

Is it possible to improve the prognosis in nickel contact dermatitis?

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A questionnaire was sent to 143 patients who had shown a positive patch test reaction to nickel sulfate more than 10 years earlier. 91 patients returned the questionnaire, revealing that after the testing, 73 had suffered from dermatitis, 61 especially from hand dermatitis. 37 of these patients were clinically examined and patch tested with standard series and in addition, 12 patients were tested with nickel sulfate and nickel chloride with different occlusion times. At the clinic visit, 23 patients had dermatitis, 16 hand dermatitis, and 11 were symptom-free. 26 of the patients had metal items close to their skin and 21 of them had current dermatitis, 14 hand dermatitis. Of the 11 patients who had no metal exposure, 9 were symptom-free. The association of dermatitis with exposure to metal objects was statistically significant ($p < 0.001$). Those patients who had current dermatitis had also developed multiple allergies and reacted to nickel with shorter application times in patch tests, as compared to those who were symptom-free. It seemed possible that the prognosis for nickel dermatitis could be improved if nickel-allergic patients would strictly avoid metal contact, especially in clothing and jewelry.

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Allergic contact dermatitis caused by nickel has a poor prognosis according to several reports (1-9). Despite the known risks for the development of allergy, the prevalence of nickel allergy has shown a tendency to increase (10-13). To eliminate nickel exposure, possibilities for systemic exposure have been examined (14) and measures to decrease the intake of dietary nickel have been advocated (15, 16). However, the normal behaviour of the patients might also lead to occasional nickel contacts (7-9). Concerning patient education, it is evident that information on contact elimination and treatment given during an ordinary hospital visit may not be sufficient (17). In the case of nickel allergy, it is rather easy to control the compliance of the patients as regards allergen avoidance, since exposure to metal contacts is easily revealed during a clinic visit. To find out the prognosis and the compliance with advice given on nickel contact elimination, we carried out a study of the outcome of symptoms among patients who had been patch-test-positive to nickel sulfate in our department at least 10 years previously.

Materials and Methods

A questionnaire was sent to 143 patients, 125 female, 18 male, with a mean age of 48 years. They

had been patch tested and found to be nickel allergic at the Department of Dermatology, Turku University Central Hospital, at least 10 years earlier. In the questionnaire, the patients were asked if they had suffered from dermatitis, if they had had hand dermatitis, and if they were willing to participate in further examinations.

From those who returned the questionnaire, 37 patients were able to come to clinical examinations. During the visit, 28 patients were also patch tested with the European standard series (Chemotechnique Diagnostics, Malmö, Sweden) supplemented with bacitracin, dequalinum, carbamix, and wood tars (in petrolatum). Patch testing was also carried out in 12 patients with nickel sulfate and nickel chloride with TRUE Test (Pharmacia, Uppsala, Sweden), containing 0.043 mg/cm² of nickel for both salts, using different occlusion times of 1 h, 3 h, 6 h and 12 h.

Statistical analysis was carried out with the Fisher exact test.

Results

91 patients returned the questionnaire: 73 had had dermatitis, 61 had suffered from hand dermatitis and 18 had been symptom-free.

Clinical examination

Of the 37 patients who could participate in the clinical examinations, 32 were female (mean age 49 years) and 5 male (mean age 47 years), age range from 27 to 73 years. Among these patients, a history of metal contact allergy could be traced from the age of 16 to 53 years. The mean age at the time when the first suspicion of symptoms caused by metals had arisen was 29 years for the females and 34 for the males.

Exposure to metal items is shown in Table 1. According to hospital files, 31 of these patients had noticed symptoms from jeans buttons, 29 from belt

Table 1. History of dermatitis from metal items and exposure to them during the clinical visit

Metal contact	History of dermatitis	Metal exposure at present clinical visit
jeans button	31	2
belt buckle	29	2
clasps	28	2
wrist watch	26	19
jewelry	24	9
garter	1	—

Table 2. Dermatitis site and exposure to metal items at the clinical visit in 37 patients

	Metal contact	
	current	none
dermatitis	21/26	2/11
hand dermatitis	14/21	2/11
head, neck	1/21	—
several loci	6/21	—
no dermatitis	5/26	9/11

