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ORIGINAL ARTICLE

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Need for new strategies to improve the recall and avoidance rates of contact allergens: A retrospective cohort study from Turkey

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Abstract

Background: Previous studies reported a low-to-moderate benefit from patch testing regarding allergen recall and avoidance.

Objectives: To determine the allergen recall and avoidance rates of patients with allergic contact dermatitis (ACD) in Turkey.

Methods: This was a retrospective cohort study based on a phone questionnaire of 465 patients diagnosed with ACD from major allergen groups, that is, metals, preservatives, rubber, fragrances (ubiquitous allergens) and hair dye/black henna, topical drug and resins (nonubiquitous allergens), at our tertiary referral centre between 1996 and 2018.

Results: Among 176 responders, allergen groups were remembered better (53.4%) than the individual allergens (36.9%). Age <40 years and keeping the allergy pass had a significantly positive impact on the recall rate of methylchloroisothiazolinone/methylisothiazolinone and nickel, particularly non-occupational nickel allergy from metal jewellery in females, respectively. Exacerbations of ACD (56.3%) were mainly due to reexposures to ubiquitous allergens. 42.9% of patients with occupational ACD changed or quit their job, most of them being construction workers and hairdressers, showing a high share (83.3%) of benefit.

Conclusions: The overall rates of allergen recall and avoidance were moderate. New strategies are needed to improve the recall and avoidance rates of contact allergens, such as increased use of allergy pass, smartphone applications and legal precautions.

KEYWORDS

allergic contact dermatitis, follow-up, methylchloroisothiazolinone, occupational, patch test, *p*-phenylenediamine, recall rate

1 | INTRODUCTION

Patch testing and evaluating the clinical relevance of positive patch test reactions are essential for diagnosing allergic contact dermatitis (ACD). During the last three decades, studies focused on patients' perspectives regarding patch testing,[1–12] as the real success of patch testing lies in educating patients with an established diagnosis of ACD to avoid the culprit allergen and the patient's ability to understand

and remember the test results and act accordingly in daily life.[9] Most studies reported that only a low-to-moderate percentage of patients could remember the exact name of the allergen and/or allergen group, influenced by multiple factors such as sex, age, number of years after patch testing and number of the allergens.[1,6–8,10,11] In this study, we aimed to investigate the patients' ability to remember the culprit of their ACD, the role of the possible influencing factors on the recall of the culprits and to assess the success of allergen avoidance at a tertiary referral centre for patch testing in Turkey.

2 | MATERIALS AND METHODS

This retrospective cohort study was conducted in the allergy unit of the Department of Dermatology and Venereology at the İstanbul Faculty of Medicine in İstanbul, Turkey. Using the purposive sampling method, we first selected files of 465 patients with the established diagnosis of ACD from seven allergen groups among 2602 consecutively patch-tested patients in our allergy unit between 1996 and 2018. These were metals, preservatives, rubber and fragrances as the ubiquitous allergen groups, and hair dye/black henna, topical drug and resins as the nonubiquitous allergen groups.

Patch tests were performed with the European baseline series and/or additional test series. Verbal and written consents were obtained from patients ≥18 years of age and the legal guardians of those under 18. Test sites were evaluated on days (D)2, D3, D4 and since 2010, additionally on D7, according to the European Society of Contact Dermatitis (ESCD) patch test guideline.[13] The COADEX scale[14] and the Mathias criteria[15] were used to determine the clinical and occupational relevance of positive patch test reactions, respectively. All patients were informed verbally and written by giving them an allergy pass, including the exact chemical name of the contact allergen and detailed information tags for the allergens to avoid. The information tags included a brief definition of the allergen and where it is found, its synonyms and cross-reactants. Reading product labels and showing the allergy pass to pharmacists/doctors were encouraged. In the case of sensitisation to allergens with complex names, patients were asked to repeat the allergen name several times to achieve appropriate pronunciation and reinforce the recall.

After a minimum of 6 months following the diagnosis of ACD, patients were invited for a phone questionnaire. The questions and patients' answers are shown in Appendix S1.

The interview was conducted with the legal guardians of patients who were < 18 years old. In order to avoid any recall bias during the phone interview, patients or their legal guardians were requested to answer the questionnaire without looking at their allergy pass.

The answers were compared with the data extracted from the patients' medical files. The recall rates of the culprit allergens were evaluated in terms of sex, age at the time of ACD diagnosis, number of years after patch testing, number of relevant allergens, occupational relevance, keeping the allergy pass, allergen ubiquity and localisation of ACD. Patients diagnosed with occupational ACD were additionally asked if they had changed/quit their job after patch testing and, if yes, how this affected the course of their dermatitis (Appendix S1).

