

Nordic dentists' knowledge and attitudes on dental amalgam from health and environmental perspectives

Katariina Ylinen and Göran Löfroth

Inkoon kunnan terveystakeskus, Inkoo, Finland and Nordic School of Public Health, Göteborg, Sweden

Ylinen K, Löfroth G. Nordic dentists' knowledge and attitudes on dental amalgam from health and environmental perspectives. *Acta Odontol Scand* 2002;60:315–320. Oslo. ISSN 0001-6357.

The aim of this study was to identify differences and similarities between the Nordic countries in dentists' use of dental amalgam as a restorative material, and also their knowledge and attitudes about amalgam from health, environmental, ethical, economic and social points of view. Procedures for handling amalgam waste were also studied. A random sample of 250 dentists was drawn from the national registers of authorized dentists in each country in late autumn 1997. At the beginning of 1998, a questionnaire was sent to all the dentists in the study group. The response rate was 77.6% in Denmark, 73.2% in Finland, 78.8% in Norway, and 84.0% in Sweden. In Finland and Sweden the use of dental amalgam had almost ceased, particularly for younger patients, while in Norway and especially in Denmark it was still widely used. Dentists' knowledge of the environmental effects of amalgam was confused, but most dentists had installed amalgam separators in their dental units by 1998. The majority of dentists in each country wanted to keep dental amalgam as a restorative material even in the future, and they did not want to ban the import of mercury to their home countries. Most dentists considered amalgam to be a health risk for at least some patients, and a great majority (from 76% in Sweden to 94% in Norway) considered composite as a possible odontological risk to patients. Since a majority of the dentists considered both amalgam and composites possibly harmful to patients, efforts to develop better alternatives to amalgam should continue.

□ *Composites; Denmark; dental mercury; Finland; Norway; Sweden*

Göran Löfroth, Nordic School of Public Health, Box 12133, SE-402 42 Göteborg, Sweden. Tel: +46 31 69 39 35, e-mail: goran@nhv.se

During the past decade, the use of dental amalgam as a restorative material has decreased markedly in the Nordic countries, as in most Western countries (1–3). This could be due to the lively debate on the possible adverse health effects of dental amalgam in the mass media and among some researchers, with the start in Sweden in the 1980s (3, 4). The debate caused worry among the patients, and led to several recommendations from the dental health authorities in all the Nordic countries (5–9). The authorities have emphasized the safety of amalgam to most patients, but some authorities have recommended not using it for pregnant women or when an acceptable alternative material is available.

An intensive research has tried to find alternative restorative materials to dental amalgam. Composites are widely used for adult patients, but they are not considered as durable as amalgam. For the deciduous dentition, glass ionomer fillings have provided a suitable alternative. Gold restorations are considered to be of good quality but too expensive for widespread use. Ceramic materials are becoming more popular and are under further development and can be a promising alternative in the future.

The environmental effects of dental amalgam, particularly its mercury component, have come into focus lately. Mercury is a well-known toxic element and its harmfulness to nature is well documented (10–12). Because the industrial use of mercury has decreased during the past decade in Western countries, the proportion of mercury waste from dental practices has increased (13, 14). This has led several environmental authorities to recommend a

decrease in the use of dental amalgam for environmental reasons, although no general ban on its use is made by any of the Nordic countries (5, 6, 8, 9). In Denmark, the authorities actually decided to ban the use of amalgam by 1999 for environmental reasons (7), but this was postponed (15) because no satisfactory alternative to amalgam in all situations had been found by 1998.

There have been few international comparative studies about dentists' knowledge and attitudes on different restorative materials. Some earlier research in which the dentists in the Nordic countries were compared (16, 17) has indicated differences in dentists' opinions about the risk of side effects, professional competence with different materials, occupational health risks, choice of treatment in special situations and perceived competence to take care of patients claiming they have adverse health effects of dental restorations. The information given by the respective dental health and environmental authorities in the Nordic countries is similar, and the interesting question is why the working behavior and attitudes of dentists towards dental restorative materials vary, and if these differences still persist.

