

# Skin reactions amongst Greek endodontists: a national questionnaire survey

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## Abstract

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**Aim** To investigate amongst Greek endodontists in the past 5 years the prevalence, aetiological factors, severity and treatment for skin reactions.

**Methodology** One hundred and 47 endodontists met the inclusion criteria and were invited to participate in the survey. Participants were asked for personal/professional data, prevalence, aetiological factors, symptoms, severity and treatment for skin reactions in the past 5 years. The type of gloves used and frequency of hand washing as well as information on history of atopy and eczema were also recorded. Data were analysed using chi-square test and independent samples *t*-test. The level of significance was set at  $P = 0.05$ .

**Results** The response rate was 84%. Skin reactions were reported by 32.5% of participants. Hands were the body part most frequently affected (66% of cases);

glove powder accounted for 73% of skin reactions. Medical care was sought by 28.2% of the affected participants. Endodontists with a history of atopy ( $P < 0.001$ ) and dermal eczema ( $P < 0.001$ ) as well as females ( $P = 0.023$ ) were more likely to report skin reactions. Replacement of powdered latex gloves with powder-free or vinyl/nitrile gloves, avoidance of potential allergens and use of pharmaceutical ointments were adopted by 48.7%, 23.1% and 2.6% of the affected endodontists, respectively, to manage skin reactions.

**Conclusions** Approximately one-third of participants reported skin reactions. History of atopy and dermal eczema as well as gender was significantly associated with such reactions. The use of powder-free latex gloves instead of powdered ones was the measure most frequently adopted to manage reactions.

**Keywords:** endodontics, occupational hazard, skin reactions.

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## Introduction

During clinical practice, dentists utilize a plethora of materials which can cause skin and mucosal irritation and/or allergic reactions. These materials include metals such as nickel, titanium, chromium, cobalt, palladium and mercury, the natural glove and rubber dam latex, resin composites, bonding agents and dentures containing acrylic or methacrylic. In addition,

local anaesthetics, detergent agents, impression materials, eugenol, glove powder, masks, caps and protective glasses can evoke such reactions (Jacobsen & Hensten-Petersen 1989, Hensten-Petersen & Jacobsen 1990, Jacobsen *et al.* 1991, Munksgaard *et al.* 1996, Crippa & Pasolini 1997, Hamann *et al.* 1998, Chownadisai *et al.* 2000, Rubel & Watchorn 2000, Wallenhammar *et al.* 2000, Gijbels *et al.* 2006). Dermatitis due to frequent hand washing, stress and seasonal reactions not related to the dental profession have also been reported (Jacobsen & Hensten-Petersen 1989, Kerosuo *et al.* 2000). Dermatitis is an inflammatory skin reaction to exogenous and endogenous factors. Two types of dermatitis have been described:

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irritant and allergic. Allergic contact dermatitis cannot be diagnosed without patch testing (Kerosuo *et al.* 2000). Professional dermatoses are not exclusively of allergic type, because many studies have concluded that only a low percentage of the affected dental personnel reacts positively to skin allergic tests (Hill *et al.* 1998, Ohlson *et al.* 2001, Leggat & Smith 2006).

Skin reactions to hands and fingers are amongst the most frequently reported occupational health problems by dentists (Malmgren & Medin 1981, Rajaniemi & Tola 1985, Jacobsen & Hensten-Petersen 1989, Kanerva *et al.* 1989, 1994, Kerosuo *et al.* 2000). Their severity may affect adversely their professional career and their daily lives (Ayers *et al.* 2009).

A literature review revealed many surveys concerning skin reactions amongst dentists (Burke *et al.* 1995, Munksgaard *et al.* 1996, Field 1998, Lonnroth & Shahnavaz 1998, Chowanadisai *et al.* 2000, Kerosuo *et al.* 2000, Sinclair & Thomson 2004, Gijbels *et al.* 2006, Leggat & Smith 2006, Ayers *et al.* 2009, Al-Ali & Hashim 2012), periodontists (Jacobsen & Hensten-Petersen 1989) and orthodontists (Altuna *et al.* 1991, Kerosuo *et al.* 2000, Jacobsen & Hensten-Petersen 2003) as well as studies combining a questionnaire with a clinical examination and allergic skin tests (Crippa & Pasolini 1997, Tarlo *et al.* 1997, Hill *et al.* 1998, Wallenhammar *et al.* 2000, Ohlson *et al.* 2001, Wrangsjo *et al.* 2001, Vangveeravong *et al.* 2011) amongst dentists, dental students and dental personnel. No study was found concerning the frequency and severity of skin reactions amongst endodontists.