IBM SPSS® Statistics Version 22 was used to store and analyse the data. Descriptive statistics were calculated as median, minimum and maximum values for continuous variables and as frequency and percentage for categorical variables. The differences in the distribution of categorical variables between two independent groups were assessed by the chi-square test or Fisher's exact test. A 2-tailed p-value less than 0.05 was considered statistically significant. The study was approved by the Ethical Committee of İstanbul University, İstanbul Faculty of Medicine (approval number: 2018/1059) and conducted in accordance with the Declaration of Helsinki.

3 | RESULTS

Among 465 invited patients, 176 (37.9%) responded to phone calls and accepted the interview. The characteristics of patients are shown in Table 1. Among 176 responders, the recall rate of the culprit allergen group and the individual allergen was 53.4% and 36.9%, respectively. The most correctly remembered allergen groups and allergens are shown in Figures 1 and 2. The complex name of methylchloroisothiazolinone/methylisothiazolinone (MCI/MI) was spelt out in nine different variations (Appendix S2, footnote b).

The impact of the factors on the allergen recall is shown in Appendix S2. Age < 40 years had a significantly positive impact on MCI/MI recall (Fisher's exact test, $p < 0.05$), whereas keeping the allergy pass had a significantly positive impact on nickel recall ($p < 0.01$, odds ratio [OR] 5.3, 95% confidence interval [CI] 1.4–16.7). Female patients who could recall nickel were exclusively those with non-occupational nickel allergy from metal jewellery. These patients had a significantly high share of keeping their allergy pass ($n = 20/26$, 76.9%). Although statistically not significant, the recall rate of MCI/MI was higher among those who were keeping their allergy pass (37.5%) in comparison to those who did not keep the allergy pass (22.2%).

Female patients recalled the chemical names of p-phenylenediamine (PPD) and nitrofurazone significantly better than males (Fisher's exact test, $p < 0.01$ and $p < 0.05$, respectively) (Appendix S2).

A total of 56.3% of patients reported exacerbations of ACD, mainly due to incomplete allergen avoidance (Appendix S1). Fragrances, preservatives, rubber and metals were at the top of the list, whereas nitrofurazone-containing topical drug was completely avoided (Appendix S1).

Among patients with occupational ACD ($n = 56$), 42.9% ($n = 24$) changed or quit their job, most of them being construction workers and hairdressers. Twenty (83.3%) of them reported a significant improvement of their dermatitis (Appendix S1).

4 | DISCUSSION

Patch testing is a cost-effective and practical method when the total amount of time and therapy for chronic ACD cases are

TABLE 1 Characteristics of patients with clinically/occupationally relevant patch test reactions who responded to phone interview ($n = 176$).

Patient characteristics	Number of patients
Responders	176
Adult patients	154
Parents of patients (for patients <18 years old)	22
Sex (male: female)	98:78 (1.3:1)
Age at the time of diagnosis (years)	2–79 (median: 34)
Atopy	None ($n = 155$), allergic rhinoconjunctivits ($n = 10$), atopic skin diathesis ($n = 7$), atopic dermatitis ($n = 4$)
Allergen groups[a]	
Ubiquitous	Metal ($n = 76$)
	Preservative ($n = 43$)
	Rubber ($n = 27$)
	Fragrance ($n = 15$)
Nonubiquitous	Hair dye/black henna ($n = 27$)
	Topical drug ($n = 25$)
	Resin ($n = 16$)
Number of relevant allergens	
One relevant allergen	108
≥2 relevant allergens	68
Non-occupational ACD	120
Occupational ACD	56 Construction worker ($n = 30$), hairdresser ($n = 18$), nurse ($n = 2$), textile worker ($n = 1$), medical doctor ($n = 1$), baker ($n = 1$), shipwright ($n = 1$), furniture maker ($n = 1$), aircraft mechanics ($n = 1$)
Relevant localisations[a]	Hands ($n = 89$), topical drug contact area ($n = 32$), metal contact area ($n = 27$), generalised ($n = 19$), face/periorbital ($n = 19$), hair dye/black henna tattoo contact area ($n = 10$), feet ($n = 7$)
Time passed after patch testing	6 months-19 years (median: 4 years)
≤5 years	110
>5 years	66

Abbreviation: ACD, allergic contact dermatitis.
[a]The number of patients does not correspond to the total number of 176 patients, since some of the patients had more than one relevant allergen group/localisation of eczema.

considered.[16] Several studies showed a significant improvement in dermatitis severity and the quality of life in patients following the identification of the responsible contact allergen through patch testing.[2,4,5,10] Meanwhile, subjects with negative patch test results also benefited substantially from the test process since they gathered information about possible causes of dermatitis other than contact allergy, its treatment and ideal skin care methods.[2,5,10,17]

It is crucial for patients diagnosed with ACD to understand and remember the patch test results. However, some patients might misunderstand or forget the patch test results after some time.[9,11] The current ESCD guideline recommends repeating the contact allergy information during follow-up visits.[13] Moreover, there are factors affecting the recall rate, such as sex, age, years after patch testing or the number of contact allergies.[6–11] Based on these factors, specific patient populations need to be identified and informed more carefully.[11]

4.1 | Sex

In many studies, females were found to remember patch test results better than males.[6,7,10,11] In a previous study this was attributed to the female predominance among patch-tested patients.[7] In contrast, the sex of the patients was not an influencing factor for correctly remembering the patch test results in a previous report[9] as well as in our present study, the latter with a slight male predominance. However, females recalled PPD and nitrofurazone significantly better than males in our study. Hair dying is a common practise in females. Thus, PPD allergy constitutes a major cosmetic obstacle for women. That would account for the higher PPD recall rate in females, but it is unclear why they recall nitrofurazone better than males. Although speculative, this might be attributed to the meticulous nature of females who take their allergies more seriously.

