Cosmetologists

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1 Core Messages

- Various nail cosmetic techniques are described as well as the chemical ingredients that are found in nail products.
- It is estimated that 6–13% of the adverse reactions to cosmetics relate to nail polish, and most of these reactions are attributed to toluene sulfonamide formaldehyde resin (TSFR), a polymer resin that is used to improve nail adhesion and gloss.
- Manicurists should be aware of the potential occupational hazards of allergic contact dermatitis and sensitization on the hand from sculpturing the not-yet-hardened resin with a file. Nail-elongating chemicals are reported to cause allergic contact dermatitis.
- Other health effects from nail salon chemical exposure include occupational asthma, pulmonary edema, and mucosal irritation of eyes, mouth, and throat.
- Prevention strategies and good work practices can reduce the risk of harming effects on cosmetologists.

2 Introduction

The term "cosmetologist" includes beauty-shop operators, hair stylists, beauticians, and manicurists (Adams 9). Aestheticians and tanning-salon operators are also under the jurisdiction of the cosmetic regulatory authority in one state in the United States (written communication, D.M. Williamson 1998). Cosmetologists' work may include skin care; giving facials; "beautifying" the face, upper body, and arms by using cosmetics; removing hair; applying makeup; and massaging, cleaning, or stimulating the skin by using the hands or appliances (The Barbering and Cosmetology Act of California). In some instances, a cosmetologist may perform several services, e.g., grooming the hair, giving facials, and applying makeup. This section will discuss manicurists, while barbers and beauty shop operators are discussed in ▶ Chaps. 121, "Barbers' Dermatoses (Barber's Hair Sinus)" and ▶ 163, "Hairdressers".

3 Manicurists

Manicurists (nail technicians) give manicures, caring for the hands and fingernails while also performing pedicures. Professional nail care is popular, with more than 114,000 licensed manicurists in California as of 2007 (Sheriff 2008).

Reports document adverse reactions to nail cosmetics among consumers and clients as well as among manicurists. Although Hemmer et al. (1996) considered operators applying acrylic nails to be at lower risk than their clients, we agree with Guin et al. (1998) that this needs to be proved. Of 22 patients with ACD attributed to contact with (meth)acrylate nails, Spencer et al. (2016) found 12 of 22 cases to be consumers of (meth)acrylate nails without relevant occupational exposure. Reviewing cosmetics used for manicures and nail care allows us to identify the hazardous exposures for this occupation. These cosmetics include nail-polish removers, cuticle removers, nail or cuticle creams, nail hardeners, nail polish (nail enamel or lacquers), and artificial nails (nail-elongating cosmetics).

3.1 Nail Cosmetics

In the 5-year study of contact dermatitis conducted by the North American Contact Dermatitis Group, 5.4% of the cases were caused by cosmetics. Nail cosmetics ranked fourth, causing 8% of these reactions (Adams and Maibach 1985).

3.2 Nail-Polish or Nail-Enamel Removers

Nail-polish and nail-enamel removers contain the following ingredients:

1. Solvent mixture: acetone, butyl acetate, ethyl acetate, ethoxyethanol, and MEK (methyl ethyl ketone)
2. Lipid: castor oil and lanolin oil
3. Color
4. Fragrance

Nail-polish removers are mildly irritating to the skin, but minimum precautions ameliorate this problem. The literature does not reveal a significant incidence of allergic reactions, and undiluted product patch testing is not recommended. In instances where ingredients are to be tested, the following concentrations are suggested (de Groot et al. 1994):

1. Acetone, 10% in olive oil
2. Butyl acetate, 25% in olive oil
3. Ethyl acetate, 10% in petrolatum
4. MEK, as is

3.3 Cuticle Removers or Softeners Are Dilute Alkaline Solutions

Cuticle removers or softeners contain the following ingredients:

1. Water
2. Softening agent: sodium hydroxide, potassium hydroxide, triethanolamine, and trisodium phosphate
3. Thickener: sorbitol and methyl cellulose
4. Fragrance

Cuticle removers may be irritating if used improperly, but they have a short contact time and do not appear to be important allergens. They should not be tested in a closed patch test. There is report of a manicurist who developed dermatitis on her hand from an allergy to an orangewood stick, an instrument used during a manicure to push back the softened cuticle (Brun 1978). Cuticle removers should not be confused with cuticle creams, which are used as emollients between manicures. There are also nail moisturizers used to prevent brittleness and splitting (Engasser 1997).

