

Transient re-emergence of oil of turpentine allergy in the pottery industry

J. T. LEAR, A. H. M. HEAGERTY¹, B. B. TAN, A. G. SMITH AND J. S. C. ENGLISH

Department of Dermatology, Central Out-Patients, Hartshill Road, Stoke On Trent ST4 7PA, UK

¹Department of Dermatology, The Skin Centre, Dudley Road Hospital, Birmingham, UK

Allergy to oil of turpentine has diminished largely due to the use of cheaper substitutes in many occupations. However, 2 particular areas still reliant on real oil of turpentine are those of the perfume industry and ceramic decoration. We report 24 cases of hand dermatitis in pottery workers involved in ceramic decoration, painters, liners, gilders, enamellers and a fine china painter, seen in a 6-month period following a change from Portuguese to Indonesian turpentine, of whom 14 were sensitive to Indonesian turpentine, 8 to α -pinene, 4 to Δ -3-carene and 2 positive to turpentine peroxides. Previous reports suggest that Δ -3-carene is the main allergen and reports of sensitivity to α -pinene in the absence of sensitivity to turpentine peroxide, in particular to the hydroperoxide of Δ -3-carene, are few. Turpentine allergy continues to be a problem in the pottery industry and is more common than allergy to the heavy metals of the colours used in ceramic decoration. α -Pinene, an unusual allergen, appears to be the most common in our area. Reversion to Portuguese turpentine seems to have alleviated the problem.

Key words: oil of turpentine; allergic contact dermatitis; epidemic; α -pinene; Δ -3-carene; pottery industry; occupational. © Munksgaard, 1996.

Accepted for publication 30 April 1996

Oil of turpentine was widely used in the past as a thinner in paints, solvents and varnishes. However, its use declined with the development of the cheaper and less sensitizing petroleum product, white spirits. Turpentine is extracted as a yellow gum by wounding pine trees and collecting the exudate, which is then separated into its component parts by steam or vacuum distillation (1). It is an oleo-resin containing oil and rosin. The volatile oily fraction derived from the distillation of turpentine is known as oil of turpentine. It can be a by-product of paper pulp production and is then known as sulfate oil or sulfate turpentine. The main sources of turpentine in use in the UK are Portugal, Indonesia and Brazil. It contains a mixture of α -pinene, Δ -3-carene and dipentene. The concentration of each of these constituents varies with the botanical species and geographical location of the tree.

Oil of turpentine is a well-known irritant and sensitizer (2). Allergy is well described in painters (3), mechanics using impregnated soaps (4), shoe repairers and home decorators (5). It was a frequent cause of allergic occupational dermatitis in

the 1950s. It is seemingly rare in the present day, especially since the introduction of less allergenic substitutes. The terpenes themselves are not thought to be sensitizers but their oxidated products, the hydroperoxides, are allergenic, particularly the Δ -3-carene products (6). Δ -3-carene is considered undesirable in the oil due to this. However, patients reacting specifically to α -pinene have been described (7, 8). In 1979, in view of its decreasing usage, the International Contact Dermatitis Research Group recommended the removal of oil of turpentine from the standard patch test series (1). Contact sensitization in the pottery industry has previously been underestimated, although the irritant nature of some of the processes has been acknowledged. As reported previously, allergy to chromate, as well as to biocides, heavy metals and oil additives are by no means uncommon (9). Oil of turpentine is still used in this industry but reports of sensitisation are rare. We report our findings in a series of patients presenting with hand dermatitis following a change from Portuguese to Indonesian turpentine, whose occupations encompassed various aspects of ceramic decor-

Table 1. Patch test results

Patient tested	Indonesian turpentine	Portuguese turpentine	α -pinene	turpentine peroxide	<i>A</i> -3-carene
1	+	-	++	-	-
2	++	-	-	-	-
3	+	-	-	-	-
4	+	-	++	-	-
5	+	-	-	-	-
6	++	-	++	++	+
7	+	+	+	-	-
8	++	+	+	-	-
9	+	+	-	-	+
10	+	-	-	-	-
11	+	-	+	-	-
12	+	-	-	-	+
13	-	-	++	-	-
14	+	-	++	-	-
15	+	-	-	+	+

ation, illustrating that allergy to oil of turpentine has re-emerged as a cause of allergic occupational dermatitis, particularly in the pottery industry.

