

Allergic patch test reactions to palladium chloride in schoolchildren

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A study of the prevalence of allergic patch test reactions to palladium chloride compared to nickel sulfate was performed in a group of Finnish schoolchildren. All adolescents 14–18 years of age in a Finnish town with 40 000 inhabitants, who had received orthodontic treatment with metallic appliances at a municipal dental clinic, were included in the study. The selection of patients was based on patient records. A non-treatment control group was randomly selected from the same age groups of the town population. A total of 700 subjects (77% of those invited), 417 (60%) girls and 283 (40%) boys, participated. The majority (91%) of the girls had pierced ears. Orthodontic treatment was equally common (67–70%) in the boys and the girls. The girls had a much higher frequency of allergic patch test reactions to both nickel sulfate and palladium chloride. Of the 700 adolescents tested, 48 (7%) had an allergic patch test reaction to palladium chloride. Of the 417 girls, 44 (11%) were palladium-chloride-positive, whereas only 4 of the 283 boys tested (1%) had an allergic patch test reaction to palladium chloride. 3 patients reacted to palladium chloride only, whereas all other patients with allergic patch test reactions to palladium chloride also had an allergic patch test reaction to nickel sulfate. The results support the concept of cross-reactivity between nickel sulfate and palladium chloride. The clinical significance of the allergic patch test reactions caused by palladium chloride remains unclear.

Key words: palladium; allergic contact dermatitis; nickel; prevalence; children; orthodontic treatment; cross-sensitivity. © Munksgaard, 1996.

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Palladium is a metal found most commonly in ore combined with platinum, gold (as in white gold), and copper (1). Palladium is used in varying amounts (4–82%) in most cast dental restorations (2). It is also used in alloys for relays, and switching systems in telecommunications equipment, and as a catalyst in white gold, aircraft, and increasingly in ornamental work (1, 3). Dermatitis caused by palladium has previously been considered rare (1, 4), but recently, a significant number of patients allergic to nickel sulfate have also shown positive patch test reactions to palladium chloride (5–17). We have recently reported on nickel allergy in adolescents and its relation to orthodontic treatment and piercing of ears (18). The frequency of nickel sulfate sensitization among 700 Finnish adolescents was 19%. Nickel allergy was significantly more often found in girls (30%) than in boys (3%), and more in subjects with pierced ears (31%) than in those without (2%). During the

same study, we also performed patch testing with palladium chloride in the 700 adolescents. Here, data from this study are presented and compared to the results obtained by patch testing with nickel sulfate.

Materials and Methods

The details of the patients of this study have been presented earlier (18). In short: all adolescents 14–18 years of age in a Finnish town with 40,000 inhabitants, who had received orthodontic treatment with metallic appliances at a municipal dental clinic, were included in the study. The selection of patients was based on patient records. A non-treatment control group was randomly selected from the same age groups of the town population. A total of 700 subjects (77% of those invited), 417 (60%) girls and 283 (40%) boys, took part in the

study, 68% had a history of orthodontic treatment with metallic appliances.

Patch testing was performed with 5% nickel sulfate and 2% palladium chloride in pet. (Chemotechnique Diagnostics, Malmö, Sweden) on the upper back, essentially as previously described (18, 19). The occlusion time was 2 days, but for practical reasons only 1 reading was performed namely 3, 4 or 5 days after application. All testing were read by the same person. Erythema with edema, papules or vesicles was considered as an allergic patch test reaction, whereas faint erythema without infiltration (?+) was not scored as allergic.

All subjects received a questionnaire to be completed at home regarding age of ear piercing, the number of holes in earlobes, symptoms after wearing earrings and metallic items such as cheap jewellery, wrist watches, jeans buttons, and orthodontic treatment, etc. (18).

Results

The characteristics of the subjects are given in Table 1. The majority (91%) of the girls had pierced ears. Orthodontic treatment was equally common (67–70%) in the girls and the boys. The girls had a much higher frequency of allergic patch test reactions to both nickel sulfate and palladium chloride. Of the 700 adolescents tested, 48 (7%) had an allergic patch test reaction to palladium chloride. Of the 417 girls, 44 (11%) were palladium chloride positive, whereas only 4 boys out of the 283 tested (1%) had an allergic patch test reaction to palladium chloride.

3 patients reacted to palladium chloride only, whereas all other patients allergic to palladium chloride also had an allergic patch test reaction to nickel sulfate. These 3 patients with an allergic patch test reaction to palladium chloride, but a negative patch test reaction to nickel sulfate, showed a relatively weak (+) allergic reaction. The patch test reaction to 5% nickel sulfate was strong-

Table 1. Frequencies and % distribution of different characteristics among the subjects examined

Characteristic	Girls (N=417)		Boys (N=283)		All (N=700)	
	n	(%)	n	(%)	n	(%)
pierced ears	378	91	33	12	411	59
>1 piercings per earlobe	162	39	7	3	169	24
eczema in metal contact sites	223	53	11	4	234	33
orthodontic treatment	279	67	198	70	477	68
positive patch test to nickel	123	30	9	3	132	19
positive patch test to palladium chloride	44	11	4	1	48	7

Table 2. Number of subjects with different characteristics among those with positive patch test to palladium chloride (N=48)

Characteristics	Girls (N=44)	Boys (N=4)
piercing of ears	44	1
orthodontic treatment	29	1
skin symptoms (eczema)	41	2

er than that to 2% palladium chloride, in those with allergic patch test reactions to both metal salts.