3.4 Nail Polish (Nail Enamel, Nail Lacquer, Nail Varnish)

Nail polishes, including base coats and top coats, are usually of similar composition, containing some or all of the following types of ingredients: (Schlossman 1980; Schoon 1998)

1. Film formers or polymers: nitrocellulose forms a hard, strong film that does not adhere well and is inelastic.
2. Polymer resins: tosylamide/formaldehyde resin, alkyd resins, acrylics, vinyls, polyesters, aryl-alkylsulfonyl urethanes, glyceryl tribenzoate, and tosylamide epoxy resin. These improve adhesion and gloss. Tosylamide/formaldehyde resin is the official name for toluene sulfonamide formaldehyde resin (TSFR), used in labeling cosmetics. In California, toluene is a restricted substance listed in that state's Proposition 65, and this may have prompted the official name change (Schlossman and Wimmer 1992).
3. Plasticizers, including: camphor; dibutyl, dioctyl, and diphenyl phthalate; tricresyl and triphenyl phosphate; and glyceryl triacetate. These improve film flexibility (Schlossman 1979; Schlossman and Wimmer 1992).
4. Solvents and diluents, including ethyl, butyl, and isopropyl alcohol, butyl, ethyl, and amyl acetate, and toluene. These improve the viscosity.

5. Colorants (organic dyes) must be approved by the Food and Drug Administration (FDA) in the United States. So-called cream enamels contain insoluble organic dyes and titanium oxide or iron oxide; a few soluble organic dyes are used to tint "colorless" polishes. The nacreous pigments guanine, bismuth oxychloride, or mica are added to pearlized polishes.
6. The suspending agent stearalkonium hectorite prevents settling of the pigments.

It is estimated that 6–13% of the adverse reactions to cosmetics relate to nail polish, and most of these reactions are attributed to TSFR (Hausen et al. 1995). Samplings of 20 brands of polish sold in Europe in 1995 showed that all contained TSFR at 0.08–11.0% concentrations, and 14 brands had detectable formaldehyde levels, which varied from 0.02% to 0.5% (Sainio et al. 1997). So-called "hypoallergenic" brands generally eliminate this ingredient, but the resulting nail polishes have not been as satisfactory because they chip more readily. Recently, a major manufacturer has reformulated its nail polishes, eliminating TSFR, toluene, and dibutyl phthalate and utilizing glyceryl tribenzoate and glyceryl triacetate without sacrificing durability (Levy, 1994, personal communication). Top coats may contain UV-absorbing material, such as benzophenones to prevent photodamage to colors. Some top coats are not traditional evaporative coatings but UV-cured acrylate oligomer blends that act as protective shields (Schoon 1998).

Allergies to nail polish are frequently ectopic, appearing at sites away from the hands and nails, such as the eyelids, lips, or neck. In an interesting report (Liden et al. 1993), 18 patients who were suspected of occupational contact dermatitis proved instead to be allergic to TSFR in nail polish. This article stated that 17 of the 18 patients with patch-test positive reactions to TSFR were positive on testing the dry nail polish itself. There have been rare reports of reactions to other allergens in nail polish, e.g., nitrocellulose (Castelain et al. 1997), methyl acrylate (Kanerva et al. 1995), and benzalkonium (Guin and Wilson 1999).

3.4.1 Patch Testing

The following components of nail polishes may be patch tested:

Nail polish may be patch tested as is, open, or closed (after thorough drying)
Tosylamide formaldehyde resin, 10% in petrolatum
Nitrocellulose, 10% in isopropyl alcohol
Dibutyl phthalate, 5% in petrolatum
Formaldehyde, 1% aqueous
Methyl acrylate, 1.5% in petrolatum
Benzalkonium chloride, 0.01–0.1% aqueous (0.1% is a marginal irritant)
Guanine, as is

3.5 Nail Hardeners

There are two types of hardeners. One contains free formaldehyde, commonly responsible for irritant and allergic reactions; these hardeners are only sold periodically when popular (Norton 1991). In the United States, FDA regulations require that they contain no more than 5% formaldehyde, have a protective shield for the nail, be applied only to the free end of the nail, and be labeled with warnings of side effects (Food and Drug Administration 1994). The second type of hardener encompasses nail enamels marketed as hardeners. They may have a high resin content, decreased amount of plasticizer, and additions, such as collagen, calcium, or minute fibers.

3.5.1 Patch Testing

The following component of nail hardeners may be patch tested:

Formaldehyde, 2.0% aqueous

3.6 Artificial Nail Products and Techniques

Artificial nails, also referred to as acrylic nails, nail elongators, nail extenders, or liquid nails, generally involve the use of one of two types of acrylic resins: (1) acrylic or methacrylic acids and their esters and (2) cyanoacrylic acid and its esters (Quenon 1989; Bjorkner 1995; Koppula et al. 1995; Kanerva et al.

1996). Other types of resins (neoprene, *p*-tert-butylphenol formaldehyde) have occasionally been used (Burrows and Rycroft 1981). Acrylics are thermoplastic resins that polymerize either at room temperature or by heating. Initiators, accelerators, and catalysts may be added to speed up the process. Ultraviolet (UV) light polymerization or curing can be used when no initiators are necessary (Bjorkner 1995). Manicurists (nail technicians) commonly use seven different techniques to elongate and enhance nails.

