

Protective gloves in Swedish dentistry: use and side-effects

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Summary

Background During the 1980s routine wearing of gloves in dentistry was recommended by health authorities in several countries. However, prolonged glove use is associated with side-effects of irritant and allergic origin.

Objectives To investigate the extent of glove use and self-reported glove intolerance reactions among Swedish dentists, and to examine how far IgE-mediated allergy to natural rubber latex (NRL) occurs in subjects who report rapid itching when in contact with protective gloves.

Subjects/methods A postal questionnaire was answered by 3083 of 3500 licensed dentists, a response rate of 88%. Of the dentists who reported rapidly occurring itching of the hands from gloves, 131 of 170 attended a clinical examination including a skin prick test (SPT) and a serological examination (RAST) for IgE-mediated allergy.

Results Seventy-three per cent of the dentists reported daily glove use of more than 2 h, 48% more than 6 h a day, and 6% reported no use. NRL gloves were used most frequently ($P < 0.001$) and were the main material that elicited symptoms ($P < 0.001$). Female dentists reported more frequent glove use than males, as did young dentists ($P < 0.001$) compared with older ones. Females also preferred vinyl gloves. Glove intolerance reactions were reported by 723 (23%) dentists, [females 28%, males 21% ($P < 0.001$)] and were more common in younger dentists. Of the 417 dentists with reported hand eczema during the previous year, 54% reported glove intolerance, compared with 20% of the dentists without hand eczema ($P < 0.001$). A logistic regression analysis including hand eczema, age, sex and atopy showed that all these factors contributed significantly to the risk of glove intolerance, and that hand eczema was a stronger factor than atopy. In 15 of 131 (11%) dentists examined for reported glove-related itch, latex allergy was verified by SPT and/or RAST. Glove-related conjunctivitis, rhinitis and asthma, in contrast to skin symptoms, showed a significant association with IgE-mediated allergy to NRL.

Conclusions Swedish dentists show good compliance with the recommendations for routine glove use. Intolerance reactions are frequently reported, especially by dentists with hand eczema, which emphasizes the need for preventive skin care programmes. Glove-related symptoms from mucous membranes showed a higher association with IgE-mediated allergy to NRL than reported itching of the skin, a fact that should be considered when composing screening questionnaires for NRL sensitization

Key words: allergy, dentist, gloves, hand dermatitis, natural rubber latex

Continuous glove use is more common in dentistry than in most other occupations. The gloves should offer protection against blood-borne infections, wet work and skin-irritating and allergenic chemicals. During the 1980s routine wearing of gloves was recommended by health authorities in several countries¹ and, since 1986, in Sweden.² Compliance with these recommendations differs between countries^{3–7} and over time.¹ Non-sterile medical gloves for single use are commonly chosen. The most frequently used materials in such gloves are and have been natural latex rubber (NRL), and polyvinylchloride (vinyl), powdered or non-powdered. There is now, however, a rapid development of new materials, e.g. synthetic rubber materials, coming on the market.

The function of gloves depends on several factors such as quality, thickness and the material used. The barrier against blood-borne infections seems effective as long as the gloves are free from holes and other mechanical damage.⁸ The barrier against acrylates used in dentistry in bonding and composite materials is often insufficient to prevent penetration of the glove.⁹

Hand eczema is recognized as an occupational hazard in dentistry. In previous epidemiological questionnaire studies during the 1990s on dentists' self-reported hand eczema, prevalence figures between 20 and 30% were found,^{10–12} exceeding those in the general population.¹³ Dentists with hand eczema have a special need for skin protection because of their defective skin barrier.

Gloves offer skin protection, but prolonged use is also associated with side-effects. Irritant contact dermatitis caused by occlusion and glove chemicals is considered to be the main problem.¹⁴ Gloves, especially those of rubber, can also provoke allergic reactions in personnel and patients. Chemicals added to rubber glove materials during manufacturing can elicit allergic contact dermatitis, becoming apparent as hand eczema.^{15,16}

The second type of allergy is IgE-antibody mediated allergy, caused by allergenic proteins derived from NRL.^{17,18} In sensitized individuals, contact with NRL may elicit contact urticaria, allergic rhinoconjunctivitis, asthma and even serious generalized allergic reactions.

