

Increase in occupational skin diseases of dental personnel

LASSE KANERVA¹, AIRA LAHTINEN², JOUNI TOIKKANEN¹, HELENA FORSS³, TUULA ESTLANDER¹,
PÄIVIKKI SUSITAIVAL⁴ AND RIITTA JOLANKI¹

¹Finnish Institute of Occupational Health, Helsinki; ²Finnish Dental Association, Helsinki;

³Oral and Maxillofacial Department, Kuopio University Hospital, Kuopio;

⁴Kuopio Regional Institute of Occupational Health, Kuopio, Finland

Occupational diseases of dentists and dental nurses were compiled from the Finnish Register of Occupational Diseases. The cases were recorded during 3 3-year observation periods, namely 1982–1984, 1986–1988, and 1992–1994 (i.e., 9 observation years). The relative risk of developing occupational allergic contact dermatitis in different occupations was calculated from the statistics of the years 1986–1991, and was expressed as the age-standardized rate ratio (SRR). During the 9 observation years, the majority of registered occupational diseases of dentists and dental nurses were skin diseases (221/312; 70.8%), followed by occupational repetitive strain injuries (61/312; 19.6%) and occupational respiratory diseases (20/312; 6.4%). The incidence rate (IR) for allergic contact dermatoses/10,000 workers (contact urticaria included) increased from 26 (95% confidence interval (CI) 16–40) in 1982–1984 to 79 (95% CI 64–97) in 1992–1994. The IR/10 000 of allergic contact dermatoses increased especially for dentists, from 5.4 (95% CI 0.7–19) in 1982 to 67 (95% CI 45–95) in 1992–1994. The increase of the IR/10 000 dental nurses was smaller: from 43 (95% CI 26–66) in 1982–1984 to 87 (95% CI 67–111) in 1992–1994. There was no increase in the IR/10 000 cases of irritant dermatoses. The most common causes of allergic contact dermatitis were plastics, disinfectants and antimicrobials, rubber chemicals, and mercury/mercury salts. The most common causes of irritant contact dermatitis were detergents, wet and dirty work, plastic chemicals and antimicrobials. Currently, Finnish dentists have the highest risk and dental nurses have the 4th highest risk of any occupation for developing occupational allergic contact dermatitis: the risk was 6.4-fold (SRR 6.4) in dentists and 6.1-fold in dental nurses, as compared to the general working population. It is evident that safer acrylics and protective gloves, better product declarations and material safety data sheets, as well as more information about protective measures, including non-touch working techniques, are needed.

Key words: occupational; allergic contact dermatitis; contact urticaria; dental personnel; methacrylate; epidemiology; statistics; risk; plastic materials; rubber chemicals; natural rubber latex; respiratory disease. © Munksgaard, 1999.

Accepted for publication 23 October 1998

The introduction of acrylic resin materials to clinical dentistry in the 1960s, followed by composite resins and glass ionomers in the 1970s, and adhesive resins in the 1980s has led to considerable modifications in restorative dental care. In Finland, the use of amalgam fillings has decreased from about 80% of all restorations to less than 10% at present (1, 2). At the same time, the use of rubber gloves to avoid increased infection risks has become part of everyday hygiene routines in all fields of clinical dentistry. As a consequence, dental personnel are increasingly exposed to a large number of sensitizing chemicals (3–5), and may be at

increased risk of developing occupational allergic diseases. Statistical data are lacking except on dental technicians (6, 7). We conducted a study to obtain information about occupational diseases in dentists and dental nurses.