4.2 | Age

In some studies, age over 40–60 years negatively affected the recall rate of the culprit allergens.[9,11] That was consistent with the present series only in terms of MCI/MI allergy, which was recalled significantly better by patients younger than 40 years. This was probably because most responders with MCI/MI allergy (69.7%; $n = 23/33$) were younger than 40 years in the present study. Indeed, MCI/MI allergy was more frequent among those who were <40 years old in a previous study from our department.[18]

4.3 | Years after patch testing

The increasing number of years after patch testing had a negative impact on the recall rate in various reports,[6–8] whereas this was not observed in the present study. Swedish researchers demonstrated that 39% of their patients remembered all the diagnosed allergens after 1 year of follow-up, while this rate was reduced to 17% for patients surveyed 10 years after patch testing.[7]

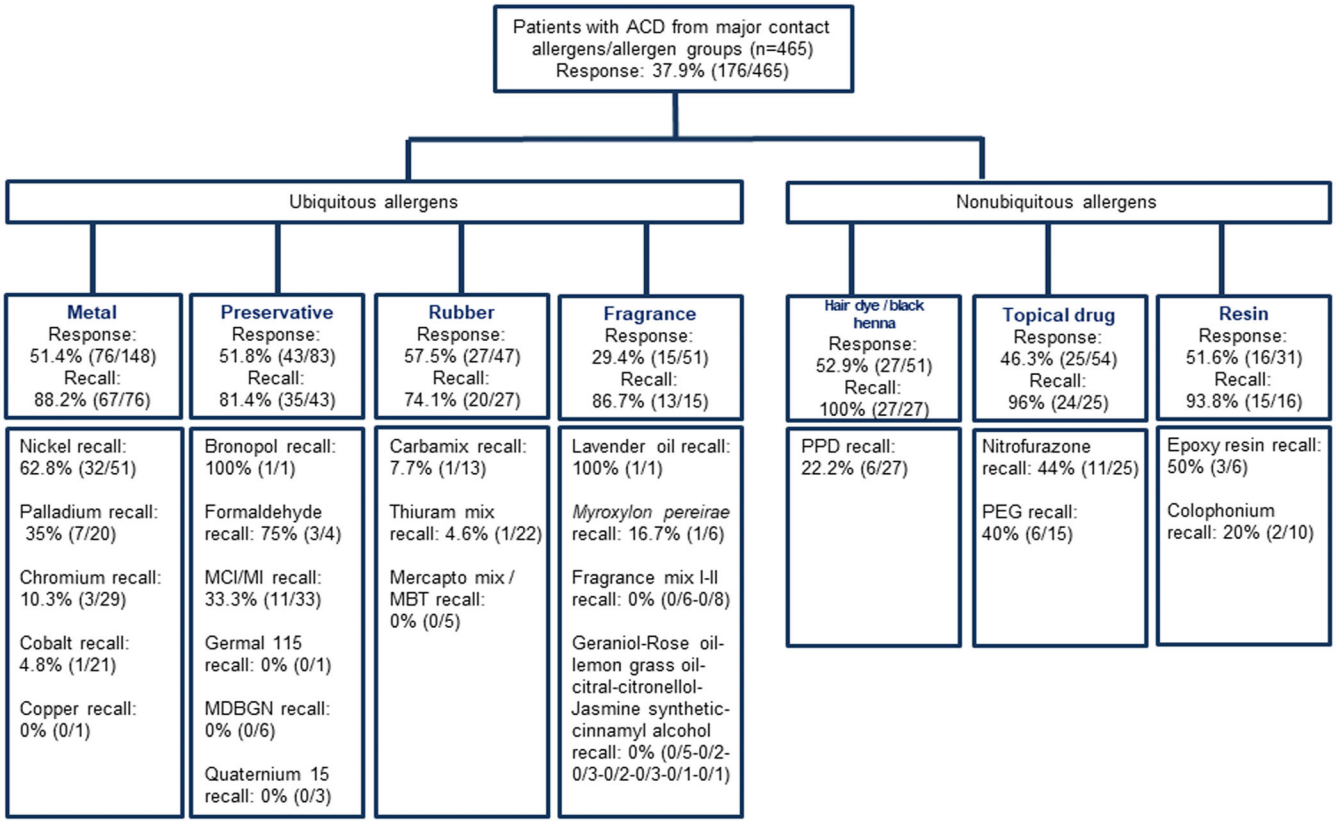

FIGURE 1 Overview of the patients with allergic contact dermatitis from major allergen groups and the related individual allergens according to their response rate (Response) to the phone interview and the recall rate (Recall) of the culprits. The sum of the responders in each allergen group is greater than the total number of responders ($n = 176$), since 68 had more than one relevant allergen positivity. ACD, allergic contact dermatitis; MBT, mercaptobenzothiazole; MCI/MI, methylchloroisothiazolinone/methylisothiazolinone; MDBGN, methyldibromo glutaronitrile; PEG, polyethylene glycol; PPD, *p*-phenylenediamine.

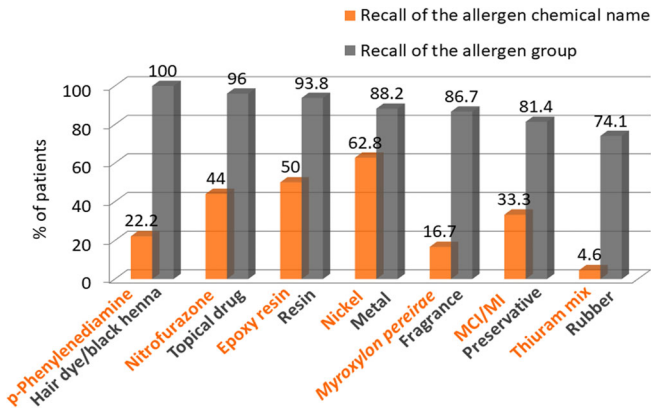

FIGURE 2 The recall rates for major allergen group names (grey bars) and the related allergen chemical names (orange bars).

4.4 | Number of allergens

Multiple contact allergies also pose a significant challenge for patients in remembering the test results.[6,7,9–11] In a recent study from Sweden, it was four times more likely for patients with one/two positive patch test reactions to recall the test results.[11] Similarly, Scalf et al. noted an approximately 50% decline (from 49.6% to 23.4%) in the rate of patients remembering the allergens correctly when they similarly compared patients regarding the number of positive allergens, that is, those with 1–2 allergens versus ≥3 allergens.[6] In the present study, such a difference was not observed between patients with a single positive allergen or ≥2 allergens.

4.5 | Localisation, severity, duration of eczema and education level of patients

The localisation of eczema was not an influencing factor in remembering the culprit allergens in the present and previous studies.[1–12] However, the severity of dermatitis and impairment in the quality of life at the time of diagnosis positively correlated with the recall rate in some studies.[9,10] The long duration of eczema prior to patch testing was further speculated to influence the recall of diagnosed allergens negatively.[7] Higher level of education was associated with an increased ability to recall.[19] On the other hand, the educational background was not an influencing factor in another study.[10]

