

Nickel allergy in relationship to previous oral and cutaneous nickel contact

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Accepted 2 August 1989.

SUMMARY

Potential relationships between the development of nickel allergy and previous ear piercing or orthodontic treatment with nickel-containing appliances were studied in 294 patients. We found 77 (31.2%) of 247 patients with pierced ears were allergic to nickel compared to only three (6.4%) patients without pierced ears ($p=0.001$), which confirms earlier suggestions that nickel allergy (as assessed by patch testing) is promoted by ear piercing. If orthodontic treatment preceded the event of ear piercing, the frequency of nickel allergy was reduced from 36% to 25%. This supports the view that oral allergenic contacts may induce immunological tolerance.

INTRODUCTION

In industrialised nations the most common allergy among women is nickel allergy.¹ Various population studies indicate that at least 10% of the female and about 1% of the male population are allergic to nickel.²⁻⁴ Allergic subjects may suffer from slight dermatitis at metal contact sites, but others may develop severe hand eczema. Various factors promoting the development of nickel dermatitis include ear piercing, wet work and frequent exposure to irritant and nickel-containing agents.⁵ Therefore, a high frequency of nickel dermatitis is observed in such occupations as nursing, hairdressing and cleaning.^{6, 7} Epidemiological studies indicate that both occupational and non-occupational nickel dermatitis is increasing.^{8, 9}

In non-sensitised individuals antigenic contacts by the oral route are known to induce tolerance rather than sensitisation, that is to suppress the capacity to develop an allergic response.¹⁰ The development of tolerance by oral administration of nickel has been demonstrated in a guinea pig model. Attempts to immunise the orally pretreated guinea pigs failed, whereas non-pretreated guinea pigs became clearly hypersensitive.¹¹ Orthodontic appliances contain nickel alloys and are a source of oral nickel in patients fitted with such devices.

This study was conducted to verify if the sensitising effect of ear piercing, and the effect of orthodontic treatment with metal appliances in inducing tolerance can be shown for a large non-selected group of patients attending dermatological clinics for patch testing.

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PATIENTS AND METHODS

Patients presenting with eczematous rashes are often patch tested to various allergens to confirm or exclude a diagnosis of allergic contact eczema. Nickel sulphate 5% in petrolatum is included in the routine battery of patch test allergens, which are applied to the patient's back in small aluminium chambers (Finn chambers^R) held in place by adhesive tape (Scanpore tape^R). The chambers are removed after 48 hours and the skin reaction is read after 72 hours at the weekly patch test clinic. The presence of erythema and/or vesiculation indicates a positive reaction.

All female patients attending the patch test clinic were questioned regarding problems with costume jewellery, watches and buttons on clothes, the wearing of a dental brace for orthodontic treatment (at what age and for how long?) and piercing of the ears (at what age?). Patch test results for nickel were recorded. As the study progressed it was decided also to include all male patients attending the patch test clinic. Our results were included in a West European multicentre study.¹⁵

The questionnaire data were processed and statistical analysis was performed using the chi-squared test (with Yates' correction) and Fisher's exact probability test.

RESULTS

Data were collected from 294 patients, 268 female and 26 male. The effects of ear piercing on nickel allergy in this group of patients are shown in Table I. Seventy-seven (31.2%) of 247 patients with pierced ears were allergic to nickel compared to only three (6.4%) of 47 patients without pierced ears, which was a significant difference ($p = 0.001$). When the effect of ear piercing was studied in the females and males separately the difference persisted only in the female group. Of the 263 females, 75 of the 241 with pierced ears (31.1%) were allergic to nickel, compared to only one of the 27 (3.7%) without pierced ears ($p = 0.006$). Of the 26 males, two (33.3%) of the six with pierced ears were allergic to nickel, compared to two (10%) of the 20 without pierced ears ($p = 0.25$).

TABLE I
Effects of ear piercing

	<i>Ear piercing</i>	<i>Number of patients</i>	<i>Nickel positive patch test</i>	<i>p</i>
Males	no	20	2 (10%)	0.25
	yes	6	2 (33%)	
Females	no	27	1 (4%)	0.006
	yes	241	75 (31%)	
Total	no	47	3 (6%)	0.001
	yes	247	77 (31%)	

The relationship between orthodontic treatment and nickel allergy is shown in Table II. Patients who had received orthodontic treatment but did not have their ears pierced had a 16.7% incidence of nickel allergy, whereas those who had

never received orthodontic treatment or had their ears pierced had only 7.3% nickel allergy, but this difference was not significant ($p=0.45$). When orthodontic treatment followed ear piercing the frequency of nickel allergy was 36%, compared to 25% when orthodontic treatment preceded ear piercing ($p=0.07$).