Patients and Methods

24 patients with hand dermatitis following exposure to Indonesian turpentine, whose occupations encompassed aspects of ceramic decoration in the local pottery industry (paintresses, liners, gilders, enamellers and a fine china painter), presented over a period of six months, to our department. This was significantly more than usual and we wanted to determine the cause of this epidemic. The patients had worked with Indonesian oil of turpentine. This had recently changed from the usual turpentine used in these factories, which was Portuguese. Patients were patch tested to the European standard series, as well as to samples provided from their workplace. Oil of turpentine 10% in olive oil (o.o.), colours 1% in petrolatum (pet.), as well as α -pinene oil (10% pet.), *A*-3-carene oil (10% pet.), turpentine peroxide (0.3% o.o.), dipentene (2% pet.), aniseed (1% o.o.), fat oil (as is and 10% o.o.) and aniseed turpentine (10% o.o.) were applied in addition. Patch tests were performed using Finn Chambers on Scanpor tape, applied for 2 days. Readings were taken at 2 and 4 days after initial application.

Results

Of the 24 patients examined, 14 showed sensitivity to Indonesian turpentine. 3 of these also reacted to Portuguese turpentine (Table 1). Positive reactions to specific turpentine constituents were

limited to 8 to α -pinene, 4 to *A*-3-carene and 2 to turpentine peroxides. 5 patients were positive to nickel in the European standard series.

Discussion

Our study illustrates that oil of turpentine can still be a potent cause of occupational allergic contact dermatitis and should not be forgotten as a potential allergen. The use of oil of turpentine has been severely limited in paints, solvents and polishes in the UK, especially due to its cost, but also because of its irritancy and allergenicity. It is still used in the pottery and perfume industry. In pottery manufacturing, oil of turpentine is used mixed in with enamel paints or in textured paints, where it is mixed with fat oil and left open to the atmosphere for a prolonged period of time. The decoration of ceramics such as fine and bone china may be as a coloured glaze, or be applied by brush either prior to glazing or after the ware has been glost fired (the glaze firing). Firing fuses the colour to the ware and glaze.

The irritant nature of turpentine is not in doubt (2). It has been used experimentally in a variety of situations to induce an inflammatory response. Similarly, its ability to sensitize the skin in the context of occupational dermatoses is widely recognised (3, 4). Oil of turpentine contains as its pre-

Table 2. Major constituents of turpentine (16)

	Portuguese (%)	Indonesian (%)
α pinene	78	85
β pinene	16.5	2.5
<i>A</i> -3-carene	<0.7	>15

dominant constituent, α -pinene, with variable amounts of Δ -3-carene, beta-carene, and dipentene (d and l-limonene), as well as camphene. The exact proportions of each oil vary with the country of origin. The main difference is the high content of Δ -3-carene in the oil from Indonesia (Table 2). Δ -3-carene oxidises to a hydroperoxide; which is believed to be the main allergen of oil of turpentine (10, 11). For reasons of cost, the Indonesian variant is the most commonly used. It has been noted that with the use of turpentine peroxide as 0.3% (o.o.), the number of irritant reactions was dramatically reduced (1). In our cases, however, only 2 patients tested positive for this. 8 tested positive for α -pinene, the principal oil in fine quality oil of turpentine required for ceramic decoration. Reports of sensitivity to α -pinene in the absence of sensitivity to turpentine peroxide, and in particular to the hydroperoxide of Δ -3-carene, are few. Pirilä et al. in 1969 described 4 cases with specific sensitivity (8). It is odd, therefore, that α -pinene sensitivity was so common in our patients, without positivity to turpentine peroxide. It may be that the standard peroxide supplied does not contain the hydroperoxide of α -pinene, which will eventually form and which may be allergenic. It is unlikely that the α -pinene tested was contaminated with Δ -3-carene hydroperoxide, as the turpentine peroxide patch test was negative. Thus, it would seem that our patients display specific α -pinene allergy, although the mechanism for this is unclear. Grimm & Gries (12, 13) suggested that another oxidised product could be the allergen and found positive skin reactions to α -pinene in the absence of peroxides, illustrating a similar pattern of results to ours. Our patients were advised against using turpentine and their dermatitis improved. The presence of Δ -3-carene in Indonesian turpentine may have facilitated α -pinene allergy in our patients, possibly via an irritant effect. This may also explain why there have been no further new cases since the re-introduction of Portuguese turpentine, which contains 78% α -pinene and little Δ -3-carene. Alternatively, the concentration of α -pinene may be crucial in allergy development, with a change from 78% to 85% becoming significant, although this seems an unlikely explanation.