4.6 | Name of the individual allergen

Previous studies reported that 29%–53% of patch-tested patients could remember the name of the positive allergens (Table 2).[1,6,7,10] The recall rate of the allergen name (36.9%) in the present study was in concordance with these findings. Two studies reported much higher recall rates. In a Danish occupational ACD cohort, this rate was 86.9%, which was not surprising since researchers provided answer categories including the specific occupational contact allergen names.[9] In a Swedish study, the recall rate of the allergen name was also high (59.4%).[11] However, these patients were given a list of allergens to choose from after 12 months following patch testing.[11]

Jamil et al. reported nickel as the leading allergen remembered by the chemical name.[7] It was also one of the most commonly remembered allergens in our series, likely attributed to its easy pronunciation. Allergens with complex, long chemical names, such as MCI/MI, were harder to remember[7] and avoid.[20] It is hard to spell them on the first visit following patch testing. In a study evaluating the relapses in patients with ACD from MCI/MI, the inability to remember the name of the allergen was one of the main obstacles to avoidance.[21] In our present study, patients who could recall MCI/MI spelt out its name in many different variations. The allergy pass would be a perfect guide for these patients and its repetitive use would help the patient memorise better. Indeed, patients keeping the allergy pass could recall MCI/MI at a higher rate in our study. Besides, MCI/MI was found to be among the most frequent allergens causing a flare of ACD in our series, supporting that it was a difficult-to-remember contact allergen.

4.7 | Name of the allergen group

Allergen group names such as fragrances were better remembered than the exact chemical names of some allergens.[7] In our series, 94/176 (53.4%) patients recalled the culprit allergen group correctly, a nearly two-fold rate of what was detected in other studies (20%–36.9%),[1,7,8,10] but similar to a previous report from Sweden (56.4%).[11] The best-remembered allergen groups in the present study were hair dye/black henna and topical drug. That was probably due to the severe dermatitis caused by these allergen groups. Moreover, these allergens are not widely distributed in the environment and are only encountered in specific settings. The bright yellow colour of nitrofurazone would further ease the recall. Fragrance and rubber groups were much better remembered than the individual fragrance and rubber allergens.