TABLE II
Previous orthodontic treatment and the prevalence of nickel allergy

<i>Orthodontic treatment</i>	<i>Ear piercing</i>	<i>Number of patients</i>	<i>Nickel positive patch test</i>	<i>p</i>
Brace	no	6	1 (17%)	0.45
No brace	no	41	3 (7%)	
No brace	yes	185	55 (30%)	0.73
Brace before ear piercing	yes	36	9 (25%)	0.07
Brace after ear piercing	yes	26	13 (36%)	

DISCUSSION

It has been suggested that the high prevalence of nickel allergy among women is due to prolonged and heavy exposure to the allergen, for example, by costume jewellery. In particular, ear piercing appears to be an important sensitising event.¹²⁻¹⁴ Our results confirm the correlation between ear piercing and the frequency of nickel allergy, although this was statistically significant only in the female patients. The number of males in our study was small. Our figures were later included in a West European multicentre trial, and in the larger series the effect of ear piercing on nickel allergy was also significant in the male group.¹⁵

The prevalence of nickel allergy was not different whether orthodontic treatment had or had not preceded ear piercing in the Belfast study, but in the larger multicentre study there was a statistically significant reduction from 39.0% to 29.9%. This supports the view that wearing a dental metal prosthesis can induce tolerance to nickel allergy.

In patients who never had their ears pierced the wearing of a dental brace did not lead to a significant change in nickel allergy. In the multicentre trial the incidence of nickel allergy in both groups was 3.5%, indicating that orthodontic treatment alone without ear piercing does not induce nickel allergy. We found a high incidence of nickel allergy (36%) in patients who had orthodontic treatment after ear piercing. The mechanism for this is uncertain, but suggests that tolerance to nickel allergy could be induced before the ears are pierced if it is to be effective.

If nickel allergy led only to a mild eczema of skin in contact with certain metallic objects such as costume jewellery, it would be relatively harmless. However women allergic to nickel run a considerably increased risk of developing nickel hand eczema, which is often a troublesome and persistent condition threatening a person's working ability.⁹ Measures to decrease the incidence of nickel allergy are therefore important since at the very least 10% of the female population are affected by this condition. It would be very difficult to curtail the practice of ear piercing. An alternative is the use of 'safe' alloys with low nickel release.¹⁶ However, only a few alloys have a low nickel release rate, and these do not have a

bright silvery appearance or are relatively expensive. The results of this study support the view that oral administration of nickel at an early age may induce a state of cutaneous tolerance. This should be further explored as a possible route of preventing nickel allergy and related skin disease.

REFERENCES

1. Cronin E. Contact dermatitis. Edinburgh: Churchill Livingstone, 1980.
2. Peltonen L. Nickel sensitivity in the general population. *Contact Dermatitis* 1979; **5**: 27-32.
3. Prysowsky SD, Allen AM, Smith RW, Nonomura JH, Odom RB, Akers WA. Allergic contact hypersensitivity to nickel, neomycin, ethylenediamine and benzocaine. Relationship between age, sex, history of exposure and reactivity to standard patch tests and use tests in a general population. *Arch Dermatol* 1979; **115**: 959-62.
4. Menne T. The prevalence of nickel allergy among women. An epidemiological study in hospitalized female patients. *Derm Beruf Umwelt* 1978; **26**: 123-5.
5. Van de Burg CKH, Bruynzeel DP, Vreeburg KJJ, von Blomberg BME, Scheper RJ. Hand eczema in hairdressers and nurses: a prospective study. I. Evaluation of atopy and nickel hypersensitivity at the start of apprenticeship. *Contact Dermatitis* 1986; **14**: 275-9.
6. Lindemayr H. Das Friseurkezem. *Dermatosen* 1984; **32**: 5-13.
7. Lammintausta K, Kalimo K, Havu VK. Occurrence of contact allergy and hand eczemas in hospital wet work. *Contact Dermatitis* 1982; **8**: 84-90.
8. Edman B, Moller H. Trends and forecasts for standard allergens in a 12-year patch test material. *Contact Dermatitis* 1982; **8**: 95-104.
9. Menne T, Børgan O, Green A. Nickel allergy and hand dermatitis in a stratified sample of the Danish female population: an epidemiological study including a statistic appendix. *Acta Dermatovener* 1982; **62**: 35-41.
10. Tomasi TB. Oral tolerance. *Transplantation* 1980; **29**: 353-6.
11. Vreeburg KJJ, de Groot K, von Blomberg BME, Scheper RJ. Induction of immunological tolerance by oral administration of nickel and chromium. *J Dent Res* 1984; **63**: 124-8.
12. Rystedt I, Fischer T. Relationship between nickel and cobalt sensitization in hard metal workers. *Contact Dermatitis* 1983; **9**: 195-200.
13. Boss A, Menne T. Nickel sensitization from ear piercing. *Contact Dermatitis* 1982; **8**: 211-3.
14. Larsson-Styme B, Wildstrom L. Ear piercing — a cause of nickel allergy in school girls? *Contact Dermatitis* 1985; **13**: 289-93.
15. van Hoogstraten IMW, Andersen KE, von Blomberg BME, et al. Preliminary results of a multi-centre study on the incidence of nickel allergy in relationship to previous oral and cutaneous contacts. In: Frosch PJ, Dooms-Goossens A, Lachapelle JM, Rycroft RJG, Scheper-RJ, eds. Current topics in contact dermatitis. Berlin: Springer-Verlag, 1989: 178-83.
16. Menne T, Brandrup F, Thestrup-Pedersen K, et al. Patch test reactivity to nickel alloys. *Contact Dermatitis* 1987; **16**: 255-9.