The principal source of turpentine for ceramic decoration, as mentioned above, is Indonesia. We are informed that the Δ -3-carene content is significant. It would seem unlikely, therefore, that oxidation of old oil of turpentine, resulting in oxidative products of α -pinene, had occurred, as concomitantly oxidation of Δ -3-carene would have produced the more allergenic hydroperoxide, sensitivity to which we could detect in only 2 patients. A difficulty arises in maintaining the reduced state of Δ -3-car-

ene in the patch test material. Perhaps the 4 positive patch test results to Δ -3-carene were in reality related to the proportion of oxidized products present or irritant reactions. It is note worthy that negative patch tests to dipentene may be caused by unoxidised patch test preparation (14). For the future, we are examining sensitivity in patients to fractions of turpentine separated by high-performance liquid chromatography, to attempt to identify the allergen(s) more precisely. The situation described here is similar to that which occurred in the French ceramic industry at Limoges, in 1970, with the importation of turpentine rich in Δ -3-carene rather than the Portuguese variety normally used. The sensitizer was identified as Δ -3-carene (15).

In conclusion, turpentine allergy has transiently re-emerged in the pottery industry, and is more common than allergy to the heavy metals of the colours used in ceramic decoration. α -pinene, an unusual allergen, appears to be the most common, acting via an unclear mechanism. Reversion back to Portuguese turpentine has been successful in alleviating the problem.

References

1. Cronin E. Oil of turpentine—a disappearing allergen. *Contact Dermatitis* 1979; 5: 308–11.
2. Pirilä V, Pirilä L. Terpentinallergie. *Berufsdermatosen* 1964; 12: 163–7.
3. Hellerström S. Hypersensitivity tests in professional eczema, their applicability and sources of error. *Acta Dermatovenereologica* 1939; 20: 657.
4. Oleffe J. Epidemiologic, social and economical aspects of occupational dermatoses in Belgium. *Archives Belges de Dermatologie* 1973; 29: 93–104.
5. Cronin E. *Contact dermatitis*, 1st edition. Edinburgh: Churchill Livingstone 1980; 797–805.
6. Pirilä V. Eczema due to oil of turpentine. *Therapeutische Umschau/Revue thérapeutique* 1970; 27: 509–514.
7. Hindson TC. Contact allergy to α -pinene in boot polish. *Contact Dermatitis Newsletter* 1969; 6: 116–7.
8. Pirilä V, Kilpio O, Olkkonen A et al. On the chemical nature of the eczematogens in oil of turpentine. *Dermatologica* 1969; 139: 183–94.
9. Wilkinson S M, Heagerty A H M, English J S C. Hand dermatitis in the pottery industry. *Contact Dermatitis* 1992; 20: 91–95.
10. Hellerström S, Thyresson N, Blohm S V, Widmark G. On the nature of the eczematogenic component of oxidised Δ -3-carene. *J Invest Dermatol* 1955; 24: 217–24.
11. Pirilä V, Siltanen E. On the chemical nature of the eczematogenic agent in oil of turpentine (3). *Dermatologica* 1958; 117: 1–8.
12. Grimm W, Gries H. Untersuchungen über die terpeninallergie (1. Mitteilung). *Berufsdermatosen* 1967; 15: 253–259.
13. Grimm W, Gries H. Untersuchungen über die terpeninallergie (2. Mitteilung). *Berufsdermatosen* 1968; 16: 190–198.
14. Karlberg A T, Magnusson K, Nilsson V. Air oxidation of d-limonene (the citrus solvent) creates potent allergens. *Contact Dermatitis* 1992; 26: 332–340.
15. Benezra C, Foussereau J, Maleville J. L'identification chi-

- mique des allergenes vegetaux et son interet dans la prevention de nombreux eczemas allergiques professionnels. *Maladies Professionnelles de Medecine du Travail et de Securite Sociale* 1970; 31: 539-543.
16. Cachao P, Menezes Brandão F, Carmo M et al. Allergy to oil of turpentine in Portugal. *Contact Dermatitis* 1986; 14: 205-208.

Address:

J. T. Lear
North Staffs NHS Trust, Central Out-Patients,
Dermatology Department,
Hartshill Road Stoke on Trent ST4 7PA
UK

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.