Materials and Methods

Data were collected from the Finnish Register of Occupational Diseases (8). In Finland, all cases of occupational diseases are diagnosed by a physician, and physicians are obliged to report every such case to the Register. The Finnish Institute of

Table 1. Reported occupational diseases in dentists and dental nurses during 1982–1994, according to the Finnish Register of Occupational Diseases

Observation period	Occupation	Occupational skin diseases	Occupational respiratory diseases	Occupational hearing loss	Occupational repetitive strain injuries	Other	Total
1982–1984	dental nurses	35	1	0	11	0	47
	dentists	6	0	0	5	0	11
1986–1988	dental nurses	46	0	0	24	1	71
	dentists	11	0	1	6	2	20
1992–1994	dental nurses	85	13	1	7	1	107
	dentists	38	6	1	8	2	56
total	dental nurses and dentists	221	20	3	61	7	312

Occupational Health has compiled these statistics since 1975. The details of the collection of data have been reported earlier (8, 9). In short, only the main cause is listed in cases of occupational dermatosis. If the disease is diagnosed as an occupational allergic disease, it is recorded as an occupational allergic disease, despite the fact that irritant factors have probably also been involved. A patient's occupational skin disease is registered only 1× for the same cause. The cases were recorded during 3 3-year observation periods, namely 1982–1984, 1986–1988, and 1992–1994. The population figures are numbers of persons registered in the profession.

The relative risk of developing occupational allergic contact dermatitis (ACD) in different occupations (3-digit level, see 7) was calculated from the statistics for the years 1986–1991. The risk was compared to the risk of the whole working popula-

tion of developing an occupational ACD, and was expressed as the age-standardized rate ratio (SRR) (10–12). SRRs were calculated for years 1986–1991, as more recent population census figures were not available. The Finnish classification of occupations is based on the international and Nordic classifications (9).

Results

Table 1 shows that the majority of the occupational diseases of dentists and dental nurses are skin diseases. The number of reported respiratory diseases have also increased in recent years (Table 1). The 3rd most common cause, repetitive strain injuries, is decreasing (Table 1). Table 2 shows the number of allergic and irritant occupational skin diseases in dentists and dental nurses in the periods studied, with the respective incidence rates (IR)/

Table 2. Incidence rates (IR) /10,000 workers and reported cases (in parenthesis) of occupational skin diseases in dentists and dental nurses during 3 observation periods, according to the Finnish Register of Occupational Diseases

Period	IR/10,000 (95% CI***) (cases)					
	1982–84		1986–88		1992–94	
dentists (average <i>n</i> *)	3711		4125		4645	
all occupational skin diseases	16 (95% CI 5.9–35***)	(6)	27 (95% CI 13–48)	(11)	82 (95% CI 58–112)	(38)
allergic**	5.4 (95% CI 0.7–19)	(2)	22 (95% CI 10.41)	(9)	67 (95% CI 45–95)	(31)
irritant	5.4 (95% CI 0.7–19)	(2)	2.4 (95% CI 0.1–15)	(1)	13 (95% CI 4.7–28)	(6)
other (mainly viral or bacterial)	5.4 (95% CI 0.7–19)	(2)	2.4 (95% CI 0.1–15)	(1)	2.1 (95% CI 0.1–12)	(1)
dental nurses (average <i>n</i> *)	4653		5671		7374	
all occupational skin diseases	75 (95% CI 52–105)	(35)	81 (95% CI 59–108)	(46)	115 (95% CI 92–143)	(85)
allergic**	43 (95% CI 26–66)	(20)	46 (95% CI 30–67)	(26)	87 (95% CI 67–111)	(64)
irritant	24 (95% CI 12–42)	(11)	35 (95% CI 22–54)	(20)	23 (95% CI 13–37)	(17)
other (mainly viral or bacterial)	8.6 (95% CI 2.3–22)	(4)	0 (95% CI 0–6.5)	(0)	5.4 (95% CI 1.5–14)	(4)
dentists+dental nurse (average <i>n</i> *)	8364		9796		12019	
all occupational skin diseases	49 (95% CI 35–67)	(41)	58 (95% CI 44–75)	(57)	102 (95% CI 85–122)	(123)
allergic**	26 (95% CI 16–40)	(22)	36 (95% CI 25–50)	(35)	79 (95% CI 64–97)	(95)
irritant	16 (95% CI 8.3–27)	(13)	21 (95% CI 13–33)	(21)	11 (95% CI 12–39)	(23)
other (mainly viral or bacterial)	7.2 (95% CI 2.6–16)	(6)	1.0 (95% CI 0.03–5.7)	(1)	4.2 (95% CI 1.4–9.7)	(5)

* *n*=number of persons registered in the profession.