4.8 | Verbal versus written information

There are controversial results on whether patients understand verbal information better than written information[5] or vice versa.[22] In a retrospective study, patients with lanolin allergy benefited from detailed information lists, including the products containing the culprit allergen.[22] Recently, increased awareness regarding product labels was observed in families of children with ACD following patch testing.[12] Parents were keen to have detailed information on products to avoid in addition to safe-to-use product lists and allergen chemical names.[12] In our present study, all patients diagnosed with ACD were given an allergy pass. According to our findings, the positive impact of keeping the allergy pass on nickel recall in female patients with allergy from metal jewellery might likewise be related to the meticulous nature of female patients who take their jewellery allergy seriously, mainly from a cosmetic point-of-view.

4.9 | Occupation

Previous studies from Europe reported that 51.3%–59% of patients with occupational ACD quit or changed their jobs.[23,24] This rate was lower (34.9%–42.9%) in a recent[10] and the present study from Turkey, while most of these patients were construction workers and hairdressers. In Denmark, patients with ACD from epoxy resin were reported to change their occupation frequently, because patients sensitised to epoxy resin are not allowed to work in epoxy-containing occupational settings in their country.[23,24] There are no similar occupational restrictions in Turkey which might explain the lower rates of occupational change in a previous[10] and the present Turkish study.

Carøe et al. defined the change of occupation as a strict term, only meaning a change to a different profession.[24] However, different occupational settings might share some allergens. One of our hairdresser patients sensitised to PPD changed his job to the leather industry, where he was exposed to cross-reacting azo dyes. This case highlighted the importance of being aware of the possible allergen sources of the culprit allergen or its cross-reactants in other occupational settings. If these sources were addressed, job change would be a manageable effort.

4.10 | Allergen avoidance

Compliance with avoidance strategies is as substantial as recalling the culprit allergens. Short-term follow-up studies for 6 weeks to 6 months on patients with established ACD diagnosis reported variable findings concerning allergen avoidance; some studies revealed very high avoidance rates (89.5%–91%),[4,5] while others noted lower rates (51.2%–56.9%).[2,10] In the present study, the majority of patients reported a flare of ACD from inevitable reexposures to ubiquitous allergen groups such as fragrances, preservatives, rubber and metals. Nitrofurazone, a nonubiquitous allergen, also known as 'yellow ointment' in our country, was avoided entirely. Similarly, Clemmensen et al. reported that a higher percentage of patients with ACD from epoxy resin, a nonubiquitous occupational allergen, achieved total eczema clearance compared to patients with ACD from ubiquitous rubber additives.[23]

TABLE 2 Overview of the studies on allergen recall after patch testing in the literature and results of the present study.

Author (year), country	Study method	Time after patch testing	Response rate (%)	Female: male (ratio)	Age of patients during survey or patch testing, years	Patch test result of the responders (*n*)	Number of patients with relevant allergens	Recall rate of the allergen group (%)	Recall rate of the allergen name (%)	Factors influencing the recall rate	Allergen avoidance (%)
Holness & Nethercott (1991),[1] Canada & United States	Interviewer-administered questionnaire survey among workers	2–9 years (range) 5 years (mean)	230/339 (67.8)	NM (1:2.3)	43.2 ± 13 (mean)	Positive (139) Negative (91)	NM	22/103 (21)	55/103 (53)	Negatively • **Positive patch test reaction to non-work-related allergens**	NM
Lewis et al. (1994),[2] UK	Mail questionnaire survey	2–3 months (range)	105/135 (77.8)	63:42 (1.5:1)	9–91 (range) 40.9 (mean)	Positive (56) Negative (49)	43	NM[a]	NM[a]	NM	22/43 (51.2)
Paul et al. (1995),[3] United States	Mail questionnaire survey and/or patient chart review	2 months	381/416 (91.6) with survey and/or chart review	NM (1.7:1)	12–83 (range) 46.2 (mean)	NM	NM	NM	NM	NM	NM/381 (56.5)[b]
Thomson et al. (2002),[4] UK	Face-to-face and mail questionnaire survey	2 months	114/160 (71.3)	102:58 (1.8:1)	≥16	Positive (only relevant) (38) Positive (non-relevant) or negative (76)	38	NM 37/38 (97.4%) (only those ACD patients who were able to recall their avoidance advice)	NM	NM	34/38 (89.5)
Woo et al. (2003),[5] UK	Face-to-face and mail questionnaire survey	6 weeks	71/140 (51)	91:49 (1.9:1)	NM	Positive (47) Negative (24)	47	NM	NM	NM	43/47 (91)
Scalf et al. (2007),[6] United States	Mail questionnaire survey	13.4 ± 6.5 months (mean)	757/1453 (52.1)	518:239 (2.2:1)	18.6–94.1 (range) 59.5 ± 16 (mean)	Positive (580) Negative (177)	NM	NM	198/580 (34.1)	Positively • Female sex • 50–59 years of age • Being nurse • 1–2 positive allergens Negatively • Male sex • Multiple (≥3) allergens • Increasing number of years after patch testing	563/646 (87.1)
Jamil et al. (2012),[7] Sweden	Mail questionnaire survey	1, 5 and 10 years	252/473 (53.3)	166:87 (1.9:1)	48.7 (median)	Positive (141) Negative (111)	NM	28/141 (20)	41/141 (29)	Positively • **Female sex** Negatively • **Male sex**	NM