Endodontists perform only a proportion of dental procedures undertaken by general dentists and utilize specific dental materials, including well-known irritating agents and potential allergens, such as gutta-percha, rubber dam, stoppers of endodontic files, sodium hypochlorite (NaOCl) and eugenol, for longer time periods compared to general dentists. On the contrary, other potential allergens, such as methacrylic, are not included in the materials routinely used by them. This may account for a divergence on the type and frequency of skin reactions amongst endodontists and general dentists or other dental specialties.

The aims of this study were to investigate the prevalence, aetiological factors, severity and treatment for skin reactions amongst Greek endodontists as well as significant associations between personal/professional data of the participants and the incidence of skin reactions.

## Materials and methods

A survey on occupational hazards in endodontics was conducted from July 2011 to March 2012 amongst members of the Hellenic Society of Endodontics and/or dentists who completed a postgraduate programme in endodontics and practice in Greece. The study was approved by the Ethical Committee of the Dental School of Aristotle University of Thessaloniki, Greece. Of the 174 endodontists who were initially eligible to participate in the survey, after exclusion criteria applied and taking into account those who refused to participate (Table 1), 123 endodontists participated in the study.

Data were gathered through interviews based on a questionnaire. The details on the methodology have been described in previous studies on percutaneous injuries (Zarra & Lambrianidis 2013a), occupational ocular accidents (Zarra & Lambrianidis 2013b) and musculoskeletal disorders (Zarra & Lambrianidis 2013c). The fourth part of the questionnaire being analysed in this study included the following:

- Personal and professional data of the participants [age, gender, dominant hand, years of clinical experience, information on postgraduate studies as well as information on the working conditions and type of employment (private/public sector)].
- Information on the incidence of skin reactions in the past 5 years. In cases of a positive response, the endodontists were asked for details on the body part affected and accompanying symptoms. Furthermore, they were requested to report whether the diagnosis was based on a medical opinion or personal experiences and hypotheses as well as measures adopted by the affected endodontists for the management of reactions.
- Information on possible accompanying symptoms from eyes, respiratory, gastrointestinal and cardiovascular systems.
- Information on the need for sick leave due to the severity of the symptoms and its duration.

**Table 1** Exclusion criteria

| Exclusion criteria                   | Number (n)<br>of endodontists |
|--------------------------------------|-------------------------------|
| Retirement                           | 4                             |
| Practice of other dental specialties | 9                             |
| Absence due to illness               | 2                             |
| Inability of contact                 | 8                             |
| Refusion to participate              | 24                            |

- Information on the type of gloves used by endodontists.
- Information on the frequency of hand washing.
- Information on the history of atopy or eczema.

Throughout interviews, the questions were addressed to endodontists by the same investigator exactly as they were formulated in the questionnaire without giving additional clarification.

The reliability of the data was evaluated prior to the survey using a test–retest model to assess answer variations by the same respondent at different times. Twenty four randomly selected endodontists were interviewed by the same investigator for a second time (approximately 6–8 weeks after the first interview), and the agreement between responses on the two occasions was measured by the kappa ( $\kappa$ ) coefficient. Only close-ended questions were evaluated.

The responses of the participants were analysed using the Statistical Package for the Social Sciences (IBM SPSS Statistics v.19, New York, NY, USA). Data analysis included descriptive statistics by analysing observed values and frequencies. Association between categorical variables was tested for statistical significance using the chi-squared test. The Kolmogorov–Smirnov test was employed to evaluate the normal distribution of continuous variables within each group. Hence, means were compared by using parametric tests. The independent samples *t*-test was used for two-level independent variables. The level of significance was set in all cases at  $P = 0.05$ .