** Including both allergic contact dermatitis and contact urticaria/protein contact dermatitis.

*** The 95% confidence intervals (CI) for the incidence rates were calculated according to Poisson distribution.

Table 3. Causes of occupational allergic contact dermatoses during 1982–1994, according to the Finnish Register of Occupational Disease

Observation period	Occupation	Plastic chemicals	Rubber chemicals	Disinfectants	Anti-microbials	Detergents	Medicaments	Mercury	Nickel	Resin	Other chemicals	Unknown	Total
1982–1984	dental nurses	7	1	2	6	0	0	0	2	0	0	2	20
	dentists	1	0	0	0	0	1	0	0	0	0	0	2
1986–1988	dental nurses	9	7	2	4	1	0	0	0	3	0	0	26
	dentists	3	3	1	1	0	0	0	0	0	0	1	9
1992–1994	dental nurses	16	9	11	2	0	0	3	0	0	3	0	44
	dentists	13	5	4	0	0	0	2	1	0	2	0	27
total	dental nurses and dentists	49	25	20	13	1	1	5	3	3	5	3	128

10 000 workers. The incidence rate (IR) for allergic contact dermatoses/10,000 workers (contact urticaria included) increased from 26 (95% confidence interval (CI) 16–40) in 1982–1984 to 79 (95% CI 64–97) in 1992–1994. The IR/10 000 of allergic contact dermatoses increased especially for dentists, from 5.4 (95% CI 0.7–19) in 1982 to 67 (95% CI 45–95) in 1992–1994. The increase in the IR/10 000 dental nurses was smaller: from 43 (95% CI 26–66) in 1982–1984 to 87 (95% CI 67–111) in 1992–1994. There was no increase in the IR/10 000 cases of irritant dermatoses. The most common causes of ACD (Table 3) were plastic chemicals and materials ($n=49$), rubber chemicals ($n=25$), disinfectants ($n=20$), antimicrobials ($n=13$) and mercury and mercury salts ($n=5$). The most common causes of irritant contact dermatitis were detergents, wet and dirty work, plastic chemicals and antimicrobials.

In 1986–1991, dentists and dental nurses had a more than 6-fold risk, calculated as SRRs (10,11), for occupational allergic contact dermatitis, as compared to other occupations (Table 4).

Discussion

In Finland, the incidence of reported occupational skin diseases among dental nurses and dentists increased during the observation period and was mainly due to the increase in allergic conditions. Because of the financial depression in Finland in the early 1990s, the actual number of dental nurses employed was much lower in 1992–1994 than the figures of the occupational population used in the calculations (Table 2). The above also pertains to dentists, but on a smaller scale. Still, the incidence rate of occupational skin diseases among nurses increased from 75/10 000 in 1982–1984 to 115/10 000 in 1992–1994. Calculating from estimated figures of the employed population, the latter IR would be 136/10 000. The increase in occupational skin diseases was still greater among dentists; from 16/10 000 in 1982–1984 to 82/10 000 in 1992–1994, and was seen especially in allergic skin diseases (Table 2).

The increase in occupational skin and allergic diseases is probably due to increased exposure to occupational allergens, and to stronger sensitizers, e.g., more allergenic acrylics (3–5). One reason for the increase may be the fact that dentists and dental nurses have learned more about the problem, which probably increases the search for help. Improved diagnostics have also resulted in a greater number of registered occupational allergic diseases.