Table 2 lists certain characteristics of the adolescents with allergic patch test reactions to palladium chloride. All girls had pierced ears, nearly all also had skin symptoms from metal contacts, and about 2/3 had had orthodontic treatment.

Discussion

This is the 1st report of the frequency of allergic patch test reactions to palladium chloride in a non-dermatologic (i.e., non-selected as regards skin symptoms) population, and also among adolescents. The proportion of subjects who reacted to palladium chloride (7%) was close to that reported in dermatology clinics: Aughtun et al. (13) reported an allergy frequency of 7.4% (486 patients at a Dermatological Department) and Gonçalves & Gonçalves (15) found a palladium chloride allergy frequency of 7.8% in a patient group with a history of contact dermatitis. All the patients of Gonçalves & Gonçalves (15) also had an allergic reaction to nickel sulfate.

In most cases, the subjects with an allergic patch test reaction to palladium chloride also had an allergic reaction to nickel sulfate. In fact, only 3 patients had a solitary palladium chloride reaction. It cannot be excluded that these patients might also have been allergic to nickel sulfate, although this could not be verified by the test methods used. More sensitive methods, such as intracutaneous tests, might have verified their allergy to nickel sulfate. Therefore, reactions to palladium chloride may reflect cross-reactions to nickel sulfate due to their proximity in the periodic table (15, 16, 20, 21). Other possibilities include (i) real sensitivity to palladium chloride, provoked by, e.g., metallic jewellery, (ii) false-positive reactions due to the presence of trace amounts of nickel sulfate in the test material (22), or (iii) concomitant sensitization to both metals. In a study with guinea pigs, palladium chloride was found to be a more potent sensitizer than nickel sulfate (20).

Todd & Burrows (22) showed traces of nickel sulfate in palladium chloride patch test material.

Eedy et al. (23) estimated by atomic absorption spectrophotometry the free elemental nickel sulfate content of the palladium chloride patch test material of Chemotechnique to be 0.02 ± 0.01 , range $0.01-0.02 \mu\text{g/g}$ material. Nickel sulfate impurities were also found in cobalt, chromium and copper, but they were below the levels sufficient to elicit false-positive patch test results in 20 nickel-sulfate-sensitive patients. Therefore, it is far from clear that nickel sulfate impurities in the palladium chloride patch test material could induce the allergic patch test reactions caused by patch testing with palladium chloride. Cross-sensitivity or possibly concomitant sensitivity seems to be a more likely explanation.

De Finé Olivarius & Menné (16) patch tested 1307 consecutive patients with palladium chloride. 32 patients (2.4%) were positive, and 29 also showed a reaction to nickel sulfate. 19 of the 32 palladium-chloride-positive patients were patch tested with a metallic palladium disc, and none of them had a positive reaction to the metal. The authors concluded that patients positive to palladium chloride tolerate skin (and apparently mucosal) contact with metallic palladium. It is therefore uncertain whether metallic palladium in the mouth could be dissolved into its salt, and accordingly induce contact stomatitis in patients with dental devices containing palladium. Earlier attempts to correlate mucosal lesions to suspected metallic allergens omitted palladium chloride as a test substance. Downey (2) reported 2 patients with contact mucositis from dental alloys who, on patch testing, were positive to palladium chloride. Data on nickel sulfate sensitivity were not given. De Finé Olivarius & Menné (16) reported 3 patients with an allergic patch test reaction to metallic palladium. 1 of the patients had symptoms from her palladium-containing dental alloy. Interestingly, all 3 patients with positive reactions to metallic palladium were negative to palladium chloride as well as to nickel sulfate.

Known palladium exposure has only recently started to occur on a larger scale. Starting in 1986, e.g., in Germany, in the provision of dental crowns and bridges, patients insured under statutory health insurance have, for cost reasons, been provided primarily with tooth-replacement material containing palladium (3, 13). In Austria, palladium has started to replace amalgam in dental fillings because of discussions on mercury toxicity, and also gold, due to its cheaper price (14). Palladium sensitization was observed in 8.3% of eczema patients in Austria (14). 8 out of 115 reacted to palladium chloride alone; the rest had concomitant or cross-sensitization to nickel sulfate. As 216 patients out of 1382 reacted to nickel sulfate only,

and not to palladium chloride, the authors concluded that nickel sulfate and palladium chloride probably do not cross-react (14).

So far, relatively few cases of relevant clinical palladium-induced allergy have been reported (3, 5, 9, 11, 17, 21). These have mostly developed from dental alloys. In addition to contact stomatitis, urticaria and lichenoid reactions have also been diagnosed (12, 24). The clinical symptoms have cleared when the alloys have been removed, indicating true hypersensitivity. In Germany, dentists have recently been advised not to use palladium, especially palladium-copper alloys, because of the risk of allergy (25).

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