The aims of this study were to identify similarities and differences between the Nordic countries in the use of dental amalgam as a restorative material, the dentists' and central decision-makers' attitudes and knowledge about dental amalgam from a health and environmental point of view and to explore their attitudes on ethical, economic and social aspects about the use of different dental materials. One of the aims was to find out the procedures

Table 1. Number of respondents, their average age, and standard deviation (SD)

Country	Women		Men		All	
	Number	Age (SD)	Number	Age (SD)	Number	Age (SD)
DK	79	48 (7)	115	52 (7)	194	51 (7)
FI	117	41 (10)	66	44 (10)	183	42 (10)
NO	73	41 (12)	124	46 (11)	197	45 (12)
SE	95	47 (9)	115	50 (8)	210	49 (9)

for handling the amalgam waste. The study was carried out simultaneously in four Nordic countries. Data from Finland have been published previously (4). Comparative data from the four countries are presented here.

Materials and methods

In late autumn 1997, simple random samples of 250 dentists in Denmark, Finland, Norway, and Sweden were drawn from the national registers of authorized dentists in each country by the national dental associations. The Danish sample was stratified with respect to the memberships in the 2 Danish associations. A pre-tested questionnaire, written in the native language of each country, along with covering letters and a stamped return-envelope, was sent to all the dentists in the study group at the end of 1997 beginning of 1998. The recipients were encouraged to answer the questionnaire by the national associations in an accompanying letter. A reminder was sent after a month.

The questionnaire consisted of 25 questions about the respondents' background, use of dental amalgam as a restorative material in their patients, the respondents' attitudes about dental amalgam as a health and environmental issue and the respondents' attitudes on the ethical and social aspects of dental amalgam. There were questions about the respondents' age, sex, dental speciality and main working sector (private, public employment, university, other). The respondents were asked about their use of amalgam, and, if yes, how often in different age groups. Alternatives were 'rarely', 'sometimes', or 'often'. Those who did not use amalgam could tell when they had stopped using it in different age groups, and which material they used instead. The respondents were given questions about possible adverse health effects of amalgam, when and where the respondents had heard about these effects and how they treated a patient with possible side effects.

In questions about the environmental effects of amalgam, the respondents could tell whether they considered its use as an environmental risk, and, if yes, in what way, whether they had installed amalgam separators in their practice and where they deposited the waste amalgam. Questions about the social and ethical aspects of amalgam enquired about economic aspects of alternative materials and whether alternative materials can put patients at odontological risk. The respondents were also asked to state whether amalgam should remain as a restorative material and if the import of mercury should be banned. The last question was an open one where the respondents could give free comments on the issues.

The answers were analyzed using the Epi Info statistical program, version 6.04 (18). Statistical calculations were made with chi-square tests on absolute numbers for groups in individual countries (2 × 2 tables). Significance was set at a *P*-value of less than 0.05. Comparison of age and sex of respondents and non-respondents was used to assess possible responder bias.

During 1998, semi-structured interviews (19, 20) were carried out with 5–6 dental health and environmental decision-makers and representatives for voluntary movements and patient organizations in Finland, Norway, and Sweden. The interview questions were formulated by all original participants and then translated into the national language of each country. The interview questions covered about the same area as the questionnaire, but were more general and not as detailed. A free discussion was encouraged after each question. The interviews were taped and written out in full and the answers then summarized under each question.

Ethics

All the recipients of the questionnaire and all the interviewees were healthy adults, and the permission of the

Table 2. Number of dentists treating a particular age class and percentage still using dental amalgam often or sometimes in 1998*

Country	3–12 years			13–19 years			Adults		
	No. treating	% using amalgam often	% using amalgam sometimes	No. treating	% using amalgam often	% using amalgam sometimes	No. treating	% using amalgam often	% using amalgam sometimes
DK	95	18	43	182	30	43	169	74	18
FI	115	0	1	151	0	3	178	7	21
NO	104	10	23	148	19	17	189	59	29
SE	152	0	1	168	0	2	201	12	28

* The frequency of amalgam use was, often, sometimes, rarely and not at all.

