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Longitudinal Study of Sensitization to Natural Rubber Latex among Dental School Students using Powder-free Gloves

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Background: A high rate of sensitization and clinical allergy to latex proteins has been reported in health care personnel. This is thought to be due to increased occupational exposure especially to natural rubber latex (NRL) gloves with an estimated prevalence varying widely (2.8–18%).

Objective: This was a longitudinal study to monitor a cohort of first-year dental students throughout 4 study years during exposure to powder-free gloves. Their atopic status was determined by skin prick testing using a panel of common allergens, and any sensitivity to latex proteins and the cross-reacting food allergens assessed.

Methods: Skin prick testing was carried out on the volunteers using latex, avocado, kiwi, banana, grass pollens, tree pollen, house dust mite and cat dander. Each volunteer completed a questionnaire detailing allergic history and any previous latex exposure.

Results: Skin prick testing showed a 65% incidence of atopy in the longitudinal study group. Initial latex skin testing was positive in 3 of the 63 students followed throughout their period of study. Subsequent testing gave a negative result in one student and one declined retesting. The third continued to give a positive response on each testing; she wore only nitrile gloves and remained free of clinical NRL allergy symptoms. No student developed latex sensitivity during the 5 yr of this study.

Conclusion: Exposure to powder-free latex gloves was not associated with subsequent sensitization over 5 yr in a population with a high atopic incidence.

Keywords: allergy, dental, gloves, latex

INTRODUCTION

During the last decade hypersensitivity to latex has become one of the primary occupational hazards within the health-care setting, with reported symptoms ranging from localized urticaria and rhino conjunctivitis to asthma and, in rare cases, anaphylaxis (Jaeger *et al.*, 1992).

Latex allergy was first recognized in the United States and much of the research into prevalence is based on US studies. The reported prevalence varies widely (3-25%) (Liss *et al.*, 1997), with a prospective study by Sussman showing that 1% of hospital personnel using latex gloves were sensitized to latex (Sussman *et al.*, 1998).

A recent study in three South African hospitals using powdered latex gloves reported a prevalence of 9-20% of latex sensitivity (Potter, 2002). The risk factors for latex sensitivity include occupational exposure to latex and pre-existing atopy. Latex gloves are by far the most common source of latex exposure in the health-care setting, and the duration of glove wearing has been positively associated with the likelihood of latex sensitization (Galobardes *et al.*, 2001). Substitution of latex gloves needs careful consideration as latex has been shown to have a lower penetration rate to small viruses, lower leakage

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during routine clinical activities and superior tactile properties than synthetic gloves (Douglas *et al.*, 1997). If substitution is warranted, nitrile gloves are considered the best synthetic alternative to latex.

Powdered latex gloves have been shown to have a greater extractable level of latex proteins than in non-powdered brands, and this increases exposure both through direct skin contact and via the respiratory tract (Heese *et al.*, 1997).

Prevention of latex-related sensitization is directly related to exposure control, the most effective method at present being the use of low-protein, non-powdered gloves (Cuming, 2002). Dental practitioners are considered as a high-risk group within the clinical specialities due to prolonged use of latex gloves during the working day. Indeed, many dental practitioners have had to leave the profession due to the development of latex allergy from the wearing of gloves (Field, 1999). This is due to the high latex component of many products associated with dental practice, such as dental dams, suction tubing and impression casts. Once allergy is present, exposure to these other materials can initiate symptoms. In view of this, most dental schools have now replaced powdered latex gloves with non-powdered, low-allergen gloves for students in training.

Powdered latex gloves were replaced with low-protein, non-powdered latex gloves in the Cardiff Dental School in 1997 following an unpublished study suggesting high rates of sensitization to latex. Students were assessed for latex sensitivity at the onset of their training and followed until the end of their fifth year. Also included in the study was a subset of staff members, senior students and dental nurses that had worked in the hospital for varying numbers of years.

This aim of this study was to determine whether these gloves were associated with any significant sensitization to natural rubber latex (NRL) among dental students over the course of their studies.

MATERIALS AND METHODS

All students enrolled were invited to take part in a study aimed at monitoring their allergic status to latex proteins throughout their study years.

Fifty-three out of a total 68 first-year dental students agreed to participate initially, and a further 10 students joined in the second year of the study. All completed a questionnaire related to demographic details and personal and family history of atopy. All subjects were assessed for general atopy and latex sensitivity by skin prick testing (SPT) to a battery of common allergens and to natural rubber latex (Stallergenes) and cross-reacting fruits including kiwi fruit, banana and avocado. Skin prick testing for latex and cross-reacting fruits were repeated annually for the following 4 yr. The same extracts were used throughout the study.