## Results

### Response rate

The response rate was 83.7%. Kappa values obtained ranged from 0.8 to 1, demonstrating a high degree of repeatability. The statistical analysis was based on 120 endodontists, as three more were excluded, having reported endodontic work of <50% of their overall performed dental procedures per month.

### Personal and professional data

The personal and professional data of the participants are presented in Table 2. The age of endodontists ranged from 26 to 63 years with a mean of 40.6 years. Participants worked a mean of 7.45 h per day and 1626 h per year, a mean of 46 weeks per year and treated a mean of eight patients per day.

### Information on skin reactions

Thirty-nine (32.5%) participants reported skin reactions in the past 5 years. Amongst them, 82.1% considered the reactions to be associated with the dental occupation. Twenty eight point two per cent of the

**Table 2** Personal/professional data of the participants in the study by number (*n*) and percentage (%) of the respondents. Relationship between categorical variables and the incidence of skin reactions [number (*n*) and percentage (%) of endodontists with skin reactions and *P*-values\*]

| Categorical variables                               | <i>n</i> (%) of participants | <i>n</i> (%) of endodontists with skin reactions | <i>P</i> -value |
|-----------------------------------------------------|------------------------------|--------------------------------------------------|-----------------|
| Gender                                              |                              |                                                  |                 |
| Male                                                | 56 (46.7)                    | 15 (23.4)                                        | 0.023           |
| Female                                              | 64 (53.3)                    | 24 (42.9)                                        |                 |
| Dominant hand                                       |                              |                                                  |                 |
| Left handed                                         | 5 (4.2)                      |                                                  |                 |
| Right handed                                        | 114 (95)                     |                                                  |                 |
| Ambidextrous                                        | 1 (0.8)                      |                                                  |                 |
| Postgraduate studies                                |                              |                                                  |                 |
| Yes                                                 | 108 (90)                     |                                                  |                 |
| No                                                  | 12 (10)                      |                                                  |                 |
| Duration of the postgraduate programme <sup>a</sup> |                              |                                                  |                 |
| 1 year                                              | 3 (2.7)                      |                                                  |                 |
| 18 months                                           | 2 (1.9)                      |                                                  |                 |
| 2 years                                             | 41 (38)                      |                                                  |                 |
| 3 years                                             | 62 (57.4)                    |                                                  |                 |
| Work load (days per week)                           |                              |                                                  |                 |
| 2                                                   | 1 (0.8)                      |                                                  |                 |
| 3                                                   | 4 (3.3)                      |                                                  |                 |
| 4                                                   | 24 (20)                      |                                                  |                 |
| 5                                                   | 90 (75)                      |                                                  |                 |
| 6                                                   | 1 (0.8)                      |                                                  |                 |
| Years of clinical practice since graduation         |                              |                                                  |                 |
| >20                                                 | 33 (27.5)                    | 16 (32)                                          | 0.907           |
| 11–20                                               | 37 (30.8)                    | 13 (35.1)                                        |                 |
| ≤10                                                 | 50 (41.6)                    | 10 (30.3)                                        |                 |
| Practice limited to endodontics                     |                              |                                                  |                 |
| Yes                                                 | 89 (74.2)                    | 28 (31.5)                                        | 0.680           |
| No                                                  | 31 (25.8)                    | 11 (35.5)                                        |                 |
| Type of employment                                  |                              |                                                  |                 |
| Private practice                                    | 99 (82.5)                    | 34 (34.3)                                        | 0.349           |
| Public sector                                       | 7 (5.8)                      |                                                  |                 |
| Both                                                | 14 (11.7)                    | 5 (23.1)                                         |                 |
| Never                                               | 58 (48.3)                    |                                                  |                 |
| History of atopy                                    |                              |                                                  |                 |
| Yes                                                 | 25 (20.5)                    | 21 (84)                                          | <0.001          |
| No                                                  | 95 (79.5)                    | 18 (18.9)                                        |                 |
| History of dermal eczema                            |                              |                                                  |                 |
| Yes                                                 | 9 (7.5)                      | 9 (100)                                          | <0.001          |
| No                                                  | 111 (92.5)                   | 27 (24.3)                                        |                 |

\*Chi-squared test.