TABLE 2 (Continued)

Author (year), country	Study method	Time after patch testing	Response rate (%)	Female: male (ratio)	Age of patients during survey or patch testing, years	Patch test result of the responders (*n*)	Number of patients with relevant allergens	Recall rate of the allergen group (%)	Recall rate of the allergen name (%)	Factors influencing the recall rate	Allergen avoidance (%)
										• **Multiple allergens** • **Increasing number of years after patch testing**	
Simonsen et al. (2015),[8] Denmark	Mail questionnaire survey	2–10 years (range) 5.2 years (mean)	1039/2260 (46)	708:331 (2.1:1)	4–28 (range) 17.7 (mean)	Positive (260) Negative (779)	NM	96/260 (36.9)	NM	Negatively • Increasing number of years after patch testing	NM
Brok et al. (2016),[9] Denmark	Mail questionnaire survey among patients with OACD[c]	2 years	149/199 (75)	97:52 (1.9:1)	20–68 (range) 46.3 (mean)	Positive (130)	130 patients with OACD from epoxy and rubber chemicals	NM	113/130 (86.9)	Positively • DLQI >1 Negatively • **Age > 60 years** • Multiple positivities to additional allergens • DLQI ≤1	NM
Korkmaz and Boyvat (2019),[10] Turkey	Face-to-face interview survey	6 months	51/57 (89.5)	26:25 (1:1)	43.6 ± 13.9 (mean)	Positive (51)	51	14/51 (27.5)	24/51 (47.1)	Positively • **Female sex** • **Single positive allergen** • **High baseline IGA** • **High baseline DLQI** Negatively • **Male sex** • **Multiple allergens (>1)** • **Low baseline IGA** • **Low baseline DLQI**	29/51 (56.9)
Dizdarevic et al. (2021),[11] Sweden	Randomised investigator blinded clinical trial/ mail questionnaire survey[d]	12 months	143/184 (78)	111:32 (3.5:1)	49 (median)	Positive (143)	NM	79/140 (56.4) Intervention group[e]: 40/67 (60) Control group: 39/73 (53)	85/143 (59.4) Intervention group[e]: 45/69 (65) Control group: 40/74 (54)	Positively • Female sex • **Age < 40 years** • **1–2 positive allergens** • **Metal allergy** Negatively • Male sex • **Age ≥ 40 years** • **Multiple (≥3) allergens**	Changes in lifestyle Intervention group[e]: 41/69 (59) Control group: 34/74 (46)

(Continues)

TABLE 2 (Continued)

Author (year), country	Study method	Time after patch testing	Response rate (%)	Female: male (ratio)	Age of patients during survey or patch testing, years	Patch test result of the responders (*n*)	Number of patients with relevant allergens	Recall rate of the allergen group (%)	Recall rate of the allergen name (%)	Factors influencing the recall rate	Allergen avoidance (%)
Pollard et al. (2022),[12] United States	Phone or online questionnaire survey among families of paediatric patients with ACD	3 years	43/138 (31.2)	25:18 (1.4:1)	12.4 ± 2.6 (mean)	Positive (43)	43	37% recalled specific products to avoid	NM	NM	NM
Özkaya and Keskinkaya (present study), Turkey	Phone questionnaire survey	6 months–19 years (range) 4 years (median)	176/465 (37.9)	78:98 (1:1.3)	2–79 (range) 34 (median)	Positive (176)	176	94/176[f] (53.4)	65/176[f] (36.9)	Positively • **Female sex (only significant for PPD and nitrofurazone recall)** • **Age < 40 years (only significant for MCI/MI recall)** • **Keeping the allergy pass (only significant for nickel recall,** high but not significant for MCI/MI recall**)** Negatively • **Age ≥ 40 years (only significant for MCI/MI recall)**	143/176 (81.2)

Note: Statistically significant findings are highlighted in bold.
Abbreviations: ACD, allergic contact dermatitis; DLQI, dermatology life quality index; IGA, investigator global assessment; MCI/MI, methylchloroisothiazolinone/methylisothiazolinone; NM, not mentioned; OACD, occupational allergic contact dermatitis; PPD, *p*-phenylenediamine; UK, United Kingdom.
[a]Lewis et al. reported the recall rate of positive and negative reactions as 86.7% (91/105).
[b]Sum of the percentage of patients with avoidance and job change.
[c]Allergen names were provided whereas the answer categories were 'epoxy', 'rubber chemicals' and 'others'.
[d]The patients were provided with a list of allergens to choose from while answering the questionnaire.
[e]A reminder letter regarding the detected allergen was sent to patients in the intervention group 3 months after patch testing.
[f]The numbers do not correspond to the sum of the patients in allergen subgroups shown in Figure 1, since some patients had more than one allergen/allergen group positivity.