3.7 Sculptured Nails

Sculptured nails are custom made by the manicurist on a template attached to the natural nail plate. The nail plate is sanded; a template is fit beneath the distal end of the nail and surrounds the other sides of the nail. The nail is coated with a primer that contains methacrylic acid. The liquid monomer and powdered polymer are mixed and painted on the nail and template extension. The sculptured nail is sanded to the desired form. Jewels, decals, and decorative metal strips can be added. As the nails grow out, the manicurist must "fill" with the same chemicals at the base above the cuticle every 2–3 weeks. The components and examples of the chemicals included are (Quenon 1989; Freeman et al. 1995):

1. Liquid monomer: ethyl-, butyl-, isobutyl-, hydroxypropyl-, and tetrahydrofurfuryl methacrylate; ethylene glycol- and diethylene glycol dimethacrylate; trimethylolpropane trimethacrylate; other esters of methacrylic acid; 4-methoxyphenol, *N*,*N*-dimethyl-*p*-toluidine, hydroquinone, resorcinol, and *p*-dimethylamino-chlorbenzene
2. Powdered polymer: poly(ethyl/methyl) methacrylate, benzoyl peroxide, and titanium dioxide
3. Primer: methacrylic acid, MEK, hydroquinone, and 4-methoxyphenol

Sculptured acrylic nails formerly used methyl methacrylate monomer as an ingredient until seizure and recall actions by the US FDA in 1974 and 1975 (Eiermann 1981; Food and Drug Administration 1994).

3.8 Porcelain Nails

Porcelain sculptured nails are like plain sculptured nails with a three-component primer, liquid, and powder, except they employ a finely ground glass-like material in the powdered material.

3.9 Gels

Light-cured gels are applied in layers to form a solid nail. The original formulas were hardened with UV light; newer ones harden under ordinary room lighting ("white light"). Some gels use layers of different resins, while others use a single resin (Quenon 1989; Draelos 1995; Kanerva et al. 1996). Gels include acrylic oligomers and monomers, modified cellulose, photo-initiators, amine co-initiators, and titanium dioxide. UV-curable resins for artificial nails resemble dental composite resins based on epoxy bisphenol A glycidylmethacrylate (BIS-GMA) or acrylated urethane as the matrix monomers in combination with mono- and polyfunctional cross-linking monomers. Hemmer et al. (1996) tested patients using photobonded nail cosmetic chemicals, and they patch positive to triethyleneglycol dimethacrylate (TREGDMA), ethyleneglycol dimethacrylate (EGDMA), 2-hydroxyethyl methacrylate (2-HEMA), 2-hydroxypropyl methacrylate (2-HPMA), aliphatic diacrylate, and urethane dimethacrylate but not to methacrylated epoxy resins.

3.10 Sculptured Nails with Dips

We have seen an acrylic nail technician demonstrate a "dip." After initial nail preparation and application of liquid acrylic, the client then dipped her nails in the polymethylmethacrylate powder.

3.11 Wrapping

The nail's free edge is splinted with strips of silk, linen, paper, or fiberglass that strengthens the nail. These strips are fixed in layers with cyanoacrylate glue. The glues also contain a catalyst,

N,*N*-dimethyl-*p*-toluidine, and hydroquinone (Bara and Schoon 1998). Material strips may also be used with sculpturing (Draelos 1995).

3.12 Artificial Tips

Artificial tips are popular with manicurists, because they do not require as much skills as sculpturing nails. The preformed tips extend halfway down the nail and are fixed with cyanoacrylate glue. Overlays with silk or fiberglass wraps are usually added; occasionally, sculpturing acrylics are blended.

3.13 Artificial Preformed Nails

Artificial preformed plastic nails come in press-on, preglued forms or those requiring glue application; the latter use either mono- or multifunctional acrylic resins (Draelos 1995). Patients use these as prostheses. Burrows and Rycroft (1981) report allergy developing to the *p*-tert-butylphenol formaldehyde resin adhesive and tricresyl ethyl phthalate in the plastic nail. For decorative purposes, some of these nails include gold metal (Quenon 1989).

Nail removal can be accomplished by soaking in acetone for about 15 min. Many artificial nail removers contain acetonitrile, which has caused deaths in children who accidentally ingested the nail remover because the containers did not have safety caps (Caravati and Litovitz 1988). Methacrylic acid, used in primers, is very corrosive, causing chemical burns in children who handle them (Woolf and Shaw 1998). Accidental poisoning may be a problem when manicurists practice these techniques in their homes or store chemicals at home and when consumers use these materials (Potter et al. 1988). Acetone cannot be used to remove photobonded nails, which is problematic if contact allergies develop (Bara and Schoon 1998).

