with localized neurodermatitis were scratched with a scratching machine with a measured number of strokes and controlled pressure. Visible pigmentation appeared after three hours of scratching over a period of three days. This appeared to be caused by the pressure during scratching. Inflammation, which is stimulated by scratching may have played a minor function since very little inflammation was produced.

Lichenification was produced in 60 to 90 hours of scratching with a pressure of 75 grams with a minimum of 140,000 scratches. Whether the lichenification was produced by pressure or inflammation is not known. It is most likely a product of both inflammation and pressure, since neither pressure nor inflammation alone will produce lichenification.

Even when the skin appeared normal except for hyperpigmentation after 60 days of scratching, the biopsy revealed rather marked lichenification. This is interesting since most dermatologists do not expect to find acanthosis unless increased skin markings are observed. These changes are not like callosities since there is not only hyperkeratosis, but there is acanthosis.

In the colored male with an infectious eczematoid dermatitis and sensitization phenomenon without any evidence of lichenification, the scratched area of skin was lichenified. It may be that the sensitization phenomenon increased this patient's susceptibility to lichenification. He could not be tested for his ability to lichenify after his dermatitis subsided.

One patient with pityriasis rubra pilaris developed an area of erythematous papules in the scratched area, which was clinically similar to the eruption over other portions of his skin. The microscopic findings in the scratched area were those of lichenification and not like pityriasis rubra pilaris since there was no parakeratosis, follicular hyperkeratosis and liquefaction degeneration of the basal cells. Vitamin A was administered while he was still being scratched. In two weeks the papules and erythema on the scratched areas, as well as on the involved area of skin, subsided, so that the areas had only slight scaling, erythema and most of the papules disappeared. It is known that pityriasis rubra pilaris will respond to large doses of vitamin A administration. Flesch reported decreased scaling in patients who were administered vitamin A, and he expressed the opinion that vitamin A had a drug effect and not a vitamin effect on keratinization. When the vitamin A was discontinued for one week, the original eruption returned in the scratched skin, as well as the previously involved skin. This may lend additional evidence as to the role of vitamin A in keratinization.

At present, further studies on the ability to lichenify are being evaluated in both normal humans and patients with associated skin conditions such as atopic dermatitis and psoriasis.

SUMMARY

A study of artificial lichenification produced by a scratching machine in patients with localized neurodermatitis, infectious eczematoid dermatitis and pityriasis rubra pilaris is presented. The significance of these findings is discussed.

REFERENCES

1. ORMSBY, O. S.: Neurodermatitis and lichenification, *Penna. M. J.*, **36**: 4, 1933.
2. BROCC, L.: Habits and nervous balance in dermatology, *Medicine*, **5**: 11, 1926.
3. EHRMANN, S.: Neurodermatitis, its relation to eczema and to diseases of internal organs, *Med. Klinik*, **21**: 10, 1925.
4. SPIETHOFF, B.: Variation in hydrochloric acid content after test breakfast, *Munchen. Med. Wehnschr.*, **70**: 2, 1923.
5. WISE, F. AND RAMIREZ, M. A.: Protein sensitization in pruritus with lichenification, *Arch. Dermat. & Syph.*, **11**: 6, 1925.
6. GOLDBLUM, R. W. AND PIPER, W. N.: Scratching machine to study mechanical trauma on skin, *In Press*.