The aims of this study were to investigate the extent of glove use and self-reported glove intolerance reactions among Swedish dentists, and to examine how far IgE-mediated allergy to NRL occurs in subjects who report the rapid onset of itching when in contact with protective gloves.

Subjects, materials and methods

Study population

From the register of licensed dentists ($n = 10,621$) at the Swedish National Board of Health and Welfare, 3500 dentists, under 65 y old and licensed between 1965 and 1995, were randomly selected. A postal questionnaire was sent to these in 1996. After three reminders, 3083 answers were received, giving a response rate of 88%. The female : male ratio was 1464 : 1619 and the mean age of the responders was 45 y (range 25–64 y). Forty-seven per cent were employed in public dentistry and 38% in private practice. They had worked in dentistry for 17 y (range 0–39 years) on average.¹³

In the Stockholm, Göteborg and Malmö areas, 170 dentists (103 females and 67 males), who reported rapid onset of itching of the hands from skin contact with protective gloves, were invited to a clinical examination. Eighty of them had also reported hand eczema during the past 12 months. In total 131 attended, 69 of 80 with hand eczema and 62 of 90 without. In addition, 80 dentists in the Stockholm, Göteborg and Malmö areas who had reported hand eczema during the past 12 months, but denied rapid onset of itching from gloves, were examined. The Ethics Committees of the Karolinska Institute, and of Göteborg and Lund Universities approved the study.

Questionnaire

The postal questionnaire included questions on the use of protective gloves, types of glove used and glove intolerance reactions, and previous and current symptoms of hand eczema and atopy. In this study, atopy was defined by reports of childhood eczema, and/or allergic rhinitis and/or asthma. Other questions covered exposure to certain contact allergens, in particular methacrylate-based dental materials; these have been reported previously.¹³

Clinical examination and skin prick test

The clinical examination in 1997–99 was performed by experienced dermatologists (BM, KW, L-MW, BB). A standardized interview was followed by the recording of objective signs of current hand eczema. Skin prick tests (SPT) were performed on the forearm, with a commercial NLR extract (Stallergènes SPT reagent, Antony, Cedex, France). Histamine dihydrochloride 10 mg mL⁻¹ and

saline were used as positive and negative controls. SPT responses were regarded as positive if the weal mean diameter was at least half of the histamine weal and there was no reaction to the negative control. The reactions were scored in accordance with the European Guidelines, with histamine chloride corresponding to +++ as a reference.¹⁹ The dentists with hand eczema were also patch tested with a standard patch test series and a dental screening series, as reported previously.²⁰

Determination of total and specific IgE

Blood samples were collected and total IgE was measured in the Pharmacia CAP system FEIA (Pharmacia & Upjohn, Uppsala, Sweden), with results given in kU L⁻¹. Levels below 120 kU L⁻¹ were considered as normal according to the instructions of the manufacturer. Measurements of specific IgE antibody to NRL were made (CAP RAST k 82, Pharmacia). Specific IgE concentrations of ≥ 0.35 kU L⁻¹ were regarded as positive.

Statistical methods

Differences between groups were generally assessed using Fisher's exact test and the Mantel-Haenszel χ^2 technique. Multivariate analysis of the impact of several variables on reported glove intolerance was performed using logistic regression analysis.

Results

Questionnaire study

Glove use routines. Forty-eight per cent of the dentists reported glove use more than 6 h daily, and 6% reported that they never used protective gloves. Female dentists reported more frequent glove use than their male colleagues (Table 1). Young dentists used gloves more than older ones ($P < 0.001$) (Fig. 1).

