

ALLERGIC SENSITIZATION OF THE SKIN AND NAILS TO ACRYLIC PLASTIC NAILS

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IN RECENT months there has been made available plastic material which can be fashioned into artificial "finger-nails" that are advertised "for those who want long nails." In addition, the plastic nails may be used by persons who wish to disguise dystrophic or diseased nails or who wish to discourage nail, biting. This plastic material is essentially the same as that used in acrylic dentures, and is marketed as a liquid monomer and powder polymer. The liquid monomer is methyl methacrylate, and the powder is polymethyl methacrylate. One manufacturer claims that the material is completely harmless. However, other manufacturers warn that allergic reactions to this material may be encountered.

The acrylic liquid and powder used in artificial "nails" do not require heat for polymerization, but will polymerize and harden at room temperature. These self-curing acrylic resins are created by inducing polymerization of the mixture of methyl methacrylate monomer and polymethyl methacrylate powder with an organic peroxide and an accelerator or promoter. The self-cured resins are not quite as hard as those resins polymerized at high temperature, and they normally contain a somewhat higher residual monomer content than do the heat-cured resins. Nevertheless, these acrylic resins can be fashioned to form excellent plastic nails which remain intact for several weeks.

In a previous communication,¹ one of us (A.A.F.) pointed out that methyl methacrylate liquid monomer is a potent sensitizer and can cause allergic contact type of eczematous reactions on the skin and the oral mucosa. When the plastic acrylic "nails" became available, we predicted that allergic reactions to this material would occur. In a short time we were able to observe four cases of allergic eczematous contact reactions of the skin, onychial, and paronychial tissues due to acrylic plastic "nails." Some of the reactions were rather severe and painful and caused nail changes which lasted for several months. In each case, we were able to prove that it was the liquid monomer that was the sensitizing agent. The powder polymer was inert, allergically speaking.

CASE REPORTS

CASE 1. One of the authors (H.G.) a 34-years old man, had applied acrylic plastic "nails" to four of his fingers to cover a long standing onychodystrophy due to *Trichophyton rubrum*. These plastic "nails" were reapplied at two-week intervals. After the fourth application a severe itching sensation was noted in the interdigital webs. This was soon followed by a marked edema of the paronychial tissue and severe subungual throbbing and pain.

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Immersion of the fingers in ice water relieved the swelling and pain somewhat, but it was impossible to remove the plastic nail mixture. Vesiculation of the sides of the fingers was observed the following day. One percent hydrocortisone ointment relieved the severe itching of the fingers and the webs. The severe onychial and paronychial pain persisted for forty-eight hours and necessitated the use of analgesics.

Patch tests with the liquid monomer revealed a very strong reaction within two hours, consisting of marked edema and vesiculation. Patch testing with the polymer showed no reaction. Patch testing of the monomer on four controls showed no reaction.

The paronychial swelling subsided in about ten days. The affected nails remained tender and brittle for two weeks and then returned to their original onychodystrophy.

Two months later, when this sensitized physician attempted to patch test one of his patients with the acrylic monomer, he immediately felt an itching sensation in the finger webs and developed a mild contact dermatitis of the finger, despite the fact that he took precautions not to come in actual contact with the acrylic monomer. The monomer is somewhat volatile, so that actual contact with the liquid substance itself is apparently not necessary to cause reaction in highly sensitive persons. The vapor emanating from an open bottle of acrylic monomer was capable of causing dermatitis in this sensitized person.