4 Occupationally Related Skin Disorders in Manicurists

Manicurists should be aware of the sensitizing potential of the mono(meth)acrylates and use no-touch techniques for the skin before the acrylates become polymerized (Kanerva et al. 1996). Occupational sensitization has not been commonly reported. Hemmer's group (1996) estimated that only 10–15% of the reported cases of acrylic nail allergy were occupationally related, in contrast to dentistry, where most cases are occupational. They postulate "...sensitization is not primarily caused by the uncured gel or monomer but by the remaining monomers in the cured plastic nail and the filing dust that is produced when the nail is smoothed or polished." In contrast, European studies found nail technicians to comprise 80% of the ACD cases caused by (meth)acrylates in Portugal (Ramos et al. 2014). Spencer et al. (2016) conducted a 13-year retrospective review of 475 patients patch tested with (meth)acrylates, identifying 52 positive patch tests, 24 of which were attributed to occupational exposure. The authors found contact with (meth)acrylic nails the most common source of ACD with (46.5% of patients). Recently, Uter and Geier (2015) conducted a large retrospective analysis among 72,244 female patients patch tested with (meth) acrylates. Dividing the subjects into four groups was on occupation [nail artists/cosmetologists (Occ+) or other profession (Occ−)] and whether or not nail care products were considered the causative agent (Cont+ or Cont−). The authors observed significantly higher rates of positive reactions to at least one acrylate/methacrylate in the Occ+, Cont+ subgroup with 47.1% testing positive; other subgroup rates of positive patch testing to at least one acrylate/methacrylate were: Occ+,Cont− (7.5%); Occ−, Cont+ (18%); and Occ−, Cont− (0.7%).

Acrylic nails evolved from similarly composed products supplied to dentists (Eiermann 1981). In California, cottage industries supplying acrylic nails sprouted from dental-supply manufacturers as well as from other companies, such as automobile-body fiberglass-fender repair shops. Although acrylic nails did not become popular until the 1970s, Canizares (1956) reported methyl methacrylate allergy in a manicurist with dermatitis localized to her left hand, and Fisher and associates (1957) reported another occupationally acquired case. Schubert et al. (1992) reported a nail modeler who became sensitized and developed allergic contact dermatitis on the left hand

from sculpturing the not-yet-hardened resin with a file in the right hand. Baran (1982) identified the manicurist thumb and third finger of the left hand as being constantly exposed to the acrylics when the customer's fingers are held during the process. Similarly, a manicurist allergic to cyanoacrylate glue with hand eczema also presented with an initial eruption on those fingers (Belsito 1987). Many manicurists also wear wraps, overlays, or sculptured nails, and presentation of allergy often includes the face, neck, and other areas, as well as the hands and fingers (Goodwin 1976; Conde-Salazar et al. 1986; Marks 1990; Fitzgerald et al. 1995; Freeman et al. 1995; Jacobs and Rycroft 1995; Hemmer et al. 1996; Kanerva et al. 1996).

Paresthesias from acrylic monomers have been noted in orthopedic surgeons and dentists. Severe and prolonged paresthesias have also been reported by Fisher (1989) and Baran and Schibli (1990) in individuals wearing sculptured nails, as well as in individuals wearing photobonded nails (Fisher 1990). This subject was reviewed by Fisher and Baran (1991). It is maintained that the side effect of paresthesias may rarely occur in the absence of allergic sensitization if the acrylic monomer contacts injured skin thereby allowing penetration and exposure of the nerves.

Nail-elongating chemicals reported to cause allergic contact dermatitis and their patch-test concentrations (Freeman et al. 1995; Koppula et al. 1995; Hemmer et al. 1996; Kanerva et al. 1996) include:

Cyanoacrylics, as is; dry before application
p-tert-butylphenol formaldehyde resin, 1% pet
Tricresyl ethyl phthalate plasticizer, 5% pet
Mono- and multifunctional esters of methacrylic acid, 0.1–2.0% pet
Methyl acrylate, 1.5% pet
Methyl methacrylate, 1% pet
Ethyl methacrylate, 2–5% pet
Ethyl acrylate, 0.1% pet
Ethylene glycol dimethacrylate (EGDMA), 2–5% pet
Triethylene glycol dimethacrylate (TEGDMA), 1–1%pet
Triethylene glycol diacrylate (TEGDA), 0.1–5% pet
2-Hydroxyethylacrylate (2-HEA), 0.5% pet
2-Hydroxyethyl methacrylate (2-HEMA), 2% pet
2-Hydroxypropyl methacrylate (2-HPMA), 2% pet
BIS-GMA, 2% pet
Bisphenol A methacrylate, 2% pet
Bisphenol A ethoxymetltacrylate, 1% pet
Butyl acrylate, 0.1–0.5% pet
Urethane diacrylate (aliphatic), 0.1% pet
Urethane diacrylate (aromatic), 0.1% pet
Methacrylic acid, 0.1–1%
Benzoyl peroxide, 1% pet
Dimethyl-*p*-toluidine, 2% pet
Hydroquinone, 1% pet

Note that the appropriate nonirritating concentration sufficient to identify delayed sensitivity needs further documentation for some of these materials.