A cross-section of 153 dental school staff were also included for the 1999 study year only; these were made up of 105 senior dental students, 33 dental nurses/hygienists and 15 qualified dentists. Clinical history, including any atopic symptoms, and family history of allergy were recorded. Previous latex exposure and demographic details were noted.

Skin prick testing to the common allergens; i.e. grass pollens, tree pollens, cat dander and house dust mite, were used to determine atopic status. Atopy was defined as the presence of one or more positive responses to these common allergens. A negative saline and positive histamine control were included.

Skin prick responses were noted after 15 min and wheal diameter of 3 mm greater than the negative saline control was considered positive.

The local ethical committee approved the study.

RESULTS

The SPT results at baseline showed that 40 out of the 63 students (63%) were atopic; however, only 25% of the students reported any symptoms of allergy.

The latex skin test gave a positive result (3 mm wheal size) in three subjects (4.75%), none of whom reported any adverse reaction to latex. These students were advised to wear nitrile gloves. Subsequent testing, however, gave negative SPT results to latex proteins in one of these students, another declined retesting and the third retained SPT sensitivity to latex.

The avocado skin test was positive in four of the students (6.35%), two of whom also reacted to the latex proteins. The avocado SPT remained positive for each year of the study. One of these subjects was SPT positive to both avocado and kiwi fruit, this also remained positive for each study year (Table 1).

The staff and final-year student group who were only skin tested on one occasion also had a high level of atopy (53%). Two subjects from this group of 153 subjects were SPT positive to latex (1.3%). Both of these subjects had a history of symptomatic latex allergy and had already switched to using nitrile gloves prior to taking part in the study.

Table 1. Positive skin prick tests for latex-related antigens in dental students throughout 4 yr of study

SPT	Latex	Banana	Avocado	Kiwi
Year 1, $n = 53$	3	0	4	1
Year 2, $n = 60$	1	0	4	1
Year 3, $n = 43$	1	0	4	1
Year 4, $n = 34$	1	0	4	1

This group also had a high incidence of avocado sensitization, with 10 subjects (6.5%) giving a positive SPT result to avocado.

None of the subjects in either group showing a positive skin prick test to fruit antigens were symptomatic after exposure to these foods.

DISCUSSION

This survey of dental students shows an overrepresentation of atopic subjects compared with the general population (Howarth, 1998). However, the level of symptomatic allergic disease was in agreement with that seen in the general population (25%). The prevalence of latex sensitization (4.5%) in this group is in accordance with previous studies (Vandenplas *et al.*, 1995; Sussman *et al.*, 1998). The sensitivity to avocado may be related to latex sensitivity rather than to true sensitivity to avocado as none of these subjects reported excessive exposure to avocado or symptoms following ingestion. None of the subjects reported any symptoms associated with latex sensitivity throughout the course of their studies.

The SPT results on the final-year students and dental staff gave a similar level of atopy (53%) but showed a lower rate of sensitization to latex (2.5%), but sensitivity to avocado was almost identical to that seen in the longitudinal study group (6.5%). This further suggests that avocado sensitivity may be latex related. The level of clinically significant allergy to NRL in this group (1.3%) was in accordance with other studies on NRL in health-care workers.

This study suggests that low-level sensitization to NRL may be pre-existing in a significant number of individuals prior to long-term exposure to NRL antigens and that these may not manifest as clinically relevant without long-term exposure. The introduction of powder-free, low-protein gloves may serve to reduce sensitization in those subjects not already sensitized to NRL.

The two latex SPT-positive subjects who were followed for 5 yr did not develop clinically relevant symptoms. However, these subjects wore only nitrile gloves during this period, although they may have had latex exposure from other materials used in dentistry. Neither subject had significant prior exposure to latex, although one individual gave a history of maternal latex allergy.

Due to concerns regarding the development of clinically relevant symptoms following sensitization, if subjects remain exposed to the allergen, those who are SPT positive to latex are currently advised to wear synthetic alternatives, usually nitrile.

A long-term study following the outcome of health-care workers with NRL allergy has shown the use of low-allergen or non-latex gloves to be an adequate precautionary step (Turjanmaa *et al.*, 2002). Interestingly, a recent study has suggested that length and frequency of exposure to latex gloves is not clearly associated with sensitization (Garabrant and Schweitzer, 2002).

The wearing of occlusive gloves can of itself cause symptomatic skin changes, although for the most part these are irritant in nature. A number of studies have indicated that many suspected incidences of latex allergy had no allergic basis but were simply related to long-term occlusive glove wearing (Nettis *et al.*, 2002).

Care must therefore be taken when assessing glove allergy. Diagnosis should be confirmed by SPT or specific IgE measurements.

This study suggests that the provision of low-protein, powder-free latex gloves may have significant benefits in reducing sensitization to NRL in atopic individuals.

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