

Avoiding Paraphenylenediamine Exposure in Children

Paraphenylenediamine (PPD) is a chemical substance that turns black in the presence of an oxidizer and functions effectively as permanent hair dye. Unfortunately, the intermediary state (partially oxidized) is highly sensitizing and has resulted in bullous contact dermatitis with scarring in some individuals.¹ With an increased popularity of permanent hair dyeing among adolescents, PPD allergy has become more widespread and recognized in this group.² Another important and unsuspecting source of PPD exposure in children is through temporary tattoo artistry. To increase the longevity of the temporary tattoo, many artists add PPD to the natural henna base compound. This practice notably darkens the pigment color from green/brown to dark brown/black, and accelerates the drying time of the tattoo. These tattoos are growing in popularity among children of all ages and provide a unique route of exposure to PPD that may lead to both sensitization and an untoward skin effect.^{3,4} In fact, severe cases of al-



lergic reactions to temporary tattoos have been reported, primarily in the shape of the appliqué, and include contact dermatitis with resultant permanent pigmentary changes and scars.⁵

Although the Food and Drug Administration (FDA) does not restrict the use of PPD as a hair dye, inclusion of PPD in cosmetics that involve direct application to the skin is prohibited.⁶ Cosmetic tattooing and temporary tattooing, however, do not fall under the jurisdiction of the FDA. Furthermore, although the general recommendation is that PPD not exceed a concentration of 5.0% in hair dye, studies have shown that temporary tattoos frequently contain as much as 3 times that concentration.^{7,8} Thus, the unfortunate responsibility to prevent children from receiving unnecessary exposures to PPD

falls on the patient, parent, and physician.

Allergen education is vital and necessary in order to bring awareness to patients (and parents) and to institute avoidance of temporary tattooing when the PPD content is unknown. Likewise, hair coloring in children should also be done with caution and knowledge of PPD-free hair dyes made available (see Table, page 105). It is also important to note some medically necessary and alternate sources with potential cross-reactivity to PPD. The basis for this chemical cross-reactivity is the common constituency of an amino group in the para position of the benzene ring, a para-amino benzoic acid (PABA). These include PABA sunscreens, hydrochlorothiazide, sulfonamides, azo dyes, p-amino-benzene, ester anesthetics, and celecoxib.⁹ (see Sidebar, page 105).

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TABLE.		
Products Containing Paraphenylenediamine and Alternative Products		
Hair Dyes Containing PPD	Company	Web Site
Nice n' Easy, Hydrience, Balsam Color, Textures and Tones	Clairol	http://www.clairol.com
Colorsilk, Colorist	Revlon	http://www.revlon.com/
Excellence, Feria, Preference, Natural Match	L'Oreal Paris/L'Oreal USA	http://www.lorealparisusa.com/
Nutrisse, 100% Color	Garnier/L'Oreal US	http://www.garnierusa.com/_en/_us/index.aspx
PPD-free Hair Color	Company	Web Site
Elumen Hair Color	GoldWell Cosmetics	http://www.elumen-haircolor.com/
Lustrous Henna	Saba Botanical of USA	http://www.sababotanical.com/
Sanotint	Cosval	http://www.cosvalitaly.com/index.en.html
Light Mountain Conditioning Hair Color	Farrell Store	http://www.farrellstore.com/shop/ppdfreecolor.htm
PPD-free Temporary Tattoos	Company	Web Site
	Tattoo Manufacturing Inc.	http://www.tattoosales.com/TempTattoos.aspx
	East Coast Tattoos	http://www.temporarytattoos.com/
	Earth Henna	http://www.earthhenna.com/
Note: Natural henna, derived from the plant <i>Lawsonia inermis</i> , is considered a rare allergen and therefore much safer for use as hair color or temporary tattoo. A group of suppliers in the United States committed to providing PPD-free natural henna can be found here: http://www.hennapage.com/henna/where/suppliers.html .		

It is important to note that the first exposures to an allergen may result in a child becoming sensitized to a chemical unbeknownst to the parent or physician. This is because the initial exposures may not necessarily elicit an allergic response. Rather, with each additional dose of the allergen, the child is at higher risk (more susceptible) of reaching the threshold for elicitation of the allergic reaction response.

SUMMARY

Although the allergenic potential of PPD is well known, it was chosen by the American Contact Dermatitis Society as the 2006 “allergen of the year” in order to increase awareness of new patterns of exposure and increasing sensitization.⁹ Temporary tattoos are a vehicle of contact with PPD that is particularly relevant to children. They are a risk not only in the United States, but in many international locations frequented by American tourist families.¹⁰ Adolescents dyeing their hair are also at risk. With this in mind, measures should be taken to increase awareness and avoid the unnecessary usage of PPD in children.

SIDEBAR.

Potential Chemical Cross-reactors of Paraphenylenediamine

Textiles/fur dyes
Azo dyes (disperse dyes)

Sunscreen
Para-amino benzoic acid (PABA)

Medications
Sulfonamides, sulfonyleureas, thiazides, benzocaine, celecoxib, para-aminosalicylic acid

Rubber chemicals
Black rubber mix: N-phenyl-N'-cyclohexyl-paraphenylenediamine (CPPD); N-isopropyl-N'-phenyl-paraphenylenediamine (IPPD); N,N'-diphenyl-paraphenylenediamine (DPPD)

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