<sup>a</sup>Percentages have been calculated with respect to the total number of endodontists having completed postgraduate studies.

affected endodontists visited a dermatologist/allergiol-  
ogist and confirmed the type of the reaction. Three  
per cent of the reactions examined were confirmed to  
be of allergic aetiology after the conduction of specific  
skin tests; the remaining cases were diagnosed as irritant  
dermatitis. Body parts affected as well as respon-  
sible materials are summarized in Fig. 1.

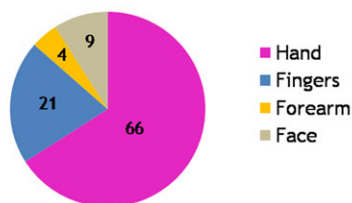
Two endodontists reported skin reactions on the  
forearm due to the use of surgical sterilized gloves during  
the performance of surgical endodontics.

No endodontist reported reactions to dental materi-  
als and local anaesthetics. Symptoms described by the  
affected endodontists are presented in Fig. 2. No reac-  
tion was accompanied by asthma, rhinitis, conjuncti-  
vitis or systemic allergic reactions.

Two endodontists reported that the severity of skin  
reactions influenced their daily activities; particularly,  
they refrained from clinical practice for a period of 3–  
10 days.

Possible associations between categorical variables  
and the incidence of skin reactions are presented in  
Table 2. There was no significant association between  
age [ $t(118) = -0.307$ ,  $P = 0.760$ ], work load (number  
of hours worked per year) [ $t(118) = 0.673$ ,  $P = 0.502$ ]  
as well as number of patients treated per day

(a)  
Percentage (%) of skin reactions having affected  
each body part



(b)  
Percentage (%) of skin reactions caused by  
materials

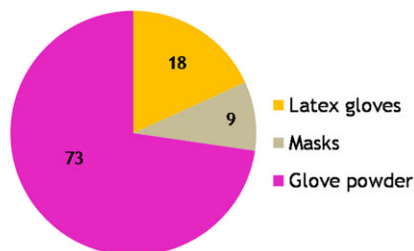


**Figure 1** (a) Percentage (%) of skin reactions having affected  
each body part in the past 5 years, (b) Percentage (%) of  
skin reactions caused by different materials in the past  
5 years.

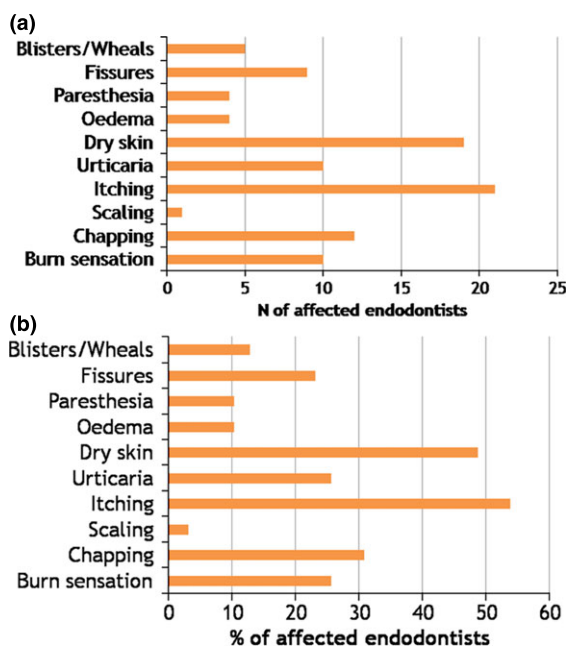


**Figure 2** (a) Number ( $n$ ) and (b) percentage (%) of endodon-  
tists with skin reactions in relation to the reported symptoms.

[ $t(118) = 1.056$ ,  $P = 0.293$ ] and the incidence of skin  
reactions. The frequency of hand washing did not influ-  
ence the incidence of hand skin reactions ( $\chi^2 = 4.775$ ,  
 $P = 0.311$ ). However, the impact of regular glove use  
on the incidence of reactions could not be investigated  
in the present study, due to the adoption of this preven-  
tive measure by the majority of the participants.