TABLE 3 Recommendations for improving allergen recall and avoidance strategies.

General recommendations
Taking time to inform the patient on the chemical name of the allergen and the related allergen group
Making sure that the patient understands the importance of adherence to avoid the allergen and the related allergen group
Legal precautions to prevent inevitable reexposures to occupational and nonoccupational culprits
Previously recommended/implemented interventions
Databases on personalised lists of safe products[25,26,28,29] or products containing the culprit allergens[22]
Handouts of allergen narrative lists[25,29]
Smartphone applications for checking the ingredients of products for a certain sensitised allergen through bar code scanning, warning the contact-allergic patients if the product contains the sensitised allergen and suggesting an alternative product[20]
Smartphone application for management of contact dermatitis (ACDS CAMP-Contact Allergen Management Program)
Adjustment of the typographical design and order of the ingredients on cosmetic labels to improve the readability[27]
Enabling access to educational resources[29]
Our recommendations
Creating a pocket-size allergy pass to keep it in the wallet
Creating pocket-size information tags for allergens to attach them to the allergy pass
Encouraging patients using the allergy pass by, for example, sending reminding text messages to their mobile phones or e-mails twice yearly
Creating new smartphone applications with easy access to all relevant information on a given allergen, and if possible, on safe alternatives

4.11 | Recommendations for improving allergen recall and avoidance strategies

The recommended/implemented interventions for better recall and avoidance rates[20,22,25–29] and our additional recommendations are listed in Table 3.

The main limitations of our study were the limited number of patients in different allergy groups and the vast interval of years (up to 19 years) after patch testing, the latter possibly resulting in a recall bias. The study's major strengths were evaluating the recall rates of only relevant positive patch test reactions over a long follow-up period. Using standardised forms for documenting the patch test results and their clinical/occupational relevance and standardised procedure to inform the patients by the same observer team in a single tertiary allergy unit prevented interobserver variability.

5 | CONCLUSION

In conclusion, the overall moderate rates of allergen recall and avoidance were in accordance with most of the previous studies. Allergen groups were remembered better than individual allergens. An allergy pass along with a detailed information tag of the culprit allergen seemed to be helpful, particularly for complex-named allergens. Obviously, new strategies are needed to improve the recall and avoidance rates of contact allergens, such as increased use of allergy pass and creating new smartphone applications. Finally, the inevitable reexposure to occupational and non-occupational culprits might only be overcome with legal precautions.

AUTHOR CONTRIBUTIONS

Esen Özkaya: Conceptualization; investigation; writing – original draft; methodology; validation; visualization; writing – review and editing; formal analysis; data curation; supervision. **Zeynep Keskinkaya:** Investigation; writing – original draft; methodology; validation; visualization; writing – review and editing; software; formal analysis; data curation.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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REFERENCES

1. Holness DL, Nethercott JR. Is a worker's understanding of their diagnosis an important determinant of outcome in occupational contact dermatitis? *Contact Dermatitis*. 1991;25(5):296-301.
2. Lewis FM, Cork MJ, McDonagh AJ, Gawkrodger DJ. An audit of the value of patch testing: the patient's perspective. *Contact Dermatitis*. 1994;30(4):214-216.
3. Paul MA, Fleischer AB Jr, Scherertz EF. Patients' benefit from contact dermatitis evaluation: results of a follow-up study. *Am J Contact Dermat*. 1995;6(2):63-66.
4. Thomson KF, Wilkinson SM, Sommer S, Pollock B. Eczema: quality of life by body site and the effect of patch testing. *Br J Dermatol*. 2002;146(4):627-630.
5. Woo PN, Hay IC, Ormerod AD. An audit of the value of patch testing and its effect on quality of life. *Contact Dermatitis*. 2003;48(5):244-247.
6. Scalf LA, Genebriera J, Davis MD, Farmer SA, Yiannias JA. Patients' perceptions of the usefulness and outcome of patch testing. *J Am Acad Dermatol*. 2007;56(6):928-932.
7. Jamil WN, Erikssohn I, Lindberg M. How well is the outcome of patch testing remembered by the patients? A 10-year follow-up of testing with the Swedish baseline series at the Department of Dermatology in Örebro, Sweden. *Contact Dermatitis*. 2012;66(4):215-220.
8. Simonsen AB, Sommerlund M, Deleuran M, Mortz CG, Johansen JD. Course of skin symptoms and quality of life in children referred for patch testing—a long-term follow-up study. *Acta Derm Venereol*. 2015;95(2):206-210.
9. Brok L, Clemmensen KK, Carøe TK, Ebbehøj NE, Agner T. Occupational allergic contact dermatitis in a 2-year follow-up study: how well does the patient remember the result of patch testing? *Contact Dermatitis*. 2016;75(1):41-47.