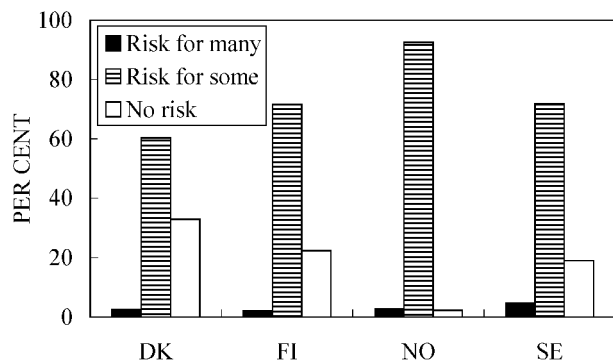


Fig. 1. Percentage of respondents in the Nordic countries who were of the opinion that dental amalgam is a health risk for many, for some or no health risk.

ethics committee was not needed. In addition, the dental associations in each country were informed about the study and encouraged the recipients to answer.

Results

An overall response rate for the four countries was slightly less than 80%, with 77.6% in Denmark, 73.2% in Finland, 78.8% in Norway, and 84.0% in Sweden. In some questions, the number of respondents can be lower, as not all dentists answered every question. The percentages working in public employment were 24% in Denmark, 50% in Finland, 35% in Norway, and 47% in Sweden. Finland had the highest percentage of women (64%), Norway the lowest (37%). Data on the age and sex of non-responders were analyzed and showed no significant differences between respondents and non-respondents (data not given). A broad characterization of the respondents is given in Table 1.

Use of amalgam as a restorative material

As indicated in Table 2, there were differences in the use of amalgam, above all for children, between the four countries. In Finland, only one dentist (1%) and in Sweden only two (1%) had used amalgam in children under 12 years of age, but only sometimes, during the previous year. In Denmark 61% and in Norway 33% of the dentists had used amalgam often or sometimes in this age group. For the adult patients, the percentage using amalgam was often or sometimes higher in all the countries, ranging from 28% in Finland to 92% in Denmark. The figures for youth are in between those for children and adults.

The dentists who did not use amalgam were asked when they had stopped using it. In Finland 64% and in Sweden 49% of the respondents, but in Denmark and in Norway only 35% and 30% had stopped using amalgam for children before 1993. The number not using amalgam grew slowly each year. As the main alternative material to amalgam in all four countries, glass ionomer was most common for children and composite for adults.

Table 3. Percentage of respondents answering 'Yes' when asked if there was an environmental risk from dental amalgam with respect to emission in sewage, using sewage sludge as fertilizer, emission from crematoria and leakage from churchyards

	DK (n = 194)	FI (n = 183)	NO (n = 187)	SE (n = 210)
Emission in sewage	30	69	53	49
Sewage sludge as fertilizer	26	54	31	42
Emission from crematoria	55	33	40	73
Leakage from churchyards	21	20	10	11

Health risk and treatment of adverse effects

Most dentists in the four countries considered amalgam to be a health risk at least for some patients (Fig. 1). The percentage answering 'no risk' ranged from 33% in Denmark to about 2% in Norway. The most common possible health risk was thought to be local allergic reaction in the mouth, the same answer in every country. The most important source of knowledge was the national dental journal in each country (49% in Denmark, 30% in Finland, 37% in Norway, and 35% in Sweden), followed by courses and discussions with colleagues.

The respondents were asked which was their most common treatment method in the case of patients who claim they have adverse health effects from amalgam. In Denmark and in Norway, the most common treatment was replacing amalgam with other materials (33% in Denmark, 47% in Norway), in Finland the allergic test (43%) and in Sweden the patient was usually sent to a specialist dentist for further examination (60%). Replacement of amalgam restorations was the second common treatment also in Finland and in Sweden.