### History of atopy and dermal eczema

The percentages of endodontists that reported a his-  
tory of atopy and dermal eczema as well as possible  
associations between them and the incidence of skin  
reactions are summarized in Table 2.

### Type of gloves used in clinical practice

Eighty per cent, 13.3% and 4.2% of the respondents  
reported the use of latex gloves (41.7% powdered and  
40.8% powder free), powder-free nitrile gloves and  
powder-free vinyl gloves, respectively. No endodontist  
reported the use of powdered nitrile or vinyl gloves.

### Management of skin reactions

Measures adopted by endodontists to manage skin  
reactions are summarized in Fig. 3. All participants

continued using gloves during clinical practice. Powdered latex gloves were replaced by powder-free latex gloves or powder-free nitrile or vinyl gloves in some cases. One endodontist reported ceasing the use of face masks which were thereafter utilized only during the management of high-risk patients for transmission of pathogens.

## Discussion

The response rate was high (83.7%); therefore, the results of the present study can be considered representative of Greek endodontists. The response rate achieved is comparable to those reported in other studies with similar methodology (Al Wazzan *et al.* 2001, Al-Ali & Hashim 2012). Data in this study were gathered through interviews, which constitute a widely accepted method of data collection in studies concerning occupational hazards (Maupomé *et al.* 2000, Al Wazzan *et al.* 2001, Venoresi *et al.* 2004). To prevent possible bias due to this process, all interviews were conducted by the same investigator and the questions were addressed exactly as they were formulated in the questionnaire whilst no additional clarifications were given. It must be emphasized that studies based on selective memory have inherent limitations as data are gathered retrospectively. Additionally, the reliability of these studies depends on the honesty of the participants' responses. Although participants are assured of confidentiality, the answers may be biased in favour of those being socially desirable. To compensate for these limitations, the repeatability of the answers was assessed by estimating the

kappa coefficient, and the obtained results indicated a strong agreement between the collected responses for the categorical variables (see Krippendorff 1980). Additionally, the cross-sectional design of the study does not permit the elucidation of a cause and effect relationship.

Estimation of the prevalence of skin reactions through a questionnaire has inherent limitations. Appropriate skin tests or blood tests for the detection of IgE antibodies are required for a diagnosis of the type of reactions. This was confirmed by the study of Tarlo *et al.* (1997) amongst dental students and dental personnel of a dental school. In that study, there were a high percentage of false positive as well as false negative results, when responses of the questionnaire and results of skin tests were compared. This is the main reason why it was decided not to record the type of skin reactions (either allergic or irritant) in the present study. The combination of a questionnaire with a clinical examination and appropriate skin tests in future studies will probably give more accurate information on the type of skin reactions amongst endodontists.

Atopic individuals were defined according to Kate-laris *et al.* (1996) and Wallenhammar *et al.* (2000) as those who had a history of asthma, allergic rhinitis, atopic dermatitis or eczema.

Eczema was defined as a multifactorial disease, which is caused by exposure to skin irritants and in some cases to contact allergens. Genetic factors, such as atopic constitution, are also important (Wallenhammar *et al.* 2000). In the present study, 32.5% of endodontists reported skin reactions in the past