Types of glove used. The dentists generally knew which glove material they used; only 2% were unaware of the material. NRL gloves were used most frequently

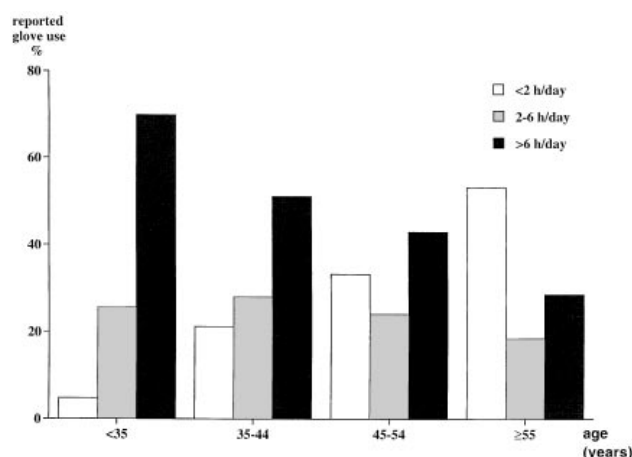


Figure 1 Percentage use of gloves in relation to age reported by 3031 Swedish dentists

($P < 0.001$), but females favoured vinyl gloves (Table 2). Use of NRL gloves dominated in dentists older than 35 y (NRL 41%, vinyl 35%), in contrast to the younger dentists who preferred vinyl gloves (NRL 34%, vinyl 44%) ($P < 0.001$).

Skin symptoms from gloves. In the questionnaire, both unspecified skin symptoms and immediate itching from gloves were asked about. Any type of glove intolerance reaction was reported by 723 (23%) dentists, [females 28%, males 21% ($P < 0.001$)] and reactions were more common in younger dentists. Rapidly developing itching from gloves was reported by 437 (14%) dentists [females 19%, males 12% ($P < 0.001$)]. NRL was the main material that elicited symptoms (Table 3). Thirty-seven per cent of the responding dentists had a history of atopy. Glove intolerance was reported by 31% of the atopics and by 20% of the non-atopics ($P < 0.001$). Of the 417 dentists with hand eczema during the past year, 54% reported glove intolerance, compared with 20% reported by the 2666 dentists without hand eczema ($P < 0.001$). In a logistic regression analysis including hand eczema, age, sex and atopy all of these factors contributed significantly to the risk of glove intolerance, and hand eczema was a stronger factor than atopy.

Table 1. Reported use of gloves by gender

Glove use, %	Females ^a n = 1436	Males n = 1595	Total n = 3031
Never	4	8	6
< 2 h day ⁻¹	14	27	21
2-6 h day ⁻¹	28	23	25
> 6 h day ⁻¹	54	42	48

^a Females reported more frequent glove use than males ($P < 0.001$).

Table 2. Types of glove used by gender

Types of glove, %	Females ^a n = 1345	Males n = 1449	Total n = 2794
NRL	33	46	40
Vinyl	42	30	36
Both types	23	21	22
Ignorant	2	3	2

^a Females favoured vinyl gloves ($P < 0.001$).

Table 3. Reported skin symptoms related to glove materials

Type of reaction, %	NRL	Vinyl	Both types
Any type of intolerance reaction (<i>n</i> = 723)	73	8	19
Rapid onset of itching (<i>n</i> = 437)	81	6	13
Difference between glove materials statistically significant (<i>P</i> < 0.001).			

Clinical examination

In 15 of 131 (11%) dentists (8 females, 7 males) who had reported the rapid onset of itching from gloves and were examined, the diagnosis of latex allergy was verified by SPT and/or RAST. The mean age was 47 years (range 36–50). Twelve were atopics with mucous membrane symptoms and five also had a history of atopic dermatitis. Eleven reported hand eczema, eight of them during the past 12 months. The results of SPT, serum-IgE and RAST are presented in Table 4.

The symptoms of glove intolerance as reported at examination of the 131 dentists who had reported rapid onset of itching from gloves in the questionnaire are shown in Table 5. Contact urticaria and symptoms from the mucous membranes were somewhat more frequent among the dentists sensitized to NRL. The differences according to mucous membrane symptoms were statistically significant. No significant differences were shown with respect to the various skin symptoms.