When asked whether dental composites could be a possible odontological risk to patients, 86% of the dentists in Denmark, 85% in Finland, 94% in Norway and 76% in Sweden thought so. A high percentage of the dentists in each country, Denmark 52%, Finland 62%, Norway 79%, and Sweden 58%, considered both amalgam and composites to be possible odontological risks to their patients.

Dental amalgam and the environment

The majority of dentists in each country considered the proportion of mercury leakage from the dental practices compared to all the other mercury leakage caused by human activity to be very small, both globally and in their own country. Most dentists in Finland and Norway and 49% of the Swedish dentists believe there was an environmental risk from dental amalgam with respect to emission in sewage, but only 30% of the Danish dentists thought so (Table 3). Only in Finland did the majority of dentists consider the use of sewage sludge as fertilizer to be hazardous to the environment. In Denmark and in Sweden the majority of the respondents considered emission from crematoria to be a risk for the environment,

but only 33% of the Finnish dentists were of that opinion. Leakage from churchyards was considered an environmental risk by 10% to 21% (Table 3).

Dentists answering 'don't know' to the questions in Table 3 ranged from 12% to 37% in Denmark, from 18% to 42% in Norway, from 16% to 47% in Sweden, and from 10% to 35% in Finland. The respondents felt most unsure about leakage from churchyards.

In 1985, a minority of the dentists had installed amalgam separators in their unit system. The lowest occurrence was in Norway (2%) and the highest in Sweden (36%), while the other countries were in between. The percentage rose over the years and by 1997 Finland had the lowest with 82%, while the occurrence was well above 90% in the other three countries. Only a minority of the dentists in Denmark, Finland, and Norway had installed amalgam separators also in the sterilization room by 1997 (35%, 18% and 0.1%, respectively), but in Sweden as many as 68% had done so.

Ethical and social aspects

The respondents were asked whether they discuss the choice of dental material with their patients. The majority of private dentists in all four countries discussed this always or often with their patients, but among the publicly employed dentists the rate was lower (Fig. 2). The difference was statistically significant for Denmark, Finland, and Norway ($P < 0.001$), but not for Sweden. Most dentists in Denmark, Norway, and Sweden believed that patient demand for dental care could diminish for economic reasons if there was a general ban on the use of amalgam (70%, 66%, and 58%, respectively), but the corresponding percentage was only 23% in Finland. There was a statistically significant difference between men and women in Finland and in Norway (men thought more often than women that demand for dental service would diminish; $P < 0.005$). In Sweden, there was a statistically significant difference between working sectors on this question: dentists working in the public sector considered

Table 4. Percentage of respondents answering 'Yes' when asked if mercury amalgam should be available in the future (and total number of respondents)

Country	Private practice		Public employee	
	% 'Yes'	(of total)	% 'Yes'	(of total)
DK	87	(147)	96	(47)
FI	60	(82)	76	(92)
NO	67	(120)	80	(69)
SE	51	(103)	80	(99)

more often than private dentists that the demand would diminish ($P < 0.0002$).

Most respondents in each country wanted to keep dental amalgam as a restorative material, even into the future (Table 4). In both Finland and Sweden there was a significant difference between private and public sector dentists; in both countries, publicly employed dentists wanted to keep amalgam available more often than private dentists ($P < 0.002$). The majority of respondents in all four countries did not want to ban the import of mercury into their respective home country.

Interviews

The main results from the interviews in the different countries can be summarized as follows: the knowledge level of the central decision-makers on amalgam, both healthwise and environmentally, was high. There was a marked consensus between the countries and between dental health and environmental authorities, which is also expressed in the similar official recommendations on the amalgam issue given by each country.

The representatives for different voluntary movements and patient organizations held opinions that could differ markedly from those of the authorities. One voluntary movement representative claimed that all amalgam restorations should be removed from deceased persons before burial or cremation. The patient organizations in Finland, Norway, and Sweden wanted a general cessation of the use of amalgam for health reasons. The environmental voluntary movements were concerned about the harmful effects of dental mercury amalgam to nature, but had little knowledge or opinions about dental amalgam from a health point of view.

