

Nail damage from gel polish manicure

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Summary

Manicures can result in nail damage via instrumentation, nail polish, nail polish removers, and artificial nails. We report nail weakness, brittleness, and thinning in five subjects after the application of a new manicure system called gel polish and removal with acetone and manual peeling. All subjects complained that the polish was very difficult to remove and that their nails became much thinner after the procedure. Pseudoleukonychia and onychoschizia lamellina were noted on examination. One subject underwent ultrasound and reflectance confocal microscopy (RCM) measurements of nail plate before and after the gel polish application, which showed thinned nail plate (0.063 vs. 0.050 cm and 0.059 vs. 0.030 cm, respectively). Overall, we call attention to the adverse effects of gel polish manicures in five subjects. In addition, our case illustrates potential utility of ultrasound and RCM in measuring nail plate thickness.

Keywords: nail, nail care, nail cosmetics, nail disorders, nail polish, nail varnishes

Aims

- Little is known about the potential adverse effects of a novel gel polish manicure system. We observed a rising number of patients presenting with complaints of nail brittleness and thinning after such gel polish manicure.
- This study provides subjective and objective insights into this increasingly popular manicure system showing a reduction in the nail thickness using reflectance confocal microscopy and ultrasound.

Background

Changes in the nail as a result of manicures can be caused by instruments, nail polish, nail polish removers, or artificial nails. We report five cases of nail weakness, brittleness, and thinning from a new manicure system

called gel polish, currently marketed under the following brands: Shellac, Gelish, Axxium by OPI, Calgel, Akzentz, Dashing Diva Gelife, IBD, and Bio Sculpture Color Gel. The gel polish is typically applied in a salon by a nail technician. The application involves a base coat that is cured under a UV lamp, two layers of a proprietary nail polish, and a top coat. During the curing process with a UV lamp, the manufacturer states that solvents evaporate and tiny “tunnels” form in the layer of polish, connected by acetone-dissolvable polymers. When the polish is removed with acetone, the removal solvent is advertised to easily penetrate the polish because of these tiny tunnels, thereby dissolving the polymers, with remainder bits of polish easily wiped away.

Materials and Methods

Five women aged 28–59 years (average, 36.4 years) presented to our institution with nail complaints from gel polish (Shellac and OPI Axxium). Clinical examination revealed severe pseudoleukonychia as a result of superficial nail plate desquamation and severe

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onychoschizia lamellina. All subjects reported that the gel polish was difficult to remove. Their nails had to be soaked in the acetone for 10–15 min, and in some cases, the polish had to be manually peeled off. All subjects complained that their nails became noticeably thinner after the manicure. To objectively evaluate the impact of gel polish system on nail thickness, one of the authors (A.C.) underwent evaluation of her nails before and after a gel polish manicure with ultrasound and reflectance confocal microscopy (RCM).

Ultrasound

For ultrasound evaluation, vertical cross-sectional images of the left thumb nail were obtained with an IU22 Philips machine, with a L15-7 hockey probe transducer. An experienced musculoskeletal ultrasound technician measured the thickness of the nail plate in three different locations along the long axis of the nail. The average of the three measurements was calculated.

Reflectance confocal microscopy

A commercially available RCM (Vivascope® 1500, Lucid Inc., Rochester, NY, USA) was used to visualize nail plate anatomy. RCM has an 830-nm diode laser beam as the light source and is increasingly utilized in the evaluation of skin, including melanocytic, vascular, and inflammatory lesions.¹ In this study, RCM automated stepper z-axis stack was used to evaluate and calculate the nail plate thickness. Z-axis stack captures a series of grayscale images ($500 \times 500 \mu\text{m}$ field-of-view) at different depths within an area of interest. The images were taken from the top of the nail plate through the nail bed of the left thumb. The top of the nail plate (most dorsal aspect) was marked by the presence of bright onychocytes, and the junction between the ventral aspect of nail plate and the nail bed was marked by the first appearance of longitudinal alternating dark and light ridges on RCM. Nail plate thickness was calculated from differences in vertical depths between the two landmarks by a single experienced clinician.

Results

Both ultrasound and RCM showed thinning of the nail plate after gel polish manicure. On ultrasound, the left thumb nail had an average thickness of 0.063 cm before the application and 0.050 cm after the removal (Fig. 1a,b). On RCM, the left thumb nail had a thickness of $588.90 \mu\text{m}$ (0.059 cm) before application and