Hairdressers, metalworkers, and construction workers have the most positive occupational relationship with different allergens and contact dermatitis. The most prevalent allergens are nickel sulfate, palladium and cobalt chloride, potassium dichromate, fragrance blends, and *p*-phenylenediamine (Bordel-Gomez et al. 2010). Hairdressers allergic to nickel who present with hand eczema should have his/her work tools tested for nickel release (Thyssen et al. 2009).

Manicurists may sustain minor skin injuries working with sharp instruments, such as scissors, files, or drills. They are at risk for skin infections, and hygienic practices should be part of their practice for their own protection and that of their clients. UV light sources should be properly filtered, shielded, and maintained.

5 Other Potential Health Effects

5.1 Pulmonary Effects

Occupational asthma was reported in five patients and was provoked by various noncosmetic exposures to cyanoacrylates and methyl methacrylate (Lozewicz et al. 1985; Savonius et al. 1993) and has also been noted in the nail salon setting (Spencer et al. 1997). Pulmonary edema has also been reported from acrylic monomer exposure (Lozewicz et al. 1985), and titanium dioxide is listed as a lung irritant (Quenon 1989).

5.2 Mucosal Irritation of Eyes, Mouth, and Throat

Mucosal irritation of eyes, mouth, and throat has been reported following industrial acrylic monomer exposure (Lozewicz et al. 1985), and this can potentially occur during a manicure. Other chemicals used in creating acrylic nails are potential occupational mucosal irritants depending on the extent of exposure and on individual susceptibility (Quenon 1989). These include acetone, diethyl-*p*-toluidine, ethyl acetate, hydroquinone, and methyl ethyl ketone. Industrial hygiene measurements with personal and arm samplers in six different sculptured nail salons recorded measurable levels of various organic vapors and methacrylate dusts. Throat irritation was the only statistically significant health effect noted among the nail technicians, although nose and skin irritation, drowsiness, spells, and trembling of the hands were reported more often among nail technicians than among the control group (Hiipakka and Samimi 1987).

5.3 Central Nervous System

Central nervous system symptoms of headaches, nausea, dizziness, and drowsiness from acetone, methacrylates, ethyl acetate, ethyl alcohol, methylene chloride, methyl ethyl ketone, toluene, 1,1,2-tricholor-1,2,2-trifluoroethane, and xylene (Quenon 1989) may potentially occur among manicurists.

5.4 Reproductive System

Several glycol ethers are known to cause birth defect or infertility in laboratory animals and are to be avoided by manicurists (Quenon 1989).

A nonsignificant increased risk of spontaneous abortion among hairdressers was found, mainly associated with perceived work-related stress (Ronda et al. 2010). One study compared congenital malformations and neonatal health outcomes between realtors and cosmetologists in New York State. The study showed that cosmetologists had an increased risk of postpartum hemorrhage (OR = 2.12; 95% CI 1.26, 3.58), failure to progress (OR = 1.31, 95% CI 1.12, 1.54), and newborn intubation (OR = 2.34; 95% CI 1.21, 4.51) (Herdt-Losavio et al. 2009a). The study did not observe an increased risk for congenital malformations among cosmetologists' offspring, but earlier studies found a slightly increased risk of having a child born with low birth weight among cosmetologists (Herdt-Losavio et al. 2009b). Other studies showed that cosmetologists are not at increased risk for infertility or of having children with medical problems compared to women in other occupations (Gallicchio et al. 2010a; Peretz et al. 2009). Quach et al. (2015) recently examined birth registry data of Californian women from 1996 to 2009, observing an association of SGA infants among Vietnamese manicurists (OR 1.39; 95% CI 1.08–1.78) and cosmetologists (OR 1.40; 95% CI 1.08–1.83) when compared to other workingwomen. The authors found additional risks among manicurists and cosmetologists for maternal complications such as gestational diabetes (further increased risk when population restricted to Vietnamese workers) and placenta previa when compared with the general population (Quach et al. 2015). The risk of having menstrual cycle abnormalities among cosmetologists is inconclusive. The findings from Gallicchio's group (2010b) suggest that cosmetologists are not at increased risk of menstrual cycle abnormalities, while the findings from Ronda's group (2009) suggest increased risk of subfertility and menstrual disorders among hairdressers.