Discussion

The advantage of using a questionnaire as a data-collecting method is the possibility to collect a great many data from a large number of respondents relatively quickly and inexpensively. One disadvantage is 'recall bias', where the respondent's older experiences influence his/her memory (21). To minimize the risk of recall bias, there were only two questions which required remembering backwards in time in this study, one concerning the installation year for amalgam separators and one about

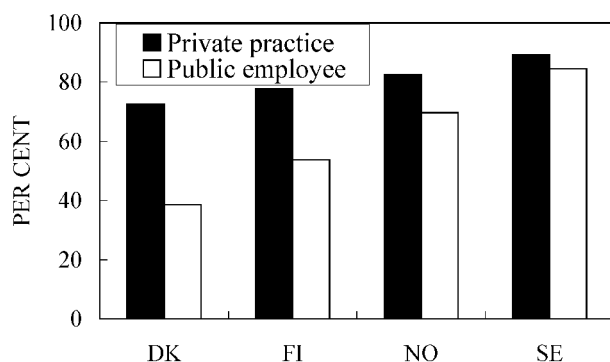


Fig. 2. Percentage of respondents in private practice and public employment in the Nordic countries who discuss the choice of dental material with their patients always or often.

the year the respondents had stopped using amalgam. The questions concerning dental amalgam from a health point of view were from an area well known to the dentists, and the risk for misinterpreting the questions in this section can be considered as low. The questions concerning dental amalgam from an environmental point of view came from an area that the dentists are not so acquainted with, and the risk for misinterpreting the terms and definitions may be higher.

The sample size in this study was 250 dentists in each country, which might seem low. Sample size has a great bearing on attaining differences and statistical significance (22). The decision of sample size is limited by economic realities, and the balance between economic aspects and statistical power can be discussed from different points of view (22). The response rate in this study varied from 73.2% in Finland to 84.0% in Sweden, which can be considered as good and helps render the results representative. The choice of the same sample size in all countries is natural in order to attain the same statistical power in each country. In addition, each country was analyzed separately.

When asked whether they had used amalgam as a restorative material in their patients, divided into different age groups, only very few Finnish and Swedish dentists had used amalgam for children under 12 years of age and then only sometimes, but 61% of the Danish dentists had used it often or sometimes (Table 2). The figure for Norway was in between, concurring with the substantial decrease in the use of amalgam that has been seen in Norway (23). For adult patients, the use of amalgam often or sometimes was more common, ranging from 28% (Finland) to 92% (Denmark). The differences between the countries were statistically significant. Why Finnish dentists have decreased their use of amalgam most, and why use is still fairly high in Denmark, cannot be answered in this study. The recommendations of the respective authorities have been relatively similar in all countries, those in Denmark actually being most strict, so this cannot explain the difference. Perhaps the different intensity of debate in the mass media or certain cultural differences can provide an explanation, but this has to be studied further.

A majority of the dentists in all four countries considered both amalgam and composite to be a possible risk to patients, either odontologically or to general health. In recent studies by Forss and Widström (24) and Dahl et al. (25), the durability of failed composite restorations proved to be markedly short compared to the durability of amalgam restorations. As most dentists consider both amalgam and composite restorations as possibly hazardous to their patients, the need to develop better dental restorative materials persists.

The methods for treating patients who claim they have adverse side effects from dental amalgam varied between the countries. In Sweden, where the most common treatment was to send the patient to a specialist dentist, there were two publicly financed dental centers taking care of these patients (in Stockholm and in Uppsala), with

dentists, medical doctors and psychologists employed; the Swedish respondents probably mean these centers in their answers. Both centers are now closed (26). Norway has an 'Adverse Reaction Unit' for dental biomaterials which records adverse reactions, examines patients, and gives advice on dental materials and their potential risks (27). No similar specialized centers for these patients have been brought into use in the other Nordic countries. The most common method in Finland, the allergy test, has had very little spread in the other countries, where replacement of restorations has been the most common treatment. This variety of treatment methods perhaps reflects the uncertainty about the best way to handle these patients that both dentists and authorities in most countries feel.