All 15 NRL-sensitized individuals reported NRL as the material eliciting symptoms, though three of them also reported symptoms from vinyl gloves. All continued to use gloves in their daily work, mainly vinyl

Table 4. Results of skin prick test (SPT) to latex extract, IgE and radioallergosorbent test (RAST) in the latex-sensitized dentists who reported hand eczema (*n* = 15)

Age	Sex	Hand eczema	SPT	RAST kU L ⁻¹	Total serum IgE kU L ⁻¹
50	f	–	+++	1.7	140
40	f	+	+++	0.8	90
50	m	+	+++	NT ^a	NT ^a
47	m	–	++	0.4	220
42	f	–	++	neg	38
46	f	+	++	neg	45
38	m	+	++	3.7	73
48	m	+	++	0.5	130
37	f	–	+	neg	130
36	m	–	+	0.9	360
48	f	+	+	neg	46
41	f	+	+	neg	46
46	m	–	–	1.1	1600
44	f	–	–	0.4	74
40	m	+	NT ^a	7.7	170

^a not tested.

Table 5. Glove-related symptoms reported at examination in 131 dentists who had noted rapidly developing itching from gloves in the postal questionnaire

Glove-related symptoms, %	Sensitized to NRL, <i>n</i> = 15	Not sensitized to NRL, <i>n</i> = 116	
Conjunctivitis	27	7	<i>P</i> < 0.05
Rhinitis	13	3	<i>P</i> = 0.08
Asthma	13	0	<i>P</i> = 0.01
Contact urticaria	33	18	NS
Itching	93	94	NS
Redness	87	83	NS
Dry skin	40	47	NS
Eczema	40	44	NS

NS = Not statistically significant.

ones. Among those who reported rapid onset of itching but without diagnosed latex allergy (*n* = 116), NRL was also the main symptom-giving material, 96% having symptoms from NRL, and 21% from vinyl. Eight of the 15 latex-allergic dentists were patch tested for hand eczema. Two of them had positive reactions to rubber chemicals, one to thiuram-mix (+ +) and one to mercapto-mix (+ +).

Among the 80 dentists who in the questionnaire denied the rapid onset of itching from gloves but were examined for their reported hand eczema, two had positive RAST in low titres to NRL but negative SPT and one had a positive SPT but negative RAST to NRL. At examination two of them admitted itching from NRL gloves. None of these three dentists were patch-test positive to rubber chemicals.

Discussion

The recommendations for routine glove use in dentistry, given in the 1980s, aimed at efficient cross-infection control. The use of gloves is, however, also known to introduce new health hazards, and it is only partially understood how glove intolerance reactions are associated with routines of use, properties of glove materials and individual vulnerability of the user.

In the questionnaire part we investigated the extent of glove use and self-reported glove intolerance reactions among Swedish dentists. The large random sample and the high response rate (88%) should make the results representative for all Swedish dentists.

The recommendation for routine glove use seems to be followed by the majority of dentists, with almost half of the dentists using gloves for more than 6 h per working day, and almost three-quarters for more than 2 h. Only 6% reported no glove use. The actual findings correspond well with internationally reported figures,

from England, 81–88%^{1,4} and from Australia 85%.³ Females reported more frequent glove use than did males, as did the younger dentists. This glove use pattern has also been recognized in previous studies.^{3,4,12} These findings strongly indicate that there will be increased demand for functional, low-risk gloves by younger dentists.

NRL was the commonest glove material, but there was a significant trend in females and young dentists to prefer vinyl. In Sweden the recognition of allergic reactions to NRL medical gloves resulted in a switch to non-NRL gloves during the 1990s. The female preference for vinyl was also noted in a previous Swedish study.¹² A more marked dominance for NRL gloves in dentistry can be seen in the studies from England and Australia.^{1,3} It is, however, difficult to analyse the reasons for differences in patterns of use for different glove materials. Local traditions, marketing and initiatives from health authorities differ over time and between countries. During the past few years new synthetic rubbers, mainly in the form of nitrile rubber, have also been introduced on the medical glove market. They offer better elasticity and tensile strength than vinyl gloves, and are free from the allergenic proteins of NRL. It is possible that these types of glove will partly replace NRL and vinyl in dental care, even if progress is made in the development of NRL and vinyl gloves as well.