5.5 Miscellaneous

A meta-analysis showed that hairdressers have a higher risk for lung, laryngeal, and bladder cancers as well as multiple myeloma compared to the general population. Improvement in ventilation and hygiene measures decrease exposure to carcinogens and reduce the risk (Takkouche et al. 2009). Another meta-analysis studied the association between bladder cancer and occupation. Among eight other occupations, hairdressers have a relative risk of 1.23, 95% CI 1.11–1.37 (Reulen

et al. 2008). Two cases of angiosarcoma of the liver have been identified among hairdressers and barbers who used sprays containing vinyl chloride (VC) as a propellant. The patients were exposed for 4–5-year periods and levels of VC ranged from 70 to 1037 ppm per hour (Infante et al. 2009). There have been rare cases where one female hairdresser developed a pilonidal sinus produced by customers' short hairs that penetrate the interdigital spaces of her hand, while another female hairdresser presented with hair fragments embedded under her fingernails, known as barber's hair sinus. This lesion is usually seen on the hands of male hairdressers (Efthimiadis et al. 2008; Nagtzaam et al. 2007).

6 Prevention

Prevention strategies for manicurists have been identified by Quenon (1989), Hiipakka and Samimi (1987), and the National Institute for Occupational Safety and Health (NIOSH) (1999). These include:

1. Substitution. Harmful chemicals should be avoided, including acrylic preparations with irritating vapors.
2. Engineering controls. Local exhaust ventilation systems, such as cable systems, capture and remove contaminated air to the outdoors. A properly ventilated table is necessary (National Institute for Occupational Safety and Health 1999), and dust masks should be used if, for some reason, the exhaust system is not functioning.
3. Good work practices. Keep dispenser bottles closed. Soaked gauze should be disposed of in sealed bags. Wash exposed skin several times each day to remove dust. Adopt a "no-touch system" with liquid monomers.
4. Manicurists should wear protective clothing with long sleeves and glasses. Glasses are needed to prevent eye damage when nails are being clipped into pieces at removal. NIOSH suggests gloves to protect from dust but does not specify type. 4H Laminate gloves (Safety 4A/S Lyngby, Denmark) are resistant to acrylates. The fingertips of the 4H gloves can be cut off and worn under a vinyl glove to minimize the bulkiness of the 4H glove. The thrust of this section relates to cosmetologists. Minimal information exists on likely risks in the manufacturing arena.

References

Adams RM (1990) Occupational skin disease, 2nd edn. Saunders, Philadelphia, pp 607–609

Adams RM, Maibach HI (1985) A five-year study of cosmetic reactions. J Am Acad Dermatol 13:1062–1069

Bara RL, Schoon D (1998) Cosmetics for abnormal and pathological nails. In: Baran R, Maibach HI (eds) Textbook of cosmetic dermatology. Martin Dunitz, London, pp 233–244

Baran RL (1982) Pathology induced by the application of cosmetics to the nail. In: Frost P, Horwitz SN (eds) Principles of cosmetics for the dermatologist. Mosby, St. Louis, pp 181–184

Baran RL, Schibli H (1990) Permanent paresthesia to sculptured nails. A distressing problem. Dermatol Clin 8:139–141

Belsito DV (1987) Contact dermatitis to ethyl-cyanoacrylate-containing glue. Contact Dermatitis 17:234–236

Bjorkner B (1995) Plastic materials. In: RJG R, Menne T, Frosch PJ (eds) Textbook of contact dermatitis, 2nd edn. Springer, Berlin/Heidelberg/New York, pp 539–572

Bordel-Gomez MT, Miranda-Romero A, Castrodeza-Sanz J (2010) Epidemiology of contact dermatitis: prevalence of sensitization to different allergens and associated factors. Actas Dermosifiliogr 101(1):59–75

Brun R (1978) Contact dermatitis to orangewood in a manicurist. Contact Dermatitis 4:315

Burrows D, Rycroft RJG (1981) Contact dermatitis from PTBP resin and tricresyl ethyl phthalate in a plastic nail adhesive. Contact Dermatitis 7:336–337

Canizares O (1956) Contact dermatitis due to the acrylic materials used in artificial nails. Arch Dermatol 74:141–143

Caravati EM, Litovitz TL (1988) Pediatric cyanide intoxication and death from an acetonitrile containing cosmetic. JAMA 260:3470–3473

Castelain M, Veyrat S, Laine G, Montastier C (1997) Contact dermatitis from nitrocellulose in nail varnish. Contact Dermatitis 36:266–267

Conde-Salazar L, Guinaraens D, Romero LV et al (1986) Occupational allergic contact dermatitis to artificial nails. Contact Dermatitis 15:242

De Groot AC, Weyland JW, Nater JP (1994) Nail cosmetics. In: Unwanted effects of cosmetics and drugs used in dermatology, 3rd edn. Elsevier, Amsterdam, pp 524–529

Draelos ZD (1995) Cosmetics in dermatology, 2nd edn. Churchill Livingstone, New York