There is very little environmental education in the Dental Schools in the Nordic countries, and the education on the chemistry of dental materials is brief owing to lack of time in the dental course. This lack of knowledge on the issue is reflected in the answers the dentists gave to questions concerning dental amalgam from an environmental point of view. The majority of dentists in each country considered the mercury waste from dental practices compared to other human mercury sources to be low both globally and in their own country. Globally, this is surely so, as the chlorine alkali industry and even other industrial processes still use mercury and the proportion emitting from dental practices is low by comparison. In the Nordic countries, however, the industrial use of mercury has decreased during recent years, making the mercury waste from the dental practices more recognizable (1, 13, 14). In 1999, Abilgaard (13) stated that: 'The use of mercury in the Nordic countries is today mainly in amalgam fillings (60–80%)'. This confusion about the effects of mercury waste is also seen in the variety of answers to the question in Table 3 (i.e. the ways mercury waste can cause environmental risks). In every study country, the majority of dentists chose at least one possible way that could be hazardous to nature, but the answers differed between the countries and showed no coherence, probably because different aspects have been pursued by different sections of the national mass media.

The installation of amalgam separators to dental units has increased during the past decade, mainly thanks to the recommendations and laws given by the environmental authorities (28, 29).

There has been much emphasis on patient rights and on the concept of informed consent in recent years. Many publicly employed dentists, above all in Denmark and Finland, do not discuss the choice of dental material with their patients (Fig. 2), and in all four countries the private dentists discussed the choices more. Whether this is an effect of public dentists treating more children or of a different attitude cannot be answered in this study.

In a study by Widström et al. (16), over 90% of the dentists in the Nordic countries wanted to keep dental amalgam at least until 1993. In this study, the majority of the dentists in each country still wanted to have dental amalgam available in the future (Table 4), but the

percentage has become lower since 1992. More than 90% of the publicly employed Danish dentists want to keep amalgam in the future; for the others the range is from 51% of the private Swedish dentists to 87% of the private Danish dentists. Consequently, the majority of the dentists in each country did not want to ban the import of mercury.

Several studies (3, 24) have indicated that the use of dental amalgam as a restorative material has diminished to a large extent in many Western countries. This may be caused by a combination of decreasing number of dentists using amalgam and the decreasing prevalence of caries (30, 31). There are, however, considerable differences in the use of amalgam between the Nordic countries; in Denmark, amalgam is still a common restorative material, while in Finland and Sweden its use has almost ceased, particularly for the younger age group. The decision-making process among dentists concerning their choice of restorative material has not been subject to much study, so it is difficult to come up with reasons for these variations. A large number of dentists in all the Nordic countries consider both amalgam and composite materials to be possible health or odontological risks to their patients. The continuous need to develop better restorative materials as alternatives to dental amalgam is emphasized.

Acknowledgements.—Financial support was obtained from the Nordic School of Public Health for travel and postage expenses. We thank Marie-Louise Ahldén in Sweden, Niels J Asbech in Denmark, and Thor Olav Sveinall in Norway, who initially collected and analyzed data from their respective country.