There is much literature on self-reported glove intolerance reactions in medical and dental care. The investigations have been initiated by the attention given to IgE-mediated allergic reactions to NRL during the past two decades. Highly varying figures are presented, ranging between 12% and 56%.²¹ The prevalence of self-reported glove intolerance among dentists in our study (24%), agrees well with the figures previously reported by dentists in studies from Sweden, 33%⁷ and England, 29–32%.^{1,4} Females reported significantly more glove intolerance than males. Atopics reported significantly more often than non-atopics, in accordance with previous results.²²

In the present study another and even more pronounced association was found between glove intolerance and self-reported hand eczema during the previous year. Hand eczema more than doubled the risk of glove intolerance reactions, 54% vs. 20%. This was not caused by over-reporting of hand eczema in dentists with glove intolerance, since clinical examination showed that 94% of dentists reporting hand eczema indeed received that diagnosis when examined by a dermatologist.²⁰ The notable association between

hand eczema and poor tolerance to gloves underscores the importance of efficient skin care programmes in dentistry.

A questionnaire investigation alone cannot determine the prevalence of IgE-mediated allergy to NRL, since only a limited proportion of reported glove intolerance is caused by IgE-mediated reactions to NRL.^{23,24} Rapid onset of itching and even contact urticaria from gloves may be provoked by several mechanisms, such as irritating chemicals and dermatographism.^{25,26}

The design of the present study did not permit accurate calculation of the prevalence of allergy to NRL among Swedish dentists. In the clinical part, the aim was to examine how far IgE-mediated allergy to NRL explained the rapid onset of itching from gloves. The diagnosis of IgE-mediated allergy to NRL was established in only 11% of the dentists examined who had reported the rapid onset of itching from gloves. In the smaller group of dentists, with hand eczema but without rapid-onset itching, who were examined, the prevalence of latex allergy was 4%. We had expected a higher rate in these two risk groups for latex allergy, since the overall prevalence in dentists in general, in several studies is around 5–10%.^{7,27,28} The prevalence of latex allergy in symptomatic groups of health care workers has in previous studies ranged from 30 to 70%.²⁹ Our low figures, with only 11% dentists allergic to latex among those reporting glove-related itching, may have several explanations. The itching from gloves reported by dentists with actual hand eczema, may be generated from the occlusive effect of glove use on the dermatitis, without any superimposed IgE-mediated allergy to NRL. The prevalence of latex allergy may also be low in our group of dentists, compared with previous studies. We used a commercial NRL extract, which has previously shown good sensitivity.³⁰ Preventive measures such as using non-latex or 'low-allergenic' non-powdered NRL medical gloves prevent NRL sensitization among students in dental schools.²⁸ Possibly the frequent use of non-NRL gloves or NRL gloves with low amounts of allergenic proteins may have improved the situation.

The glove-related symptoms from mucous membranes: conjunctivitis, rhinitis and asthma, showed an association with IgE-mediated allergy to NRL, a fact that should be considered when composing screening questionnaires for NRL sensitization. This has also been clearly shown in Finland³¹ and deserves more attention. The fact that skin symptoms from NRL and vinyl gloves are reported by NRL-sensitized, as well as non-sensitized dentists, indicates complex causes of the skin intolerance to gloves.

In conclusion, Swedish dentists show good compliance with the recommendations for routine glove use, but glove intolerance reactions are frequently reported, especially by dentists with hand eczema. How these difficulties when using gloves should influence the recommendations for glove use is a delicate question. Our findings emphasize the need for preventive skin care programmes in dentistry, which also include further development of glove materials with acceptable levels of irritant and allergenic ingredients.

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