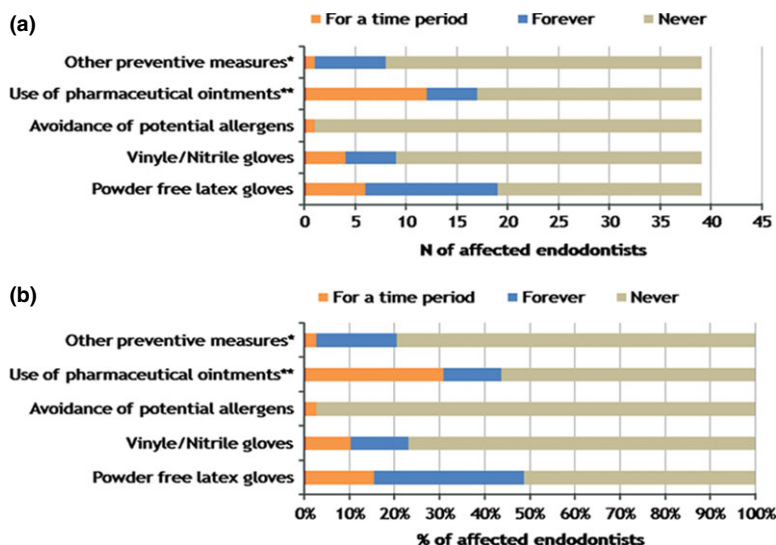


**Figure 3** (a) Number (*n*) and (b) percentage (%) of affected endodontists in relation to the measures adopted for the management of skin reactions and their duration.

5 years. Although endodontists come in contact with many materials containing latex or presenting cross-reactions to latex, such as gutta-percha, rubber dam and stoppers of endodontic files, the prevalence of skin reactions was not much higher than that reported in previous studies on general dentists. This could be attributed to the fact that endodontists use these materials when wearing protective gloves. Although allergies may affect eyes, respiratory, gastrointestinal and cardiovascular systems (Hamann *et al.* 2002), no such reactions were reported by the participants. In these cases, materials, such as rubber dam and gutta-percha, could be harmful to sensitized individuals. An environment totally free from latex is recommended in cases of hypersensitivity to latex (Kleier & Shibilski 1999, Kosti & Lambrianidis 2002). This is the reason why it was decided to include these materials in the present questionnaire even though it mainly investigated skin and not allergic reactions. The results of the present study and those of previous studies concerning skin reactions on general dental practitioners (Altuna *et al.* 1991, Burke *et al.* 1995, Munksgaard *et al.* 1996, Chowanadisai *et al.* 2000, Kerosuo *et al.* 2000, Wallenhammar *et al.* 2000, Wrangsjo *et al.* 2001, Sinclair & Thomson 2004, Gijbels *et al.* 2006, Leggat & Smith 2006, Ayers *et al.* 2009, Agrawal *et al.* 2010, Al-Ali & Hashim 2012), orthodontists (Jacobsen & Hensten-Petersen 1989, Kerosuo *et al.* 2000, Jacobsen & Hensten-Petersen 2003), dental students (Rankin *et al.* 1993, Vangveeravong *et al.* 2011) and dental personnel (Hill *et al.* 1998, Ohlson *et al.* 2001) are not directly comparable due to the heterogeneity of the studies concerning the time period of recording data, the type of materials being evaluated and the type of study, for example whether this was based on a questionnaire or this was accompanied by clinical examination and conduction of skin tests.

Eighty-two per cent of those endodontists having reported skin reactions believed them to be an occupational disease. A similar high percentage (75%) has been reported in a previous study amongst general dentists (Munksgaard *et al.* 1996).

In the present study, 3.1% of the skin reactions were diagnosed to be of allergic aetiology. This finding is in accordance with the 2.1–5% (Ohlson *et al.* 2001, Leggat & Smith 2006, Vangveeravong *et al.* 2011) reported in previous studies amongst general dental practitioners and dental students. However, it should be noted that the result of the present study could not be considered representative of Greek end-

odontists, as only a low proportion of the affected participants visited a dermatologist/allergist. In a survey based exclusively on a questionnaire, it is almost impossible to record further details on the type of specific skin tests performed as this information may be vague or incorrect. The low percentage of affected endodontists having visited the corresponding doctors in the present study possibly implies low severity of the reported symptoms.

In the present study, skin of the hands and fingers was more frequently affected. This should be expected as these regions come in contact with gloves and other potential irritant/allergenic dental materials.