Efthimiadis C, Kosmidis C, Anthimidis G, Grigoriou M, Levva S, Fachantidis P, Psihidis G (2008) Barber's hair sinus in a female hairdresser: uncommon manifestation of an occupational disease: a case report. Cases J 1(1):214

Eiermann H (1981) Methacrylate nail builders. Fact sheet. Food and Drug Administration, Division of Cosmetics Technology, Rockville

Engasser PG (1997) Nail cosmetics. In: Scher RK, Daniel CR III (eds) Nails: therapy, diagnosis, surgery, 2nd edn. Saunders, Philadelphia, pp 276–281

Fisher AA (1989) Permanent loss of fingernails due to allergic reaction to an acrylic nail preparation: a sixteen-year follow-up study. Cutis 43:404–406

Fisher AA (1990) Adverse nail reactions and paresthesia from "photobonded acrylate 'sculptured' nails". Cutis 45:293–294

Fisher AA, Baran RL (1991) Adverse reactions to acrylate sculpture nails with particular reference to prolonged parethesia. Am J Contact Dermat 2:38–42

Fisher AA, Frank A, Glicks A (1957) Allergic sensitization of the skin and nails to acrylic plastic nails. J Allergy 28:84–88

Fitzgerald DA, Bhaggoe R, English JSC (1995) Contact sensitivity to cyanoacrylate nail-adhesive with dermatitis at remote sites. Contact Dermatitis 32:175–176

Food and Drug Administration (1994) (HFS-565) Department of Health and Human Services, Washington, DC, p 13

Freeman S, Lee M-S, Gudmundsen K (1995) Adverse contact reactions to sculptured nails: 4 case reports and a literature review. Contact Dermatitis 33: 381–385

Gallicchio L, Miller SR, Greene T et al (2010a) Health outcomes of children born to cosmetologists compared to children of women in other occupations. Reprod Toxicol 29(3):361–365 Epub ahead of print

Gallicchio L, Miller S, Greene T et al (2010b) Menstrual cycle abnormalities among cosmetologists: the Reproductive Outcomes in Salon Employees study. Reprod Sci 17(1):20–28 Epub 18 Sep 2009

Goodwin P (1976) Onycholysis due to acrylic nail applications. Clin Exp Dermatol 1:191–192

Guin JG, Baas K, Nelson-Adesokan P (1998) Contact sensitization to cyanoacrylate adhesive as a cause of severe onychodystrophy. Int J Dermatol 37:31–36

Guin JD, Wilson P (1999) Onycholysis from nail lacquer: a complication of nail enhancement? Dermatitis 10:34–6

Hausen BM, Milbrodt M, Koenig WA (1995) The allergens of nail polish. I. Allergenic constituents of common nail polish and toluenesulfonamide-formaldehyde resin (TSFR). Contact Dermatitis 33: 157–164

Hemmer W, Focke M, Wantke F, Gotz M, Jarish R (1996) Allergic contact dermatitis to artificial fingernails prepared from UV light-cured acrylates. J Am Acad Dermatol 35:377–380

Herdt-Losavio ML, Lin S, Druschel CM, Hwang SA, Mauer MP, Carlson GA (2009a) The risk of congenital malformations and other neonatal and maternal health outcomes among licensed cosmetologists. Am J Perinatol 26(9):625–631 Epub 23 Apr 2009

Herdt-Losavio ML, Lin S, Druschel CM, Hwang SA, Mauer MP, Carlson GA (2009b) The risk of having a low birth weight or preterm infant among cosmetologists in New York State. Matern Child Health J 13(1):90–97 Epub 23 Feb 2008

Hiipakka D, Samimi B (1987) Exposure of acrylic fingernail sculptors to organic vapors and methacrylate dusts. Am Ind Hyg Assoc J 48:230–237

Infante PF, Petty SE, Groth DH, Markowitz G, Rosner D (2009) Vinyl chloride propellant in hair spray and angiosarcoma of the liver among hairdressers and barbers: case reports. Int J Occup Environ Health 15(1):36–42

Jacobs MC, Rycroft RJG (1995) Allergic contact dermatitis from cyanoacrylate? Contact Dermatitis 33:71

Kanerva L, Lauerma A, Jolanki R, Estlander T (1995) Methyl acrylate: a new sensitizer in nail lacquer. Contact Dermatitis 33:203–204

Kanerva L, Lauerma A, Estlander T, Alanko K, Henriks-Eckerman M-L, Jolanki R (1996) Occupational allergic contact dermatitis caused by photobonded sculptured nails and a review of (meth)acrylates in nail cosmetics. Am J Contact Dermat 7:109–115

Koppula SV, Fellman JH, Storrs FJ (1995) Screening allergens for acrylate dermatitis associated with artificial nails. Am J Contact Dermat 6:78–85