Contact urticaria and protein contact dermatitis were included in the same group as ACD before 1989, but contact urticaria (24 cases during 1992–

Table 4. 10 occupations with the highest risk of developing occupational allergic contact dermatitis, and the most common causes of their allergy during 1986–1991; The relative risk is expressed as the age-standardized rate ratio (SRR)

Rank	Occupation (code of occupation in parentheses)	SRR (95% confidence interval)/most common causes
1	dentists (031)	6.4 (3.8–11) (meth)acrylate compounds, rubber and rubber chemicals
2	leather good workers (625)	6.3 (2.8–14) rubber and rubber chemicals, plastic chemicals
3	plywood and fibreboard workers (672)	6.1 (3.9–9.6) phenol-formaldehyde resin
4	dental nurses and assistants (033)	6.1 (4.3–8.7) rubber and rubber chemicals, (meth)acrylate compounds
5	masseurs (043)	5.8 (1.6–21) massage creams and ointments
6	cast concrete product workers (758)	5.4 (3.3–9.1) chromate compounds
7	tanners, fellmongers and pelt dressers (753)	5.1 (2.1–12) chromate compounds, dyes
8	reinforcement concreters, cast concrete product workers (693)	4.5 (2.5–6.2) chromate compounds
9	plastic product workers (752)	4.1 (2.8–8.2) plastic chemicals (e.g. epoxy resin)
10	other woodworking occupations (679)	4.0 (1.6–9.6) plastic chemicals

1994, mainly caused by natural rubber latex; NRL) significantly increased during the observation period because of the increased use of disposable NRL gloves. The NRL gloves also contained high concentrations of sensitizing proteins. Fortunately, their quality has now improved, and only low-protein NRL gloves should be used in general and in dental care (13).

Good advice to prevent occupational contact dermatitis is available in the literature (14,15). As regards acrylics, many problems have not been satisfactorily solved. We have suggested that dental products containing acrylics should be delivered in such containers that no-touch techniques could be used when handling them (15). Unfortunately this is not yet possible, although better bottles/packages have recently been introduced. Identification of acrylic allergens can be performed by gas chromatographic/mass spectrometric analysis (16–18), and accurate material safety data sheets and product declarations should be required from manufacturers before the products are marketed; otherwise many dental personnel will be sensitized before any preventive measures have taken place.

Acrylic monomers penetrate in a few minutes practically all NRL, polyvinyl chloride (PVC) and polyethylene gloves (19, 20) and therefore no-touch techniques (i.e., no acrylics should be touched) should be used. Acrylics and many other chemicals do not readily penetrate the multilaminated 4-H® (Silver Shield®) glove, but the anatomic fit of this glove is poor for delicate tasks where good dexterity is necessary. A fingerpiece of the 4H glove under a disposable glove may be of help (3–5).

Previous questionnaire studies from the Nordic countries have demonstrated high prevalences of work-related skin diseases in dental personnel (21), which is in agreement with our statistics. These observations are in contrast with some data from the United States, where military dental personnel

have less occupationally related hand dermatitis problems (22) than observed in Finland. One explanation might be that the increase in the use of plastics in restorative dentistry is not common in military dental practice in the United State. Furthermore, the use of plastics in clinical dentistry is proportionally smaller in Canada and the United States (23) than in Finland and the other Nordic countries. Data from Canada and the United States indicate that dental amalgam is still the main restorative material in posterior teeth, and dental composites and glass ionomers may not be used as extensively as in Finland and the other Nordic countries (23). The United States may face the increase in occupational skin diseases caused by dental acrylics in the future. We have recently started an extensive epidemiological study in dental nurses to clarify the problem in more detail.

To prevent occupational dermatoses in dental personnel, safer acrylics and protective gloves, better product declarations and material safety data sheets, more information about protective measures, as well as more careful non-touch working techniques, are needed.

References

1. Widström E, Forss H. Selection of restorative materials for children and adults in public and private dental care in Finland. *Swed Dent J* 1994; 18: 1–7.
2. Tiainen L. Tilastotietoja sairauksivakuutuksen korvaamasta hammashuollosta. (Statistics on dental care subsidized by health insurance. *Suomen Hammaslääkäril* (Finnish Dent J, in Finnish) 1997; 4: 1072–1078.
3. Kanerva L, Estlander T, Jolanki R. Occupational skin allergy in the dental profession. *Derm Clinics* 1994; 12: 517–532.
4. Kanerva L, Estlander T, Jolanki R, Tarvainen K. Dermatitis from acrylates in dental personnel. In: Menne T, Maibach H I (eds): *Hand eczema*. Boca Raton FL, CRC Press inc, 1994: 231–254.
5. Kanerva L, Estlander T, Jolanki R. Dental problems. In:

- Guin J D (ed): *Practical Contact Dermatitis*. McGraw-Hill Inc, 1995: 397–432.
6. Rustemeyer T, Frosch P J. Occupational skin diseases in dental laboratory technicians (I). Clinical picture and causative factors. *Contact Dermatitis* 1996; 34: 125–133.
7. Mürer A J L. *Hudproblemer blandt tandteknikere*. Københavns Universitet og Arbejdsmiljøinstituttet, Denmark, 1996: 1–74 (PhD thesis, in Danish).
8. Estlander T. Occupational skin disease in Finland. Observations made during 1974–1988 at the Institute of Occupational Health, Helsinki. Thesis. *Acta Dermato-venereologica* 1990: suppl 155: 1–85.
9. Kanerva L, Toikkanen J, Jolanki R, Estlander T. Statistical data on occupational contact urticaria. *Contact Dermatitis* 1996; 35: 229–233.
10. Rothman K J. *Modern epidemiology*. Mass: Little Brown, Boston, 1986.
11. Hytönen M, Kanerva L, Malmberg H, Martikainen R, Mutanen P, Toikkanen J. The risk of occupational rhinitis. *Int Arch Occup Environ Hlth* 1997; 69: 487–490.
12. Jolanki R, Estlander T, Karjalainen A, Kanerva L. Ammatti-ihtouttavaara eri ammateissa. Suomen Lääkärilehti. (*The risk of occupational skin disease in various occupations*) *Finnish Med J* (in Finnish) 1998; 53: 927–936.
13. Palosuo T, Turjanmaa K, Reunala T, Mäkinen-Kiljunen S, Alenius H. Allergen content of latex gloves used in 1994–1996 in health care in Finland. Results of a renewed market survey in 1995. *Publications of the National Agency for Medicines* 1996; 2: 1–7.
14. Lachapelle J-M. Principles of prevention and protection in contact dermatitis (with special reference to occupational dermatology). In: Rycroft R J G, Menné T, Frosch P J (eds): *Textbook of contact dermatitis*, 2nd edition. Berlin: Springer, 1995: 695–702.
15. Kanerva L, Estlander T, Jolanki R. Allergy caused by acrylics: past, present and prevention. *Curr Probl Dermatol* 1996; 25: 86–96.
16. Kanerva L, Henriks-Eckerman M-L, Estlander T, Jolanki R, Tarvainen K. Occupational allergic contact dermatitis and composition of acrylates in dentin bonding systems. *J Eur Acad Derm Venereol* 1994; 3: 157–48.
17. Henriks-Eckerman M-L, Kanerva L. Product analysis of acrylic resins compared to information given in material safety data sheets. *Contact Dermatitis* 1997; 36: 164–165.
18. Kanerva L, Henriks-Eckerman M-L, Jolanki R, Estlander T. Plastics/acrylics: Material safety data sheets need to be improved. *Clinics Dermatol* 1997; 15: 533–546.
19. Pegum J S, Medhurst F A. Contact dermatitis from penetration of rubber gloves by acrylic monomer. *Br Med J* 1971; 2: 141.
20. Munksgaard E C. Permeability of protective gloves to (di)-methacrylates in resinous dental materials. *Scand J Dent Res* 1992; 100: 189–192.
21. Jacobsen N, Hensten-Pettersen A O. Occupational health problems and adverse patient reactions in orthodontics. *Eur J Orthod* 1989; 11: 254–264.
22. Hill J G, Grimwood R E, Hermes C B, Marks J G Jr. Prevalence of occupationally-related hand dermatitis in dental personnel. *J Am Dent Assoc* 1998; 129: 212–217.
23. Department of Health and Human Services. *Dental amalgam: scientific review and recommended public health service strategy for research, education and regulation*. Washington, USA; 1993.

Address:

Lasse Kanerva
Section of Dermatology
Finnish Institute of Occupational Health
Topeliuksenkatu 41 aA
FIN-00250 Helsinki
Finland