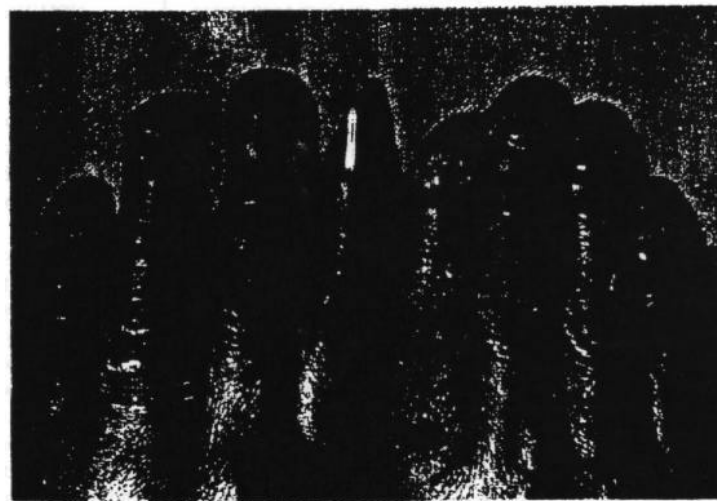


Fig. 1. Residual dystrophy three months after first and only application of acrylic nail plastic: Both thumbnails (not shown), all the nails of the right hand and the left third and fifth fingernails remained dystrophic. The left second fingernail did not have any plastic applied. The left fourth fingernail shows approximate condition of all the nails before the acrylic plastic had been applied.

CASE 2. - A 40-year-old woman applied acrylic plastic to nine of her nails because the nails were short, and broken off at the distal ends. Forty-eight hours later, marked swelling and pain of the paronychial and subungual tissues occurred. A dermatitis appeared on the dorsa of the affected fingers. Fig. 1 shows the condition of the nails three months after the acrylic

material had been applied. The left index finger had always been normal and no plastic had been applied. The left fourth finger, which apparently had been least affected, shows the best recovered' and portrays the approximate condition of the nails before the application of the acrylic plastic. The other nails, including those of the thumbs, show a marked dystrophy and moth-eaten appearance of the nail plate. Almost complete lysis of the affected nail plate had occurred. The dorsal aspect of some of the fingers shows a healing scaling dermatitis. Scraping of the nails revealed no evidence of fungi. The patch test with acrylic monomer was strongly positive. The polymer produced no reaction.

CASE 3. - A woman, aged 30 years, was employed as a demonstrator for the application of acrylic plastic nails." Her own nails were normal. For four months she applied the material to her own nails and instructed others on how to make the applications. At the end of this four-month period she suddenly developed redness and itching about the nails, and a severe paronychia developed. A vesicular dermatitis of the right cheek and eyelids also became evident. The distal portion of the nails separated slightly from the nail bed. One month later the nails had returned to normal. Patch test with the acrylic monomer was strongly positive.

CASE 4. - A 26-year-old woman was also employed as a demonstrator for the application of acrylic plastic "nails." Her own nails had always been considered normal. She would demonstrate the use of the acrylic "nails" by applying the plastic to her own nails. At the end of the two-month period she developed itching and a vesicular dermatitis of the tips of the fingers. The following day a moderately severe paronychia developed on those fingers that she used for demonstration purposes. She avoided further contact with the acrylic plastic material. The finger dermatitis and the paronychia subsided within three weeks. Patch testing with the acrylic monomer showed a strongly positive reaction. The polymer produced no reaction.

COMMENT

In this series of cases, all four patients reacted strongly to the acrylic liquid monomer on patch testing. We had previously shown that this substance is not a primary irritant and that a positive patch test usually means clinical hypersensitivity. None of the patients studied were hypersensitive to the polymer powder. This agrees with our previous findings with regard to the acrylic polymer used in dentures.

It should be noted that in Cases 3 and 4 the patients had normal nails originally. Both had been employed as demonstrators of this method of applying 'artificial nails.' One became sensitized in two months, the other in four months. The nail changes in these two patients were not severe, and restitution to normal took place in three weeks. The first patient was a physician with onychomycosis who had a very painful reaction and had become sensitized within a two-month period. The onychomycosis itself was not affected by the allergic reaction. It should be noted that the second patient showed symptoms within forty-eight hours after the first application of the acrylic plastic. Apparently she somehow had previously become sensitized to this material. Severe nail changes were still present three months after the initial application of the acrylic material. None of the paronychia reactions became pustular or required incisions.