Liden C, Berg M, Farm G, Wransjo K (1993) Nail varnish allergy with far-reaching consequences. Br J Dermatol 128:57–62

Lozewicz S, Davidson AG, Hopkirk A et al (1985) Occupational asthma due to methyl methacrylate and cyanoacrylates. Thorax 40:836–839

Marks JG (1990) Cosmetics. In: Adams RM (ed) Occupational skin disease, 2nd edn. Saunders, Philadelphia, pp 326–348

Nagtzaam IF, van der Velden JJ, Kelleners-Smeets NW, Frank J (2007) Onycholysis associated with subungual manifestation of barber's hair sinus. Int J Dermatol 46(Suppl 3):48–49

National Institute for Occupational Safety and Health (1999) Controlling chemical hazards during the application of artificial fingernails. Department of Health and Human Services, Washington, DC, pp 99–112

Norton LA (1991) Common and uncommon reactions to formaldehyde-containing nail hardeners. Semin Dermatol 10:29–33

Peretz J, Gallicchio L, Miller S et al (2009) Infertility among cosmetologist. Reprod Toxicol 28(3):359–364

Potter JL, Drill CE, Neal D, Kalron WG (1988) Methemoglobinemia due to ingestion of *N*,*N*-dimethyl-*p*-toluidine, a component used in the fabrication of artificial fingernails. Ann Emerg Med 17:1098–1100

Quach T, Von Behren J, Goldberg D, Layefsky M, Reynolds P (2015) Adverse birth outcomes and maternal complications in licensed cosmetologists and manicurists in California. Int Arch Occup Environ Health 88(7):823–833

Quenon S (1989) Artificial fingernail products: a guide to chemical exposures in the nail salon. California Department of Health Services, Berkeley

Ramos L, Cabral R, Gonçalo M (2014) Allergic contact dermatitis caused by acrylates and methacrylates – a 7-year study. Contact Dermatitis 71:102–107

Reulen RC, Kellen E, Buntinx F, Brinkman M, Zeegers MP (2008) A meta-analysis on the association between bladder cancer and occupation. Scand J Urol Nephrol Suppl 218:64–78

Ronda E, Garcia AM, Sanchez-Paya J et al (2009) Menstrual disorders and subfertility in Spanish hairdressers. Eur J Obstet Gynecol Reprod Biol 147 (1):$32#61–64

Ronda E, Moen BE, Garcia AM et al (2010) Pregnancy outcomes in female hairdressers. Int Arch Occup Environ Health 83(8):945–951 Epub ahead of print

Sainio E-L, Engstrom K, Henriks-Eckerman ML, Kanerval L (1997) Allergenic ingredients in nail polishes. Contact Dermatitis 37:155–162

Savonius B, Keskinen H, Tuppurainen M, Kanerva L (1993) Occupational respiratory disease caused by acrylates. Clin Exp Allergy 23:416–424

Schlossman ML (1979) Nail-enamel resins. Cosmet Technol 1:52–55

Schlossman ML (1980) Modern nail enamel technology. J Soc Cosmet Chem 31:29–36

Schlossman ML, Wimmer E (1992) Advances in nail enamel technology. J Soc Cosmet Chem 43:331–337

Schoon D (1998) Nail varnish formulation. In: Baran R, Maibach HI (eds) Textbook of cosmetic dermatology, 2nd edn. Martin Dunitz, London, pp 213–218

Schubert HJ, Lindner K, Prater E (1992) Kontakallergie im nagestudio. Z Hautkr 67:1067–1069

Sheriff RL (2008) Policy matters: pedicures at what price? Policy matters. California Senate Office of Research, Sacramento

Spencer AB, Estill CF, McCammon JB, Mickelsen RL, Johnston OE (1997) Control of ethyl methacrylate exposures during the application of artificial fingernails. Am Ind Hyg Assoc J 58:214–218

Spencer A, Gazzani P, Thompson D (2016) Acrylate and methacrylate contact allergy and allergic contact disease: a 13-year review. Contact Dermatitis 75(3):157–164

Takkouche B, Regueira-Mendez C, Montes-Martinez A (2009) Risk of cancer among hairdressers and related workers: a meta-analysis. Int J Epidemiol 38 (6):$32#1512–1531

Thyssen JP, Milting K, Bregnhoj A, Sosted H et al (2009) Nickel allergy in patch-tested female hairdressers and assessment of nickel release from hairdresser's scissors and crochet hooks. Contact Dermatitis 61(5):281–286

Uter W, Geier J (2015) Contact allergy to acrylates and methacrylates in consumers and nail artists – data of the Information Network of Departments of Dermatology, 2004–2013. Contact Dermatitis 72(4):224–228

Woolf A, Shaw J (1998) Childhood injuries from artificial nail primer cosmetic products. Arch Pediatr Adolesc Med 152:41–46