

The validity of the Mathias criteria for establishing occupational causation and aggravation of contact dermatitis

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Mathias proposed 7 criteria for establishing occupational causation and aggravation of contact dermatitis (Mathias, *J Am Acad Dermatol* 1989, 20, 842–848). 4 of the 7 criteria must be positive to conclude occupational dermatitis. In order to evaluate the validity of these criteria, we re-examined 19 patients (17 male and 2 female) with contact dermatitis, who had given a positive answer to at least 4 of the criteria and had either exchanged their workplace or stopped working. We re-evaluated them, 2–5 years later, for the presence of contact dermatitis. 14 of 19 patients (74%) reported that their dermatitis had cleared after they had left their previous workplace. Only 5 patients still suffered from dermatitis, 2–5 years later. 3 of these 5 patients could have been exposed to the causative allergens in their new workplace. We conclude that the Mathias criteria are useful to assess occupational contact dermatitis.

Key words: chromate; Mathias criteria; occupational contact dermatitis; prognosis; rubber chemicals. © Blackwell Munksgaard, 2004.

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Establishment of the diagnosis of occupational contact dermatitis is often difficult, because no clinical or histological features are characteristic. The physician must reach his conclusions on the medical history and cutaneous findings. Mathias (1) proposed 7 criteria for establishing occupational causation and aggravation of contact dermatitis (Table 1). The answer to at least 4 of these criteria should be positive for there to be a reasonable probability of occupational contact dermatitis. The aim of the present study was to evaluate the validity of these criteria.

Patients and Methods

We studied patients patch tested at the Department of Dermatology of the Hadassah University Hospital, Jerusalem, Israel. Patients were included only if there was doubt regarding the connection between the contact dermatitis and their occupation. When there was a clear connection between the workplace and the dermatitis, we did not use the Mathias criteria.

We excluded from the present study patients in whom the occupational nature of the contact dermatitis was clear, including patients who:

1. Developed contact dermatitis a few months or years after starting a particular occupation, and patch tests showed sensitivity to an allergen known to cause contact dermatitis in their specific occupation (e.g. chromate sensitivity in construction workers or acrylates in dental workers).
2. Following weeks to months away from work (e.g. long vacations), there was marked improvement of the dermatitis and relapse of the dermatitis upon returning to work.
3. The employer or the insurance company accepted the diagnosis of occupational dermatitis.

Patch tests were performed using Finn Chambers[®] on Scanpor[®] tape (Epitest, Tuusula, Finland). All substances were applied on the upper back and removed after 2 days. The sites were examined on removal and 2 days after removal according to international guidelines. Only positive reactions of +, ++ and +++ grades were considered valid. When occupational contact dermatitis was suspected, the patient was patch tested also with the relevant patch tests series of his occupation. For standard and occupational patch tests, we used the products of Chemotechnique Diagnostics, Malmo, Sweden.

Table 1. Mathias criteria for establishing occupational causation and aggravation of contact dermatitis

Criterion 1:	Is the clinical appearance consistent with contact dermatitis?
Criterion 2:	Are there workplace exposures to potential cutaneous irritants or allergens?
Criterion 3:	Is the anatomic distribution of dermatitis consistent with the form of cutaneous exposure in relation to the job task?
Criterion 4:	Is the temporal relationship between exposure and onset consistent with contact dermatitis?
Criterion 5:	Are non-occupational exposures excluded as likely causes?
Criterion 6:	Does avoiding exposure lead to improvement of the dermatitis?
Criterion 7:	Do patch tests or provocation tests implicate a specific workplace exposure?

In the years 1996–99, 26 contact dermatitis patients were evaluated for probable occupational dermatoses. Patients were selected only if there was doubt regarding the connection between the contact dermatitis and their occupation and after giving at least 4 positive answers to the Mathias criteria. All these patients changed jobs or stopped working. We contacted these patients during 2001 regarding the status of their dermatitis.

19 of these 26 patients (17 male and 2 female) responded (Table 2). Patients were asked whether the contact dermatitis they suffered from had improved or subsided. Those answering that they had changed their workplace were asked the whereabouts of the new worksite. Patients still suffering from dermatitis were invited to our clinic for re-evaluation.

Results

Hand eczema was the most common site for the dermatitis in all except 1 of the patients.

Patients were followed up 2–5 years after the Mathias criteria were established.

- (1) 2 patients gave 4 positive answers to the 7 criteria.
- (2) 8 patients gave 5 positive answers to the 7 criteria.
- (3) 8 patients gave 6 positive answers to the 7 criteria.
- (4) 1 patients gave 7 positive answers to the 7 criteria.