10. Korkmaz P, Boyvat A. Effect of patch testing on the course of allergic contact dermatitis and prognostic factors that influence outcomes. *Dermatitis*. 2019;30(2):135-141.
11. Dizdarevic A, Troensegaard W, Uldahl A, et al. Intervention study to evaluate the importance of information given to patients with contact allergy: a randomized, investigator-blinded clinical trial. *Br J Dermatol*. 2021;184(1):43-49.
12. Pollard B, Collis RW, Stahl D, Coughlin CC, Sheinbein DM. Changes in product use and quality of life after patch testing in children with allergic contact dermatitis: a follow-up survey. *Dermatitis*. 2022;33(5):337-340.
13. Johansen JD, Aalto-Korte K, Agner T, et al. European Society of Contact Dermatitis guideline for diagnostic patch testing—recommendations on best practice. *Contact Dermatitis*. 2015;73(4):195-221.
14. Spiewak R. Patch testing for contact allergy and allergic contact dermatitis. *Open Allergy J*. 2008;1(1):42-51.
15. Mathias CGT. Contact dermatitis and workers' compensation: criteria for establishing occupational causation and agravation. *J Am Acad Dermatol*. 1989;20(5 pt 1):842-848.
16. Rajagopalan R, Anderson RT, Sarma S, et al. An economic evaluation of patch testing in the diagnosis and management of allergic contact dermatitis. *Am J Contact Dermat*. 1998;9(3):149-154.
17. Boonchai W, Charoenpipatsin N, Winayanuwattikun W, Phaitoonwattanakij S, Sukakul T. Assessment of the quality of life (QoL) of patients with dermatitis and the impact of patch testing on QoL: a study of 519 patients diagnosed with dermatitis. *Contact Dermatitis*. 2020;83(3):182-188.
18. Özkaya E, Kılıç Sayar S, Babuna Kobaner G, Pehlivan G. Methylchloroisothiazolinone/methylisothiazolinone and methylisothiazolinone contact allergy: a 24-year, single-center, retrospective cohort study from Turkey. *Contact Dermatitis*. 2021;84(1):24-33.
19. Boonchai W, Desomchoke R, Iamtharachai P, Sornmek D. Factors influencing patients' awareness of the benefits of patch testing: a questionnaire survey. *Siriraj Med J*. 2013;65(4):96-99.
20. Gether L, Thyssen JP, Avnstorp C. 'Allergyapp'—a novel app(lication) to detect contact allergens in cosmetic products. *Contact Dermatitis*. 2014;71(6):379-381.
21. Bouschon P, Waton J, Pereira B, Schmutz JL, Le Bouëdec MF, D'Incan M. Methylisothiazolinone allergic contact dermatitis: assessment of relapses in 139 patients after avoidance advice. *Contact Dermatitis*. 2019;80(5):304-310.
22. Edman B. The usefulness of detailed information to patients with contact allergy. *Contact Dermatitis*. 1988;19(1):43-47.
23. Clemmensen KK, Carøe TK, Thomsen SF, Ebbehøj NE, Agner T. Two-year follow-up survey of patients with allergic contact dermatitis from an occupational cohort: is the prognosis dependent on the omnipresence of the allergen? *Br J Dermatol*. 2014;170(5):1100-1105.
24. Carøe TK, Ebbehøj NE, Bonde JP, Agner T. Occupational hand eczema and/or contact urticaria: factors associated with change of profession or not remaining in the workforce. *Contact Dermatitis*. 2018;78(1):55-63.
25. Yiannias JA, el-Azhary RA. Contact allergen avoidance program: a topical skin care product database. *Am J Contact Dermat*. 2000;11(4):243-247.
26. Kist JM, el-Azhary RA, Hentz JG, Yiannias JA. The contact allergen replacement database and treatment of allergic contact dermatitis. *Arch Dermatol*. 2004;140(12):1448-1450.
27. Yazar K, Seimyr GÖ, Novak JA, White IR, Lidén C. Readability of product ingredient labels can be improved by simple means: an experimental study. *Contact Dermatitis*. 2014;71(4):233-241.
28. Rocha VB, Machado CJ, Bittencourt FV. Program for contact allergen research (PPAC) - a new tool for dermatologists. *An Bras Dermatol*. 2016;91(3):390-392.
29. Haque MZ, Rehman R, Guan L, Kerr H. Recommendations to optimize patient education for allergic contact dermatitis: our approach. *Contact Dermatitis*. 2023;88(5):423-424.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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