References

1. Eley BM. The future of dental amalgam: a review of the literature. Part 2: Mercury exposure in dental practise. *Br Dent J* 1997;182:293–7.
2. Widström E, Forss H. Dental practitioners' experiences on the usefulness of restorative materials in Finland 1992–1996. *Br Dent J* 1998;185:540–2.
3. Spencer AJ. Dental amalgam and mercury in dentistry. Invited Review. *Aust Dent J* 2000;45:224–34.
4. Ylinen K. Finnish dentists' and decision-makers' knowledge and attitudes on dental amalgam (in Swedish). Göteborg: Nordic School of Public Health; 2001.
5. Mercury/amalgam health risks (in Swedish). Stockholm: National Board of Health and Welfare; 1987.
6. Possibility to dispose of amalgam as dental filling material (in Swedish). Stockholm: Ministry of Health and Social Affairs; 1992.
7. Notification on prohibition of sale and export of mercury and mercury-containing products (in Danish). Copenhagen: Ministry of the Environment; 1994.
8. Recommendation on materials in restorative caries therapy (in Finnish). Helsinki: Ministry of Social Affairs and Health; 1993.
9. Røynesdal K. The Norwegian Board of Health and the amalgam debate (in Norwegian). *Nor Tannlegeforen Tidsskr* 1995;105: 254–5.
10. Environmental Health Criteria. Methylmercury. Geneva: WHO; 1990.
11. Environmental Health Criteria: 118: Inorganic Mercury. Geneva: WHO; 1991.
12. Co-operation on existing chemical risk reduction. Lead country report on mercury. Paris: OECD; 1991.
13. Abilgaard A. Mercury. Copenhagen: Ministry of Environment and Energy; 1999.
14. Chin G, Chong J, Kluczevska A, Lau A, Gorjy S, Tennant M. The environmental effects of dental amalgam. *Aust Dent J* 2000; 45:246–9.
15. Notification on prohibition of sale and export of mercury and mercury containing products (in Danish). Copenhagen: Ministry of the Environment and Energy; 1998.
16. Widström E, Birn H, Haugejorden O, Sundberg H. Fear of amalgam: dentists' experiences in the Nordic countries. *Int Dent J* 1992;42:65–70.
17. Widström E, Haugejorden O, Sundberg H, Birn H. Nordic dentists' opinions on the safety of amalgam and other dental restorative materials. *Scand J Dent Res* 1993;101:238–42.
18. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burton AH, et al. Epi Info, Version 6: A word processing database and statistical program for epidemiology in micro-computers. Atlanta (GA): Center for Disease Control and Prevention; 1995.
19. Miles MH, Huberman MA. Qualitative data analysis. Beverly Hills, CA: Sage Publications; 1984.
20. Lantz A. Interview methods. The professionally accomplished interview (in Swedish). Studentlitteratur: Lund; 1993.
21. Rogers EM. Diffusion of innovations, 4th ed. New York: Free Press; 1995.
22. Beaglehole R, Bonita R, Kjellström T. Basic epidemiology. Geneva: WHO; 1993.
23. Wang NJ. Is amalgam in child dental care on its way out? Restorative materials used in children and adolescents in 1978 and 1995 in Norway. *Community Dent Health* 2000;17:97–101.
24. Forss H, Widström E. From amalgam to composite: selection of restorative materials and restoration longevity in Finland. *Acta Odontol Scand* 2001;59:57–62.
25. Dahl JE, Mjør IA, Moorhead JE. Placement, replacement material selection for longevity of direct restorations (in Norwegian). *Nor Tannlegeforen Tidsskr* 2001;111:552–6.
26. Leonhardt T. The amalgam syndrome from a historical perspective. The Swedish amalgam disease epidemics (in Swedish). *Lakartidningen* 2001;98:3940–5, 3947–8.
27. Dental Biomaterials: Adverse Reaction Unit. www.uib.no/bivirkningsgruppen/ebivirk.htm; May 21, 2002.
28. The decision on dental mercury waste in sewage (in Finnish). Helsinki: Ministry of the Environment; 1997.
29. Regulation about amalgam containing waste water and waste from dental clinics and offices (in Norwegian). Oslo: Norwegian Board of Health; 1992.
30. von der Fehr FR. Caries prevalence in the Nordic countries. *Int Dent J* 1994;44 4 Suppl 1:371–8.
31. Reich E. Trends in caries and periodontal health epidemiology in Europe. *Int Dent J* 2001;51 6 Suppl 1:392–8.