Table 3. Patch test results

Test result	Current dermatitis	
	yes	no
negative	—	1
positive	17	10
nickel (Ni)	7	6
Ni, cobalt (Co)	2	1
Ni, Co, chromate (Cr)	—	1
Ni, neomycin (NM), bacitracin (B)	—	1
Ni, fragrance mix (FR), dequaline (D)	—	1
Ni, Cr, colophony (Col)	2	—
Ni, Cr, PPD	1	—
Ni, formaldehyde, Kathon CG	1	—
Ni, balsam of Peru (BP), FR, PPD mix	1	—
Ni, BP, FR, D hydrocortisone-17-butyrate (HC-17-B)	1	—
Ni, Co, NM, carba mix, B	1	—
Ni, PB, thiuram mix, col, wood tar, HC-17-B, Kathon CG, D	1	—

Table 4. Positive patch test results with nickel sulfate and nickel chloride using different occlusion times

	No current dermatitis		Current dermatitis	
	NiCl ₂	NiSO ₄	NiCl ₂	NiSO ₄
positive test result				
1 h	4/7	2/7	4/5	2/5
3 h	5/7	2/7	5/5	3/5
6 h	6/7	2/7	5/5	3/5
12 h	7/7	2/7	5/5	4/5
negative test result	0/7	5/7	0/5	1/5

buckle, 28 from clasps, 26 from wrist watch, 24 from jewelry and one from garter.

During the clinical examination, 2 patients were wearing jeans with metal buttons, 2 had a belt with a metal buckle, 2 metal clasps in their clothing, 19 a wrist watch with metal buckle and 9 jewelry.

Of these patients, 23/37 had current dermatitis, 16 had hand dermatitis, 1 in the face and neck region and 6 had dermatitis in several loci. 7 of these patients had dermatitis in areas with corresponding metal contacts. 14 patients were completely symptom-free at the clinic visit. When the patients were evaluated according to metal exposure, it appeared that 21 patients with ongoing dermatitis and 5 without dermatitis had metal items close to their skin (Table 2), as compared to 11 patients who were not exposed, 2 with dermatitis and 9 with no current dermatitis. The number of current dermatitis cases in association with metal contact is significantly higher ($p < 0.001$) as compared to those who had no current metal contacts.

Patch test results

Patch testing was carried out in 28 patients: 17 had dermatitis and 11 were symptom-free. The results of patch testing with the standard series are shown in Table 3. 1 symptom-free patient was negative on patch testing tests with the standard series, all the other patients reacting to 5% NiSO₄. Among patients with current dermatitis, several patients with multiple positive patch test reactions were found.

Patch testing with nickel sulfate and nickel chloride using different occlusion times was carried out in 12 patients, 7 without current dermatitis and 5 with dermatitis. Among those who had no dermatitis, 5 of the 7 were negative when tested with nickel sulfate with a maximum occlusion time of 12 h, whereas patients with dermatitis were patch-test-positive in 4 out of 5 cases after 12 h occlusion. Every patient in both groups reacted to nickel chloride, in the non-dermatitis group, 12 h occlusion being needed, as compared to dermatitis

Table 5. Occupations of patients who were working

No dermatitis		Dermatitis	
cashier	2	truck driver	2
farmer	2	cleaner	1
assistant nurse	1	dental technician	1
bookkeeper	1	designer	1
cleaner	1	foodworker	1
housewife	1	gardener	1
laboratory technician	1	housewife	1
office worker	1	janitor	1
plater	1	mechanic	1
waitress	1	office worker	1
		post office worker	1
		saleswoman	1
		waitress	1

patients who were all positive after only 3 h occlusion (Table 4).

History of working life

Of the patients with dermatitis, 14 were working and 9 had retired (mean age 59 years); in the non-dermatitis group, 12 were working and 2 had retired (52 and 71 years). The occupations of the patients are given in Table 5.

Discussion

In our material, 73/91 (80%) of previously tested, nickel-sensitive subjects reported that they had experienced episodes of dermatitis after their nickel allergy had been found. Dermatitis had occurred in variable locations, but hand dermatitis was the most common. This data corresponds with previous reports on the prognosis (1–9). From the patients who had returned the questionnaire, only 37 were able and willing to participate in the clinical examination. No further effort to increase their number was made.

The cause of persistent dermatitis has been unsettled. Repeated exposure to allergens might be one possibility, as suggested by our results and also proposed previously (18–23). In our study, 26 patients had ongoing dermatitis and 11 were symptom-free. 23/26 (91%) of the dermatitis patients and 5/11 (36%) of the symptom-free patients were exposed to metal items at the clinic visit in spite of earlier information to avoid them. On the other hand, 9/11 (81%) of the patients who had no metal contacts were symptom-free compared to only 5/26 (19%) of those who were wearing metal items close to their skin. Thus, metal exposure was frequent and careful avoidance seemed to give a better prognosis for dermatitis. The difference is statistically highly significant ($p < 0.001$). The patients who had metal items were generally aware of the risks, but the contacts were considered short-

lived or minor and the risk was neglected. Furthermore, the fact that eczema changes were not always seen in metal contact areas resulted in use of metal items. The clinical course of the dermatitis in a nickel-sensitive patient may also reflect the patient's common attitude to allergen avoidance and skin care and protection in general (17).

