

Frequency of contact allergy to pentylene glycol. Retrospective cross-sectional study with data from the Società Italiana di Dermatologia Allergologica Professionale e Ambientale (SIDAPA)

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INTRODUCTION

Pentylene glycol (PTG) (1,2-pentanediol; 1,2-dihydroxy pentane; CAS no. 5343-92-0) is a preservative, solvent, and humectant that is increasingly used in cosmetic products as an alternative to propylene glycol (PG), compared to which it is considered a weaker irritant and allergen.¹ However, recent reports of allergic contact dermatitis (ACD) from PTG in cosmetics for sensitive skin and antiage creams suggest that its allergenic potential may be underestimated.²⁻⁴

Our objective was to evaluate the frequency of allergic contact sensitization to PTG compared to PG in consecutive patients undergoing patch testing for the suspicion of ACD.

METHODS

This retrospective cross-sectional study included patients from centres of the Società Italiana di Dermatologia Allergologica Professionale e Ambientale (SIDAPA) who, from March 2021 to July 2022, were consecutively patch tested with PTG in addition to the SIDAPA baseline series. Patch testing was performed according to the Italian guidelines.⁵ Readings were done on day (D) D2 and D3, in some cases also

Rosella Gallo and Fabrizio Guarneri contributed equally to this study.

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on D4. PTG was tested at 5% and 10% aq. concentrations freshly prepared by dilution of a 50% stock solution obtained from Symrise (Holzminden, Germany). All patients were also patch tested with PG 5% pet and 30% aq.

RESULTS

A total of 1235 consecutive patients, 880 women and 355 men, mean age 51.10 ± 19.02 years, were patch tested for PTG and PG.

Allergic reactions to both 5% and 10% PTG were seen in five patients and to 10% PTG alone in two more patients. They were six females and one male, mean age 55.71 ± 12.53 years. The body areas involved were: face in two cases (plus neck in one of them), hands, neck, back, leg, and feet, respectively, in the remaining five cases. Overall, the clinical relevance was judged certain/likely in two patients, possible/doubtful in three patients, absent in two patients.

The sources of exposure to PTG in the two patients with certain/likely clinical relevance were face/body creams. The patients with possible/doubtful relevance had used leave on cosmetics (mainly face or body creams) that contained or might have contained PTG but it was not possible to establish a direct causal relationship.

Irritant reactions to both 5% and 10% PTG were seen in three patients and to 10% PTG alone in one patient.

As for PG, the 5% pet concentration gave no allergic or irritant reactions; the 30% concentration gave allergic reactions in 4 patients and irritant reactions in 11 patients. They were all males, mean age 52.25 ± 18.96 years. The body areas involved were oral mucosa, neck, back, and diffuse, respectively. The clinical relevance was judged certain/likely in two patients, possible/doubtful in one patient, absent in one patients. The sources of exposure to PG in the two patients with certain/likely clinical relevance were face/body/hand creams.

Overall, PTG gave 0.57% allergic reactions versus 0.32% irritant reactions, while PG gave 0.32% allergic reactions versus 0.89%

irritant reactions. Only one patient showed simultaneous sensitization to PTG (5% and 10%) and PG (30%) with certain/probable relevance for ACD.

The intensity scores and clinical relevance of positive allergic reactions to PTG and PG are shown in Table 1.

DISCUSSION

PTG is an aliphatic alcohol with antibacterial properties that is increasingly used in “hypo-allergenic” cosmetic products as a solvent and humectant as a less irritant and less allergenic alternative to PG. The latter is a well-known contact sensitizer and it has long been included in patch test cosmetics/topical medicament series.¹ On the contrary, PTG is not commercially available as a patch test allergen. This may partly explain why reported cases of ACD from PG are not frequent^{2–4,6–11} although it is suspected to be an emerging cosmetic allergen.^{2,3}

Due to their similar chemical structure, cross-reactivity between PTG and PG could be expected, but has rarely been reported, indicating that PG would be a poor marker of ACD to PTG.

This is the first study that tries to statistically evaluate the allergenic potential of PTG and its degree of cross reactivity with PG. It also provides some information about the appropriate concentration for PTG to be used in patch tests.

Based on our results, PTG shows a prevalence of allergic reactions of 0.57% and would appear to be more allergenic and less irritating than PG. The 10% aq. concentration seems preferable to 5% aq.

Our data seem to confirm that cross-reactivity between PTG and PG is infrequent, although the number of our cases is too low to draw definitely reliable conclusions. Further multi-centre studies are needed to verify our findings, and testing with higher concentrations of PG and late readings beyond D3/D4, essential in case of weak sensitizers, should also be considered.

In conclusion, we feel that PTG deserves to be considered as an audit allergen for the cosmetic series as it would allow the diagnosis

TABLE 1 Intensity scores and clinical relevance of positive allergic reactions in patients sensitised to pentylene glycol (PTG) and/or propylene glycol.

Patient no. (sex, age)	PTG			Propylene glycol		
	5% aq.	10% aq.	Relevance	5% pet	30% aq.	Relevance
1 (M, 58)	+	+	Certain/likely	Neg.	+	Certain/likely
2 (F, 44)	+	+	Certain/likely	Neg.	Neg.	—
3 (F, 37)	++	++	Possible/doubtful	Neg.	Neg.	—
4 (F, 55)	++	++	Possible/doubtful	Neg.	Neg.	—
5 (F, 60)	Neg.	+	Possible/doubtful	Neg.	Neg.	—
6 (F, 76)	+++	+++	Absent	Neg.	Neg.	—
7 (F, 60)	Neg.	++		Neg.	Neg.	—
8 (M, 25)	Neg.	Neg.	—	Neg.	+	Certain/likely
9 (M, 69)	Neg.	Neg.	—	Neg.	+	Possible/doubtful
10 (M, 57)	Neg.	Neg.	—	Neg.	++	Absent

of a relevant number of contact allergies that are not detectable with PG and that would otherwise be missed.

AUTHOR CONTRIBUTIONS

Rosella Gallo: Conceptualization; data curation; formal analysis; investigation; methodology; writing – original draft; writing – review and editing; supervision. **Fabrizio Guarneri:** Conceptualization; data curation; formal analysis; investigation; writing – review and editing; writing – original draft. **Silvia Mariel Ferrucci:** Data curation; investigation; validation; writing – review and editing. **Luca Stingeni:** Data curation; investigation; validation; writing – review and editing. **Katharina Hansel:** Data curation; investigation; validation; writing – review and editing. **Monica Corazza:** Investigation; validation; writing – review and editing; data curation. **Alessandro Borghi:** Data curation; investigation; validation; writing – review and editing. **Caterina Foti:** Data curation; investigation; validation; writing – review and editing. **Paolo Romita:** Data curation; investigation; validation; writing – review and editing. **Cataldo Patruno:** Data curation; investigation; validation; writing – review and editing. **Maddalena Napolitano:** Data curation; investigation; validation; writing – review and editing. **Nicole Morini:** Data curation; investigation. **Ilaria Trave:** Data curation; investigation. **Luigi Rigano:** Resources. **Aurora Parodi:** Validation; supervision; writing – review and editing.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to declare.

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