**A LOOK AT PARA-PHENYLENEDIAMINE**

Para-phenylenediamine is an oxidative substance that was initially formulated for use in dye at the end of the 19th century.

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**Allergic contact dermatitis (ACD)** affects over 14.5 million Americans each year, notably defining itself as an important widespread disease. Due to overwhelming patient morbidity, loss of school and work time and significant expenditures for healthcare visits and medicaments, ACD represents a high economic burden. Fortunately, through keen patient interviewing and patch testing, an avoidable culprit may be identified. Remission can then occur with implementation of an allergen avoidance regimen. Education becomes the critical bridging intervention to ensure treatment adherence and symptom resolution. Patients who are unable to comply with avoidance regimens are at risk for sustained, recurrent, progressive or even systemic dermatitis. To ensure patients have an appropriate understanding of all the potential outcomes and their central role in disease pathology and treatment, education of the patient may begin even before the diagnostic patch test is performed.

Important aspects of patient counseling include explaining the nature of their disease, for example, the delayed presentation of ACD [aka the importance of a delayed read at 96 hours]; the relationship with the immune system (sensitization to a chemical followed by elicitation of dermatitis with re-exposure) and the indifference to time (a substance the patient has been using regularly, briefly or intermittently can sensitize at any point). In certain cases, the topics of irritant contact dermatitis (ICD) and contact urticaria (CU) are also explained. Of note, unlike ACD, history rather than patch testing can often lead to the correct diagnosis of ICD and CU.

ICD, the most prevalent form of contact dermatitis, can at times precede or be a concomitant diagnosis with ACD. Unlike ACD, ICD may occur on the first exposure to an irritating or abrasive substance. The innate immune system is activated and inflammation ensues. CU (wheal and flare reaction), on the other hand, represents the least prevalent form of the ACD. It is an immune-mediated phenomenon governed by a hallmark IgE and mast cell-mediated immediate-type hypersensitivity reaction. We acknowledge this form of hypersensitivity due to its potentially deadly associated anaphylactic reactions and direct the reader to key sources.

In this article, we highlight ACD and explore the top relevant allergens, regional and topic based dermatitis presentations and clinical tips and pearls for diagnosis and treatment.
Para-phenylenediamine, a widely used culprit behind millions of reported and unreported cases of ACD, is an oxidative substance that was initially formulated for use in dye at the end of the 19th century.
tic screening of ACD to hair-dyes and fur.s

Also, for the last 80 years, PPD has remained one of the most prevalent allergens and atop most standard series panels. In 2006, PPD was designated by the European Commission and Scientific Committee on Consumer Products as 1 of the 10 strong sensitzizers, and with the prevalence of contact sensitization on the rise in North America, it was designated the Allergen of the Year by the American Contact Dermatitis Society (ACDS) that same year.

Because of PPDs ability to provide a natural look with permanent results, it has remained the most popular permanent hair dye chemical. Despite the sensitization risk, more than 50% of female residents of developed countries worldwide use permanent or temporary hair dyes for some period of their life. Hair dyeing is also becoming increasingly popular among the male population. Sensitization to PPD should be acknowledged as an occupational hazard for hairdressers and cosmetologists who may have daily exposures.

Although PPD use is allowed in hair dyes, the FDA prohibits its use on the skin. In spite of this, many temporary tattoo artists mix PPD with “natural” henna to give it a brown-black color and to accelerate the fixing time of a temporary henna tattoo. Its use can result in severe dermatitis and long-lasting consequences such as scarring and post-inflammatory pigment changes (Figure). As previously mentioned, the use of black henna tattoo can sensitize patients to PPD-containing hair dyes. The maximum permitted concentration in hair dye is 6%, however; studies show that the levels of PPD in henna tattoos are alarmingly higher — up to 29.5%.

In response to increased reports of “temporary-water-application-tattoos” (notably many in children), the FDA has issued an advisory warning and created a reporting hotline: MedWatch, 1-800-332-1088. Furthermore, the inherent mutagenic properties of PPD have been demonstrated in rats: female rats subjected to topical application and subcutaneous injection of PPD had increased incidence of mammary, uterine and soft tissue tumors.

**PPD is most dangerous when it is in an intermediate state, partially oxidized and thus confers a higher occupational risk to hairdressers who handle the chemical throughout its composition.**

**Table 2. EXAMPLES OF PTDS-BASED ALTERNATIVES TO PPD-BASED HAIR DYE.**

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<th>PTDS-Based Permanent Hair Dye Products</th>
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<td>Schwarzkopf Igora Royal</td>
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<td>Walla Koleston Perfect</td>
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<tr>
<td>PTDS-Based Demi-Permanent Hair Dye Products</td>
<td>Clairol Professional Beautiful Collection Advanced Gray Solution</td>
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<td></td>
<td>Goldwell ReShades for Men</td>
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<td>L’Oreal Paris Excellence ToGo 10-Minute Creme</td>
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<td>Schwarzkopf Igora Viviance</td>
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<td>Sanatint Light</td>
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<td>Walla Color Charm Demi Permanent</td>
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Notably, some individuals allergic to PPD may have crossreacting allergies to PTDS due to their related chemistries. Therefore, allergic persons should utilize caution in introducing these new products. PPD, paraphenylenediamine; PTDS, paratoluenediamine sulfate.

**Pearls of Treatment: Every Dose Counts in Avoidance**

A person might be exposed to and subsequently sensitized to a particular allergen for days to years before actually developing ACD. Exposures can be additive, eventually causing one’s immune system to become trained to identify a chemical, at which time a cutaneous response would be elicited upon exposure. Just as repeated contact over time leads to an immune response, repeated avoidance over time will induce remission. Avoidance creativity, however, may be necessary by utilizing alternatives and by being aware of indirect exposures. For example, PPD exposure can occur by “second hand,” as in “conjugal contact dermatitis.” Both spouse and children have been reported to have acquired ACD from exposure to close contacts who used hair dye with PPD. As this may easily be underrecognized and missed, underscoring the
32. Onder M. Temporary holiday “tattoos” may cause lifelong allergic contact dermatitis when henna is mixed with PPD. J Cosmet Dermatol. 2003;2(3-4):126-130.