14 of 19 patients completely recovered from the dermatitis 2–12 months after leaving their workplace. 5 patients still suffered from dermatitis. 4 individuals of the 14 had stopped working and 10 had changed their workplace or their occupation.

In the group still suffering from dermatitis (patients nos 2, 5, 9, 14 and 16) (Table 2), 3 of 5 had stopped working. The other 2 had changed their workplace. 1 of these patients worked as a gasoline filler in a gasoline station, and on patch testing, he was found to be sensitive to allergens in antifreeze solutions and cooling fluids (no. 14 in Table 1): he had changed his occupation to agriculture. He was in contact with assorted

agricultural machinery and, clearly, it is possible that he continued to be in contact with the allergens that he was found to be sensitive to. The other such patient worked in construction, principally as a rubber product assembler. On patch testing, he was found to be sensitive to rubber chemicals. (no. 16 in Table 1). It is possible that he continued to work with rubber products in private houses unofficially.

15 of the 19 patients failed to fulfil criterion 7. This was not related to the prognosis.

Discussion

Contact dermatitis constitutes 90–95% of occupational dermatoses (2, 3). It is difficult to establish the connection between contact dermatitis and a specific occupation without objective criteria. In the past, trials were made to determine such criteria, but they gave only a partial answer to this problem (1, 4). Mathias inferred that, considered separately, no single criterion provides sufficient evidence for probable occupational causation of contact dermatitis. Therefore, he proposed 7 criteria for evaluation of the connection between contact dermatitis and a given occupation. Because worker's compensation laws require only reasonable probability (more than 50% likelihood) of causation, the answers to only 4 of the criteria must be positive in order to establish the connection between the contact dermatitis and exposure to an allergen or allergens in the workplace.

According to my personal experience, we can note that, generally, this is also the approach in Israel. The Israeli Institute for Welfare or private insurance companies who are asked to pay indemnification to a worker, who is forced to stop working or change his workplace because of occupational contact dermatitis, very often plead that the worker is in contact with the suspected allergen(s) not only at work, but also outside of his working environment. It is true that almost all allergens responsible for occupational dermatitis can be found in other different environments, but this plea, if accepted, might undermine the diagnostic basis of occupational dermatology and even that of occupational medicine itself.

Table 2. Patients, occupations, allergens and Mathias criteria

Number	Sex	Age	Occupation (years)	Contact dermatitis	Standard patch tests	Occupational patch tests	Mathias criteria number of positive answers
1	Female	37	Dentist (12)	Hand eczema	Nickel ++	Dental screening 2-Hydroxyethyl methacrylate ++ N-ethyl-4-toluenesulfonamide ++ Hydroxy-4-methoxy-benzophenone + Acrylate series - printing Epoxy acrylate ++ Oil and cooling fluid series Negative Textile series Disperse blue 106+ Shoe series Diphenylguanidine + Oil and cooling fluid series Kathon CG ++ Epoxy series Diaminodiphenylmethane ++ Not done	5
2	Male	40	Printer (5)	Hand eczema	Nickel ++		5
3	Male	39	Metal works (8)	Hand eczema	Cobalt +, caine mix +		5
4	Male	24	Sock model (measured socks hours everyday) (2)	Feet eczema	Negative		4
5	Male	43	Car mechanic (23)	Hand eczema	Kathon CG++		4
6	Male	33	Aviation works – glueing (11)	Hand eczema	Negative		6
7	Male	43	Optical elements – glueing (5)	Hand eczema	Nickel ++, formaldehyde ++, balsam of Peru ++		6
8	Male	37	Storekeeper – medical supply (5)	Facial and hand eczema	Negative	Not done	5
9	Male	30	Litter worker (5)	Hand eczema	Potassium dichromate	Not done	5
10	Male	45	Car mechanic (5)	Hand eczema	Negative	Oil and cooling fluids series Triethanolamine	7
11	Male	50	Aviation works – painter (3)	Hand eczema	Negative	Photographic chemicals series Hydroquinone + Not done	5
12	Male	48	Milking machinery mechanic (2)	Hand eczema	Potassium dichromate +, nickel +, benzocaine ++		6
13	Male	39	Cutting metal sheets (3)	Hand eczema	Cobalt +	Not done	6
14	Male	31	Gasoline station worker (5)	Hand eczema	Negative	Oil and cooling fluids series Ethylenediamine dihydrochloride +, 2-phenylphenol + Oil and cooling fluid series Triethanolamine +, hexahydro-1,3,5-tris-triazine +	6
15	Female	45	Electronics engineer (4;5)	Hand eczema	Potassium dichromate +, cobalt +		6
16	Male	42	Construction worker – rubber elements (14)	Hand eczema	Mercaptobenzothiazole ++, mercapto mix ++	Not done	5
17	Male	32	Orthopaedic devices mechanic (6)	Hand eczema	Negative	Plastics and glues series	5
18	Male	38	Leather worker (4)	Hand eczema	Potassium dichromate +++	Negative	6
19	Male	42	Tyre dealer (7)	Hand eczema	Negative	Not done Rubber additives series N,N-di-beta-naphthyl-4-phenylenediamine ++	6