In contrast to previous studies (Jacobsen & Hensten-Petersen 1989, Hensten-Petersen & Jacobsen 1990, Jacobsen *et al.* 1991, Munksgaard *et al.* 1996, Crippa & Pasolini 1997, Hamann *et al.* 1998, Chowanadisai *et al.* 2000, Rubel & Watchorn 2000, Wallenhammar *et al.* 2000, Gijbels *et al.* 2006) amongst general dentists and orthodontists, no endodontist reported skin reactions due to dental materials. This discrepancy may be attributed to the fact that endodontists do not use methacrylate-based materials. However, even eugenol or sodium hypochlorite (NaOCl) which are known sensitizers (Kaufman & Keila 1989, Johansen *et al.* 1996, Dandakis *et al.* 2000) used widely during endodontic treatment was not responsible for any skin reaction in the present study. Gloves and glove powder accounted for the majority of the skin reactions.

The materials most frequently used in glove construction are natural rubber, polyvinylchloride (vinyl) and synthetic rubber materials such as nitrile rubber. Latex gloves are made of natural rubber with the addition of other chemicals. They may be powdered to facilitate their placement or powder free. Nitrile gloves are considered more advantageous as they offer better elasticity and tensile strength than vinyl gloves and are free from the allergenic proteins of natural rubber (Boyle *et al.* 2002). In the present study, 41.7% of the respondents reported using powdered latex gloves, a percentage lower than the corresponding 49.7% reported by Tarlo *et al.* 1997 amongst dental students and similar with the 43% reported by Kerosuo *et al.* (2000) amongst dentists and orthodontists. On the contrary, nitrile or vinyl gloves were utilized only by the 17.5% of the participating endodontists.

In the present study, the frequency of hand washing was recorded and its association with the prevalence of skin reactions was evaluated, because

frequent hand washing and the use of protective gloves many hours per day contribute to skin irritation (Katelaris *et al.* 1996, Munksgaard *et al.* 1996, Vangveeravong *et al.* 2011). Thereafter, this impairs the protective function of the skin barrier and increases the risk of contact sensitization (Wilkinson & Rycroft 1992). In the present study, there was no significant association between the frequency of hand washing and the prevalence of skin reactions, which is in accordance with the findings of Katelaris *et al.* (1996). The impact of the frequent glove change on the prevalence of skin reactions could not be estimated in the present study, as all respondents changed them between patients.

Many respondents in the present study managed skin reactions by changing glove brand. Latex gloves from different sources vary in the amount of latex protein detectable on their surface (Yunginger *et al.* 1994). Consequently, gloves with a lower amount of latex protein might reduce the risk of sensitization and should be preferred. This is confirmed by the study of Vangveeravong *et al.* (2011), in which three brands of gloves differed with respect to the frequency of latex sensitization.

The severity of skin reactions could be estimated by the percentage of affected endodontists having sought medical care. In the present study, 28.2% visited a dermatologist. This is indicative of the fact that the majority of the reported cases were mild. Similar low percentages ranging from 25% to 39% have also been reported in previous studies amongst general dental practitioners (Berky *et al.* 1992, Wallenhammar *et al.* 2000).

In this study, females reported skin reactions more frequently compared to males and could be attributed to their greater willingness to report health problem.

Atopic individuals were more likely to report skin reactions in the past 5 years, in accordance with the findings of previous studies (Katelaris *et al.* 1996, Tarlo *et al.* 1997, Field 1998, Kerosuo *et al.* 2000, Wrangsjö *et al.* 2001, Ghasemi *et al.* 2007, Agrawal *et al.* 2010, Vangveeravong *et al.* 2011) amongst general dentists and dental students. A significant association between the history of hand eczema and the prevalence of hand skin reactions was found in the present as well as in previous studies (Field 1998, Wrangsjö *et al.* 2001, Agrawal *et al.* 2010).

To prevent skin reactions, exposure to potential allergens should be minimized (Sinclair & Thomson 2004). Skin irritations as well as allergies should be diagnosed timely, and the affected individuals should

seek medical advice to avoid more severe complications.

## Conclusions

Approximately one-third of the participants reported skin reactions in the past 5 years. Hands were the body part most frequently affected; glove powder accounted for the majority of skin reactions. History of atopy and dermal eczema as well as gender was significantly associated with the incidence of skin reactions. The replacement of powdered latex gloves with powder-free ones solved the majority of the reported problems. The materials implicated in the appearance of skin reactions amongst endodontists did not seem to differ from those reported in previous studies on general dentists.

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