"Pre-use" patch testing, except possibly in the second case, would not have revealed allergic sensitivity since the sensitivity developed only after the use of the

material for from two to four months. Spealman and associates² state that the monomer methyl methacrylate has been shown to have a sensitizing index of 30 percent. We have not attempted to confirm this statement, but we agree that the monomer is a potent sensitizer and frequently may cause clinical symptoms. We also found that the completely polymerized acrylic material, such as heat-cured acrylic dentures and Lucite or Plexiglass, is apparently inert.^{1,3} MacKay,⁴ who used acrylic implants for repairing cranial defects, considers acrylic plastic substances to be "biologically entirely inert and innocuous." We believe that this statement is correct, provided that the acrylic plastic is cured by heat and complete polymerization takes place so that no residual monomer remains. If a method could be devised for curing acrylic "nails" by heat, we believe that such nails would not sensitize or cause clinical symptoms.

It is interesting, at this point, to compare the clinical picture caused by acrylic plastic material used on the nails with that caused by "undercoat" plastic. In 1948 and 1949 several reports of nail changes were published showing the effects of the application of a plastic consisting of phenol formaldehyde and synthetic rubber to the nails. This combination of plastics, which was applied to allow better adherence of nail polish and to prevent flaking and chipping, was called a plastic nail "undercoat."

Fig. 2 compares in table form the salient features of reactions due to acrylic plastic applied to the nails with those due to the phenol formaldehyde synthetic rubber nail "undercoat"

REACTION	ACRYLIC PLASTIC "NAILS"	PHENOL FORMALDEHYDE AND SYNTHETIC RUBBER NAIL "UNDERCOAT"
Paronychia	Always present and usually severe	Infrequent
Dermatitis	Fingers, face, and eyelid dermatitis may be present	Not reported
Subungual hemorrhage and nail discoloration	None	Frequently Present
Residual nail dystrophy	Disfigurement of nail may continue for several months	Restitution to normal usually in two months, but the changes may continue much longer
Subjective symptoms	All cases had severe onychia and paronychia pain	Most cases symptomless, but some with very severe and painful onychia and paronychia

Fig. 2. Comparison between reactions to acrylic plastic "nails" and plastic nail "undercoat."

It will be noted from Fig. 2 that the reactions from the acrylic are much more frequently drastic and tend to be of longer duration than those reported from the nail "undercoat." There were no permanent nail changes from the nail "undercoat."

Further observation will be necessary to determine whether the majority of the nail changes due to acrylic plastics will be of very long standing or even of a permanent nature.

Another type of disturbance of the nail and nail bed was described by Frumess, Lewis and Henschel.⁷ They described one case with symptoms similar to those caused by the "undercoat." The cause of the disturbance in their case was the application of artificial fingernails which contained nitrocellulose and was applied with an adhesive substance containing cellulose nitrate dissolved in butyl acetate and an unidentified plasticizer. These authors felt that there was a close relationship between the nail disorder due to "base coat" and that described in their report.

SUMMARY AND CONCLUSIONS

Four cases of onychia, paronychia, and dermatitis are reported which followed the application of acrylic plastic material to the nails. The plastic consists of a liquid monomer and a powder polymer. Patch tests revealed that all four cases showed a marked allergic reaction to the acrylic liquid monomer (methyl methacrylate). None reacted to the powder polymer (polymethyl methacrylate). The acrylic monomer is essentially the same as that used in dentistry and is a potent sensitizer. When sensitization occurs, severe onychia and paronychia occur and dystrophic nail changes may persist for several months. Diagnostic features of the reactions due to acrylic monomer are compared with those due to phenol formaldehyde rubber resin nail "undercoat."

Some patients followed for three months after the application of the acrylic plastic to the nails still showed dystrophic nail changes. Further observation will be necessary to determine whether these changes are temporary or permanent.

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