The basis of the argument connecting contact dermatitis to exposure in a workplace is more intensive exposure to an allergen or allergens in the workplace than anywhere else. This should be sufficient to prove more than 50% likelihood that the dermatological disease was acquired or aggravated by exposure to an allergen or allergens in the workplace. In cases in which the difference between the sides is to be decided in court in Israel, this argument is accepted by the court on the understanding that 100% proof is not obtainable. The Mathias criteria provide a basis of more than 50% likelihood to establish a connection between contact dermatitis and occupation.

In 74% of our patients, the contact dermatitis cleared 2–12 months after the patient stopped working or changed workplace or occupation. Of the 5 patients in which the dermatitis continued, 2 had changed their workplace but were possibly still exposed to the allergen in their new environment. We are aware of the poor prognosis of occupational skin diseases in previous studies (5, 6) and agree that the reasons for that include incorrect diagnosis, endogenous eczema and persistent occult exposure to allergens. A major additional factor for occupational skin disease prognosis is the influence of the prevailing occupational medicine paradigms relating to work, health and compensation. An analysis of skin diseases reported in relation to United States Occupational Health Act (OSHA) shows clearly that the number of occupational skin diseases declined steadily from 1970 since the OSHA paradigm (7).

We believe that application of the Mathias criteria together with the Israeli system for application of work, health and compensation rules contributes to the surprisingly better prognosis of occupational contact dermatitis in our patients. The strict rules in Israel regarding compensation for unemployment or exchanging workplaces are important in preventing occult exposure to allergens. A recent study from Singapore (8) showed that the prognosis of occupational dermatitis is relatively good in contrast to earlier studies. The overall outcome for occupational dermatitis showed 60% complete clearance at 1 year, 43% of these patients suffering from allergic contact dermatitis. In this study from Singapore, chromate in cement was the commonest allergen. It carried a poor prognosis. In our present study, 4 patients had chromate sensitivity, 3 showing complete clearance after discontinuing contact with chromate. None of our chromate-sensitive patients had dermatitis from cement, but they were in

contact with cutting oils and still the prognosis was good.

The only criticism that we have of the Mathias criteria concerns criterion no. 1. According to Mathias, even if criterion no. 1 is negative, one cannot rule out contact dermatitis. We agree that non-eczematous contact dermatitis does exist. Contact dermatitis may present as psoriasis, seborrhoeic dermatitis, erythema multiforme, atopic dermatitis, etc., in some special cases. We have evidence that in cases of clear palmar tinea 4 criteria may still be positive (criterion nos. 2, 3, 4 and 5). We believe that if the answer to criterion no. 1 is negative, there is no reason to continue checking other criteria. If criterion no. 1 is positive, the Mathias criteria serve as a very important diagnostic tool in establishing a diagnosis of occupational contact dermatitis.

This study tested the validity of the Mathias criteria in 19 patients. 16 of 19 patients gave 5 or more positive answers to the Mathias criteria. In this pilot study, the number of participants is too small to evaluate the connection between the number of positive answers given and the validity of the criteria. In the future, it will be interesting to examine this question in a larger group of patients.

References

1. Mathias C G T. Contact dermatitis and workers compensation: criteria for establishing occupational causation and aggravation. *J Am Acad Dermatol* 1989; 20: 842–848.
2. Hogan D J, Tanglertsampan C. The less common occupational dermatoses. *Occup Med* 1992; 7: 385–401.
3. Diepgen T L, Coenraads P J. The epidemiology of occupational contact dermatitis. In: *Handbook of Occupational Dermatology*, Berlin: Springer Verlag, 2000: 3–16.
4. Schwartz L, Tulipan L, Peck S M. In: *Occupational Diseases of the Skin*, Philadelphia: Lea & Febiger 1947.
5. Burrows D. Prognosis in industrial dermatitis. *Br J Dermatol* 1972; 87: 145–148.
6. Coenraads P J. Prevalence of hand eczema. Association with occupational exposure, especially in construction workers. MD Thesis. Groningen: University of Groningen, 1983.
7. Loh T H, Leow Y H, Gan S L, Goh C L. Prognosis of occupational dermatosis. *Contact Dermatitis* 2002; 47: 166.
8. Emmet E A. Occupational contact dermatitis. I. Incidence and return to work pressure. *Am J Contact Dermat* 2002; 13: 30–34.

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