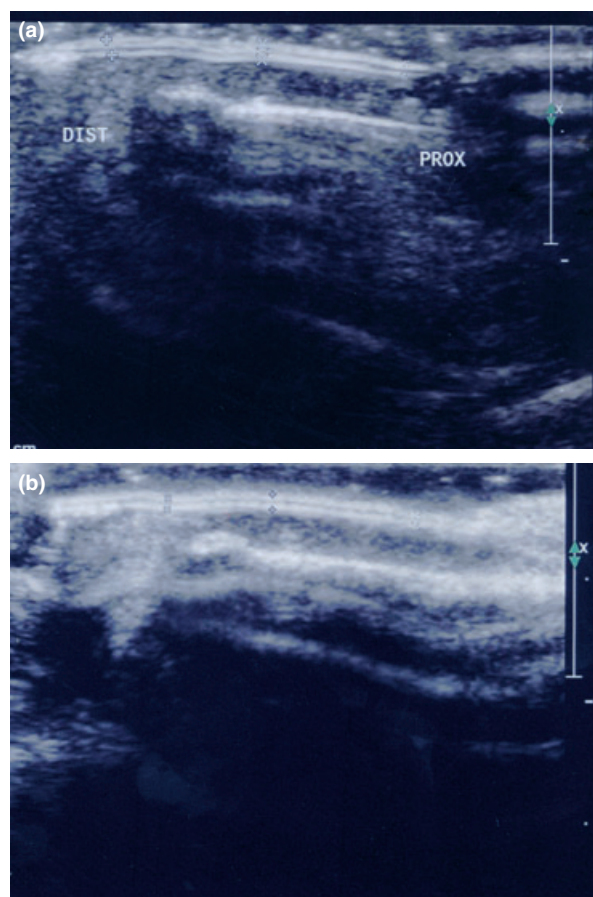


Figure 1 (a) Ultrasound of the left thumb nail before gel polish manicure, in which the nail thickness was found to have an average thickness of 0.063 cm. (b) Ultrasound of the left thumb nail after gel polish manicure, in which the nail thickness was found to have an average thickness of 0.050 cm.

$298.57 \mu\text{m}$ (0.030 cm) after removal of the gel polish system.

In all subjects, the clinical appearance of the nails improved with time. Pseudoleukonychia resolved in approximately 3 weeks in A.C. (Fig. 2). Onychoschizia and subjective brittleness were still present 5 weeks after removal.

Conclusion

Gel polish is a novel manicure system gaining popularity. Shellac is the leading brand launched in May 2010 by Creative Nail Design. The marketed benefit of Shellac is that it gives a 2-week perfect manicure and then can be removed easily without damaging the natural nail plate. The three different coats of polish contain numerous chemicals in addition to the proprietary formula



Figure 2 After gel polish manicure, pseudoleukonychia and onycholysis lamellina was observed.

Table 1 Ingredients of shellac manicure system from MSDS sheets provided by Creative Nail Design⁷

Base coat	Color coat	Top coat
Proprietary formula	Proprietary formula	Proprietary formula
Acetone	Butyl acetate	Cellulose acetate butyrate
Ethanol		Aliphatic urethane methacrylate oligomer
Butyl acetate		Di-hexamethylhexyl dicarbamate Tetrahydrofurfuryl monomethacrylate Butyl acetate Ethyl acetate Ethyl trimethylbenzoyl phenylphosphinate CL 60730 (ext. violet 2)

(Table 1). Many of these have been shown to cause nail damage as well as contact dermatitis, including acetone, butyl acetate, and acrylates.² Additionally, chemicals used to remove the nail coatings may cause paronychia and onychodystrophy, including onycholysis, trachyonychia, brittleness, and dryness.^{2,3} It is likely that the general public is not aware of such potential adverse effects. Ours is the first report of observed clinical effects of gel polish manicure system on nail plate.

We found that the gel polish system caused both subjective and objective signs of nail thinning. Both the application and removal process likely lead to exfoliation of the superficial nail plate as evident by subjective reduction in nail strength. In one subject, we were able to measure nail thickness using two noninvasive

techniques, ultrasound and RCM, before and after the manicure. We found considerably decreased nail plate thickness after the manicure. While the measurements obtained by ultrasound and RCM were different, we believe that RCM provided more precise measurements of nail thickness, as ultrasounds require manual measurements. Interestingly, the measurements of nail plate thickness we obtained are similar to those previously reported using noninvasive techniques.^{4–6} Our measurements of the healthy nail prior to manicure were greater than those reported by Mogensen *et al.*⁴ using high-frequency ultrasound, but were within the normal range as reported by Cecchini *et al.*⁵ in their analysis of normal nail anatomy using ultrasound. Individual variability of nail plate thickness as well as operator-dependent differences in ultrasound technique likely attributed to such small differences.

Overall, we hope that this report raises the awareness of potential adverse effects of the gel polish system on nail health. A patient presenting for advice about various manicures may be advised that the gel polish may lead to thinner and more brittle nails, especially when the general public may have the misconception that the gel polish system can strengthen nails. It is unclear whether the changes in nail plate are related to the chemicals present in the gel polish or to the physical and chemical aspect of the removal process (e.g., mechanical peeling, soaking with acetone). Regardless, it is important to advise patients of potential damages to nail plate, particularly those patients with existing nail pathologies.

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