A dimethylglyoxime test was used to convince certain patients of the presence of nickel. However, because the patients were not using the test at home and because it can give false-negative results, we wanted to correlate the presence of dermatitis with seen exposure to metal items, which according to our routine had initially been denied by the treating physician. This correlation might give better information on how the patients had followed the advice given during past years.

In the patch tests, persistence of dermatitis and metal exposure was associated with higher sensitivity. Nickel chloride can lead to irritant reactions and in nickel-allergic patients, it has given positive reactions with shorter application than NiSO_4 (24, 25). In this study, nickel chloride gave a positive reaction in every patient with 12-h occlusion, compared to nickel sulfate which was positive in 50% after 12 h and 100% after 48 h occlusion. The occlusion needed to elicit a positive reaction was shorter among dermatitis patients, indicating higher sensitivity.

Hand dermatitis in patients with nickel sensitivity might be related to increased susceptibility to irritants as well as allergens (26–28). Need of protection-increasing occlusion may even increase penetration of allergens (29). When these susceptible patients develop dermatitis, they also need medication, which may lead to further sensitization as reported earlier (8, 9) and, as seen in our material, these patients often had multiple contact sensitivities. Similar results were seen among colophony-positive patients after 9 to 13 years of follow-up (30).

The favourable outcome after complete metal avoidance in the clothing and jewelry as judged during the clinic visit, was also reflected in working life, since symptom-free patients were seen as cashiers, cleaners or nurses, in occupations with apparent nickel or wet work exposure, as also noticed previously (19). The results suggest that patients who eliminate the constant, long-lasting triggering contact from their clothing, jewelry, buckles, etc., will have a better prognosis regardless of occupation. This also points to the fact that before laborious occupational changes, intensive efforts to decrease the exposure in everyday life should be accomplished.

In conclusion, according to our results concerning nickel allergy, all long-lasting metal exposure to skin is important and should be eliminated, i.e., items that are worn close to the skin all day long.

They can lead to chronic exposure, trigger allergy and lead to dermatitis. Although the results that can be achieved with information and education may be limited at times, more effort should be directed to patient education, since avoidance of all metal contacts seemed to improve the prognosis significantly. This measure should also be better utilized while waiting for common legislative measures to decrease the potential for exposure (31–33).

References

- Christensen O B. Prognosis in nickel allergy and hand eczema. *Contact Dermatitis* 1982; 8: 7–15.
- Dooms-Gossens A, Ceuterick A, Vanmaele N, Degreef H. Follow-up study of patients with contact dermatitis caused by chromates, nickel and cobalt. *Dermatologica* 1980; 160: 249–260.
- Ogan D J, Dannaker C J, Lal S, Maibach H I. An international survey on the prognosis of occupational contact dermatitis of the hands. *Dermatosen in Beruf und Umwelt* 1990; 38: 143–147.
- Menné T, Bachmann E. Permanent disability from skin diseases. A study of 564 patients registered over six year period. *Dermatosen in Beruf und Umwelt* 1979; 27: 37–42.
- Menné T, Bachmann E. Permanent disability from allergic contact dermatitis. *Contact Dermatitis* 1980; 6: 59–64.
- Menné T, Borgan Ö, Green A. Nickel allergy and hand dermatitis in a stratified sample of the Danish female population, an epidemiological study including statistic appendix. *Acta Dermato-venereologica* 1982; 62: 35–41.
- Von Schnuch A, Preinfalk C, Fuchs T, Uter W. Nachbefragung von Patienten mit allergischen Kontaktekzem. Beeinflusst die ärztliche Aufklärung den Verlauf der Erkrankung? *Dermatosen in Beruf und Umwelt* 1994; 42: 195–198.
- Schubert H, Berova N, Czernielewski A, Hegyi E, Jirasek L, Kohanka V, Korossy S, Michailov P, Nebenfürer L, Prater E, et al. Epidemiology of nickel allergy. *Contact Dermatitis* 1987; 16: 122–128.
- Schubert H, Kohanka V, Korossy S, Nebenfürer L, Prater E, Rothe A, Szarmach H, Temesvari E, Ziegler V. Epidemiology of nickel allergy: results of a follow-up analysis of patients with positive patch tests to nickel. *Contact Dermatitis* 1988; 1: 237–239.
- Dotterud L K, Falk E S. Metal allergy in Norwegian school children and its relationship with ear piercing and atopy. *Contact Dermatitis* 1994; 31: 308–313.
- Larsson-Stymne B, Widström L. Ear piercing – a cause of nickel allergy in schoolgirls. *Contact Dermatitis* 1985; 13: 289–293.
- Liden C. Nickel in jewelry and associated products. *Contact Dermatitis* 1992; 26: 73–75.
- Lidén C, Menne T, Burrows D. Nickel containing alloys and platings and their ability to cause dermatitis. *Bri J Dermatol* 1996; 134: 193–198.
- Menné T. The prevalence of nickel allergy among women in hospitalized female patients. *Dermatosen in Beruf und Umwelt* 1978; 26: 123–125.
- Peltonen L. Nickel sensitivity in general population. *Contact Dermatitis* 1979; 5: 7–32.
- Menné T, Veien N, Sjölin K-E, Maibach H. Systemic contact dermatitis. *American Journal of Contact Dermatitis* 1994; 5: 1–12.
- Christensen O B, Möller H. External and internal exposure to the antigen in the hand eczema of nickel allergy. *Contact Dermatitis* 1975; 1: 136–144.
- Veien N K, Menné T. Nickel contact allergy and nickel restricted diet. *Semin Dermatol* 1990; 9: 197–205.
- Holness D L, Nethercott J R. Is a worker's understanding of their diagnosis an important determinant of outcome in occupational contact dermatitis. *Contact Dermatitis* 1991; 25: 296–301.
- Romaguera C, Grimalt F, Vilaplana J. Contact dermatitis from nickel: an investigation of its sources. *Contact Dermatitis* 1988; 19: 52–57.
- van Ketel W G. Occupational contact with coins in nickel allergic patients. *Contact Dermatitis* 1985; 12: 108–124.
- Kanerva L, Sipiläinen-Malm T, Estlander T, Zitting A, Jolanki R, Tarvainen K. Nickel release from metals and a case of allergic contact dermatitis from stainless steel. *Contact Dermatitis* 1994; 31: 299–303.
- Räsänen L, Tuomi M L. Diagnostic value of the lymphocyte proliferation test in nickel contact allergy and provocation in occupational coin dermatitis. *Contact Dermatitis* 1992; 27: 250–254.
- Malten K E, Spruit D. The relative importance of various environmental exposures to nickel in causing contact hypersensitivity. *Acta Dermatol-venereologica* 1969; 49: 14–19.
- Gollhausen, Ring J. Allergy to coined money. Nickel contact allergy in cashiers. *J Am Acad Dermatol* 1991; 25: 365–369.
- Kalimo K, Lammintausta K. Nickel bioavailability from patch tests. Comparison between nickel sulphate and nickel chloride using TRUE test (Pharmacia). *Current Topics in Contact Dermatitis* 1989; 540–543.
- Lammintausta K, Kalimo K. 24 and 48 h allergen exposure in patch testing. Comparative study with 11 common contact allergens and NiCl₂. *Contact Dermatitis* 1984; 10: 25–29.
- Hindsen M, Bruze M, Christensen O. The significance of previous eczema for elicitation allergic contact dermatitis from nickel. *Allergologie* 1995; B 1366 E: 447.
- Allenby C F, Basketter D A. The effect of repeated open exposure to low levels of nickel on compromised skin of nickel allergic subjects. *Contact Dermatitis* 1994; 30: 135–138.
- Uter W, Fuchs Th, Häuser M, Ippen H. Patch test results with serial dilutions of nickel sulfate (with and without detergent), palladium chloride and nickel and palladium metal plates. *Contact Dermatitis* 1995; 32: 135–142.
- Seidenari S, Manzeni B M, Belletti B. Pretreatment of the test area with 1-day occlusion improves the response rate to NiSO₄ 5% pet. patch tests in subjects with a positive history of nickel allergy. *Contact Dermatitis* 1995; 33: 152–156.
- Färm G. Contact allergy to colophony and hand eczema. A follow-up study of patients with previously diagnosed contact allergy to colophony. *Contact Dermatitis* 1996; 34: 93–100.
- Delescluse J, Dinot Y. Nickel allergy in Europe. The New European Legislation. *Dermatology* 1994; 189 (Suppl): 56–57.
- Gawkrodger D J. Nickel dermatitis: how much nickel is safe? *Contact Dermatitis* 1996; 35: 267–271.
- Menné T. Prevention of nickel allergy by regulation of specific exposures. *Annals of Clinical and Laboratory Science* 1996; 26: 133–138.

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